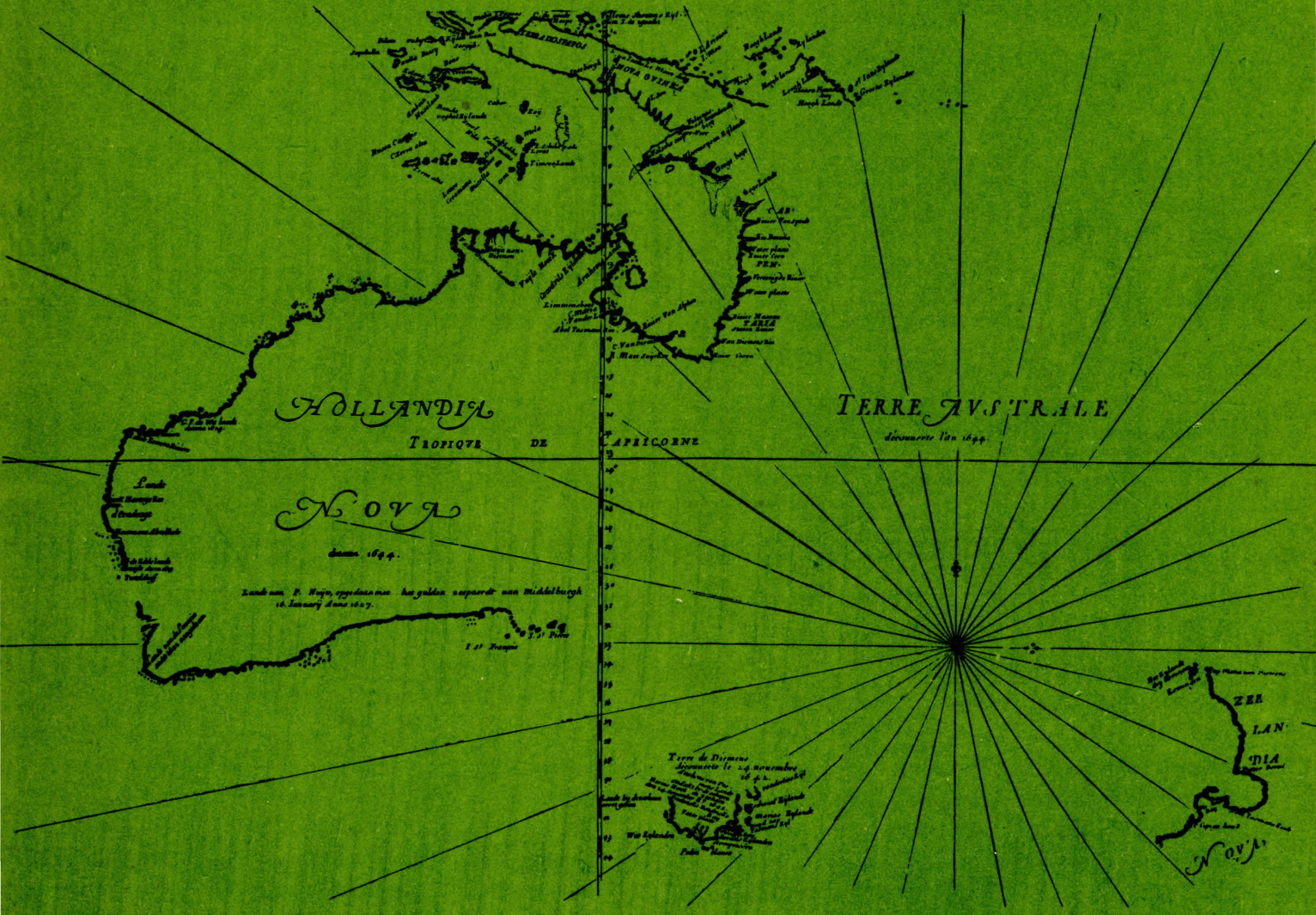
New Guinea Stone Age Trade

Ian Hughes



TERRA AUSTRALIS

3

Department of Prehistory
Research School of Pacific Studies
The Australian National University

Terra Australis reports the results of archaeological and related research within the region south and east of Asia, though mainly Australia, New Guinea and Island Melanesia - lands that have remained *terra australis incognita* to generations of prehistorians.

Its subject is the settlement of the diverse environments in this isolated quarter of the globe by peoples who have maintained their discrete and traditional ways of life into the recent recorded or remembered past and at times into the observable present.

Terra Australis
3

NEW GUINEA STONE AGE TRADE

the geography and ecology of traffic in the interior

Ian Hughes

Department of Prehistory, Research School of Pacific Studies
The Australian National University Canberra
1977

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FOREWORD

The exchange of raw materials and processed goods by people from regions where those materials occur naturally or are processed in a particular way, to people in regions where they do not occur, or are not so processed, is a basic underpinning of much human economic history. Anthropologists, human geographers, historians and economists have long been fascinated by the variety of ways in which, and the variety of reasons for which goods and materials have been exchanged in the past, and such studies in Papua New Guinea, beginning with Malinowski's classic assessment of the *Kula* trade ring, have made the coastal trading systems of that country famous in anthropological literature.

Patterns of trade and exchange for social, ritual and economic purposes in the highlands of New Guinea are less well known; but this is perhaps more understandable when it is remembered that *Argonauts of the Western Pacific* had been published for more than a decade before white men first saw the area of the interior which is Dr Hughes' concern in this volume. This fact of history carries a number of advantages which Dr Hughes has been quick to grasp. Despite the rapid infiltration of European goods into the region, even ahead of white men, traditional patterns and purposes of trade still exist or are readily recalled by informants whose memories go beyond the earliest white occupation. Thus the research has sought to separate out a truly traditional trade pattern, to determine the effects of the arrival of exotic goods into the region before whites, and indirectly to gauge the disruption of traditional trading practices by the white presence. Dr Hughes' research has led him far from his home discipline of human geography into the realms of anthropology, archaeology, linguistics, oral history and material culture, to mention but a few of the areas in which he has pursued New Guinea highlands trade. As will be seen, this topic is highly complex, but the deftness with which Dr Hughes guides us through the wealth of data he has accumulated, to the conclusions which he draws, ensures that this book will remain a fundamental contribution to the subject of traditional New Guinea trade.

Dr Hughes graduated from the University of Sydney with honours in geography in 1966. During his undergraduate honours year Dr Hughes undertook a study of agricultural land use in the Sinasina language area of the Chimbu Province of Papua New Guinea. Between 1967 and 1971 he carried out the doctoral research which forms the basis of this volume, while he was a scholar in the Department of Human Geography, Research School of Pacific Studies, Australian National University.

Between 1971 and 1975 Dr Hughes held the post of Research Fellow in the Australian National University's New Guinea Research Unit in Port Moresby, where his main research interest concerned the history and settlement of land use during remembered times in and around the swamplands of the upper Wahgi Valley. This work has formed an important segment of Professor Jack Golson's multi-disciplinary investigations into the agricultural prehistory of the area.

Dr Hughes is currently lecturer in human ecology in the Human Sciences Program, School of General Studies, Australian National University.

Jim Allen

PREFACE

The observations reported here were made in Papua New Guinea in 1967 and 1968 and the analysis and library research was completed in 1970. Most of the data were presented in more detail and with more caution in a PhD thesis in 1971, prepared while in the Department of Human Geography, ANU. There have been additions, especially to the section on stone, and some corrections. The tools discussed in Chapter VI are now in the Department of Prehistory, ANU.

Ian Hughes
January 1977

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Wherever possible, SI units (Système International d'Unités) have been used, with the English equivalent in brackets where it was thought helpful. Miles and kilometres are an exception, for we are concerned with large distances and areas which most English-speaking readers still have difficulty conceptualising when expressed in kilometres. When historical documents have been cited, the original statements of distance have been used. Elsewhere, when a cited source used imperial measure, this has been given first followed where relevant with the SI unit equivalent in brackets. Altitude has been given in metres above mean sea level (m MSL).

ORTHOGRAPHY

New Guinean terms here are written sub-phonemically, as outlined for 'Neo-Melanesian' by Mihalic (1957:xiv-xxi) except that in vernacular words the 'schwa' vowel like a short English 'uh' is represented by (ë), a low-central vowel resembling the German 'ö' is represented by that symbol (ö), the glottal stop is shown by (') and nasalisation by (,). In much of the study area 'f' and 'p' vary locally and are almost interchangeable and I have used that which sounded closest to me when I first recorded a word. Melanesian Pidgin terms are indicated by (MP).

ABBREVIATIONS

When New Guinean informants are identified, F = father and FF = father's father.

General

New Guinea

LMS	London Missionary Society
ANGAU	Australian New Guinea Administrative Unit
DASF	Department of Agriculture, Stock and Fisheries
DDA	Department of District Administration (formerly DNA, Department of Native Affairs)
PNG	Papua New Guinea, formerly TPNG
TPNG	Territory of Papua and New Guinea

Australia

AWRC	Australian Water Resources Council
BMR	Bureau of Mineral Resources, Geology and Geophysics, Department of National Resources
CSIRO	Commonwealth Scientific and Industrial Research Organisation
LRRS	Land Research and Regional Survey Division (now the Divisions of Land Use Research and Land Resources Management), CSIRO
RSPacS	Research School of Pacific Studies, ANU

Personnel

Papua

RM	Resident Magistrate
ARM	Assistant Resident Magistrate
VC	Village Constable

New Guinea, Mandated Territory
(Some designations common to Papua and to Papua New Guinea)

DC	District Commissioner
DDC	Deputy District Commissioner
ADC	Assistant District Commissioner
DO	District Officer
ADO	Assistant District Officer
PO	Patrol Officer
CPO	Cadet Patrol Officer
a/	acting
LL	Luluai
TT	Tultul

Documents

B.N.G.A.R.	British New Guinea Annual Report
G.N.G.R.	German New Guinea Annual Report
H.R.A.	Historical Records of Australia
P.A.R.	Papuan Annual Report
P.R.	Patrol Report (these are usually numbered in sequence for a year from July to June under the name of the Sub-District Office)

Imperial Measure

doz	dozen
oz	ounce
lb	pound (weight)
in	inch
ft	foot
yd	yard
mi	mile

ACKNOWLEDGEMENTS

I am greatly indebted to the Australian National University for providing the funds for this study. It was not cheap - walking is the most expensive way to collect data in New Guinea, even with the minimum of travelling companions. Unfortunately or fortunately, depending on your point of view, the most rewarding data collection sites were away from the spreading network of roads.

Many ANU people provided assistance and helpful criticism, above all H.C. Brookfield and W.C. Clarke. Needless to say, errors of fact or interpretation are mine alone. My thanks to J. Allen, S.E. Bulmer, J.M.A. Chappell, A. Dani, K. Fitchett, J. Golson, K.A. Green, H.E. Gunther, J. Heyward, A. Hinton, J. Hope, R. Lampert, R. Langdon, K. Lockwood, D. Markovic, M.V. Pancino, H. and F. Panoff, B.J. Stevenson, A.J. and M. Strathern, J.B. Toner, J.P. White and to the ANU Press. For publication most of the graphics have been transformed by Winifred Mumford, and the final draft was typed by Maureen Johnson and Lois White.

Other help in Canberra came from J.C. Saunders and J. McAlpine of the Land Research Division, CSIRO and from Eben H. Hipsley of the Commonwealth Department of Health. The geologists of the Bureau of Mineral Resources were invaluable in Canberra and in the field, especially J.H.C. Bain, R.J. Ryburn and D.E. Mackenzie.

For rewarding discussions in the field and in Sydney I must thank R.G. Hausfeld and G.C. Scott of the School of Public Health and Tropical Medicine, University of Sydney, and in connection with their leprosy study, D.R. Vincin of Mt Hagen. P.B. Booth, formerly of Port Moresby and now of Christchurch, has also been of help. Information and encouragement was provided by R.L. Hide, formerly of the New Guinea Research Unit and now of Auckland University. Roy Wagner of Northwestern University gave me the benefit of his knowledge of the Daribi, both in the field and subsequently, and the pleasure of his stimulating company on a journey to Lake Tebera.

In New Guinea I am indebted to a very great number of people, indigenous and expatriate. Officers of the Administration gave their complete cooperation and smoothed the progress of this research in innumerable ways far in excess of what was asked of them. The hospitality of outstation staff was exceptional and I am sure that the growing army of itinerant research workers represents a considerable imposition on these busy men who so generously give time and often shelter. It is impossible to name them all but my grateful thanks go to the staffs of the establishments, large and small, at Baimuru, Bundi, Chuave, Gembogl, Goroka, Gumine, Karimui, Kerema, Kerowagi, Kikori, Kundiawa, Madang, Mendi, Minj, Mt Hagen, Pangia, Simbai, Sinasina, Tabibuga and Usino.

Since I was based near the Chimbu District centre I am particularly obliged to the staff of the District and Sub-District Offices at Kundiawa under S.M. Foley DC and later under L.J. Doolan DC, and to the personnel of other government departments at Kundiawa and to many private citizens. Their assistance and friendship is remembered with gratitude. My wife and I are very much in the debt of J.R. Bartlett, M.F. Bell, W.H. and R. Biscoe, T. and J. Hubbard, J. Higginbotham, J.K. and R. Karukuru, B. Langsford, P. and D. Miller, and F.S. and M. Parker.

Many mission stations rivalled Patrol Posts in helpful discussion and hospitality. Special mention must be made of Fr Jack Sheerin, Mr and Mrs Ken Messplay, Mr Norm Norden, Rev John Cribb, Fr W.J. Saiko, and I thank all those at Aird Hill, Ambuluwa, Bundi, Kapuna, Karimui, Koge, Kondiu, Nomane and Wangoi.

Despite the number of people who approach them for information, the pioneers of highland exploration remain courteous and patient and much valuable data was provided by M.J. and D. Leahy and J.L. Taylor, and those who arrived in the highlands not long after them, Jack Fox, W. Bergmann, John Nilles, Rev. Hannemann and the late W.A. Ross.

My greatest obligation is to hundreds of New Guinean informants without

whose courtesy, patience and willingness to educate a stranger in the practices of an earlier age this study would not have been possible; they supplied the basic information on which the findings are based. Many of them expressed regret that children were no longer being taught the ways of their fathers and asked that these things be written down so that one day their descendants might read them. This is a contribution to that end. My deepest thanks to them, and to my cheerful helpers, guides, mentors and mates whose tolerance and good humour made work a pleasure, especially the veterans Gendua, Dokupa, Wena, Weiyangk, Kunba, Waine and Witne of Bamugl, Chimbu, Seleme of Iene on the Pio River, Tua region, and Wempi of Wapere in the Poru region.

I THE DEVELOPMENT OF THE PROJECT

THE CONCEPTION

This project was first conceived as a study in the geography of primitive trade, using ecology as a conceptual and methodological framework. Other studies of trade in technologically simple societies, of which the most relevant is Harding's monograph on a New Guinea coastal trading system, explained trade as the result of environmentally caused specialisation and cultural diversity (e.g. Harding 1967:241). This view was taken as a basic assumption in formulating the present project. Trade goods, the routes over which they travelled, and the rates at which they were exchanged, were all viewed as the product of varied, culturally controlled responses to different natural environments.

Originally it was hoped to develop a picture of ongoing trade in the 'ethnographic present', the period immediately before white contact, over a substantial part of central New Guinea, to be supplemented by a quantified record of present trade in traditional and modern goods in a small locality and over a selected route in an area lately brought under administrative control and only recently exposed to the effects of the modern colonial economy. It was postulated that there was an ordered relationship between the continuing exchange of traditional goods and the investment of wealth and labour in the new cash economy, and a number of questions were posed, both substantive and theoretical, bearing on this supposed connection.

This optimistic program was short-lived. The first four months of field-work showed that patterns of trade were considerably more complex within a relatively small area than had been expected and suggested that these patterns had changed substantially during living memory before Europeans arrived. The degree of change, especially the increase in quantities of shell valuables, was quite unexpected, and forced attention to the question of change during the prehistoric period to an unforeseen degree. It became essential to seek an additional historical frame of reference, and a methodology which would permit validation of the raw data as historical evidence as well as satisfying the requirements of the spatial ecological study. Accordingly, the local study was eliminated and program developed to provide a reliable view of pre-contact trading activity as a continuing and changing process over a substantial area encompassing a diverse range of natural resources, habitats, and cultural differences.

A number of substantive questions were involved. Were the described changes real? If so, to what were they due? In the light of Salisbury's findings (1962) about the effect of steel on a traditional New Guinea economy, were they initiated by the arrival of steel in advance of the white men? Europeans were known to have been supplying coastal people with factory goods, especially steel and cloth, for more than 80 years. Had the European presence on the coast so affected indigenous trade that some new goods and technological changes had been diffused inland as far as the highlands before 1930? If so, the economy in the period immediately before white contact was not really neolithic at all. On the other hand, highlanders who had been interviewed already had said that they did not have steel before the whites arrived. What was more, they had said that it was traditional valuables, particularly shells, that had increased in quantity, quality and variety. If this was true, how were these imports paid for? Westerners conventionally saw stone-age trade as slow in development if not actually homeostatic. If some of these questions could be answered it would have profound geographical, ecological and socio-economic implications and would in turn generate other questions.

There were methodological problems: the most urgent need was to test the reliability of the statements already collected, for great scepticism was expressed by authorities with experience of New Guinea, some pointing to the archaeological evidence of the antiquity in the highlands of trade goods like sea shells and polished stone axes, others doubting whether the impediments of translation and sometimes double translation would permit the evaluation of such statements at all.

Three approaches were thought useful, one based on increased area, one based on increased time-depth, and one which used both. Informants' statements had to be tested against each other, not only in the one locality but over a wide area, for if change was brought about by flows of goods from outside then this should be reflected in every statement about direction, quantity, values and time and should produce consistent patterns with continuous gradients in each direction. Greater time-depth could be achieved from oral data by attempting to include statements of hearsay about the past, particularly the transmitted personal experience of parents and grandparents. Equally important was the search for documentary evidence over a wide area of space and time for statements about the innovation and diffusion processes in and around the study area. Information was wanted about the time and place and circumstances of first contact, about the visitors' views of existing indigenous technology, wealth, economic behaviour and environment and about the new goods and information introduced by the observers themselves. Information was also wanted on the difficulties of communicating across cultural barriers; how, in a country where strangers were enemies, peaceful intercourse was established and what role was played in this by the exchange of goods.

THE AREA AND TIME SCALE

Within the core area, encompassing the densely populated valleys of the central highlands and the sparsely populated lowlands to the south, Europeans had introduced sufficient iron and indigenous valuables to seriously affect the traditional stone-age economy by 1939 in the main valleys and by 1950 in more isolated parts. This was the first decade or two of European dominance, depending on the varied spread of the administrative frontier after 1933, and is considered here only in so far as it affected trade in traditional products in uncontrolled areas.

The principal period of interest extends backwards from the arrival of the Europeans through the time covered by living memory and hearsay once removed. For most of inland New Guinea the year 1900 is about the earliest for which reasonably secure historical data can be got either from oral or documentary sources, and for the first 30 years of this century within the study area the memories of old people are almost the sole source. The starting date for this period, then, is around 1900 and the concluding date is 1933 or later; for most of the study area it is prehistoric.

The second period of concern, before 1900, is prehistoric throughout the study area and largely prehistoric in the neighbouring coastal hinterland, though there, in Golson's expressive phrase,'prehistory has been progressively caught alive' (1971) - in many valuable accounts by navigators, merchants, missionaries and government officials. Oral data for this early period are almost non-existent. The area was totally lacking codified traditions, custodians of tradition, and the mnemonic aid of long genealogies. It was a rare man who could name his own great-grandfather. Origin myths were telescoped together with traditions of specific migrations referring to recent times and in some cases supported by other evidence, both internal and external, linguistic and botanical. Myths and legends rarely mentioned such mundane things as material culture and then only in the most general terms and unlocated in scientific time. Study of this period in the inland is particularly dependent upon inferential evidence from botany and geomorphology and upon archaeology.

In general, for its history to be written, New Guinea is exceptionally dependent on the disciplines of prehistory and oral history, as has been stressed by R.N.H. Bulmer (1971) in a review of priorities and problems. This imposes special requirements on any study of aspects of material culture, including trade, and is discussed below (p.8)

SOURCES OF DATA

Field Observations

At the time field-work was carried out, many aspects of the way of life

were still traditional, even in the highland valleys where development had been concentrated. Apart from the use of steel axes and knives, the basic subsistence economy was little changed. Except in the northern sub-coastal hills, many aspects of traditional barter and institutions of ceremonial exchange continued.

Observations were made of the many traditional trade objects that survived, including those that were no longer made or used and others that were no longer traded. Valuables still worn as daily ornaments were seen in use everywhere, and others worn on special occasions were seen in use at festivals in many places and elsewhere were seen stored in houses. Many had changed in type, quality, quantity and popularity, but they provided essential reference points for discussion of the past.

Although stone tools and weapons were now rarely used, many had been kept, some still hafted, and the fine stone blades formerly used as valuables had been especially well preserved. Traditional pigments were still in use and the trade-area of one had grown greatly in modern times. Pottery was still made and used, though no longer so widely traded. In one area, traditional salt was still a valuable, ritually important in feasts, but was no longer a normal consumption good. Some specialised fruits once ceremonially exchanged across ecological boundaries were now sometimes traded as well, and new trade had developed in some ornamental plants.

Fur, feathers and brightly coloured beetles were still collected, fur and skins were hunted, traded and worn as ornament, and everywhere bird of paradise skins and feathers were hunted, traded and displayed more vigorously than ever. Areas hunted over by individuals and groups had expanded and the trade areas of individual goods and traders had grown out of all proportion to those existing before enforced peace.

In many areas some shell ornaments had retained value, and in some parts they were still highly valuable and essential to bride-wealth and other ceremonial display and gift-exchange. Pigs, the nexus between subsistence production and trade, were still an important item in many forms of exchange.

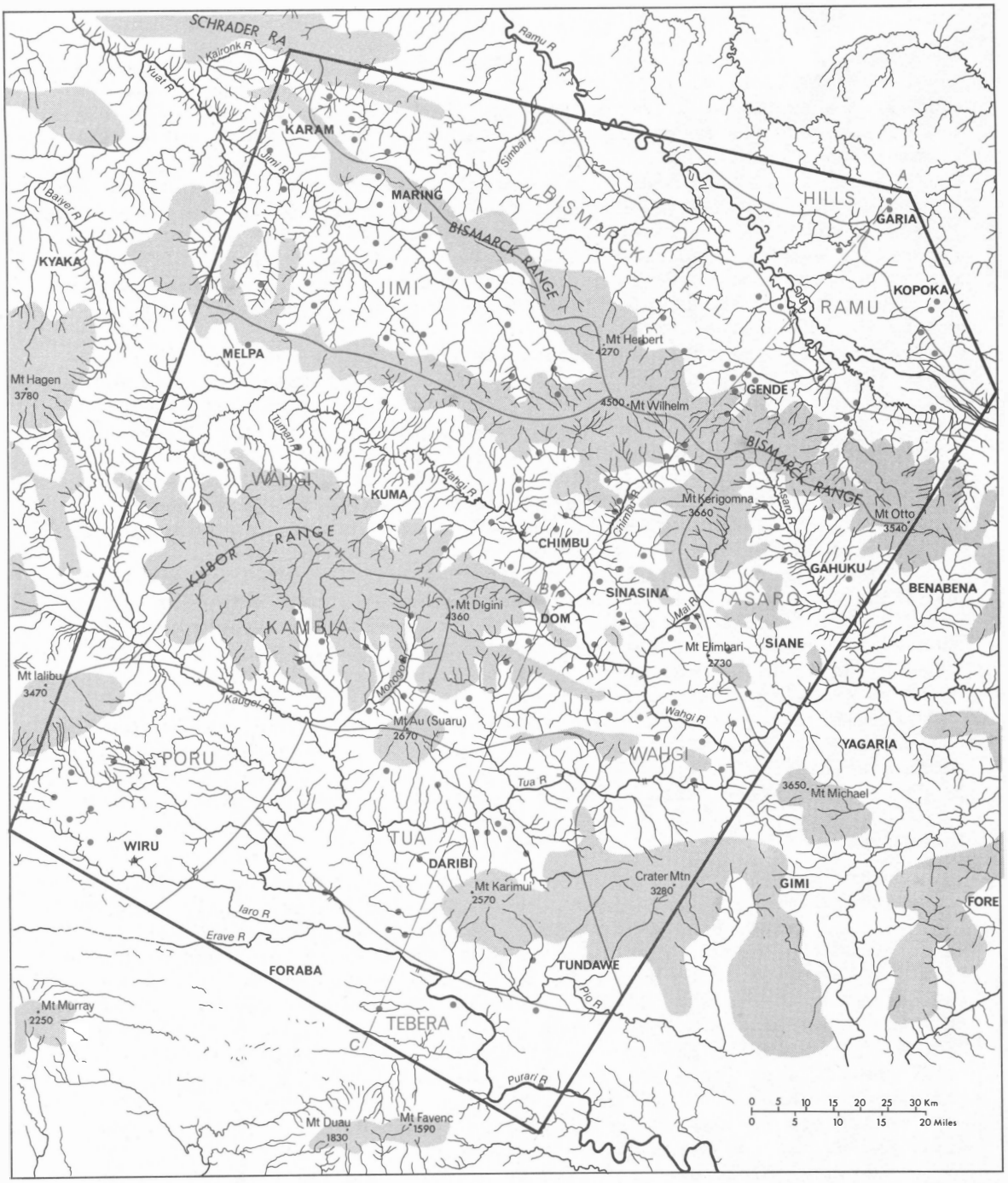
Interviews

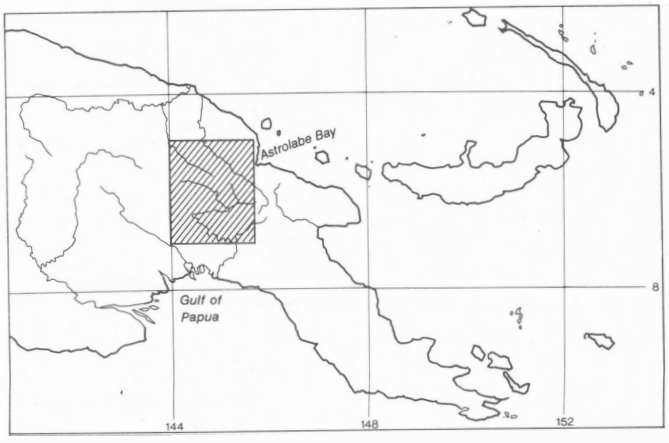
Twelve months were spent collecting participants' accounts of trade and these interviews were the main source of data for the principal period of interest. Working outwards from the highlands, traverses eventually extended north-south from Astrolabe Bay to the Gulf of Papua and east-west from the Asaro Valley to Mt Hagen; detailed interviews were carried out from the northern sub-coastal hills to the Lake Tebera-middle Purari lowlands, and from the upper Asaro to the Kaironk Valley, upper Wahgi Valley and Poru Plateau. Map 1 shows the area and the places where formal interviews were held: the dividing lines are arbitrary boundaries to aid discussion and are explained in Chapter IV. Within this area, groups which have been studied by anthropologists include the Chimbu, Daribi, Gafuku, Garia, Gende, Karam, Kuma, Maring, Melpa, Narak, Siane and Wiru.

Interview points were selected bearing in mind language and tribal boundaries, known exploited resources, stone factory sites, ecological differences, mountain passes and bridges, and the need to re-interview on specific points. More than 300 structured interviews were conducted as well as many minor ones directed to limited topics. In the densely populated highland valleys two or three were possible per day, but in sparsely populated parts interviews were often a day apart and sometimes more.

Verbal statements about the past were both eyewitness accounts and hearsay, but some of the causes of distortion affected both categories and most of the means of testing statements were applied to both.

Informants of 70 years were mature married men in their mid-thirties at the time of the first highlands exploration of the early 1930s. Many men of 60 were already married at that time. Men aged 55 were young warriors in their prime and beginning to take part in trade and ceremonial exchange. Nearly all interviewees fell within this age range and the critical pre-contact period of 1925-30 was therefore firmly recorded in the memories of participants. Recollections of this time were vivid and were recalled with pleasure.





Location of the area shown in Map 1

Main interview sites ●

The stippled area is mountain forest above 1500 m MSL, mainly uninhabited

Line A-B-C is the section shown in Fig.1

Map 1 The study area and regions

The preceding 10 years were covered by an overlap of eyewitness and hearsay accounts and the early years of this century by hearsay only. However, allowing a generation interval of from 25 to 30 years, even informants in their sixties who recounted statements made by their fathers were telling of the experience of men who were mature in the period 1905-10, and for informants in their seventies this period of hearsay was the 1890s. This was the only data which fell into the category of oral tradition in the sense used by Vansina (1965:20), and in all cases was hearsay only once removed.

The problem of relative and absolute dating of all pre-contact and some post-contact events was met by the use of sociological time. By combining continual reference to life-crisis events, especially marriage, child-birth and death, with memories of documented events such as first-contact patrols, police post and mission establishments, recorded killings, major warfare and events of the Pacific war, it was possible to date most statements and to re-evaluate one's estimate of the informant's own age. This last factor was important for the dating of all testimony. In practice, first age estimates tended to be overcautious and had to be revised against the diary of recorded and remembered events and the estimated ages of wives and children present.

Interview Techniques

The area included more than 30 languages (Claassen and McElhanon 1970; Franklin 1968a, 1968b; Wagner 1969b; Wurm 1964; Z'graggen 1968), and of necessity all interviews were conducted in Melanesian Pidgin. With some of the older men and in more isolated parts this required double translation, with its additional hazards of mistranslation. Interviews in each new language area were prepared for with check-lists of some 70 items in English, MP and in a neighbouring language, and the new terms were filled in at the first opportunity. Subsequent interviews used at least two sets of terms, and in Papua word lists included Hiri (Polis) Motu, the trade language widely adopted as the administrative lingua franca.

Most interviews took place in men's 'club' houses, good ones taking two to three hours and some going late into the night. Each began with a formal speech about the purpose of the inquiries, stressing how the old ways were being lost, that young men were no longer being taught the ways of their fathers, that the knowledge of these ways existed only in the minds of old men, and that when they died this knowledge would be lost. It was said that many believed that this was bad, and that it would be better if their knowledge could be written down, so that children brought up in the new ways could one day read what their fathers and grandfathers had done. But it was not good, it was said, that they should read misinformation, no matter how insignificant, and that it behoved all who talked about these things to say only what they themselves knew to be true, so that the children would know how it really was. This was always warmly supported.

Most interviews followed the same broad outline. Undirected statements were recorded first, followed by general questions about topics, but not specific objects. This provided a first testimony that was the work of the informant alone and methodologically different from data gathered later by directed questions. Although question-and-answer testimony is the product of two people and condemned by Vansina when applied to true oral tradition (1965:29,30), it was a valuable technique for the recent time period considered here, and especially so for the eyewitness accounts. Questions of the 'yes-or-no' type were rarely needed.

The early part of the interview was also used for recording names, descent, marriage, offspring, and for leading into a discussion of bride-price and other transfers of property, all needed to provide time referents and for later cross-checking of statements about goods and values. After questioning from check-lists, local artifacts were examined, and finally my own sample collection was produced and commented upon by informants. Although the interviews were planned, the degree of informality was adjusted to suit each speaker, new lines of inquiry being followed up as they arose.

Almost invariably an informant began by assuming ignorance on the part of the interviewer, in spite of the fact that one would have expected him to

think that similar questions had probably been asked of others. This was most useful, for not only did it help the objectivity of the undirected testimony, but information offered at this stage tended to be elementary and basic, enabling initial veracity to be evaluated. As Bulmer has pointed out (1969:11) the quality of information improves when the informant recognises some expertise in the questioner, for as it became obvious that objects and trade could be discussed with much common ground, detail, complexities and local peculiarities were brought out. Some of the most productive discussions were with groups of two or three old men together, a technique frequently possible in the highlands but difficult in the sparsely populated lowlands where old men were sometimes hard to find. Fortunately, these are the areas most recently brought under government influence, and all men of middle age had taken part in traditional trading.

Reliability

Organised interviews were a protection against failure of memory and were the means of testing internal consistency but the main defence against distortion was provided by external consistency. When testimony was checked by repeat interviews with fresh informants in the same locality, it was without them knowing what had previously been said or who had been interviewed and usually without them knowing in which settlement earlier interviews had been conducted. Consistency within the one locality was matched by consistency between neighbouring localities. As Oliver (1964:310) has said

> ...it is remarkable how well...the main outlines recoverable from neighbouring streams of tradition accord with one another; and it is certain that for the period in question a much wider and more comprehensible range of evidence is preserved in...traditional sources than, for example, in the purely material relics recoverable by archaeological methods.

Artifacts changed in type, in density of distribution and in relative value, over space and over time. Flows of artifacts began, changed direction, met, mingled, separated and ended. Yet despite such incentives to falsification as the desire for prestige and the wish to please, conflicts of evidence were rare, and over the entire area changes were consistent, showing gradients in time sequences and artifact types, quantities, qualities and values.

The reliability of cautiously acquired oral testimony in Melanesia should surprise no one, for many observers have remarked on the correspondence achieved between oral and documentary sources (e.g. F. Panoff n.d.:121,125).

Documents

Three months were spent in New Guinea examining documentary records, especially accounts of first-contact journeys, and interviewing Europeans who had participated in inland exploration. In Australia, historical accounts of exploration in neighbouring areas and the records of the early ethnographers, particularly those who worked in Astrolabe Bay and the Gulf of Papua, were found to be remarkably helpful in supplying the sort of information listed as desirable at the beginning of this chapter.

I believe Bradbury was right when he stressed the importance of oral sources (1964:146) and wrote of the African material:

> ...the testimony of European visitors is scanty, lacks continuity, and is for the most part superficial and biased in content towards the interest of traders, missionaries, and government officials, (and) unorthodox approaches are necessary for getting at the evidence of the past.

Nevertheless, these historical and ethnographic accounts supported the verbal statements well and helped to establish the view of the area and period as one experiencing a truly stone-age economy. They provided valuable descriptions of the quality of initial and other early interactions between representatives of grossly different cultures and thereby supplied a model of the political

difficulties of beginning peaceful exchange with total strangers. The documents vary greatly in quality. For the period after the start of colonial administration in 1884 the most useful are administration reports, particularly patrol reports, and the travel diaries, notes and photographs of missionaries and mining prospectors. Photographs, especially the large number taken by Michael J. Leahy, provide the best record of material culture, showing daily and festival ornaments, weapons and tools, house styles, gardens, fallow and forest, and sometimes the results of warfare. People wearing ornaments may have been photographed more often than undecorated people, but generally in photographs selective observation is at its minimum. They provide a datum line from which to work backwards in time and they are a means of checking statements made by foreigner and native alike about types of goods, their quality, quantity and geographical distribution at the time the observations were made. The journeys they record were historic events well remembered by the local inhabitants, and they provided time fixes to which other recounted events could be related.

SELECTION AND PRESENTATION OF THE DATA

Parts Three and Four describe the study area in terms of its resource differences, outline some of the cultural differences and present a selection of the trade data. Logistic problems prevented any attempt at a total view of neolithic trade: this has not been achieved even for one locality. In this large and complex area the collection of data had to be selective; it became apparent in the first few weeks of interviewing that attention would have to be concentrated on some items and others relegated to a minor place. The context in which goods changed hands was very varied, ranging from apparently unrewarded gifts, through casual barter and planned short trade journeys to large ceremonial prestations, and the number of products exchanged was very great indeed, as Table 1 shows. Certain goods and groups of goods had advantages for revealing particular aspects of trade, and the table summarises those of particular significance for this study. Because of their very limited distribution and the existence of a general demand for them some goods were particularly appropriate for delineating long-distance inter-regional trade. Others were significant only intra-regionally or locally. Goods chosen for close inquiry had to be economically important, had to test the supposed ecological basis of trade and at the same time enable it to be placed in its developmental and historical context.

For knowledge of past trade and its relationship to the history of migration and settlement, technological borrowing and technological innovation, we are almost completely dependent on the methodology and techniques of archaeology. Any hope of placing an understanding of early twentieth century trade in the context of its antecedents in the nineteenth century and earlier depended on selecting goods which were also amenable to study by archaeological methods. For this they had to be diagnostic of technology and culture traits, and had to be relatively durable.

Fortunately, most of the goods of highest unit value were also the most durable and they were also the best markers of technological and cultural differences. Furthermore, they were the most widely traded and thus the best indicators of inter-regional relationships, contemporary or prehistoric. Special attention was therefore given to collecting data on stone tools, pottery, sea shells and mineral pigments. Secondary attention was given to the other item of particularly limited distribution and high value, common salt, and two other items of less restricted distribution but high value, cassowaries and bird plumes, especially those of the birds of paradise.

Ornaments of wild animal teeth were said to have been valuable items of trade in ancient times but to have been supplanted first by the teeth of domestic animals and later by shells. In contrast to the coast, ornaments incorporating dog teeth were rare, especially in the highlands. Dog teeth were traded from the northern hinterland to the coast (Hood 1936:25) and there the exchange of animal teeth for shells seems to have been important in terms of high unit value and in total numbers. Other than those made of pig teeth, the only tooth necklace collected in the highlands during field-work contained 94 marsupial teeth, mostly of lowland species, and three dog

Sets of needs	Geographical and ecological		Economic	Historical
	inter-regional emphasis	intra-regional emphasis		
General attributes	Goods that expose the problems of distance and access by being of very restricted natural distribution or manufacture and very wide demand	goods that highlight smaller differences in resource bases including those of forest and farm by being of restricted distribution or manufacture and wide demand	goods that are important because of high unit value or large quantity which are transferred between groups	goods that reflect technological and cultural change by the possession of traits shown here or elsewhere to be distinctive
Particular attributes and categories of goods	localized minerals, for inland areas — marine products, goods dependent on very specialized and localized skills for which a demand exists elsewhere	minerals of discontinuous distribution but general demand, animals and plants of restricted habitat, goods dependent on special local skills for which a demand exists elsewhere	valuables, luxuries, subsistence essentials	artefacts, especially pottery, tools, weapons and ornaments; domestic animals, crop plants, pigments
Goods	stone of implement quality, stone tools, pottery, salt, selected pigments, sea shells	stone tools, pottery, stone of implement quality, potting clay, salt, pigments, mineral oil, sea shells, wild animals and birds, animal and bird products, forest plant products, vegetable oils, crops, domestic animals, medicaments, stimulants	ceremonial stone tools and weapons, other valuable stone tools, bulk salt, valuable ornaments of shell, teeth, and feathers, pigs, dogs, cassowaries, marsupials, special pigments, skins, fur, feathers, vegetable oil, pottery, small containers of salt, minor pigments, mineral oil, specialized luxury crops, forest timber and fibre products, medicaments, stimulants, seasonal staple crops	pottery, stone tools, stone weapons, tools and weapons of wood and fibre, ornaments and tools of shell and bone, pigs, dogs, crops, pigments
Aspects peculiar to the study areas	no stone raw material traded interregionally	stone raw material trade only very local in one region, no trade in potting clay, only stimulant trade was lime in one region	no trade in seasonal staple foods (unlike sago elsewhere), only stimulant trade was lime in one region	historical research largely dependent on the methodology and techniques of archaeology; therefore durable products most useful; no trade in staple crops.

Table 1 Trade goods of special inter-regional and historical significance

canines (identified by Dr J. Hope, Department of Prehistory, ANU). In the upper Chimbu ornaments of marsupial teeth were said to belong to an older tradition. In the Kaironk they were still common in 1960 (R.N.H. Bulmer pers.comm. 1971) but are now rare.

Ornaments of pig teeth were common throughout the area during the twentieth century and those made from tusks rather than incisors were frequently seen. Most are from domestic pigs and in the highlands this is the rule. Furthermore, though many are old most were made locally and they have not been an important item of trade within the study area this century. Tooth ornaments should survive in archaeological sites and workers in that discipline may yet be able to show changes in ornament style and distribution and in particular may find evidence to support the tradition that in the inland animal ornaments declined in favour of shell.

The pig, in particular the domestic pig, was very important in trade. Pigs were not valuables yet they were of high value and in descriptions of barter and ceremonial exchange transactions they were mentioned more often than any other item as an appropriate payment for valuables. Size was proportional to the value of the other good and pigs had some of the characteristics of a medium of exchange. Rappaport's examination of their

role in the ecology of one highland group (1967 [1968]) illustrated the animal's central socio-economic role and I have previously appealed for a wide-ranging study of the ecology of the animal itself in the context of subsistence agriculture of varying labour intensity (Hughes 1970, 1971). Their special place in social relations is a commonplace of Melanesian ethnology and their critical role in converting production for subsistence into production for exchange must be apparent to all. Associated with pigs in many of their economic and ceremonial functions were dogs and cassowaries raised in captivity. Of the three, only young cassowaries figured significantly in inter-regional trade. In this survey, all that was done with these items was to record their exchange whenever it was mentioned and to note the direction of movement.

While extra attention was paid to traffic in bird of paradise skins and plumes only the bare outlines of trade in other forest products was recorded. These included costly items like live marsupials and their skins, as well as loose fur, birds, feathers and plant products. Forest plant products were traded continually and everywhere were quantitatively important for subsistence; localities with limited alternative resources were dependent on them to pay for imports. Nevertheless, they were the items of least unit value and were the hardest to get any quantitative estimate of. Similar difficulties were experienced with the few examples of exchanged seasonal and prestige foods. The exchange of all plant products, in particular the semi-cultivated forest crops and garden specialities, requires an economic ethno-botanical study of its own. Here, these items are mentioned only in the context of traffic in the major goods.

Stone tools, pottery, shells and mineral pigments satisfy all four sets of criteria listed in Table 1 and their place in trade is dealt with in detail. When it was analysed, the data on the salt trade was found to illustrate a particular aspect of cultural adaptation and it has also been given in full. An excess of data of less urgent relevance has been a considerable embarrassment and a large amount of it remains to be presented later. Hopefully, it will help to provide deeper theoretical insights into the place of trading and traders in stone-age society.

The presentation has been divided into three sections; the first is focused on exogenous influences and based on documentary evidence alone, the second outlines the ecological context in which trading proceeded in and around the study area, the third is focused on the technology and traffic of a functioning neolithic trading system and is based primarily on oral evidence and observation supplemented by documentary evidence where it existed.

The first part establishes beyond doubt that in spite of very ancient coastal contacts with post-neolithic cultures and the immediate proximity of colonial administrations for more than 50 years, the subsistence farmers of the study area during the generation before white contact were living a truly neolithic way of life. The second and third parts provide a valid view of some of the economic features of this way of life as expressed through trade, by presenting new information on the distribution of key resources and specialised technological skills, on aspects of the relationship between cultural adaptation, aesthetic preference and production for exchange, and on the extensive traffic that resulted.

II IMPORTS BEFORE THE EUROPEAN OCCUPATION OF 1884

INTRODUCTION

The study area and the principal period of interest have arbitrary boundaries but they exist in a wider context of inter-regional trade, and adjacent coastal regions were involved in overseas trade. Hughes (1974) provides a summary statement and map of these distant trading links. This chapter examines the history of early importations into New Guinea of products and knowledge from post-neolithic societies until the beginning of the colonial period. Goods of metal, glass and porcelain, cloth, new crop plants, pathogenic organisms, methods and techniques and cultural ideas of many kinds were received and all had some effect.

The accurate placing of these introductions in time and space and a knowledge of their local effects and slow diffusion is critical for any understanding of changes in technology that may have influenced production for subsistence and exchange and altered the pattern of trading advantages. Some introductions induced changes in local and regional ecology (cf. Salisbury 1962) and affected patterns of settlement and movements of population. Some seem to have influenced the development and evolution of indigenous artifact styles which are one of the prime diagnostic criteria for contemporary students of New Guinea history, including the history of trade.

The validity of the description of neolithic trade presented later depends in part on establishing that although products and influences from metal-age Asia and industrial Europe were received by coastal New Guineans many years ago, and in some areas, centuries ago, the few that reached the study area before 1900 did not even begin to bring an end to the stone-age. It has to be demonstrated that the few that penetrated this area by the end of the main period of interest, 1933, were merely the precursors of the technological changes that began in the thirties and became profound after the Pacific war.

The contacted parts of the littoral were not far from our study area in terms of the distances and speeds of travel of seaborne trade, including indigenous canoe trade, but in terms of the speed of travel of rare goods in inland New Guinea they were effectively far off.

On many parts of the coast the new imports first arrived in the hands of representatives of the cultures that made them but in other parts of the coast and in all of the inland the goods first arrived in the hands of New Guineans. For most of the mainland and for all of the study area the sequence of innovatory influence was first of all the products, followed by the strangers and then by a growing awareness of their novel ideas and ways. In general, a penumbra of trade goods of a new type preceded the frontiers of navigators, merchants, missionaries, explorers, miners and colonial administrators.

On the northern, western and south-western coasts and their immediate hinterlands, the new products and people were Asian. Here the first introductions of goods could well have been 1,000 years before the arrival of the first Europeans, and the first visits from Asian traders may have been hundreds of years before the first Portuguese and Spanish voyages. The archaeology required to establish the antiquity of these contacts has barely begun.

On the north-eastern, eastern, south-eastern and southern coasts, the strange products and people were European and the earliest introductions were less than 400 years ago. Had the Europeans not begun to dominate the coastline when they did, Asian goods would have spread further around and into New Guinea with the extension of Chinese trading voyages and 'Macassan' fishing voyages.

For most of New Guinea the basic technological change when it began was directly from stone to iron, without any knowledge of other metals. However, in the north and west it was accompanied by bronze and probably porcelain, and everywhere on the coast it was accompanied by glass beads and cloth, at first Asian, later European. In the eastern half of the country the first iron received was accompanied by very little other metal; the little brass,

copper and bronze that was obtained was mainly gathered from wrecks or pilfered from visiting ships. In nearly all the inland the fundamental change was directly to steel with little soft iron and no other metals being used. Inland, beads and cloth did not accompany the steel but came later, usually with the Europeans themselves.

In reviewing this secular, serial and often spatially discrete process, it is necessary to briefly examine pre-European cultural influences, the evidence for which is partly documentary, partly inferential from the documents and archaeology of neighbouring areas, and in part consists of artifacts found in New Guinea but not yet found in a datable context. These influences result from imports and possible visitors from bronze-iron-age south-east Asia, China and the eastern part of the Indonesian archipelago. The question of the possible effects of 'Macassan' fishermen on the south coast is an allied one.

European exploration must be examined more closely not only because its documentation precisely locates introductions in time and space but because it also explains a number of associated phenomena. Documents describe the nature of initial and subsequent contacts from the point of view of the intruders and complement verbal accounts given later by the indigenes. Detailed descriptions of the inhabitants and their culture or of the nature of the communication established are rare; most consist of passing references to ornaments and clothing, goods got by barter, warfare and the difficulties of opening communication, and often dismiss the visitor's contributions to the local economy as 'a few trifles'. Even the early ethnographers often failed to mention their own gifts with any care. But looked at over a long period the many small descriptions gradually build up a picture of increasing clarity, supplementing the records from the short period of inland exploration after 1900.

The view that emerges shows the usual pattern to be initial hostility, wary appraisal, attack by the New Guineans, a strong response from the intruders, flight, an armed truce, cautious communication and exchange of wares. In inland New Guinea the period of appraisal tended to be longer and in the densely populated valleys of the highlands the attempt to plunder the goods of the visitors more often occurred on the second or third confrontation. In the inland, too, the visitors sometimes robbed gardens.

Initially each group was totally ignorant of the other with no comprehension of the other's appearance, manners, language, material possessions or intentions. This handicap lasted longer for the indigenes, for only repeated or prolonged communication could reduce it and those who travelled learned most quickly. One group of Europeans might make five contacts on the coast in a month but for most of those contacted it was a unique experience, without precedent and totally unexpected, often shocking, and with no expectation of being repeated. In the earliest times it was not repeated for generations, until the memory had been lost, and in the nineteenth century even many of those in geographically favourable locations did not see another group of strangers for a generation.

Usually, the visitors were prepared for barter, and the locals prepared for war. There was no question of mutual need. The visitors often needed water and food, some wanted products of the forest and sea and local manufactures and a few even collected people. Later some wanted the locals to change their customs. But the New Guineans did not need or want their visitors; for them, the initial hostility and attack as well as subsequent attempts to kill the strangers and seize their property were sanctioned by the traditional reality that strangers were in fact enemies.

The locals were disadvantaged most by ignorance of the visitors' intent and the visitors were handicapped most by ignorance of the local rituals appropriate to the opening of trade relations with non-kinsmen. In these circumstances, each group had to learn respect for the other's ability to defend themselves before peaceful communication could be opened. In effect this meant almost invariably that it was the New Guineans who had to learn of the defensive ability of men with muskets reloaded from the protection of ship's bulwarks and the terrible destructive power of ship's guns. As Shineberg has pointed out (1967:170; 1971) it was not until the late nineteenth

century that European civilians on foot really had firepower superior to that of practised warrior bowmen. In some early bloody encounters it was only the element of surprise and shock that carried the day for the Europeans.

Europeans tended to indicate peaceful intent by showing articles intended for barter but these were of no recognisable value to New Guineans. It was the most useful and valuable objects, axes and knives, that tended to be most often displayed, but ironically these were the most difficult to comprehend; in contrast, coloured cloth and brightly coloured beads were obviously desirable. In parts of the highlands, men at first and even second contact often preferred ornaments to steel, even after the superior cutting ability of steel axes and superior edge-holding ability of steel knives had been demonstrated. They already had stone axes of good efficiency and established high value, and wanted the bright ornaments that fitted so well into their existing system of valuable marks of affluence. Ultimately the greatest problem everywhere arose from conflicting views on appropriate spheres of exchange. It was understandable that ornaments and implements would be tradeable but in native eyes no one would exchange such things for food. Yet it was often food that the strangers wanted most.

A variety of established gestures suing for peace and indicating peaceful intent on the part of the New Guineans was readily understood by the Europeans. Once a truce had been established and gifts exchanged, subsequent events depended on a variety of factors and the pattern of interaction became more complex. New needs and wants developed among the indigenes but mistrust of intentions and fear of the unknown persisted. Even after relatively relaxed conditions of trade developed, there were many interruptions. Breakdowns occurred through misunderstandings on both sides, through lack of concern for local custom on the part of the newcomers or contemptuous disregard of propriety and protocol, or positive ill-will on either side. The visitors were always highly conscious of their technological superiority, usually convinced of their moral superiority and often believed in their racial superiority.

Long-term continuing trade was frequently sacrificed to quick gains, particularly on the part of the indigenes, who had little reason to believe that these or similar visitors would come again. Custom sanctioned pillage, and the taking of lives and often heads was a means to fame and often a requirement for status. The final establishment of relatively stable and enduring trading relationships occurred in different ways and with varying speeds in each locality, sometimes aided by existing indigenous trading systems and sometimes hindered by them.

It is significant that the ultimate motive that enabled peaceful intercourse to be eventually established across the huge cultural gap between foreigner and native was the desire for commerce and that subsequent tolerance of continued foreign presence was largely due to a desire for material things. The documentary and oral evidence alike show that in spite of the other social benefits accompanying traditional stone-age trade in New Guinea, it was the same motive that permitted the development of a great network of trade routes from coast to coast transcending the formidable barriers that continued to exist between thousands of mutually hostile groups. The factors common to both stone- and steel-age trade emerge piecemeal but sharply from the scattered historical records.

The literature of exploration is extensive and the only voyages and overland journeys that are considered here are those that could have affected the material culture and trade goods of the peoples neighbouring the study area, those that contain information on prior material culture and technology, and those that contribute to our understanding of the nature of contact between culturally diverse groups and the opening of trading relations. In the movement of trade goods, as in the diffusion of all artifacts and cultural traits, distance travelled is obviously directly related to time; as the main period of interest is approached, the area to which attention must be paid contracts. Because of the probable antiquity of New Guinean coastal canoe trade, goods introduced to Geelvink Bay 500 years ago are relevant. One hundred years ago only those introduced in Astrolabe Bay and the Gulf of Papua are relevant. The gradual spread of the knowledge of iron can be traced

with surprising accuracy in the numerous but individually often insignificant accounts of the navigators and early explorers.

Compared with the freely ranging foreign ships the coastal canoe trade moved goods relatively slowly, and the trade was seasonal. It is fundamental that it was not until the new imports ceased to be rare goods that they began to be traded in significant quantities by New Guineans. This was especially so with utilitarian items - iron pieces, axes and knives - a generalisation unaffected by their parallel status as valuables. For all items a degree of local saturation had to develop before they moved out into the traditional trading networks.

Inland, the division of the population into small mutually hostile groups and the absence of specialised traders combined with the shortage of supply to prevent exotic imports from entering the study area until the late nineteenth century, from reaching south of the Ramu River until after 1920, and stopped all but a little steel from being traded further inland before 1930.

This chapter surveys the process until the beginning of the foreign occupation of eastern New Guinea in 1884 and Chapter III covers the period to the second world war. Maps of the better known voyages are included in the major surveys of relevant exploration by Collingridge (1895), Wichmann (1909, 1910), Klein (1953) and Sharp (1960, 1963) but these studies have many gaps and do not focus attention on the topic with which we are concerned, the commencement and growth of a peaceful import trade and the technological impact of foreign introductions. Table 2 is a list of the main events and the pages on which they are discussed.

Table 2 Pre-colonial contacts

Page	Date	Place	Comment	Means
15	B.C.?	N & W coasts	bronze	?
	early A.D.?	coast & inland	Dongson motifs	?
16-17	early A.D.?	N & NW coasts, NW inland	Asian glass	?
17	500–1500	W & NW coasts?	various?	Asian sea trade?
18	ancient	all coast except SW	Asian products, styles	indigenous canoe trade
	16th C.	W & NW coasts?	glass, metal, porcelain?	Chinese ships?
19	16th C.	W, NW & N coasts?	Asian & Europ. glass, metal	European ships
	1606	SE, S, SW, W coasts	violence, kidnapping	Prado & Torres
20	1606	SW coast	iron? sailors killed	Jansz
	1619	"	" " "	Dutch
	1623	"	iron gifts, sailors killed	Carstensz
		Fred. Hendrik Is.	iron wanted & known	"
		Cape York	iron known?	"
	1616	NE coast	metal unknown, violence	Schouten & Le Maire
		N coast	peaceful trade, iron, glass	" " "
	1644	SW & Cape York	?	Tasman
	1642	NE New Ireland	Iron unknown, gave nails, beads, cloth	"
21		N coast	eager for metal, beads	"
	1645	NW coast	?	Vries & Vischer
	1663	SW coast	?	Vinck
	1678	SW coast	?	Keyts
	1700	W coast	peaceful trade, metal, cloth	Dampier
		S coast	negative evidence against	Macassans
22	1800	SW Carpentaria	iron familiar	"
	c.1700	N Australia	Macknight & Thorne	"

Table 2 (cont'd)

Page	Date	Place	Comment	Means
	12th C.	N Australia	archaeology, C.14	Macassans?
	1700	Bismarck Arch.	iron, glass given	Dampier
23	1705	Geelvink Bay	men taken to Batavia	Weyland
	1722	Islands off N coast	visit	Roggeveen
	1730	" " " "	visit (5th)	Wiggers
	1750s	Cape York	varied contact	Dutch
	1767	SW New Ireland	trade, nails, hoop? wanted	Carteret
		Admiralties	attacked	"
		Pegun Island	iron in great demand	"
	1768	NE New Ireland	attacked	Bougainville
		Hermit & Ninigo	ignored	"
	1770	SW coast	attacked, no iron	Cook
	1775	NW coast, Geelvink	iron, china, glass, cloth traded for bird of paradise, spices and sea products	Chinese
23-24		NW coast	sophisticated by Moluccan trade	Forrest
24	1791	NW coast	more European contact	McCluer
	1793–5	NW coast	European colony	English
	1789	Torres Strait	contact avoided	Bligh
	1791	" "	violence, canoe trade seen	convicts
		" "	fish hooks, needles, traded	Edwards
		" "	salvage from Pandora wreck	"
	1792	" "	attacked, defeated, eager trade for iron	Bligh, Portlock, Flinders
25	1791	SW New Ireland	iron unknown, unwanted violence then trade	Hunter
25-26	1793	Papuan Gulf,	no contact	Bampton & Alt
		Torres Strait	attacked, reprisals, iron wanted	" "
26		d'Entrecasteaux Is.	iron unknown, trade	d'Entrecasteaux
	1795	Is. off NE coast	possible contact?	Raven
	1802	Torres Strait	iron wanted, armed trade wanted larger items	Flinders
	1805	SE coast, Gulf	attacked	Coutance
	1810–30	Torres Strait	probable communication	at least 20 ships
		N coast	" "	at least 5 ships
27	1823	NE coast	no contact	Duperrey
		N coast	probable contact	"
	1827	NE coast	no contact	d'Urville
		N coast	attacked	"
	1830	NE coast, (Rai coast)	impressed by iron, trade	Morrell
	1834	Is. off N. coast	sophisticated trade	"
		Torres Strait	wreck salvage, survivors killed or ransomed for axes	*Charles Eaton*
	1838	Torres Strait	trepanging	for Malays?
	1840	SE coast	little contact	d'Urville
28		NE coast	iron unknown, timid	Belcher
		Is. off N. coast	vigorous trade, glass beads valuable	"
	1840s	Torres Strait	commercial fishing trade alternating with violence	Malay and colonial
29-31	1843	Papuan Gulf	Europeans and their goods unknown, violence	Blackwood and Jukes

Table 2 (cont'd)

Page	Date	Place	Comment	Means
31	1847	" "	barter, robbery	Yule
31-32	1849	Is. off SE coast	tomahawks and other iron known and wanted	Stanley, *et al.*
32		Redscar Bay	iron unwanted but trade peaceful	Stanley
	1840s–50s	Umboi (Rooke Is.)	mission attempted, failed	Marists
	1860	Torres Strait	big increase in iron, etc.	commercial pearling
	1871	" "	further increase	L.M.S. mission
	1873	" "	steel tomahawks usual now	McFarlane
	1875	d'Entrecasteaux Is.	little iron, but in great demand	Moresby
33	1871	Astrolabe Bay	possible contact	*Emma Patterson*
	1871–2	" "	European goods, friendly communication with visitors and resident scientist	Miklukho–Maclay
	1871	Redscar Bay	European goods	LMS teachers
	1873	Port Moresby	permanent European settlement	LMS Europeans and Pacific Islanders
		SE coast	little iron, but great demand	d'Albertis
	1875	Yule Is.	some knives and axes already, more goods distributed	"
		" "	more iron distributed	Macleay
	1880s	S coast	almost no iron on mainland	McFarlane
	1877-81	SE coast	planned contact, steel, etc.	Chalmers
	1883	eastern Gulf and Purari mouth	" " " "	"
34	1878	Port Moresby area	influx of whites and goods	gold prospectors
	1875–6)	NE coast	little contact, timid	Powell
	1877–8)	N coast	keen to trade	"
	1878	Astrolabe Bay	short visit	gold prospectors
	1881	" "	" " few goods	Romilly
	1883	" "	" " " "	Miklukho–Maclay
	1880–85	NE coast	v. few European goods	Finsch
	1884	NE coast	permanent settlement	Neu-Guinea Kompagnie
		SE coast	formal administration	British officials

IMPORTS FROM BRONZE-IRON-AGE ASIA

Metal, Motifs and Style

In the Philippines, Borneo, and the rest of the Indonesian archipelago, as in most of east and south-east Asia, there was no distinct bronze-age but a transitional period, termed broadly *Dongson* culture by Heine-Geldern, when copper, bronze and glass ornaments were associated with either polished stone tools or iron, and where iron technology diffused swiftly once it was introduced (Cheng 1969:8, Fox 1967b:93; van Heekeren 1958:1).

Bronze axe and spear heads and other objects of *Dongson* type have been found in New Guinea on the Vogelkop peninsula and at Lake Sentani behind Humboldt Bay on the mid-north coast (de Bruyn 1959, 1962). They are all essentially surface finds and no archaeological excavations have been reported but some iron may yet be found associated with them, though it is not so durable. A brass dagger hilt from Sentani may well have held an iron blade (de Bruyn 1959:3).

Iron was in use in the Philippines by 200 A.D. (Fox 1959:24; Roces 1968: 19) and in Borneo by 600 A.D. (Cheng 1969:17, 18) and probably much earlier since the Chinese were using cast iron as early as 700 B.C. and Chinese pottery

made in 45 B.C. has been found as far south as Sumatra (ibid:1, 19). Although Timor was far from the centres of Indonesian culture it may have received metal tools 3000 years ago and by 2000 years ago metal may have been sufficiently common to have replaced stone for most purposes (Glover 1969b:24, 25). Iron was in common use among the Chinese and Indian traders who voyaged to the Indonesian archipelago in early Christian times (G. Clark 1962:205).

Although prehistoric metal artifacts have not yet been found in New Guinea east or south of Humboldt Bay, a number of workers discern south-east Asian bronze-iron-age influences in eastern Melanesia. Golson mentions evidence for the occurrence of the 'S' spiral and 'ship-of-the-dead' *Dongson* motifs on shell and stone objects in south-eastern Papua and of the bird motif on stone mortars and pestles widely distributed in inland New Guinea (1972a: 584-8). The 'S' spiral and modified 'ship-of-the-dead' motifs are prominent in May River (West Sepik) art (Schuster 1969) and can be seen on bamboo pipes in inland Papua. Van Heekeren calls the former 'circlets joined by oblique tangents' (1958:98) and these occur on two of the bronze finds in northern New Guinea as well as on carved wooden bowls, gourds and bamboo from northern and north-eastern New Guinea (van der Sande 1907:230, 231, plates III, IV, XXIV, XXIX; Hannemann 1969).

Prehistoric stone implements found inland from the Baliem Valley to north-eastern Papua (including some from within the heart of the study area) have been seen as homologues of metal tools and weapons (e.g. Heider 1969; Bulmer and Tomasetti 1970; Bulmer and Clarke 1970). Possible bronze influences on stone axe and club heads in the highlands of Australian New Guinea have been suggested by S. and R. Bulmer (1964:68, 72). It is possible that the 'planilateral' axe/adzes which are archaeologically recent in this area and which are discussed in a later chapter may have antecedents in the quadrangular axe/adzes found in early *Dongson* sites.

Glass, Asian and European

Prehistoric glass beads and bracelets found on the north New Guinea coast and north-west hinterland are evidence of trade links with the Asian bronze-iron-age. As far east as longitude 141° eight types were distinguished by van der Sande among the beads of white, yellow, green, blue and multi-coloured semi-transluscent and opaque glass collected by the 1902 Dutch expedition. He believed that the coastal canoe trade distributed beads of this type much further east and argued that it was this type that were seen off Biak Island in 1616 by Schouten and Le Maire (van der Sande 1907:218, 221). They also saw earrings of green, blue and white glass, as well as cassava and herbs and Chinese porcelain, and assumed that all had been obtained from Spanish ships (de Villiers 1906:223, 224).

Finsch collected glass beads from Humboldt Bay to the Huon Gulf between 1880 and 1885. Those from the Gulf he recognised as modern and thought that they had been traded there around the coast from Miklukho-Maclay's recent camp on the Rai coast, but, as we shall see, a number of ships had distributed beads in these and adjacent waters. Finsch made no comment on the possible origin of valuable antique red beads that he got at Dallmannhafen (near modern Wewak), but believed that beautiful and highly valued 'mosaic-enamel' glass beads from just east of Humboldt Bay were old Venetian ones brought by Portuguese or Spanish vessels 300 years earlier. He saw that they had achieved a role as valuables similar to that of the Palawan *kalebukub* beads (Finsch 1893:180).

Van der Sande maintained that no beads like those he described from the New Guinea coast occurred in the Murano glass collection and noted that Le Maire was so impressed by the 'Indian' appearance of the beads that he traded European beads for them. Similar green beads occurred on Timor, similar yellow ones on Seram and identical blue and yellow ones in Borneo: he believed them to be of Chinese make and interpreted the Chinese pottery seen in Geelvink Bay and on Biak Island as well as the porcelain reported by Schouten and Le Maire, as evidence of direct Chinese contact (1907:218-23, plates XI, XIV, XV, XXIII). Similar beads found in bronze-iron-age sites in the Philippines are regarded as Chinese by Fox (1967a:49) and as possibly Filipino by Fernandez and Rogel (1968:12).

Between 1896 and 1900 Biro collected two antique blue beads (together with a small lead annulus) in Astrolabe Bay (Biro 1901:56, fig.23, 1). Others in the same collection are red and white, and van der Sande remarked that these, as well as Finsch's valuable red beads from Dallmannhafen, were types not seen in Dutch New Guinea (van der Sande 1907:221).

A highly valued antique green glass bracelet of sub-triangular cross-section found at Humboldt Bay (ibid:224, 225, plate XXIII, fig.143) is identical with valuable glass bracelets of Chinese origin reported by European observers in the Indonesian archipelago, notably by Rumphius in 1740, and occurring as close to New Guinea as Seram and the Kei, Aru, and Timor Laut Islands. A glass bracelet similar in cross-section to that illustrated by van der Sande is reported from Yap in Micronesia. Together with glass beads, it is said to be probably of bronze-iron-age, glass ornaments there being older than shell discs and stone money as measures of value (Beauclair 1961:113, 114; 1963:233, 234). Similar bracelets are found in bronze-iron-age contexts in the Philippines (Roces 1968:19, 20; Fernandez and Rogel 1968:12) and in Borneo (Cheng 1969:9).

Van Heekeren gives detailed chemical analyses of prehistoric Indonesian glass beads and sees European affinities in at least some of them from Java, Sumatra and Borneo (1958:40, 41, 71, 72, plate 13). Cheng (1969:9) says that both European and Chinese types occur in Borneo bronze-iron-age sites, the Chinese ones being associated with ceramics dating from before 900 A.D.

The Indonesian Trade

It is clear that during the first millennium of the Christian era and well in advance of the first European voyagers, glass ornaments from Europe, the Middle East, India, China and probably some of local south-east Asian manufacture met and mingled in the Indonesian archipelago, and formed part of the stuff of a flourishing international trade carried on by thousands of small-scale peddlers (van Leur 1967:133). The inhabitants of Geelvink Bay, the coast south of the main isthmus of western New Guinea, and the western peninsulas, had traded turtle shell, massoi bark and nutmegs for metals, pottery and cotton cloth long before 1500 (van der Sande 1907:214).

The vigour and range of pre-European trade in the archipelagos to the west of New Guinea is often underestimated. Van Leur has observed that world trade (outside of Europe) in terms of the traders themselves and the products they handled was very similar in early Christian times to what it was in the seventeenth century (1967:67, 90). Arab traders had settled in south China in the fourth century and are recorded again as being there in the seventh century; they were in Sumatra in 674 A.D., in Java in 1082 A.D. and probably much earlier: other contemporary traders included Indians, Persians, Jews, Armenians and Nestorian Christians. Goods exported from the archipelago between the seventh and fifteenth centuries included all the items later mentioned by Europeans as being offered for sale on the north-west, west and south-west coasts of New Guinea; pearls, areca nut, tortoise shell, cassowaries, bird plumes, parrots, hornbill, benzoin, nutmeg and black slaves. Papuan slaves were found in Java in the tenth century (van Leur 1967:90-111). However, all of these items were available from the eastern islands of the archipelago.

Chinese documents describe Arab sailings between China and the Philippines in 982 A.D. and in 1225 A.D. tell of an expansion of this trade, a trend that reached a climax in the fifteenth century (Fox 1967a:41, 42, 58; 1959:26). In the same period expanding political hegemonies facilitated trade within the archipelagos. In the eleventh century the Sumatran empire of Sri-Vishaya spread cultural influences as far as Ceylon, Formosa and the Philippines and was replaced in the fourteenth century by the Javanese power of Madjapahit. This in turn waned under pressure from the Chinese Ming fleets at the end of the fifteenth century (Fox 1959:27-9). Connections to the south were already well established. Pigafetta noted that Filipinos used some Malay words and were able to supply pilots to guide the Spanish to the Moluccas. There they learned of the heathen 'Papuas' inhabiting Halmahera and among the gifts received for the King of Spain were beautiful birds, plumed, from the terrestial paradise (Nowell 1962:136-222).

In the sixteenth century southern Halmahera and the western shores of New Guinea recognised Tidore as suzerain. The centralised Ternate regime had

governors on Seram and Ambon when the first Dutch trader established himself on Banda in 1599 and the rulers received tribute from as far as the Aru Islands 500 miles to the south-east (van Leur 1967:143, 175). Vogelkop, accessible without losing sight of land, was only 100 miles away and was probably incorporated by this time.

THE COASTAL CANOE TRADE

The New Guinea coastal canoe trade was probably extensive then and even earlier. Much is known of this trade between the mainland and its major island neighbours during the past 100 years, especially with Cape York and the Torres Strait Islands (see particularly Haddon 1935), the archipelagos of south-eastern Papua (see particularly Malinowski 1922; Lauer 1970b), Bismarck Archipelago (see particularly Harding 1967) and Geelvink Bay (van der Sande 1907:215, 216). These essentially overseas systems were linked with several large trans-coastal ones, those of the Motu and Mailu being well known (see, for example, Chalmers n.d.:3-33; Barton 1910; Malinowski 1915; Williams 1932: 139-44), sometimes directly and sometimes through many regular local systems embracing the coast and small groups of offshore islands (see, for example, Hogbin 1935; 1947; 1951:81-92; Harding 1967:195-200). A most important route for our purposes was the regular connection between Geelvink and Humboldt Bays (Cheesman n.d.:38). In Malinowski's view it was 'certain that the Mailu community was one of the very important links in the great chain of inter-tribal trading which encircled the whole of Papua' (1922:629). Only the south and south-west coasts, lacking offshore islands apart from those of Torres Strait and lacking Austronesian settlers, had no trans-coastal canoe trade.

It is highly probable that similar trade occurred between the western peninsulas of New Guinea and the eastern islands of the Indonesian archipelago (especially with Halmahera via Waigeo Island but also with Misool, Seram and the Kei and Aru Islands) and that these were joined with the Geelvink Bay system by short-haul links. It is likely that the first glass and metal reached New Guinea and some distance along its north-west coast as locally-borne goods on the fringe of the highly developed Asian trade area before the great expansion of Chinese and European voyages.

POSSIBLE CHINESE VISITS

During the sixteenth century Chinese ships were large and ranged far afield. By 1596, a year after the Dutch arrived at Bantam, eight or nine large junks came from China each year and others visited different ports; some were more than 600 tons, larger than European vessels trading there (van Leur 1967: 130). Ten years later Prado was told that Chinese ships came to the area of the west coast of New Guinea to barter for gold and black pepper (Stevens 1930: 179). Morga listed rich Chinese cargoes in the Philippines in the early 1600s, annual fleets of 30 to 40 junks bringing manufactures that included beads of all kinds and colours, many of which were later diffused south through the islands (1868:339).

Spanish settlement in the Philippines stimulated a general boom in trade throughout the Asian archipelagos and in particular brought a further expansion of Chinese trade (van Leur 1967:122). It is possible that Chinese ships visited the north coast of New Guinea during the sixteenth and seventeenth centuries, but there are no known Chinese references to early contact there (Wang Gung-wu pers. comm. 1970). Cheesman believed that Chinese traded for bird of paradise skins along the north coast as far east as Humboldt Bay for at least 200 years before the Europeans became involved in this trade (n.d.:36).

EUROPEAN GOODS IN THE 16th AND 17th CENTURIES

Both Chinese and European glass ornaments were almost certainly distributed along the west, north-west and north coasts in the sixteenth century by Portuguese and Spanish ships, and they probably also distributed some metal goods. Ships of both nations brought ornaments and metal objects from Europe to the Far East and acquired Chinese ones there by barter and piracy. When

Magellan's ships traded for cloves with Tidore, they paid partly with pirated Chinese goods (Nowell 1962:208).

De Abreu was off the west coast in 1511 and Serrano lived in the Moluccas for nine years from 1512. Under the protection of the Muslim ruler of Ternate he may have visited Waigeo and the Vogelkop Peninsula (Trotter 1884:196, 197; Nowell 1962:15-18). In 1526 Menezes stayed on or near Vogelkop for some months and two years later Saavedra sailed along the north coast, spent a month ashore somewhere between Waigeo and Biak Island, took three prisoners from west of the Admiralty Islands back to the Moluccas, and in the following year returned over the same route as far as Manus (Klein 1953:45; Sharp 1960: 19, 20; Jack-Hinton 1972:250).

In 1537 Grijalva's ship visited Geelvink Bay and was wrecked on an island near there: the fact that the few survivors were ransomed by the Portuguese commander in the Moluccas (Gordon 1951:23; Sharp 1960:24) suggests established avenues of contact.

The Spanish flag was planted on the north coast by Retes in 1545. He sailed near offshore islands as far east as the Sepik mouth and perhaps as far as Karkar Island and had an armed clash with the people of the Ninigo and/or Hermit groups (Collingridge 1895:160-87; Sharp 1960:31, 69). He appears to have communicated with some of the islands at which Le Maire later noted much sophistication (Wichmann 1909: 24, 69, 172) and at which collectors later recovered ancient glass beads.

Contemporary literature and maps reviewed by Collingridge (1895:190-223) and Sharp (1963:4-15), (see also Stevens 1930:17, 20; Klein 1953:10, 11, 45; and Jack-Hinton 1972:250-2) support Trotter's opinion that 'the coasts (of New Guinea) were probably surveyed to a greater extent than is commonly supposed by the early Spanish and Portuguese navigators' (1884:197).

The earliest references to metal in New Guinea are those of Prado and Torres in 1606. At their first landing near the south-east cape of Papua they were attacked and fired arquebuses but near Orangerie Bay they presented a local leader with a Milanese bell in return for pigs (Stevens 1930:137, 147). Bells were a popular trade good with the Spanish; Magellan's cargo included 20,000 of them (Nowell 1962:58). However, Prado and Torres did little to encourage trade in New Guinea. Near the mouth of the Lakekamu river their landing was opposed, so

> seeing that we were losing time by treating them with further consideration we knelt down and saying a Pater Noster and an Ave Maria, Cierra España, (the ancient Spanish war cry) we gave them a Santiago, (an attack with invocation of St James) and in that skirmish some fell dead, and we seized their gate and pressed on, shooting as they fled;...

Prado records a great slaughter of men, women and children. They kidnapped 13 children who were later baptised in Manila 'to the honour and glory of God' (Stevens 1930:151-5). On an island south of the Fly River they came across a number of women and two men

> and one of the men climbed up a high tree and left a bow and arrows on the ground, and however many signs they made to him he would not come down; they shot at him with the arrows and he caught them all in his hand, an extraordinary thing. At last they let off an arquebuse at him and he fell lifeless. We selected three of the youngest women and put them on board for the service of the ship;... (ibid:159).

Another clash occurred at the entrance to Torres Strait. Off the south-west coast they made the first European observation of strange instruments later remarked by others - hollow canes filled with powdered lime which was blown into enemy eyes to aid capture (ibid:173). Torres said that the lime was thrown out, according to Dalrymple's translation (Torres 1607:40).[1]

In a group of five small islands, perhaps near Misool or Salawati according

1 A recently acquired trait? Fire or lime blown from cane, wooden and metal tubes was a war device used from 400 B.C. to the 12th century A.D. (Carman 1955:2-6). Containers of quicklime were fastened to arrows in the 13th century and powdered lime was thrown from Chinese and Indian pirate ships attacking from the windward in the 16th century. Bamboo tubes were once used as guns by the Chinese (Cipolla 1965:117, 124, 125). However, where betel was chewed in New Guinea, lime was commonly used to ward off evil spirits, and this seems the most likely explanation.

to Prado's narrative but near Triton Bay according to his map and on the mainland according to Torres, they found Chinese hooks and lines, pieces of porcelain, iron adzes and harpoons, and cane bellows with a nozzle of clay for working iron (Stevens 1930:173, 245; Torres 1607:40). (The method was no doubt similar to that observed more than 200 years later near Dorei, described and illustrated by Dumont d'Urville [1834, Vol.2:185, and facing p.163]). It was near here that Dampier nearly 100 years later noticed sticks that had been cut with a sharp instrument and which he interpreted as evidence of iron tools (1729:181).

Earlier in 1606 Jansz lost some of his men on the south-west coast and had some contact with the Aborigines of western Cape York; unfortunately his journal has been lost. In 1619 men from another Dutch ship were killed somewhere on the south-west coast and there, too, four years later Carstensz lost nine of his men, though he had put gifts of iron on the beach (Heeres 1899:4, 13; Sharp 1963:17-20, 24). Pool and three of his crew were killed near the same spot in 1636 (Major 1859:46, 75, 76). It may have been Jansz who introduced knowledge of iron to Frederik Hendrik Island and western Cape York. Of the former in 1623 Carstensz wrote that men in canoes encouraged him to land and showed great satisfaction with pieces of iron and strings of beads thrown to them but did not appreciate other metals; broken iron, bush knives and ordinary knives were in special demand (Heeres 1899:29, 32). He noted too that Aborigines on western Cape York Peninsula north of Albatross Bay were acquainted with muskets and were hostile, seeming to have been fired on by Jansz's men in 1606. A piece of metal thought to have come from the expedition was found in a shelter hut and although the Aborigines picked up iron thrown to them they refused to come close. When they opposed a landing one of them was shot (1899:42, 43).

Further south towards the head of the Gulf of Carpentaria the people were utterly unacquainted with metal of any kind, showed no fear, and accepted gifts of iron and beads. While they were trying to examine the muskets a native was seized to take to Amboina. Next day the crew were attacked and a man was shot; when driven off, gifts of iron and beads were tied to weapons left on the shore but the Aborigines seemed to be quite indifferent to them (ibid:27-42).

The earliest documented introduction of iron and beads to New Guinea was by Schouten and Le Maire off the north coast in 1616. These exchanges were in marked contrast to those that they had with eastern New Guineans though similar to those with Polynesians earlier in the voyage and indicative of earlier local contact with foreign ships. Off New Ireland and north-east New Guinea near the mouths of the Ramu and Sepik metal appeared to be quite unknown; beads and 'trifles' were handed out but the ships were attacked and muskets and cannon killed many (de Villiers 1906:216-22). (Indeed, east of Humboldt Bay, the only metal objects received in significant quantities before the nineteenth century were cast iron cannon balls and lead musket balls. These were received with some regularity on most parts of the coast over a period of more than 300 years. A musket ball may have been the raw material for the lead ring collected by Biro in Astrolabe Bay and van der Sande saw a lead ball in a paddle at Humboldt Bay (1907:202). It is surprising that more evidence of missiles from firearms has not been found.) West of Humboldt Bay Le Maire found evidence of earlier contact, for the natives peacefully and eagerly bartered for glass beads, rusty knives and old nails, talked of the firing of cannon, and tried to enlist help in killing their enemies (de Villiers 1906:222-4).

In the south, after Pool's death in 1636, his ships visited the western end of the north coast of Australia, an area important for evidence of possible Macassan influence on southern New Guinea. Though they stood close in and went ashore in many places they saw no Aborigines (Heeres 1899:67). The north-east tip of this coast had been charted by Colster in 1623 after he separated from Carstensz but only the chart survives (Sharp 1963:53, 54). Although the journals have been lost, we know that on his second voyage to the New Guinea coast in 1644 Tasman had some contact with the inhabitants as well as with the Carpentarian Aborigines, for a composite chart shows that he sailed close to the shore and anchored many times near Frederik Hendrik Island, Prince of Wales Island and around the Gulf of Carpentaria and Arnhem Land. A 1705 geographical work tells of an attack on Tasman's men but the anecdote is probably a blend of

incidents as it puts bows and arrows into the hands of bark-canoe-using Aborigines at 17°12' south latitude (Sharp 1968:324, 332) where such weapons are unlikely to have been.

Prior familiarity with or ignorance of iron were clearly shown in the records of his earlier voyage during 1643. Both he and members of his crew wrote of the response of Polynesians and Melanesians to their gifts. In contrast to central Polynesia, the people of Tabar Island and the north-east coast of New Ireland did not esteem nails, although they accepted them together with strings of beads and old cloth (Sharp 1968:50, 198, 210-18). Trading with the islands between Humboldt Bay and the Mamberamo River where earlier Spanish and Dutch visits had produced a great desire for metal and for beads, was quite different. At Iamna and Moar Islands alone, his two ships got 6,000 coconuts, 100 bunches of bananas, as well as fresh and smoked fish and some artifacts. On the last day of their stay the coconut supply was low, the nuts small, and when they left a sailor noted that the locals seemed relieved. But at the rate of five or six nuts for a nail and 12 to 14 nuts for a piece of rough hoop-iron sharpened into a knife and fitted with an improvised wooden handle, the inhabitants of these two small islands must have received scores of iron pieces and hundreds of nails as well as many strings of glass beads. It is likely that these early seventeenth century beads were of Chinese make, for those used earlier on the same voyage at Tongatapu were described as Chinese (ibid:153, 236, 237, 240, 302).

In 1645 Vries and Visscher sailed along part of the north coast; the south-west coast was further explored in 1663 by Vinck and in 1678 by Keyts (Wichmann 1909:102, 109-11, 116-20).

During the seventeenth century more industrial products may have reached west New Guinea via the coastal trade from the Moluccas, for in 1624 the Dutch negotiated a trade treaty with the chiefs of the Kei and Aru Islands and by 1636 this included the coast of New Guinea (Gordon 1951:27). By the end of the century European influence through intermediaries had been felt for a long time and when Dampier made friends with people on a small island near McCluer Gulf he received in return for knives and calico a variety of introduced foods including pawpaws, oranges, pineapples, 'potatoes and other large roots', as well as native nutmegs, which were highly prized by the vendors who were well aware of their value in the spice trade. The chief ornaments were blue and yellow beads. The people told him that they sailed to the mainland for slaves and other goods which they exchanged in Goram for calico (Dampier 1729:183-6).

MACASSANS ON THE SOUTH COAST

A question that has not been answered from historical documents but which may still be answered by archaeologists is whether fishermen or traders from the Indonesian archipelago visited the south coast of New Guinea and Torres Strait ahead of the first known Europeans, Jansz, Prado and Torres, or during the century that followed.

Though it is negative evidence, Prado's account suggests that there had been no prior contact. While he wrote of iron and iron-working on the far south-west coast he made no mention of it elsewhere. The encounter at the eastern entrance to Torres Strait has already been mentioned: more than a month was spent working west through the islands and shoals but only one further incident occurred when a small attack by canoes was driven off by shooting. No metal objects seem to have been given or asked for (Stevens 1930:161, 165).

At Cape York itself, 160 years later, Cook and Banks found no knowledge of metal and Banks remarked that the Aborigines had no idea of 'traffick' and could not grasp the idea. (One of the group had a bow and arrows showing that within their own sphere they travelled and trafficked well enough.) But in 1770 they were neither given nor did they ask for iron (Beaglehole 1962, Vol.II:109-25). We know, however, that some iron was handed out close by on the north-western shores of Cape York in the first half of the previous century (as outlined in the previous section) and the conclusions of Cook and Banks show that when the quantities of novel goods were small or the time lapse more than three generations their effect was completely lost.

The evidence of Macassan visitors to north Australia may yet prove to be

pertinent though at present it is ambiguous. Flinders recounts that in 1803 Aborigines near Groote Eylandt knew what bows and arrows were and had names for them, though they did not have any themselves (1814, Vol.II:215). The Macassan fleet that Flinders met did not have bows; had Aborigines already accompanied Macassan praus to Torres Strait or to the western islands of Indonesia? We know that Macassans had been as far as the Wellesley Islands at the head of the Gulf and had familiarised the Aborigines there with iron (ibid:137-83). The Malay captain told Flinders that they had been fishing these waters for only about 20 years, a figure later supported by the governor at Kupang (ibid:231, 257), but ethnographers think that this is a serious underestimate (Warner 1964: 448; R.M. and C.H. Berndt *et al.*, cited by Macknight 1969:378, 379). By 1840 it was said that Macassans occasionally visited the southern shores of the Gulf, and it was clear that Australian Aborigines were easily recognised by the people of Timor who had seen them returning on Macassan vessels (Stokes 1846, Vol.2:185, 326, 356).

It was known in London in the 1760s that Bugis were accustomed to sail to the Australian coast (Fry 1969:85), which casts doubt on the accuracy of the statements made to Flinders. Modern Aborigines had a tradition that the Macassans were preceded by a different people called *Baijini* who fished and traded for trepang (bêche-de-mer), turtle shell and pearls, giving food and cloth in return and from whom they had acquired dug-out canoes. Aborigines were employed on Macassan vessels and some accompanied them to the Aru Islands, Timor and the Celebes (Worsley 1955:2-9).

Macknight and Thorne believe that Macassan or Bugis trepang-collecting voyages to Arnhem Land are 'most unlikely' to have begun much before 1700 (1968:216). In his major study of this industry on the Arnhem Land coast Macknight carefully reviews the literature and the results of his own excavations and repeats this view. He says that the Dutch ships which surveyed the north-west coast of Arnhem Land in April to June 1705 noted the absence of iron and did not, as far as we know, report any Macassans or dug-out canoes (Macknight 1969:385, 391). However, this was late in the year for Macassans and we have no journals from the expedition, only a report compiled from them and from verbal accounts. The report did say that at one place the Aborigines were greedy for linen, knives and beads (Major 1859:166, 169; Heeres 1899:90) which suggests prior contact with visiting ships, though these could have been the earlier Dutch vessels mentioned in the preceding section.

Much of Macknight's argument depends on evidence which suggests that Chinese first began to eat trepang in the seventeenth century and that the trepang trade existed for the Chinese market; but others were eating it in a different fashion by 1775 for Forrest saw New Guineans and Moluccans eating it raw with salt and lime juice on the west coast (Forrest 1779:74). In reaching his conclusions Macknight discounted the radio-carbon dates from his own excavations, which by his own account gave consistent and apparently uncontaminated sequences within and between three sites back to the twelfth century (1969:388-90). If these dates prove reliable, then visitors from the Indonesian archipelago were probably also off the New Guinea coast in Torres Strait long before they were first recorded there in the early nineteenth century.

EUROPEAN AND CHINESE TRAFFIC IN THE 18th CENTURY

Dampier was the second voyager to introduce metal and glass into New Ireland when in 1700 he threw a knife and bottle of beads to men in canoes who were too cautious to approach; they then beckoned him to land and attacked when he refused. Knives and beads were given to men from the Lihir and Tanga groups and Dampier remarked that they seemed utterly ignorant of iron (1729:196-202). In south-east New Britain he fired warning shots to frighten the inhabitants and they remained very afraid even after being presented with a knife, beads and glass bottle; they admired his hatchets and axes but refused to trade. In seizing food he wounded some of them and in compensation had two axes, two hatchets (one helved), six knives, six mirrors, a large bunch of beads and four glass bottles placed in a canoe. Along the north-east coast of the mainland he sailed well out to sea and though he saw canoes off Crown Island and Bagabag Island, had no further communication (ibid:207-19).

Weyland explored Geelvink Bay and took Papuans to Batavia in 1705. In 1722 Roggeveen visited Moar and Arimoar Islands, and eight years later Wiggers also called there making the fifth European expedition known to have traded with them (Wichmann 1909:171, 176; Klein 1953:36, 46).

In the south the people of the Cape York Peninsula still showed the 150 year old contrast between those near Torres Strait who retained bad memories of visitors and those further away who were more 'tractable'; two Dutch ships commented to this effect in 1756. Somewhere on this coast a ship's boat and eight men failed to return and were abandoned (Heeres 1899:92-9).

New Ireland was contacted again in 1767 by Carteret who landed on the southern tip and sailed up the west coast. His observations showed clearly which areas had learned from earlier European contacts. In the north the people were too apprehensive to come aboard and 'they had a very watchful eye upon our guns, as if they apprehended danger from them; so that possibly they are not wholly unacquainted with the effect of firearms'. But they traded for things held out to them on sticks and 'seemed to prefer such iron as we gave them to everything else, though none of it was manufactured except nails'. This was a good route, he said, for refreshments of every kind could be got 'for beads, ribands, looking-glasses, and especially iron tools and cutlery-ware, of which they are immoderately fond, and with which, to our great misfortune, we were not furnished'.

In contrast, several hundred Admiralty Islanders came off in canoes but although trade goods were held up to invite them on board they 'threw lances' as soon as they came close. They were fired on and made off and a little later the same events were repeated with a fleet from another settlement. Nonetheless Carteret observed that 'nothing would be more easy than to establish an amicable intercourse with them, as they would soon be sensible that our superiority would render contest vain, and traffic advantageous', shrewdly characterising a sequence of events typical of most coastal contacts and still usual in inland New Guinea 150 years later. Compare his reception 120 miles north of Vogelkop at Pegun Island where ships had called several times and where the population made signs of peace and came on board without the least fear to sell coconuts with 'great joy' for a few pieces of iron.

> I gave one of them three pieces of an old iron hoop, each about four inches long, which threw him into an extasy little short of distraction: I could not but sympathize in his joy, nor observe, without great pleasure, the changes of countenance, and extravagance of gesture, by which it was expressed. All these people indeed appeared to be more fond of iron than any we had seen before, and I am sure, that for iron tools we might have purchased everything upon the islands which we could have brought away. (Hawkesworth 1773, Vol.I:378-87).

At small and isolated Pegun, stone for axes may always have been short and the advantages of iron therefore more quickly seen.

In the following year Bougainville was attacked by men in canoes (though he threw them gifts) off north-east New Ireland where Le Maire and Dampier had been attacked previously. As he passed through the Hermit and Ninigo groups he wrote that fishermen ignored him, a remark unique in the literature of New Guinea discovery. Were they so accustomed to ships that did not stop? The central coast was sighted and followed west apparently without further contact (Bougainville 1967:324-51).

Cook's one contact with New Guineans was on the south-west coast in 1770 and in this area, like so many before and after him, it was short and violent,[1] with no suggestion of the possession of or desire for iron (Hawkesworth 1773, Vol.III:252-4; Beaglehole 1962, Vol.II:142-5). Some of Rees's crew were killed and eaten there 13 years later (Fry 1969:90).

The first documented observation of Chinese ships on the New Guinea coast was Forrest's at Dorei Bay on Vogelkop in 1775. To settlements all around Geelvink Bay the Chinese brought iron tools and cooking pans, bush knives,

1 Though he was there long enough to observe, somewhat differently, the strange 'weapons' described long ago by Prado. Something was thrown to one side which 'burnt exactly like gunpowder, but made no report...those who discharged them had in their hands a short piece of stick, possibly a hollow cane, which they swung sideways from them, and we immediately saw fire and smoke, exactly resembling those of a musquet, and of no longer duration' (Hawkesworth 1773, Vol.III:254).

blue and red cloth, porcelain, and china and glass beads of all colours, and they carried away slaves, Massoi bark, ambergris, trepang, 'tortoise'[1] shell, pearls, parrots, bird of paradise skins and other dead birds.

Through participation in the Moluccan trade sphere the New Guineans of Dorei Bay were relatively sophisticated. Adults were quite unafraid of the firing of the ship's gun, women had brass rings for their ears and men knew of the Seramese massoi bark trade on the south-west coast from which iron crossed the isthmus to Geelvink Bay. One man spoke some Malay. They enjoyed a favourable and jealously guarded trading relationship with the people of the hinterland who supplied them regularly with vegetables in return for a restricted number of axes and knives, a pattern later observed in Australian New Guinea. Domestic fowls were rare and eaten only for feasts. Men were able to name places around Geelvink Bay as far as its eastern shores but this they may have been able to do generations earlier as a result of their own canoe trading system. It is apparent that the Moluccan trade reached little further than western Geelvink Bay at this time for Forrest was told that on the east coast stone axes were still in use and there was as yet no iron (Forrest 1779: 95-113). It also shows that the demand for iron on the western shores had not been satisfied.

Vogelkop was visited again in 1791 by McCluer (Wichmann 1909:250). Two years later the English made the first attempt at European settlement in New Guinea and set up a small colony at Dorei Bay (according to Souter) but after much loss of life it was withdrawn in 1795 (Souter 1963:20-2). The geographer, John Winslow, believes that this settlement may have been much further east. Locating it accurately is critical for the study of diffusion, especially of food crops, for a number of European plants were introduced (Winslow, pers. comm. 1972).

In the last decade of the eighteenth century the rate of contact began a dramatic increase because of the establishment of the New South Wales colony.

Bligh passed through Torres Strait in the *Bounty*'s launch in 1789 but avoided contact with the islanders (Bligh 1792:222). In 1791 a group of convicts sailed around Cape York in an open boat and provided more evidence of visits there by Torres Strait islanders, for when they fired a musket to prevent an attack they received arrows in return, and as they set off across the Gulf of Carpentaria they saw two very large canoes with matting sails, each carrying from 30 to 40 men (Currey 1963:22). Later the same year Edwards in four of the *Pandora*'s boats gave fish-hooks and sail needles to men near Cape York to have casks filled with water but had an arrow fired at his boats and fired a musket in return (Edwards 1791, 2 September; Thomson 1915:22, 76). (Another account attributed to Edwards says that the gifts included knives and buttons from their coats but these may have been the payment said elsewhere to have been made later to Timorese for food.) Bows and arrows are said to have been used by the men who attacked them near Cape York (Edwards 1791, 14 September; Thomson 1915:78, 149).

By the time that Bligh, Portlock and Flinders passed through Torres Strait in 1792 the evidence for local familiarity with iron was beyond doubt - their ships were attacked strongly from each island visited until the supremacy of firearms was recognised, then all bartered for iron. When men from Erub (Darnley Island) were prevented from seizing what they wanted by force they signalled for peace and asked for 'toore-tooree! by which they meant iron' (Flinders 1814:xxi, xxii, xxv); they valued nothing else but eagerly bartered for every kind of iron-work. The same thing happened on Damut (Dalrymple Island) though here Portlock heard the word as 'tureeke' (Haddon 1935:94, 184). Others heard it as 'toorik' and said that the natives were 'frantic when they heard it jingle' - they were delighted with nails and called these and hatchets by the same name. They were not particularly impressed by anything they saw on the smaller of the two vessels and although they were surprised at the size of Bligh's *Providence* they cared for nothing but iron (Lee 1920:180-3, 256, 257).

Haddon interpreted this as evidence of unrecorded trade with other ships between 1770 and 1792 (1935:184). This was possible, but some knowledge of metals could have spread to eastern Torres Strait from 200 years of contacts on the New Guinea mainland and on Cape York and Prince of Wales Island in the

1 The trade term 'tortoise' shell refers to the shell of marine turtles.

western strait, or even around the Carpentaria coast from Macassan fishermen and traders.

It is possible that 'toorikee' or 'turika' was derived from the Malay 'tukar', to barter or exchange, for although Ray 100 years later gave 'tulik' as the generic term for axes, including those with a shell blade, in the language of the eastern strait, by then iron axe/adzes had been the dominant form for at least a generation in that area. He said that 'turika' was the word for iron on the adjacent New Guinea coast and in Kiwai (1907:162, 401). The term may have come with the iron from the islanders. A generation later Riley gave 'turi' as the Kiwai word for canine tooth, and the word for iron as 'mariri' (n.d. [1932?]). It is possible that in eastern Torres Strait, the main supply of iron in the early 1790s came from the wreck of the *Pandora* and possibly other unrecorded lost ships, and that alternatively the traditional term for axe may have become attached to the new material so well suited to axe blades and engravers.

Haddon saw a number of large well-shaped polished stone tools scattered in the bush of the mainland in 1898 and said that the use of stone tools, even of small adzeheads, had been quite forgotten. He estimated that three generations would be needed for this and thought that iron collected from shipwrecks had probably displaced stone about 100 years earlier, a time lapse and loss of knowledge paralleling that postulated above for loss of knowledge of iron in this area prior to Cook. Shell adzes (of *Melo* spp.) appeared to have persisted much longer for specialised tasks (1901:108, 110).

Torres Strait is especially important for this study as it was the source of much of the mother-of-pearl oyster shell (*Pinctada maxima* Jameson) that eventually reached the central highlands, and if iron had been got in sufficient quantities it could reasonably have been expected to move along the same trade routes.

A fine example of the sequence of events which was to become a common experience for both visitors and indigenes even in inland New Guinea was recorded by Hunter during a voyage in 1791. He put in for water to Duke of York Island between New Britain and New Ireland and made what may have been a second or third contact for these people but was their first real communication with white visitors. Initially they bartered cautiously from canoes and filled kegs with water when asked to do so, even pursuing the ship to return one of the kegs. Since this was bound with iron Hunter thought the people scrupulously honest. Honest they may have been but other evidence suggests that they did not recognise iron. The crew was shown where to draw water (under the protection of six loaded 3-pounders) and anxious to complete watering 'without being under the necessity of convincing them of our superiority in arms' the first day was spent in demonstrating friendship and an interest only in water. Both sides kept a sharp lookout that night.

When watering resumed an influential old man rejected all gifts and appeared to convince his people that they should attack. They were 'ignorant of what the musquets were' wrote Hunter, and 'had certainly taken them for clubs'. Eventually muskets and ships' guns were fired, the latter aimed high, producing terror and consternation and all fled. As watering proceeded over the next four days green boughs were waved in friendship by both sides. Finally great gifts were brought and exchanged and the canoes resumed bartering under the protection of green branches, white and coloured cloth being the main request. The journal continues 'they are, I believe, the only people in those seas, who do not set a value upon iron work, in preference to any other things ...nails they would not accept at all'.[1] (Hunter 1793:227-38).

The first known close penetration of the Papuan Gulf occurred in 1793 when Bampton and Alt in the *Hormuzear* and *Chesterfield* tried to find a passage to the north but they made no contact with New Guineans until they reached Torres Strait. They anchored near one of Bligh's anchorages of the previous year close to Erub (Darnley Island) and when boats were sent to find water they

1 They carried lime in small gourds and when hostile 'they frequently take a quantity of this powder into the hollow of the hand, from which, with a strong blast from the mouth, they blow it before them; and at a small distance it has exactly the appearance of firing gun powder, and no doubt is meant as a token of defiance'. Hunter thought that this was what Cook had seen on the New Guinea coast. It is worth noting that he gave these people a pair of pointer dogs and a cock and hen, though he saw they already had domestic fowls.

were surrounded by men in canoes who exchanged weapons for knives and beads and invited them to land. Canoes accompanied them back to the ships without fear and one man came aboard but next day a ship's boat was attacked and three men killed. A search party shot two men and destroyed many huts, canoes and gardens. Loot from the boat was discovered on a neighbouring island together with a spike nail from a government ship, probably one of Bligh's or the *Pandora* or her tender (Bampton 1793:15-40; Anon 1803:23, 24; Flinders 1814: xxx-xliv, Plate XIII; Langdon 1966a:186, 187).

In the same year the eastern archipelagoes were visited by d'Entrecasteaux who said that in the Bonvouloir group the people did not understand the use of iron and in spite of friendly overtures were extremely timid and could not be induced to come on board, though they gave some sweet potatoes and bananas in return for various presents (MacGillivray 1852, Vol.I:174). The islands of the north-east coast from Karkar to the Schoutens were seen by Raven in 1795 but there appear to be no records of contact with the inhabitants (Wichmann 1909:280, 218). In the same decade others are known to have visited islands in the Bismarck Archipelago and on the north-west coast.

HYDROGRAPHERS, NATURALISTS, MISSIONARIES AND TRADERS

In the nineteenth century the traffic in government and private ships increased still further with the expansion of the Australian colony, the growing commercial exploitation of the Pacific and the establishment there of European colonial empires. The number of accounts of contacts with the native population grew quickly. Planned surveys of coastal waters began and, thanks to the growing practice of allowing naturalists to accompany the hydrographers, the first careful descriptions were made of people, material culture and bartering behaviour.

We are now concerned with the last 100 years before the period preserved in living memory and the events and conditions described are less than four generations removed from old men still alive at the time of the field study. Inquiries can now safely be limited to events on the northern, eastern and southern coasts of the New Guinea mainland and its close off-shore islands. In the later part of the period the only relevant events are those in the north between the Sepik River mouth and the Huon Peninsula coast, and in the south between the Fly River and the Motu traders and newly established missionaries and administrators of Port Moresby.

By the time of Flinders' voyage of 1802 the Torres Strait islanders confidently traded for iron instead of attempting to take it by force, as long as they were within range of the ship's guns. They kept their weapons handy in their canoes and on board the *Investigator* the marines were kept under arms, the guns clear and slow-matches lighted, and officers were stationed to watch every movement, one to each canoe. At Mer (Murray Island) men in canoes asked for 'tooree', at first taking anything of iron but later refusing nails; one was given a hammer, nails and hand-saw (Flinders 1814, Vol.II:109).

Two years later[1] the first known European landing on the coast of Papua since the Spanish in 1606 was made near present Port Moresby by Coutance in the *Adele*. A cutter collecting wood on a small offshore island was attacked and pursued back to the ship by canoes; when the incident was repeated, cannon shots forced the inhabitants to the mainland. Coutance followed the coast north-west to the head of the Papuan Gulf and while taking on water, drove threatening natives off by musket fire (Langdon 1966b:83).

Private traders were beginning to exploit the tropical sea products of Australia and Melanesia, expecially turtle shell, pearls and pearl shell, and Trepang. In 1804 a trial shipment of trepang was collected while salvaging wrecks from shoals off the Queensland coast (H.R.A., I, v:8) but this trade could not be profitably developed until the East India Company monopoly on trade with China was broken in 1834 (Shineberg 1967:6, 10).

Off the south-east coast in 1808, islanders could not be induced to trade with Captain Bristow (Purdy 1816:105, 106). At least 20 ships are known to have passed through Torres Strait and at least five sailed along the north coast of New Guinea between 1810 and 1830, and the frequency was steadily increasing

[1] In 1804, not 1802 as given in Jack-Hinton (1972:256).

(Purdy 1816:89, 101, 107; Wichmann 1910:293, 330). At Mer in 1822, Wilson found continuing peaceful trade in old knives and 6-8 inch pieces of straightened hoop-iron. Seven years later, near Melville Island, he was told by Macassans that they fished for trepang as far east as Cape York (1835:75-82, 305-7).

The gradual change from plunder to barter was occurring at different times in different places and at different rates. One of the first areas where this happened within the section of coastline potentially a source of supply to inland eastern New Guinea was Torres Strait. The exchange situations were still essentially those of an armed truce between strangers who in the New Guinea view were presumptive enemies. There were violations by both sides but mutual respect for each other's fighting prowess and mutual interest in the results of barter were now beginning to ensure that traffic was non-violent. The trend was being recognised by the Europeans. Kolff showed that the crews of two small vessels sent from Melville Island in 1824 to trade in the eastern Indonesian archipelago were killed in parts not previously traded with and his translator commented that if they had gone where trade was already known they would have been safe (1840:xiv).

In the north, Duperrey sailed past Manam Island and through the Schouten group in 1823 and in the following year Willinck passed the same way but did not approach the coast until west of 144° east longitude. In 1827 d'Urville retraced much of Dampier's route off the north-east coast, though closer in shore; he named Astrolabe Bay after his ship but did not enter it, passed between Karkar Island and the mainland and continued west, being attacked by men in canoes near Humboldt Bay (d'Orbigny 1859, Vol.II:258; Wichmann 1909, Vol.I: 327-30). The second European attempt at colonisation in New Guinea was made in the following year, when the Dutch settled at Triton Bay on the south-west coast and formally took possession. It was abandoned in 1835 after much death through sickness (Wichmann 1910, Vol.II:7).

The north-east coast was visited in 1830 by Morrell. Off Umboi (Rooke) Island canoes were enticed alongside by showing knives and beads and the occupants seemed very surprised by all they saw. They were excited by the chain plates and heavy bolts and attempted to pull them off and even attempted to cut the links of the cable with 'jasper' axes; failing in these attempts they now 'condescended to resort to honest traffic'. Off the Rai coast canoes brought food and shells to trade, wrote Morrell, and he offered the general advice: 'When natives are once convinced that pilfering is out of the question, and that the vessel is perfectly secure from their attacks, they will immediately turn their attention to trade...' (Morrell 1832:456-61). Four years later he called at much-contacted Moar Island and said that he was politely invited ashore and told that in a month he would be brought much 'tortoise' shell, pearl shell, paradise birds, ambergris, bêche-de-mer, gold dust, ostrich plumes, ivory, camphor, nutmegs, edible birds nests, palm oil, diamonds and more besides (Wichmann 1910:28). His improbable list suggests that Chinese traders had by now travelled as far east as 138° but unfortunately his other writings show that one of his main interests was in persuading wealthy merchants to finance further voyages and he invariably painted the rosiest picture of the wealth to be collected.

In Torres Strait the traffic increased still further and the wreck of the *Charles Eaton* in 1834 boosted the local supply of metal and skulls, some of which were traded to the New Guinea mainland. Most of those who escaped from the wreck were killed, two young survivors being adopted by the people of Mer and ultimately rescued by a search vessel in exchange for axes (Stokes 1846, Vol.1:444-54; Haddon 1935:8-11). A 'New Guinea' canoe was seen collecting trepang near Prince of Wales Island by the ship *Lord Lyndock* in October 1838 (Wichmann 1910:42), presumably expecting Macassan buyers with the onset of the monsoon.

In 1840, Orangerie Bay on the Papuan south-eastern coast, first contacted more than two centuries earlier, was visited by d'Urville. He stood offshore and could not induce visitors in canoes to venture on board and for a long time they hesitated to accept presents floated to them on a plank. They appeared to be unarmed and by signs asked him ashore, but with a sick crew he sailed for Torres Strait, as MacGillivray retells, 'having in seven days made a "running survey" extending over a space of 450 miles in length, without anchoring or

communicating with the inhabitants' (1852, Vol.1:177, 178); though Haddon says that as he passed through the Strait he landed at Erub (1935:12).

In the same year Belcher was told by a man on the southern tip of New Ireland, who spoke a little English, that visits from vessels out of Sydney were frequent. The record of his journey along the north coast of New Guinea is an excellent example of a gradient of increasingly sophisticated trading directly correlating with frequency of contact. On Kairiru Island west of the Sepik mouth some of the people on the beach were openly nervous and some apparently relaxed but all were curious; he suspected they had their weapons concealed in the bush. They showed no particular desire for anything shown to them and he failed to discover what they really wanted in barter though they accepted axes, knives and iron, and despised beads (Belcher 1843:72, 79-81). Unenthusiastic acceptance was normal with those receiving iron for the first time.

Further west at Jamna Island there was no fear or distrust and trade was brisk for bits of hoop-iron and beads, and 'some large blue China [porcelain or Chinese glass?] beads...were singly worth anything offered in the market. *One small blue bead* [his emphasis] was fixed as the price of a cocoa-nut'. The people were good humoured, docile and honest. Though many tarnished bird of paradise feathers were worn, none were offered for barter, so it would seem that their familiarity with glass and metal did not come from plume traders. 'About six inches of rusty useless hoop' would buy a good plate of 'tortoise' shell (ibid:84). Next day in the Arimoar group still further west people

> for a short period trafficked without reserve. Iron hoop had fallen desperately in value, and nothing but knives or beads would succeed. The incautious appearance of a sentinel, with his musket, caused an immediate panic, which we were unable to dispel; and although compelled by calm to anchor close off their village, not a soul came off during the remainder of that day, although they remained in their canoes at a short distance in shore, laden with cocoa-nuts, bananas, etc.

They were as afraid of a telescope as of a musket (ibid:86, 87). Off Japen Island in Geelvink Bay many canoes came out and no one was intimidated by firearms. They came on board without invitation but would not come alongside to traffic, which Belcher thought

> evinced some knowledge of war tactics. We noticed that in their approach they observed a very ceremonious distance and pace in passing the broadside, but on completing the circuit as far as the quarter, pulled up for the stern. They were evidently aware of the use of the ports, as well as the destructive engines concealed within, and that the quarter was the weakest point.

They knew what articles were useful, displayed iron, steel and cloth, insisted on receiving knives or cloth and gave little in return. Accustomed to visits from Europeans, they knew the vessel was English from its colours, were good tempered, independent, and anxious to have the crew visit their towns (ibid: 90, 91).

At this time Dampier Strait was being increasingly used by vessels running between New South Wales and the Far East and some contacts could be expected in the region of the Huon Peninsula, but I can find no records of them. In southern New Ireland, near increasingly frequented St Georges Channel, regular contact and settlement by deserters had already produced a steady demand for iron goods, as noted in 1843 by the surgeon of the whaler *Gypsy* (Maude 1966:194).

In Torres Strait Malays were fishing for trepang on behalf of colonial entrepreneurs before 1846 (*Naut. Mag.*, Vol.15:550) and in that year, a vessel from Sydney was there collecting trepang and 'tortoise' shell (MacGillivray 1852, Vol.1:308). In the following year at least two were there and the captain of one remarked that although the people of the Turtle Islands had some knowledge of firearms they nevertheless attacked and in consequence received two volleys of musketry at five paces. A number of canoes had come south from New Guinea, in search of wrecks it was thought, and they exchanged 'tortoise' shell for iron. In the same year two ships were off the coast of east New Guinea, one fishing trepang, the other whaling (*Naut. Mag.*, Vol.16:117, 174-8, 266).

In the mid-nineteenth century private traders had not yet made much impact on the coasts of eastern New Guinea but the spirit of scientific inquiry combined with idealism, a Victorian conviction of moral superiority and romantic ideas of the 'noble savage' were beginning to produce some novel contact situations between New Guineans and the naturalists and hydrographers of Her Majesty's ships. During the surveying voyage of the *Fly* Jukes described a meeting on the eastern shores of Cape York Peninsula in 1843, noting that presents were given and the Aborigines amused by talking, laughing and dancing, 'as usual' (1847, Vol.I:107). Others who used this music hall performance included Fitzmaurice and Keys in north-west Australia (Stokes 1846, Vol.1:414, 415; Vol.2:frontispiece) and Huxley, MacGillivray and Brierly in the Louisiades (MacGillivray 1852, Vol.1:192, 221; Huxley 1935:184, 197). If it inhibited aggression, it was doubtless more from astonishment than amusement. Extreme caution, careful observation and subtle awareness were essential for the deadly serious negotiations required if strangers were to avoid conflict, and in this delicate confrontation no communication gap was wider than that between native and European. The quality of the first exchange affected every future meeting, and the insensitivity of these comedies was tragic.

When a crew member was fatally speared in what, to the English, was an unprovoked attack, Jukes wrote frankly and revealingly (1847, Vol.I:111-14):

> It was the first time in my life in which I had seen wounds (and as it turned out, death) inflicted in open field, or in any kind of strife, and the sensations were as new to me as they were unpleasant. A burning feeling of mixed rage and grief, and a kind of animal craving for revenge, seemed to take possession of the heart, and a reluctance to leave the spot till some kind of amends had been obtained.
>
> I have always joined in reprobating the causeless injuries sometimes inflicted by civilized, or quasi-civilized man, upon the wild tribes of savage life; and many atrocities have doubtless been committed in mere wantonness, and from brutality or indifference. I have always looked, too, with a favourable eye on what are called savages, and held a kind of preconceived sentimental affection for them, that I believe is not uncommon. I had been inclined to suppose that they were rarely the aggressors, and were always more sinned against than sinning. One such practical example of this, however, wrought a great change in my feelings on these points; and though far, I hope, from abetting cruelty, I could make great allowances for anyone who, under such circumstances as I have detailed, took a larger revenge than the strict justice of the case demanded. I felt that the life of one of my own shipmates, whatever his rank might be, was far dearer to me than that of a wilderness of savages, and that to preserve his life or avenge his death I could willingly shoot a dozen of these black fellows; and I could read the same feelings in the eyes of those around me. Nor was this very transient; for many days or weeks after, it would have been felt as a relief by all those who saw Bayley's fall, to have come into collision with any party of black fellows they could have been justified in firing on.

In Torres Strait their many exchanges were effected with great confidence once trust was established by the use of words acquired at the previous point of call (ibid:132-213) but in the virtually uncontacted Gulf of Papua it was quite another matter. Off the Fly River mouth in 1845 the ship's gig was pursued by four large canoes (ibid:215) and near the mouth of the Aird River a group of armed men fled when they saw the white men at close quarters. Blackwood was making the first landing at the head of the Gulf since Coutance 40 years earlier. Seeing natives on a mud bank he sent a crew member to wade towards them but when he took off his shirt and they saw that his body was white 'they seemed struck with horror, and after a ghastly stare, fled into the bush'. As the visitors were leaving without having harmed them a canoe approached to 10 yards distance, the occupants staring in horror, fearful and disgusted (ibid:223, 224). In another of the Kikori River mouths they drove off attacking canoes with musket fire and after penetrating about 15 miles inland were attacked by 150 men in 10 canoes and had to shoot some to escape (ibid:231, 241).[1]

[1] As they passed a village, men on a house balcony 'waved their arms, and a jet of smoke proceeded from them "like the puff of a pipe". I did not succeed in seeing this action myself,' wrote Jukes, 'but I have no doubt it was the same as that observed by Cook...' (ibid:233).

Having failed to establish communication themselves they attempted to get 'chiefs' from Erub to mediate but were refused with horror (ibid:261), showing that the islanders had difficulties in their contacts with even their nearest Kiwai neighbours.

In the Turama River they stood on the taffrail shouting the Erub words for 'peace' and 'friends' and thought that the Turamans understood the word for iron 'tooree'. Hatchets were displayed but when the distance closed to 60 yards two arrows were shot over the ship and 30 muskets fired in reply, killing several and wounding others. When warriors opposed a landing a 6-pound round shot was fired over the long house and the villagers fled. The place was examined with care - no iron or other European articles were found. Village pigs were taken aboard and Jukes remarked in his diary that it was not until after they had gone 'that the reflection occurred to me that we had in fact *stolen them*' (his emphasis).[1]

Stone axes found here 'were similar to those of the South Sea Islanders - some made of jade, others apparently of a more earthy rock, a kind of flinty slate' (ibid:265-77). (Quadrangular? Two qualities, hard greenish stone from the highlands and a poorer product? See p.180). Jukes's observations on a common bamboo beheading knife and cane head carrier 'collected' from this village nicely illustrate a reluctance to accept even the most direct statements by native informants if they clashed with his romantic preconceptions. He wrote: (ibid:277, 278)

> We also got two instruments tied together, and which we always observed together at the backs of the natives, the use of which we could not make out. These were a cane loop, with a toggle or handle, and a bamboo scoop, with a handle bound round with twine, in which small beads (or seeds) were inserted. I afterwards saw some of these among the natives of Eroob, who said they came from Dowdee (New Guinea mainland). They ...said the first was for twisting round people's necks, and the second for cutting their heads off--which merely showed they did not know what their real use was, as they are not at all adapted for those purposes.

The difficulties of beginning trade with strangers without the benefit of a mediator known to both was perhaps most acute among the communities of the south and south-west coasts where head-taking was an essential part of politico-religious life. It was reflected in the well-documented contacts of a number of explorers with tribes speaking one of the Kiwaian languages.

On their way out of the other mouth of the Turama, Blackwood's party was inspected by twelve men in a reconnoitring canoe who ignored glass bottles thrown to them as gifts and hatchets held up for them to see. Jukes thought that they too understood the word 'tooree'. A hatchet was tied to a small keg and floated down to them but they poked it fearfully with paddles. At last they saw the hatchet, took it off and discarded the keg, though it was bound with iron hoops (cf. above, Hunter's experience in the Duke of York Islands). The hatchet was passed around and closely examined and finally, seeming to comprehend its use, they shouted and waved it at other canoes and immediately paddled forward and attacked the ship. Later as the vessel passed a village near the river mouth Blackwood ignored an invitation to land and a major attack was prepared by those ashore, canoes going in to discharge cargo and take on fighting men and weapons. The ship's guns were loaded with round and grape shot and all muskets were readied. One canoe drifted down at a distance of 50 yards, the occupants shouting derisively, pointing ashore and laughing. All men had the 'scoop' and bamboo loop over their shoulders. The manoeuvre was repeated four times, on each occasion the sailors shouting Erub words for peace, making peace signs and holding up hatchets for trade. Once, while Jukes was earnestly addressing men in a canoe, one of the occupants presented his bow and drew the arrow to its head and when Jukes stooped to pick up his musket, laughed as if mocking him for shrinking. Six men in a canoe were induced to pick up some bottles and at length to come near enough to exchange a coconut for a hatchet from the gig being towed astern. They seemed in much

[1] J.H.P. Murray thought that Jukes was being jocular about this theft and thought that it reflected 'a strange code of morals' (1912:270). I do not think Jukes was being jocular, and in the context of the earlier period Murray's own code would have been unusual.

fear and disgust at finding themselves so close to hideous white people.

Repassing the village earlier shelled and ransacked they received shouts of welcome rather than defiance, the villagers holding up green branches and shell ornaments and inviting them ashore. Jukes' opinion was that having learned of the strangers' power, friendly intercourse was now possible (ibid: 281-7).

Both parties were slowly learning but the romantic vision of the principal European actors was still strong and was to last a long time. As Jukes reflected:

> I know of no part of the world, the exploration of which is so flattering to the imagination, so likely to be fruitful in interesting results, whether to the naturalist, the ethnologist, or the geographer, and altogether so well calculated to gratify the enlightened curiosity of an adventurous explorer, as the interior of New Guinea. New Guinea! the very mention of being taken into the interior of New Guinea sounds like being allowed to visit some of the enchanted regions of the 'Arabian Nights', so dim an atmosphere of obscurity rests at present on the wonders it probably conceals (ibid:291).

In 1846 Yule in the *Bramble* continued the survey of the Gulf and while off the Vailala River made the first European observation of a *lakatoi* (and unwittingly of the Motu canoe trade) describing it in some detail and noting that when approached the 40-50 men on board took the precaution of stringing their bows but made no hostile act. The *Bramble*'s tender, *Castlereagh*, under Lt Aird, was visited by eight men in two small canoes who gave coconuts and bows and arrows for 'trifles'.

Near Cape Possession Yule went ashore to take possession and begin triangulation and as he attempted to get off again the ship's boat was swamped in the rising surf, nearly all the equipment being lost. Other boats tried to help but a second was swamped and smashed. At this stage more than 80 Papuans approached, with spears, clubs and stone axes. Yule advanced with 'playful' gestures and waved a branch and, while one Papuan pointed a spear the rest just stared in wonder. Yule offered them tobacco but they would not approach. Finally, seeing that the sailors were helpless they came up and took their possessions. As another large group appeared in canoes a ship's boat got in twice and succeeded in taking off most of the sailors. Yule wrote that he just managed to stop one bowman from taking aim at an embarking sailor and that when he tried to recover the quintant which had been wrested from the coxswain he was threatened by a club. Four men grabbed him and took micrometer, chronometer and notebook and stripped him of his clothes. At last the boat took off the final load. In view of the experiences of those on board the *Fly* in the previous year, he wrote that he expected to be killed but in fact no-one was hurt. The editor of the *Nautical Magazine* commented '...after all, the treatment they received was not a whit worse than what many a shipwrecked mariner has met with on the coast of Devon and Cornwall within the last 50 years' (Vol.16:416-19). Apart from Blackwood's few axes three years earlier, this was the first supply of metal objects and cloth to reach the Gulf of Papua and it was at the extreme eastern end.

The naturalist MacGillivray in Torres Strait in 1848 with Owen Stanley's *Rattlesnake* remarked that 'twenty to thirty or more ships go through every summer' and that peaceful trade alternated with violent attacks (1852, Vol.1: 127, 303, 308, 309).

This expedition began a survey of the coast of south-eastern Papua in the next year and although some of the axes given out by them could have been transported west along the coast by Mailuans and Motuans, this is unlikely in view of the unsatisfied local demand. The inhabitants of the Louisiade Archipelago appeared to have learned to fear guns (ibid:188); some knew what iron was, calling it 'kelumai', and were eager to trade for it (ibid:195). MacGillivray gives 'kelam' as the word for stone axe (Vol.II:324) and since 'ai' is a reasonable rendering of 'iron' it seems that these people had learned to know tomahawks and other metal from some of the many ships now taking the eastern passage to China and India and perhaps from some prospecting for marine products.

Canoes visiting the ship from Brierly Island included women and children

and all confidently gave weapons, ornaments, coconuts, yams and bananas for strips of calico and pieces of hoop-iron, the latter being quickly substituted for stone in the adzes carried by the men. Axes were most highly prized and were bartered for with great eagerness. Even the pigs of iron used to moor the ship's boat were stolen from the reef (Vol.I:200, 201). In spite of continuing trade MacGillivray felt that hostility was only temporarily repressed; after exchanging 368 pounds of yams for 17 axes and a few knives the Brierly Islanders seemed anxious to get rid of their visitors; he wrote (ibid:230):

> Even during the height of the bartering very few of the natives had laid aside their weapons, and it was evident that they were influenced by no very friendly feeling towards us, and were glad to be relieved of our presence. They had latterly become more noisy than usual, and even insolent, and I believe that had we staid a little longer, hostilities would have commenced...

At that time two boats visiting another island were attacked without provocation by hitherto peaceful traders; the description of the fight showed that the islanders felt strong enough to seize the coveted iron by force (ibid:234-36).

'Indian corn' was offered by the people of the Calvados group without exciting any comment from the naturalist (ibid:247). At Brumer Island off the tip of the mainland friendly barter proceeded ashore for a time, and continued aboard ship. Iron seemed already well known, iron hoop being highly prized and valued according to its width and thickness. Hatchets, fish-hooks and glass bottles were wanted, the latter thought to be used as a substitute for obsidian, but possibly used as lime 'gourds'. Imported seeds were handed out (ibid:262, 269, 270). Stanley, however, maintained careful precautions against attack (Lubbock 1968:58). It is not made clear whether iron was already known in Orangerie Bay but the canoes included women and children and trading went on peacefully until the failure to pay for a pig led to violence with the crew of the *Bramble* (MacGillivray 1852, Vol.I:285-7, 289-90). Huxley considered the violence unnecessary (1935:235-9).

At Redscar Bay, for the first time according to Lubbock (1968:60), they met people to whom iron was quite unknown; no name existed for it and it was not valued. Barter began readily enough, glass bottles again being sought and clothing valued most of all; but gifts of knives and other iron tools were refused (MacGillivray 1852, Vol.I:297). The ease with which trade commenced with the people of the south-east coast, even where Europeans and iron were unknown, was probably due to the traditions of sea-borne trade maintained by the Mailu and Motu canoes. It was in marked contrast to the experiences of all on the south-west New Guinea coast where a trans-coastal canoe trade was absent.

In the late 1840s and early 1850s, attempts to found Marist missions on Woodlark and Umboi (Rooke) Islands failed miserably and they were abandoned by 1855, defeated by malaria and violent death (Souter 1963:23), both no doubt occasioned by the same failure to adapt to their Melanesian environment that these missionaries had earlier displayed in the Solomon Islands (Laracy 1969:33-59).

A great increase in the rate at which iron tools were introduced into the Torres Strait area and ultimately traded north to New Guinea occurred with the beginning of the pearl shell industry there in the late 1860s and its growth into a major business in the following decade (Yonge 1930:165-7). It may also have permitted a dramatic increase in the traditional trading of pearl shell. In 1871 the beginning of London Missionary Society activities in Torres Strait provided another source of supply of iron, new ornaments, cloth and clothing (McFarlane 1888:86) and by 1873 steel tomahawks had completely replaced stone except for a few remaining on Prince of Wales and Horn Islands (Moresby 1874:5).

Off the eastern shores there was little iron in use but it was widely known and in great demand. The d'Entrecasteaux people knew that there was iron on board the *Basilisk* and were eager to exchange stone axes for rusty hoop-iron, and the 'utmost anxiety' for it was shown off the Huon Peninsula and part of the north-east coast (Moresby 1875:156, 162; 1876:285-7).

The deeper gulfs lay off the tracks of the ships that introduced the

first iron to the coastal promontories and off-shore islands but the schooner *Emma Patterson* entered Astrolabe Bay in 1871 (Wichmann 1910:150). In September that year Miklukho-Maclay began his first stay at the village of Bonggu in what he named Konstantinhafen and is now Melanua Harbour at the head of Astrolabe Bay. In the next 15 months and during his second long residence from mid-1876 to November 1877 he visited most of the villages around the bay and a few in the immediate hinterland, and received return visits from many. His was the first scientific observation of New Guinea life in any depth and he was instrumental in introducing iron and factory-made beads to the people living just north-east of the study area. The ship's officers distributed red calico, imitation pearls, gold paper, empty bottles and buttons. Maclay found, as others had done and were to do, that his friends were jealous of their access to him and tried to stop him visiting inland villages. (Fischer 1955:43-230, 319-60, 415-25; Greenop 1944:51, 82.)

In the Gulf of Papua too, 1871 was the beginning of the end of isolation from western manufactures. Mission teachers stayed for a short time at Redscar Bay and were settled at Hanuabada in 1873. In the following year the Lawes family arrived to develop a base for London Missionary Society operations (Chalmers 1895:23, 24).

In 1873 d'Albertis saw that the people of Orangerie Bay were still dependent on stone implements, though they well knew what iron was and to get it 'would have sold their skins'. Hoop-iron was still enough to satisfy them (1880, Vol.I: 185, 221). But when he established himself on Yule Island for nine months in 1875 knives and iron axes already acquired were brought to him for sharpening on his grindstone. He made the second recorded observation of Motuan *lakatois* on their annual trading voyage to the Gulf and saw them return at the end of the year. Most of the local iron axes had probably been obtained from Port Moresby Motuans. He noted the visits of the missionary McFarlane and the W. Macleay expedition in the *Chevert*, both of whom used iron as gifts and in payment for purchases, and had iron pilfered from them. D'Albertis himself distributed beads, strings of 'venetian pearls', knives and axes. He penetrated some 20 miles inland, wrote of a flourishing indigenous trade and the absence of metal away from the coast, and saw two domestic fowls which he speculated had come from the *Basilisk* (ibid:243-394). Others thought they resembled the fowls of Indonesia (see p.38)

Early in the 1880s McFarlane wrote that the only iron *weapon* (my emphasis) that he had seen on 600 miles of the southern New Guinea coastline was a Tugeri 'battle-axe' from near the border of Dutch New Guinea. It was more like a small pick-axe than an ordinary axe, he said, and evidently made from iron salvaged from a wreck (McFarlane 1888:116). It may have served to fell sago palms, for helved tools with pick-shaped stone heads were used for this purpose.

James Chalmers arrived in New Guinea for the London Missionary Society in 1877 and in the following year began a program of contacting as many coastal villages as possible. By 1881 he had made successful visits to Vailala and Orokolo (Lovett n.d.:95, 128, 173-83).

In 1883 he accompanied a Motuan trading voyage to Vailala and met Maipuan visitors from the eastern mouth of the Purari River. As usual, he carried a stock of trade goods. At Vailala fish-hooks were preferred to everything except tomahawks; further west towards Orokolo, beads were much sought after. In addition to pots and armshells, the *lakatois* contained much Motuan-owned European cargo, carrying tomahawks, knives, beads, red cloth, mirrors and twist tobacco to the Gulf. Chalmers recognised that his presence was valued for the goods he brought and that the people he gave them to were jealous of their favourable trading position; they were angry when he gave goods to visitors. An old man recalled a happy visit to a big ship off the Vailala River mouth many years ago and showed him two carefully preserved handkerchiefs he had been given (ibid:35, 41; Chalmers n.d.:10-43; 1895:90). (Aird had such an encounter off the Vailala while surveying in the *Castlereagh* 37 years before, see above.) Accompanied by his Orokolo friends, Chalmers walked west to the Purari, was met there by Maipuans in canoes who took him across the Alele and Aivei mouths to their village and after a friendly visit put him on the road back to Vailala (Lovett n.d.:212-19). This visit, and trips made by Maipuans

to Vailala to get Motuan pots at about the same time, undoubtedly brought the first significant supplies of steel to the Purari delta.

The small gold rush of some 60 people to the Laloki River behind Port Moresby in 1878 (Souter 1963:44, 45) boosted the supplies of foreign goods available to Motuan traders for two or three years, but it was a temporary boom.

Meanwhile, the north-east coast, Astrolabe Bay and the north coast were visited by Powell in 1875-6 and 1877-8. In general people were very timid east of Humboldt Bay, he said, and in some places avoided the ship altogether; others could be persuaded to trade peacefully by careful negotiation. On the northern Huon Peninsula where obsidian was widely used he distributed beads and cloth and after a week was invited to a hinterland village, claiming to have climbed to 3,000 feet. Crossing Astrolabe Bay he stood well out. Off the Ramu mouth people were excessively timid even after they had been thrown cloth and beads but at Passier Point (near Sissano?) and further west they were friendly and keen to trade (Powell 1883a:505-13; 1883b:13, 14).

Maclay's old base in Astrolabe Bay, Bonggu, received a short visit in 1878 from a party of gold prospectors but they received a cold reception and soon left (Lawrence 1964:35, 66). When Maclay briefly revisited the place five years later he found that the prospectors' visit had changed local attitudes to whites and caused three coastal settlements to be abandoned (Greenop 1944:107, 108). He must have known that in the interim the British Deputy Commissioner for the Pacific had also been there. A proposed New Zealand expedition to Astrolabe Bay (*Nature*, 1879:491) apparently did not eventuate. This may have been the vessel *Courier* which Romilly was checking on when he went ashore there in 1881, having acquired some local words and names of important men from Maclay. He said that he was Maclay's brother. His reception was quiet and the people were not much interested in trading for European goods; though a few asked for trade tobacco they did not seem to care much about it; knives and beads were in greater demand but nothing much was offered in exchange and he gave away few tomahawks and knives. At the village of Gurendu he saw 'absolutely no articles of European manufacture'. (1887:221-30; 1893:168-9). He had little communication with the north-east coast but where he did he found that while beads were appreciated the use of a knife was not understood (1889:251).

Finsch's travels in 1880-2 and 1884-5 included visits to the Rai coast and Astrolabe Bay. (His observations on two types of glass beads have already been discussed.) Except for a few Russian words at Konstantinhafen, he found no knowledge of European words anywhere, not even a syllable of Dutch or English at Humboldt Bay where Powell had said he heard English spoken. Apart from a piece of very old, rusted, unusable iron 2 cm x 7 cm which was treasured as a rare item by a man at the mouth of the Ramu River, the only European goods on the whole north-east coast were a few Russian uniform buttons, old tin boxes, small barrels and planes (plane blades?) from Miklukho-Maclay's stay. A little further west at Guap and Kairu Island there were a few pieces of old iron, apparently chisels, hafted as adzes, which the owners would not sell. He though that they were probably from Belcher's visit some 40 years earlier. Elsewhere on this coast there was no knowledge of iron and when it was given them people had to be shown how to use it (Finsch 1893:180).

The year 1884 saw the formation of the Deutsche Neu-Guinea Kompagnie and the beginning of formal civil administration by the Germans and British, with ceremonial proclamations and flag-raising at a number of sites, including Friedrich Wilhelmshafen (Madang) on the western shores of Astrolabe Bay, and at Hall Sound on the eastern shores of the Gulf of Papua (Gordon 1951:241-9; Lovett n.d.:223).

III THE COLONIAL FRONTIER

The slow advance of the frontier of contact and European observations on the movements of traditional and introduced goods are summarised in Table 3.

Table 3 The colonial frontier

Page	Date	Place	Comment	Means
37-38	1885	E & NE coast	knowledge of iron v. localized	Chalmers, various
	1880s	Is. off SE coast	many goods, violence	fishermen and traders
		NE coast	commercial base	Neu-Guinea Kompagnie
		lower-Sepik	some contact	explorers
		to mid-Sepik	iron unknown, some trade	"
38-39	1887–8	Papuan Gulf deltas and up lower Purari	friendly contact near Chalmers' limits, attack elsewhere	Bevan
		western Gulf	iron apparently known, attacked	"
39	1889	Torres Strait	government station est.	officials
	1886	NE coast	mission established	Lutherans
	1887	Astrolabe Bay	" "	"
	1892	" "	commercial headquarters	New-Guinea Kompagnie
	1888	Rai coast and hinterland	some contact	explorer
	1890	Gogol River	contact with explorer	Lauterbach
	1896	Astrolabe Bay to	" " "	" et al.
40	1898	lower and middle Ramu	" " "	Lauterbach
	1896	N coast	mission stations est.	Roman Catholic
	1905	Alexishafen	" " "	" "
	1892	E & W Gulf	missions established	L.M.S.
		Papuan Gulf	visit	MacGregor
	1894	lower Purari	gifts from whites	"
		Purari mouth	attacked	"
	1893–5	Purari and Pie mouths	friendly visits	Chalmers
40-41	1901	Kikori mouth	missionaries killed	Chalmers & Tomkins
41		" "	punitive expedition	Le Hunte
	1902	" "	some contact	" "
	1904	" "	punitive expedition	Robinson
	1901	Lower Ramu	contact	explorers
		Hills, middle Ramu	some	
	1902	middle Ramu	some contact	explorers
		Bismarck foothills	some contact, violence	Schlechter
42	1906	Astrolabe Bay	recruiting post estab.	government
	1907	Markham-Ramu	contact with explorers	Dammköhler & Frölich
	1908	Bismarck foothills	some contact	Schlecter
	1900s	NE hinterland	conflict with hunters	bird shooters
43	1912–13	Sepik, Schraders	peaceful contact	Behrmann, & Thurnwald
		Keram & lower Ramu	some iron from lower Ramu to Keram River	" "
	by 1905	Yule Is.	large mission	Roman Catholic
	1906	Purari mouth	mission	L.M.S.
		E. Gulf (Kerema)	station estab.	government
	1907	Pie River, delta	peaceful contact	Griffin
43-44	1908	middle Purari and 50 miles east	European goods, some violence	Mackay, Little

Table 3 (cont'd)

Page	Date	Place	Comment	Means
44		Kikori mouth	peaceful trade	Murray
	c. 1908	Kikori mouth	L.M.S. contact again	Butcher
	1910	Samberigi-Kikori	some worn steel tools seen	Smith
44-45	1911	Samberigi-Mubi	steel tomahawks wanted evidence of shell trade	Beaver & Ryan
45		Gulf lowlands	violence with explorers	Little
	by 1912	Kikori mouth (Aird Hill)	L.M.S. mission built	Butcher
	1916	eastern Bismarcks	explorer near Mt. Otto?	Detzner
46	1914–20	north hinterland	waning of influence	reduced mission and government staffs
47	1922	hills (Bagasin)	mission station	Lutheran
	late 20s	middle Ramu	evangelist visits	"
	1923	Bismarck Fall	botanical expedition	Lane-Pool
	1927	eastern highlands	missionaries visited	Flierl & Saueracker
	1929	" "	" "	Pilhofer & Bergmann
	1920s	deltas of Gulf	missionary visits	Butcher
47-48	1922	Samberigi, Kerabi	had tomahawks, knives and wanted more	Flint & Saunders
48		lower Purari	axes traded upstream	Woodward
	1923	lowlands	geological exploration	Anglo-Persian Oil
	1925	Samberigi, Kerabi	keen to get steel	Rentoul
	1929	Samberigi, Erave Purari	Kewa, Foraba and Pawaians keen to trade for steel	Faithorn & Champion
49		eastern highlands	miners prospecting	Rowlands & Levien
49-51	1930	eastern highlands, lower Asaro, Tua, lower Pio, Purari	miners prospecting steel mostly refused, some seen had come from east	Leahy & Dwyer
51	1930	Benabena, Asaro, Bismarck Fall, Ramu	no steel a few European goods and sea shell ornaments	" "
	early 30s	Gulf hinterland	consolidating influence evidence of inland trade including govt. goods	government & L.M.S.
52	1930–1	lower Jimi	gold prospectors	Exton & Green
	1932	Bismarck Fall Benabena	mission established gold prospectors	Schaefer & Baas, RC Leahy brothers
	1933	Asaro-Elimbari	no European goods	" "
52-53	Feb.	Benabena	Europeans decide to adopt the local currency, shells	Leahys & Taylor
53	March	Wahgi	first flights over Valley	" " "
	"	Asaro-Elimbari	prospectors & govt.	" " "
54	"	Mai Riv. Sinasina	no steel	" " "
	April	Chimbu	change in shell ornaments	" " "
	"	Koronigl	saw beads, tin, tiny pieces of steel from north	" " "
55	"	middle Wahgi	steel unknown	" " "
	"	upper Wahgi	steel unknown, refused	" " "

Table 3 (cont'd)

Page	Date	Place	Comment	Means
	May	upper Wahgi	money cowries flown in	" " "
56	"	south Wahgi	reluctant to accept steel	" " "
	"	middle Jimi	refused steel	" " "
	June	upper Wahgi	some now accepting steel	" " "
	"	lower Jimi	refused steel	" " "
	July	Mt Hagen	E–W trading seen	" " "
	"	upper Wahgi	liking for steel growing refusing inferior pearl shell	" " "
	"	Nebilyer divide	worn steel axe seen	" " "
	"	upper Wahgi	keen demand for steel	" " "
	August	middle Wahgi, Sinasina	attacked, deaths	Taylor
57	September	Wahgi	friendly	"
	October	"	friendly	Taylor & Leahys
	1934	S Wahgi	2 steel tomahawks seen	Leahys
	March	upper Wahgi	missionaries visited	R.C.
	April	" "	shell values already depreciated	Leahys
	"	upper Kaugel	some steel tomahawks from South	Leahys
	May	SW of Mt Ialibu	some good knives seen	"
	"	Poru region	no steel	"
	"	Chimbu	mission built station labour paid in steel and shells	R.C.
	"	"	another mission station begun	Lutheran
	"	upper Wahgi	missionaries visited	"
	"	" "	more prospectors visited	"
57-58	July	W Kambia	prospect streams	Leahys & Fox brothers
58	Sept.	W and central Kambia middle Wahgi	" "	Leahys & Taylor
	Oct.	lower Wahgi	salt dialect area	Leahys
	Nov.	upper Wahgi	two missions built	R.C. and Lu.
		Chimbu	administrative post built	government
	1936	E of Mt Giluwe	many old tomahawks from south	Champion & Adamson
	"	Poru region	old axes from the west	" "
	"	Tua region	keen to get steel	" "
59	"	Karimui	a few axes and beads seen	" "
	1938	upper Wahgi	patrol post opened	government

THE COASTAL FRINGE AND THE NAVIGABLE RIVERS

Although after 1884 Europeans had bases on the New Guinea coast from which to explore, proselytise, trade, and widen their sphere of influence, this advanced slowly for the next 20 years. Journeys were made up rivers navigable by steamer but most land exploration was restricted to the immediate hinterland of the new settlements.

Knowledge of European goods remained isolated in each contacted locality in spite of the existence of local trade routes, and except for the Motu-borne traffic, spread very slowly. For example, while men in Goodenough Bay appeared to recognise steel tools in 1885, a 'chieftain' further away in Dyke-Ackland Bay who was given a tomahawk 'certainly did not know how to use it or what it was for' (Chalmers n.d.:136, 140, 144). Goodenough Bay had had the advantage of vigorous traditional trade links with the earlier-contacted south-east coast (Malinowski 1915:624-6). At one village on north-eastern Huon Peninsula the people were using stone and shell adzes 'of the meanest kind' and 'knew nothing of a tomahawk or any other of our foreign stuff' but men in canoes that approached shortly afterwards from another settlement seemed delighted by tomahawks and beads. Across Vitiaz Strait at Umboi (Rooke Island) there was only a little hoop-iron and one very old steel axe thought to have been traded from New Britain (ibid:148, 150, 151).

The relatively large influx of manufactured goods to the far south-east of Papua during the growth of bêche-de-mer fishing and shell collecting by Chinese and Europeans in the 1870s and 1880s and from returning indentured labour in the 1880s helped satisfy some of the local demand for steel but did not significantly affect those farther away, though a few imports, including European heads (sic), were included in the indigenous trading systems at this time. Men fortunate enough to return from the Queensland canefields each brought with them between £3 and £6 of factory goods, including iron. More iron and other foreign goods were got from wrecked ships and sacked store houses than from barter; there were many successful attacks on foreign traders and their employees, more than 80 people being killed by the middle of 1886, according to one official report (Romilly 1889:194, 225-36; Bevan 1890:121, 177-83; Scarr 1968:2; Corris 1968:86-102). Plundered and bartered goods in this area probably exceeded those supplied to all the rest of British New Guinea at this time, reinforcing the good trading position of these islands already so well placed for the transmission of stone ceremonial and work axes from Woodlark Island. Mailu canoes probably carried a few westward towards the Motu trade system but those that reached the Gulf came from the centre of government and missionary activity at Port Moresby.

In German New Guinea and in the Mandated Territory until the late 1930s, private individuals and not government officers were nearly always the first strangers to have been seen by the inhabitants and careful contacts made by scientific explorers were the exception rather than the rule. Planters, labour recruiters, traders and bird of paradise hunters were allowed unrestricted movement in areas beyond the frontiers of government influence. As a result, the administrative contact when it ultimately occurred was often in the form of a police action into what Rowley has characterised as 'the frontier of culture clash' and 'the skirmishing frontier', designed to punish natives for attacking an intruding foreigner (1958:116, 199, esp. 191-205).

The Neu-Guinea Kompagnie established itself at Finschhafen, Bogadjim and Hatzfeldhafen in 1885, with Finschhafen as its centre. The exploration of the lower Sepik River began in 1885, and in 1886 it was negotiated for 240 miles (Souter 1966:71-3). Iron was unappreciated there, though red cloth was wanted and glass bottles were popular for lime. The Kompagnie had more than 100 indigenous employees who were paid solely in red cloth, iron and beads: they also employed Malays and were recruiting more (Lindt 1887:191-3). By 1900 there were 135 Chinese and 238 Javanese employed in the Friedrich Wilhelmshafen (Madang)-Konstantinhafen (Bogadjim) area (Lawrence 1964:41).

Malays were also being used in British New Guinea at this time as boat hands and carriers, and Lindt remarked on the presence inland from Hall Sound of domestic fowls similar to those of Indonesia. D'Albertis had thought the fowls here were from the *Basilisk* (see above). Their origin is unknown but an earlier route of diffusion is suggested by the presence of *Gallus gallus* L. of the Game type, both domesticated and feral, elsewhere in eastern New Guinea.

By 1886 there were about 20 Europeans in British New Guinea, most of them traders, and there were 10 schooners involved in the trepang trade. (Lindt 1887: 130, 154, 158, 172). European buyers, especially the scientific collectors and naval 'tourists' of the men-of-war, had already inflated the prices being asked for bird of paradise plumes, stone axes and other curios near Port Moresby - Lindt complained that the prices charged by Andrew Goldie's store for a set of plumes was 15 shillings and that an entire skin cost 25 shillings. He got some from mission teachers more cheaply but at prices 'still above what they could be bought for in London' (ibid:62).

Several observers commented on the apparent existence of trade links crossing the peninsula of south-eastern Papua. Chalmers heard bushmen visiting Dyke-Ackland Bay using Koiari words from the south coast: observing close similarities in dress and ornament he concluded that there were at least strong cultural links through the people of the Owen Stanley range (n.d.:136). Near Cape Possession Bevan was told of visitors from the inland ranges who had seen the Morobe coast and who used a pass near Mt Yule (Bevan 1890:140).

Europeans were avoiding the head of the Papuan Gulf, sharing the belief that Goldie expressed in a letter to *The Queenslander* when he said that no other part of the world was so dangerous (ibid:185); but Bevan, a private trader who

had established a chain of trepang stations as far west as Freshwater Bay, decided to extend his trading to the delta in spite of official opposition. He was attracted there, he said, by the sight of 'black Gulf Papuans' bringing big *lakatois* to Port Moresby each year for Motuan pots and European goods (ibid: 137-9, 145-50).

In a 90-ton steamer and a launch he explored much of the deltas of the Kikori and Purari Rivers in 1887 and 1888. He found that he was able to make friendly contact with the people living just beyond the limits of Chalmers' travels, those living 15 to 20 miles from the sea on the Wame and Varoi branches of the Purari being typical. They had not seen white people but once they were convinced that he was on peaceful business they shouted for 'kyri-oh', meaning hoop-iron, and traded their weapons for it. Travelling from 40 to 60 miles inland on the lesser streams and the Kikori and about 100 miles up the Purari, he found that the very different people met towards the limit of his navigation on the Kikori made signs of peace and exchanged visits and goods with him but those in the large villages of the Era and Ivi Rivers attacked him boldly. They knew nothing of the power of guns but the magic of the steamer's whistle and the ship's uncanny ability to reverse direction at speed enabled him to avoid bloodshed. West of Cape Blackwood, in the entrances to the Newberry and Bamu Rivers the people knew of iron and cloth and one man would accept no less than a scrub-knife for a young pig. A wooding party was nearly cut off for the sake of its axes (Bevan 1890:188-254).

A Western Division was established in British New Guinea in 1889 and a headquarters established first at Mabaduan Island on the northern shores of Torres Strait and transferred to Daru four years later.

In Kaiser Wilhelmsland (mainland German New Guinea), Johann Flierl of the Neuendetelsau Lutheran Mission settled on the Huon Peninsula near Finschhafen in 1886, incidentally noting that in the village that he selected for his first station at least one man had already fitted a plane-iron to his adze handle (Flierl 1932:7, 8). This mission began a vigorous program of conversion and expansion of territory, made easier by the shifting away of Neu-Guinea Kompagnie headquarters to Astrolabe Bay in 1892.

The Rheinische Society Lutheran Mission began work in New Guinea at Bagadjim in Konstantinhafen between plantations of the Kompagnie in 1887 and established missions on Siar and Ragetta Islands near Friedrich Wilhelmshafen (Madang) in 1894. They observed manioc cultivated near Bogadjim at this time but without commenting on who was believed to have introduced it (Hoffman n.d.: 2). In 1902 an out-station was set up at Bonggu where Mikloukho-Maclay had lived (Braun n.d.). However, the small Rheinische Society suffered many setbacks, both from loss of life and the opposition of secret societies among their potential recruits. They were also handicapped, according to Flierl, by the proximity of Neu-Guinea Kompagnie headquarters for they tended to be identified with Kompagnie activities (Flierl 1932:163-74; Rowley 1958:259). By 1895 this locality boasted several commercial buildings, residences, a clubhouse, hospital and Chinese store as well as the mission headquarters. After 25 Europeans had died the centre of Kompagnie affairs was again shifted in 1895, this time to Friedrich Wilhelmshafen, and in 1899 the German government relieved it of its administrative responsibilities and moved the capital to New Britain (Souter 1963:75, 78).

At first the Kompagnie did not attempt to penetrate the hinterland but recruited most of its labour from around the coast and up the navigable rivers (Flierl 1932:15). Private explorers and geographical and scientific expeditions pioneered overland exploration but by the late nineties the Kompagnie itself was financing journeys seeking new resources, especially labour. In 1888 a German newspaper correspondent with three companions and 20 carriers went south-east from Konstantinhafen to an altitude of 2650 m in the western Finisterre Range from where he had a view of the Bismarck Range.

The botanist Lauterbach travelled up the Gogol River for 40 miles in 1890 and in 1896 headed a Kompagnie-financed overland expedition which included Kersting and Tappenbeck. They explored the Oertzen mountains behind Bogadjim and set out for the Markham and were the first white men to enter the study area. After travelling south-west up the Nuru River through the territory of the Garia they found, instead of the expected upper Markham, a large river, the

Ramu, flowing north-west. They reached it near the Peka tributary and canoed downstream for a fortnight but with insufficient supplies and an unknown distance and destination ahead of them they returned the way they had come. To find out if this river was a tributary of the Sepik or emerged east of it at a mouth previously named the Ottilie, Tappenbeck entered the latter in a Kompagnie steamer in 1898. After five days he recognised part of the stream and built a base camp. Returning some months later he continued to the limit of navigation, about 190 miles, demonstrating that this was indeed the Ramu. He pushed on by canoe as far as the Korigi-Kesawai area and before the year was out had found gold, mapped the river and many tributaries and established an inland base camp (Werner 1911:endpaper; Souter 1963:76-8). In 1899 and 1900 Lauterbach ascended the Bismarck foothills several times to an altitude of 1000 m (Biskup 1968:18).

The Society of the Divine Word began the first Catholic mission in Kaiser Wilhelmsland in 1896 when five German missionaries arrived at Friedrich Wilhelmshafen. They began work on the far north coast but by 1904 a station had been started at Bogia opposite Manam Island and in 1905 a church, school and saw-mill were established at Alexishafen (Wiltgen 1969:330-55; Rowley 1965:256).

For a short time in 1897 the Gogol River area was terrorised by two escaped Buka convicts who had stolen rifles and ammunition and taken to the bush. They killed the Governor, von Hagen, who was leading a patrol to capture them and were eventually themselves killed by the local inhabitants (Souter 1963:82; Lawrence 1964:68). In 1900, native police killed three Europeans and a Chinese near Astrolabe Bay (Worsley 1968:46).

It was scant return for their alienated lands but by the turn of the century some of the new goods had been getting into the hands of coastal New Guineans through plantation labour for more than a decade. Lawrence gives the total number of natives employed between Madang and Bogadjim as 468 in 1900-1 and 1027 in 1904-5 (1964:41); in comparison, there were only 97 Europeans in the whole of Kaiser Wilhelmsland in 1901 (G.N.G.A.R. 1900-1:75).

In British New Guinea, LMS stations were begun at Orokolo and on Kiwai Island in 1892 (Chalmers 1895:207). In the same year the Administrator, MacGregor, visited the Papuan Gulf (ibid:232) and in 1894 he took the government vessel *Ruby* up the Purari River almost to the limit of navigation. No people were seen until the Subu (Aure) junction, where men cutting canoe trees indicated that they were connected with the Ipikoi people of the Pie River. Two 'three-storied' houses[1] at the furthest point reached were inhabited by a group called Biroe who retreated to the arrowproof upper storey of one of the houses but were persuaded to lower vines to which gifts were tied. MacGregor got a cheerful reception from two of the powerful villages at the Purari mouth when he returned, until one of the groups, Kairu, decided that they were strong enough to kill the government party and seize its goods: the fight was broken off with few casualties on the Kairu side and none on the side of the government (Murray 1912:286-90; Lett 1935:22-31).

When he re-visited the Gulf in 1893, Chalmers extended his travels west to near Port Romilly, believing that his influence had established friendship for the first time between rival groups of Koriki speakers living at the mouths of the Purari River, where he had been asked for a tomahawk during his first visit. His description makes it plain that the Koriki-speakers living near the salt water were relatively at ease with his Toaripi-speaking companions because of their journeys east to get cooking pots. When he persuaded them to conduct him through the waterways to a village 10 miles inland all were in great fear but their introduction enabled him to go as a friend (Chalmers 1895:212-22). A year or two later he travelled 35 miles up the main branch of the Purari with an interpreter from the river mouth and briefly met a group of villagers in circumstances of great tension. Apparently no gifts were exchanged (Lovett n.d.:288-94).

The people of the western delta still had great faith in their own strength and ability to take what they wanted. MacGregor had only just succeeded in avoiding violence there in 1892 (Lovett n.d.:317) and when Chalmers attempted to extend mission influence to Goaribari Island in 1901, he and

[1] Two raised stories, one for men, one for women, the ground area under them sometimes enclosed for pigs, a clan-house style widespread among Pawaian, Daribi and Foraba speakers.

Tomkins together with 10 mission trainees and a visiting chief were killed and eaten. A strong punitive expedition burned down at least 10 of the men's great club-houses and a village, killed 24 people and wounded many others (ibid:312-18; Souter 1963:90). In the following year Lieutenant Governor Le Hunte recovered Chalmers' skull but was unable to get Tomkins'. In 1904, his successor, Robinson, made an attempt to find it and to arrest the murderers: with displays of trade goods he allayed Goaribari suspicions and attracted some on board the government steamer and when a Goaribari witness identified a suspect the police grabbed as many as they could. Those in the canoes fired arrows and everyone on the ship fired guns: none on the ship were hurt but many in the canoes were killed. Tomkins' skull was later recovered by Robinson's successor, Barton (Souter 1963:90-1).

Meanwhile, exploration of the big rivers was being pushed ahead in German New Guinea and in 1901 an expedition supplied by a small steamer had bases at the Ramu mouth and on the lower part of that river. Their main effort (under an Australian miner) was in building a road from Erimahafen, north of Bogadjim in Astrolabe Bay, via the Nuru River to a point further up the Ramu. Progress was slow but the route had been surveyed on foot and was essentially the same as that followed by Tappenbeck five years earlier. For some years a short field railway had linked Bogadjim and Erimahafen but the road north to Friederick Wilhelmshafen could not be completed because of the Gogol River (G.N.G.A.R. 1900-1:78, 79).

Neu-Guinea Kompagnie activities, apart from river exploration, were still dependent on the coast. The tobacco plantation at Bogadjim was closed and other exotic crops were tried but Kompagnie income depended on copra, trepang, pearl shell, green snail shell and 'tortoise' shell, with individual traders buying from native gatherers and selling to the Kompagnie, which had an export monopoly in Kaiser Wilhelmsland (ibid:81). Consolidation on the coast was also official government policy (Biskup 1970).

In 1902 the continuing Kompagnie Ramu expedition consisted of Dammköhler, Klink and Schlenzig (Souter 1963:112): the bridle track to Erimahafen was completed and the Ramu base shifted 200 km upstream, their steamer being wrecked there. It had not yet been decided if the Ramu gravels contained enough gold to mine (G.N.G.A.R. 1901-2:82, 94, 95). The botanist, Schlechter, was seeking rubber-bearing trees in Germany's south-seas territories and joined the Kompagnie expedition in a journey to the Bismarck foothills. To judge by his remarks to the head of the Catholic mission at Alexishafen, the party visited people living among the foothills of the Ramu fall between Mt Herbert and Mt Otto, for they were said to have seen people in the Bismarcks in numbers larger than anywhere else in New Guinea and gardens so large that they took two hours to pass through, and there were many such garden areas (Wiltgen 1969:354). This description fits the Gende of the Inbrum River best of all, and Werner's map (1911) shows Schlechter to have visited this area. The people of the Ramu plains attacked them several times and burned their camps. Gutta-percha bearing trees were found and attempts were made to encourage the people to tap them but the trade did not develop (G.N.G.A.R. 1901-2:95, addendum). In the following year the Ramu expedition abandoned its middle-Ramu base (G.N.G.A.R. 1902-3:100).

The Germans called this tract the 'upper Ramu', referring to that part of the river lying under the Bismarck range in the low Ramu-Markham trench. To the Australians, 'upper Ramu' came to mean the Ramu headwaters some 1500 m above sea level on the slopes of the Kratke range. In the same way, early Papuan explorers referred to the Purari above the Subu confluence as the 'upper Purari'. After 1930, even in official documents, 'upper Purari' meant the headwaters north of Mt Michael. Now, the 'upper Purari' is the portion between the Erave or Pio confluences and Hathor Gorge, the limit of navigation.

Rheinische mission activities received a further setback in 1904 when Siar, Ragetta and Bilibili Islands were involved in an abortive revolt against the whites in Friederich Wilhelmshafen. Nine leaders were executed and the rest forced to resettle on the mainland. While the official report described the uprising as due to fear at the continued expansion of plantations, including those on the Astrolabe Plain (G.N.G.A.R. 1904-5:70), Neuhauss attributed Bilibili participation to anger over the loss of their coastal trading

monopoly (1911:Vol.1, ch.x, tr.15). Lawrence has said that the people believed that the whites were preventing them receiving goods supplied and intended for them by their own culture heroes (1964:68-72).

A government outpost was opened in Astrolabe Bay in 1906 and labour was recruited from as far as 30 km inland; 'the employment of force was unnecessary' said the Annual Report (1906-7:tr.3, 4). Some material returns from wage labour were now reaching as far as the headwaters of most of the streams draining into Astrolabe Bay - as far as the low Oertzen ranges and western outliers of the Finisterres. Nevertheless, the administration admitted that its real sphere of influence extended only 10-15 km from the coast and that it had no permanent footing in the interior. At this time the Ramu River was closed to recruiters (G.N.G.A.R. 1907-8:tr.1-5).

CONTACT AND CONTROL IN THE HINTERLAND

In 1907, Dammköhler and Frölich travelled up the north side of the Markham Valley and down the Ramu until they reached a familiar point near Dumpu, then turned north to Konstantinhafen (Werner 1911:map; Souter 1963:112). In 1908, Schlechter, this time with Hahl, again travelled south from Astrolabe Bay but on this occasion followed the Minjim River, crossed the Ramu near Kesawai and climbed the lower slopes of Mt Otto (Werner 1911).

In considering the personnel engaged in spreading the products and ideas of the industrial world in German New Guinea, it should be noted that missionaries always formed the largest single European group (Rowley 1958:253); the staffs of the Neu-Guinea Kompagnie and government were small, especially in Kaiser Wilhelmsland after 1899. In 1907 there were nearly as many Chinese as Germans in Kaiser Wilhelmsland, Rowley giving the relative figures as 151 and 162 (ibid:75). By 1910 there were still only about 200 whites. By 1914, 20,000 New Guineans were employed as labourers in German New Guinea, many of them recruited from Kaiser Wilhelmsland, especially from the Sepik (Biskup *et al.* 1968:49-54) and it was as plantation labourers that most men had their first experience of Europeans and European goods. Labour recruiting for plantation work was getting very difficult, according to Neuhauss, returning labourers being sometimes paid off in cheap cloth instead of the expected hatchets. In addition, villagers had found that they could get iron by working casually for the missionaries, and hid in the bush whenever the plantation recruiter came (Neuhauss 1911, Vol.1, ch.xxx:tr.4-6). Lawrence has said that in its early years the mission was regarded primarily as a source of wealth, especially steel implements (1956:74).

Neuhauss noted, too, the early effects of hunting birds with firearms, saying that in areas close to white settlement the crowned pigeon (*Goura victoria* Fraser) had already been shot out, having been killed in hundreds for their crests and meat (1911, Vol.1, ch.xxx:tr.2, 3). Much of the violent conflict of the period was due to commercial bird shooters poaching in tribal hunting territories. In Humboldt Bay hardly a month passed without violence against bird of paradise hunters, where some at least recognised that shooters were violating native hunting rights (Cheesman n.d.:35). In 1912-13 11,000 bird of paradise skins were exported from Kaiser Wilhelmsland and in the same year two bird hunters were killed in the interior, one on the right bank of the middle Ramu, 'apparently in envy of their guns'. The Administration proclaimed an annual closed season from November to May and three reserves permanently closed to commercial shooters, though there was little hope of policing them (G.N.G.A.R. 1912-13:tr.4, 29, 32). A punitive expedition shot 10 people in the Finisterres and villages near Hatzfeldhafen and Potsdamhafen were shelled by a cruiser and burned by a ground party, according to the 1910-11 Report (tr.:4, 5). In the following year a special troop of native police was formed for punitive purposes and for 'opening up the territory by slowly penetrating into unknown parts of the country and finding out the roads and getting into touch with the natives'. A punitive expedition was made to the hinterland of Hatzfeldhafen (G.N.G.A.R. 1911-12:tr.2, 3) and in 1912-13 the special troop was stationed for five months on the plains between Hansa Bay and the mouth of the Ramu because of 'repeated serious attacks' on bird of paradise shooters (G.N.G.A.R. 1912-13: tr.2).

In general Lawrence is right in saying that by 1910 German 'control' extended no further than 8 or 10 miles from the coast and 'influence' a little further (1964:42) but Meyer mentions a station on the middle Ramu at about this time and gives its location as 5°42'S 145°18'E (1910:413), which places it near the Imbrum confluence in the area of the 'upper' Ramu base camp of the earlier Ramu expedition. The activities of hunters, labour recruiters and explorers were still continuing to affect the traditional technology and probably the patterns of wealth distribution along the routes to the Ramu and along the Ramu itself, and the slow diffusion of some iron and steel from these people was revealed by the Kaiserin Augusta (Sepik) River Expedition two years later.

In 1912 and 1913 Behrmann, Thurnwald and their colleagues travelled extensively around the Sepik mouth and Murik Lakes in the course of an 18-month survey of the Sepik basin and meticulously mapped the Keram River (Töpferfluss), western Schrader Mountains and the Yuat River (Behrmann 1924, Vol.I:59-70, map 3). These parts are now known to have been involved in the highlands' shell and stone axe trade. With one exception, the party enjoyed peaceful relations with the inhabitants wherever they went (G.N.G.A.R. 1912-13:tr.2). Behrmann regarded the lower Keram as the chief centre of the pottery industry in the lower Sepik and its tributaries and described these villagers as a busy trading people. In the middle portion of the Keram he met 'quite primitive natives' who did not know iron and further upstream there was no population at all. However, in the upper reaches he came to quite another culture where the people recognised the word 'Ramu' and apparently had got iron and steel from that direction. By walking 3 km through the swamps he reached the Ramu and rightly guessed that there was a navigable waterway linking it with the Keram during the wet season (Behrmann 1914:263, 264). At that time the Neu-Guinea Kompagnie had a trading post only 25 miles down the Ramu from this point (Behrmann 1924:map 3) which Detzner's map shows as 'Tamol Df.' (1921:endpaper).

The Rheinische mission received its most serious setback at the end of 1912 when the villages of Siar, Ragetta, Panutibun, Beliao and Yabob took part in the preparation of an armed attack against Friedrich Wilhelmshafen because, said the Report, of the forced sale of land for the expansion of the town. Their leaders were exiled to the Bismarck Archipelago and the rest banished to the Rai coast and Cape Croisilles (the latter a Catholic mission area), and their land near the town confiscated. The government thought that because the former centre of Rheinische mission activities was denuded of natives it would probably now work further east along the Rai coast (G.N.G.A.R. 1912-13:tr.3, 21, 22).

In British New Guinea, soon to become Papua, missionary expansion continued. By 1905 there were about 70 Catholic priests, brothers and nuns working from the Sacred Heart centre at Yule Island. Their efforts were directed inland - the coast was the province of the London Missionary Society (Butcher 1963:39). The LMS had a station at the Urika mouth of the Purari in 1906, staffed by Mr Holmes (P.A.R. 1907:51) and in that year, too, Kerema government station was opened as a centre for the newly created Gulf Division.

On one of his visits to the Purari delta in 1907 the Resident Magistrate, Griffin, made the first official visit to Vaimuru village near the Pie River, a day's canoe travel beyond Maipua, and although the tension was great, succeeded in being accepted peacefully. These people were very active raiders still, he wrote, and were themselves afraid to travel further than Maipua. Nevertheless, he appointed a village constable and persuaded a few men to accompany him to Kerema where he set them on their way home with gifts and a police escort as far as Maipua (Griffin n.d.:120-39).

The first land journey near but still outside the southern boundaries of the study area was made in 1908 by a private expedition seeking minerals and land suitable for white settlement. Led by Donald Mackay and the Hon. W.S. Little, and including two other Europeans, Pratt, a surveyor, and Eichorn, a naturalist, it was accompanied for its first 130 miles of river travel by L.L. Bell, ARM. In two whaleboats and 12 canoes they travelled up the Purari to Biroe, the 'village' visited by MacGregor in 1894. The people 80 miles upstream said that they communicated overland with the people of the upper Vailala River. The reception here was good but after passing the Subu (Aure) junction arrows were shot at them from the river bank and they fired back. The Biroe people were

friendly, according to the Annual Report, and had a great desire for tomahawks (1909:54, 55; Clune 1942:184, 189). Here they established a base, leaving gifts of knives, beads, calico, tobacco and salt, and after Bell started downstream with the whaleboats the party set off along the north bank until they were stopped by the huge limestone walls which Mackay named Hathor Gorge. Their camp was visited by people who knew nothing of iron.

After three weeks they crossed the flooded Purari below the gorge and set off westward, striking the Samia River above its junction with the Irou (Murray 1912:309). At this stage they still hoped to reach the Strickland or Fly Rivers. With no experience of New Guinea or its forest dwellers, no knowledge of how to attempt peaceful passage of others' territories and no apparent use of intermediaries, the party stumbled west through the difficult limestone of the Samia valley for two months to a point some 50 air miles west of Biroe (75 miles on their map). All suffered from malaria, from frequent falls, and, in spite of the constant rain, from shortages of water, which at one time they went without for 32 hours. Finally, finding their progress blocked at 900 m MSL by the spur of a mountain which Mackay named Mt Murray, they retraced their steps to the Purari. They built canoes and set off downstream, arrows being fired at them from Biroe as they passed. Their passage in both directions had been constantly opposed by the inhabitants who managed to kill one carrier and wound others, while suffering casualties in return. Although they left gifts in return for the food they took from gardens they did not understand the local ownership of the sago stands on which they so heavily depended (Clune 1942:189-208; his summary account, 1943:170-2, is misleading).

By 1908 the villages at the Purari mouth were 'not well disposed to whites' and were 'sullen' according to Beatrice Grimshaw, who accompanied the Lieutenant Governor, J.H.P. Murray, on a visit to the area. Women were kept hidden in spite of the presence of a white woman among the visitors. A year later, after a punitive expedition had visited the delta without killing anyone, she wrote that the people were no longer sullen but were helpful. At Goaribari Island during the first European visit for two years the entire day was spent exchanging trinkets, red calico, tobacco and knives at the ship's side, for the people were said to have no traffic with white settled districts and no opportunity to get iron. (Clay pots inside the houses were evidence of some trade with the east, however.) Finally, convinced of the visitors' peaceful intent, they tried to take everything movable. Next day an armed party ashore for the first peaceful landing since the killing of Chalmers and Tomkins saw pieces of brass in the houses and recovered more of Chalmers' and Tomkins' bones. With the aid of a Goaribari interpreter peace was also made at the other villages which had suffered during the punitive raid six years earlier (Grimshaw 1911:121-251; Murray 1912:187).

At about this time the LMS missionary, Ben Butcher, began to visit the Aramia, Bamu, Gama and Turama Rivers, and shortly after, through a Goaribari intermediary, established friendly relations with Dopima, the village whose inhabitants had killed Chalmers and Tomkins (Butcher 1963:67-91).

EXPLORATION INTO THE MOUNTAINS

By 1910 Murray had been up the Kikori River as far as Bevan had been (Souter 1963:104). During his absence later that year, the Administrator, M.S.C. Smith, led an expedition to the Gulf intending to continue west from near where Mackay had left off. Three weeks after leaving a base camp on the Kikori River his party reached the Samberigi Valley north-west of Mt Murray. From there the journey became the most notorious disaster of New Guinea exploration, with much privation and loss of life. Three months later they found themselves back at the Kikori base camp, having come down that river in the belief that it was the Strickland (ibid:104, 105; Sinclair 1969:119, 121; Murray 1912:311, 312).

Smith's group, and the search party comprising W.N. Beaver RM, H.J. Ryan ARM and two of the crew of the government steamer who followed Smith into the Samberigi and Mubi Valleys in 1911, saw evidence that the people of the hinterland traded with those living on the lower Kikori and Turama Rivers. On the upper Kikori many had pearl shell and cowrie ornaments and at Samberigi

some had cowrie forehead bands. There, too, they saw a worn steel axe blade, a few worn plane-irons and found a great desire for steel, the sight of the tomahawks in the carriers' belts being enough to prompt attacks on Beaver's column. These were all thefts, and while often violent, no attempt was made to wound or kill the carriers or police. Beaver, too, refrained from opening fire. Smith's party had passed this way unmolested, and Lett has commented that there was little doubt that the attacks were not the result of hostility but of a desire for steel, adding, '...it has been a frequent experience in Papua that the first visitors to a new district get through without difficulty where the next comers meet with determined opposition'. Inhabitants of both the Samberigi and Mubi Valleys knew the people of the lower Kikori River and those of the upper Kikori knew the names of Goaribari and Turama groups and had regular communication with them. There was no manioc or maize, but the visitors thought that because tobacco was called *suku*, a term similar to the coastal *kuku*, the plant may have been introduced from the coast. Pots used by the coastal people did not come this far. The people dressed their hair with oil and near Mt Murray they had splendid 'greenstone' axes (P.A.R. 1911:168-84; Lett 1935:50-69; 1944:188). This appears to be the first reference to cosmetic oil in the inland, where in some parts it is an important item of trade.

Until 1910, Papuans were allowed to engage in the Torres Strait pearling industry, of which mother-of-pearl shell was the mainstay, but in that year they were excluded from it and this caused much resentment (P.A.R. 1911:65). Access to remarkable supplies of shell during the 30 years of their participation in the pearling trade may well have enabled them to boost temporarily the supplies of pearl shell and baler shell traded into the interior of western Papua and to the delta and from there to the central highlands, a possibility which should be urgently investigated.

In 1911, Little, Stanton and a coal expert, Evans, approaching from the Sirebi-Curnick junction, examined coal seams that Little and Mackay had found three years earlier. Judging by their description of the terrain, they travelled north-east over the limestone to the coal seams then east to the 'Ilo' River (Illau on the Pratt-Mackay map, the upper Irou on others) and returned to their starting point by passing between the limestone ridges and volcanic Mt Duau and down the Sireru Valley. For three days before reaching the 'Ilo' they were accompanied and probably guided by a group who had been making sago; at the river, apparently according to plan, these suddenly attacked and killed a carrier before being driven off by gunfire with the loss of two or three men (P.A.R. 1911-12:121; Murray 1912:314, 315).

By now the people of the lower Kikori River-Bevan Sound area had agreed to allow Butcher to build a mission station on Aird Hill. In 1912 he was in residence and had extended his successful visits to the Urika people of the Pai-a Inlet (Butcher 1963:98-108). In that year the administration created a Delta Division and built a headquarters on the banks of the Kikori.

A 'FIRST CONTACT' DISALLOWED: DETZNER

After Australia took over German New Guinea in 1914, a German army surveyor, Hermann Detzner, remained at large until the war was over. His claims to have travelled as far as the valleys of the central highlands (Detzner 1921:140-85, map) have not been allowed by most students of New Guinea exploration.

Detzner's 1914 journey in the area of the boundary between Papua and New Guinea cannot have taken him closer to the highland valleys than about 6°50'S and 145°50'E in the southern limb of the Kratke Mountains, from where he could have overlooked the Azana or Lamari Valleys. Although his own map shows his point of turning back at about 6°25'S, 145°10'E, it shows no major river, but to get to this position from where he is firmly known to have been he would have had to cross the substantial trench of the Subu (Aure) River, in that area only 300 m above sea level.

His claimed journey of 1916 was a fantasy. His map shows the point of farthest penetration to be south of the Bismarck Range where we know the Chimbu Valley to be, just under Mt Wilhelm. If his statement about travelling time were true, his four day march down the Ramu from the Markham divide followed by a climb south over the Bismarcks into a highland valley would have led him

into the upper Asaro Valley; a fast trip should have put him into the Chimbu and a slow one into the Benabena Valley. But he said that the valleys he saw south of the Bismarcks were sparsely populated, whereas the above valleys are well populated, the Chimbu being the most densely settled in the highlands. The appearance of this steep valley cultivated from top to bottom by 25,000 people so strongly affected the first Europeans known to have visited it that their descriptions are dramatic. There is nothing of this in Detzner. As Howlett has pointed out (1962:52), his map does not show these valleys at all.

He wrote that drought forced him north back across the Bismarck divide and that he then continued west along the northern slopes but his map shows him continuing south of the divide. Except in the centre of the Bundi Fault Zone, travelling across the northern fall of the Bismarck Range is difficult, cutting across the grain of the country and the principal routes, and the ridges of Mt Otto are the worst. The altitude he gave for the highest peak in German New Guinea was 900 m short but fits that of Mt Otto very well. With surveying instruments it could have been estimated from the Ramu, as indeed it was by others many years earlier; reasonable heights for Mt Otto and Mt Wilhelm had been published on German maps before Detzner left Germany for New Guinea (e.g. Meyer 1910). As others have pointed out, in an area where memories of the first white visitors are well preserved, no one remembers Detzner. He himself said in 1932 that his so-called 'break-through attempts' did not take place (Biskup 1968:21).

A STATIC FRONTIER

The first world war slowed the extension of European influence in Papua and contracted it in New Guinea, reducing both government and mission establishments. The new military administration in New Guinea had a conservative policy, a shortage of both military and civil personnel and difficulties associated with the change of power. This lasted until 1921 and little attempt was made to maintain the degree of control exercised by the Germans, let alone to extend the administrative area (Rowley 1958:esp. 39). Some patrol posts, including the one at Lae, were closed, and road maintenance was neglected (Biskup 1968:15). The District Officer at Madang reported that he had started to build a road to the Ramu but it came to nothing (Rowley 1958:40). European influence waned particularly in outlying areas like the Ramu, and a former Madang District Officer wrote that the best that could be said of this time was that natives up to 10 miles from the coast were more or less under control and were sometimes compelled to pay head-tax (Lyng 1925:172). However, labour recruiters were still active and are known to have visited the Bagasin-Sumau-Garia area and the middle Ramu. Lawrence was told by the Garia that coercion, kidnapping and shooting were common (1964:44, 45) and a wartime Chinese recruiter was accused of the same methods by the people of the Ramu (Lane-Poole 1925:190-6).

With the re-establishment of civil administration, the Madang District boundaries were formally extended to include the central highlands and the Department of District Services and Native Affairs adopted a policy of opening up the country, but with a staff numbering only six when at full strength (Lawrence 1964:46) they were not able to effectively administer even the area formerly controlled by the Germans.

Missionary activity was reduced by the internment of several German nationals and the Rheinische Society in the Madang district was particularly hard hit, two of its stations closing. This small mission had always been partly dependent on trained native helpers from the Neuendettelsau mission at Finschhafen and during the war they were advised to consolidate their immediate hinterland. As Flierl put it in retrospect, 'unless our brethren extended their field farther inland the Catholics would work round their coastal fields and isolate them' (1932:168). So they opened a station at Amele on the Gogol River in 1916 and at Keku a little further south in 1919 (Braun n.d.) but were in no position to attempt to missionise inland until after 1921 when the help they had begun to receive from American and Australian Lutherans increased and they joined with the Neuendettelsau Society in a unified Lutheran Mission New Guinea (Flierl 1932:169, 170).

THE EXPANSION OF THE TWENTIES: FROM THE NORTH AND EAST

The Lutherans founded a station at Bagasin in 1922 and during the late 1920s and early 1930s evangelised the Garia to the south and sent representatives to the Ramu River and upstream as far as Dumpu (Lawrence 1964:54). (I can find no evidence for Rowley's statement that in 1917 the mission had already reached the Ramu (1965:137) and can only surmise that he is referring to some pioneer journey from the Markham by Neuendettelsau personnel which I have not seen recorded.)

When the geologist, Stanley, sailed up the Ramu River in 1922 (Stanhope 1968b:138) he stopped short of the study area but in the following year Lane-Poole, the forester, came overland to the Ramu and climbed to 2750 m on a north-east spur of Mt Otto. Like Schlechter, he had his camp and equipment destroyed by the Ramu villagers, in his case his base camp north of the river being ransacked in retaliation for rape by his interpreter (Lane-Poole 1925: 198, 199). He had surveyed the forests of the middle Purari in the preceding year, remarking the continuing use of stone tools, the presence of ornaments of pearl shell and the absence of steel and cloth. There he was shown the oil tree and on testing the heart wood found that he could collect oil at the rate of nearly a gallon an hour (Report 30.10.1922:5, 6, 8; letter 14.6.1927 to Lewis Lett, copy in Kikori PR file, Archives, Port Moresby).

The Lutheran missionaries Pilhofer, Oertel and L. Flierl visited the eastern Kratke range in 1920. Willis has cited Pilhofer in regard to a supposed journey from the Kamano village of Lihona into the Benabena Valley in 1926 by L. Flierl, who left no record of the trip, but Willis found that the people of the Dunantina Valley did not recall this visit, saying that the first strangers they saw were *two* white men, whom he thought were probably Pilhofer and W. Bergmann in 1929 (1969:35, 36). However, writing to J.L. Taylor in 1939 (copy in the possession of J.R. Black) W. Flierl said that in July 1927 L. Flierl and another German missionary, Saueracker, entered the upper Dunantina Valley and after crossing the Kamamuntina River continued east over the divide into the upper Ramu to the Kainantu area on their way back to Huon. These two may well be the remembered white men. Two years later Flierl and a companion visited the upper Ramu Tairora area and Pilhofer and W. Bergmann walked to the Dunantina-Benabena divide. Souter is mistaken in saying that L. Flierl visited the Benabena and Asaro Valleys in 1927 (1963:180).

THE EXPANSION OF THE TWENTIES: FROM THE SOUTH

After he returned to Aird Hill in 1920, Butcher began to visit other parts of the deltas of the Gulf rivers, and during the twenties government officers again began to penetrate the uncontacted hinterland. Wherever the Europeans went, they distributed tomahawks, knives, cloth, beads, mirrors, fish-hooks and lines, tobacco, salt, matches and sometimes handkerchiefs in return for food and help, and the inhabitants even collected their waste, especially tins. But these goods were insufficient to meet the local demand for tools, ornaments and curiosities; the few items passed on further were rarities and remained outside the established pattern of trade, travelling slowly and not going far.

Most of these journeys were in the low country drained by the Sirebi, Era and Pie Rivers south of the dissected volcanic cones of Mts Murray, Duau and Favenc and the rugged limestone between. Writing of this period, Butcher remarked on how much easier it was for him to make successful new contacts than it was for the government, since he was concerned with friendship, not law and order. In the delta region with which he was familiar, the government came to be regarded with deep suspicion and as a result tended to find empty villages where Butcher found full ones. Consequently official patrols resorted to dawn raids, which was what the villagers expected from enemies. One such raid led by an inexperienced young officer resulted in the killing of six Aird Hill villagers, which seriously jeopardised the safety of the mission (Butcher 1963: 141-4, 166-9).

In 1922, L.A. Flint ARM and H.M. Saunders PO, starting from the site of Smith's and Beaver's old campsite on the Kikori River, followed a more westerly route around Mt Murray into the Samberigi, Tugi and Kerabi Valleys. They were

guided there by men anxious to get tomahawks and knives and found when they arrived that many already had them. At the northern end of the Tugi Valley they were told that during the dry season men travelled three days north-north-east where they camped until trade friends came from five days further on and exchanged forest products such as feathers and spears for knives and tomahawks; in the Kerabi Valley to the east Saunders saw fine stone axes whose owners would not part with them. Feathers were offered for barter, the caged cassowaries seen in every Samberigi village were offered for knives, and they saw gardens drained with wooden spades growing tobacco for trade to the coast in return for shells, knives and tomahawks. They saw, too, a kind of salt said to be made from sago mixed with part of an areca palm, noted the absence of pottery, and paid a short visit to the Foraba people east of the Kerabi before returning to Kikori via the upper Sirebi River. Photographs show the Samberigi wearing a variety of ornaments including shell, the only ones clearly identifiable being small cowries and half-moon shaped pearl shells (P.A.R. 1921-22:9, 141-51 and plates; P.A.R. 1922-23:18).

In the same year R.A. Woodward ARM ascended the Purari past the Subu junction and found that the Kairu and Pawaian people who previously fought were now trading with each other. Members of a group who had recently migrated down the Subu were able to name settlements many days' travel upstream and others named a 'large village' called Iari much higher up the Purari. These people had got one or two steel axes from downstream and were keen to get more (Kikori PR 29.9.22).[1] In the following year geologists of the Anglo-Persian Oil Company were accompanied by government officers in a survey of the low country between the Purari and Sirebi Rivers (Kikori PR's Saunders 15.1.23 and Austen 15.4.23).

In 1925 A.C. Rentoul ARM followed the Iehi Creek route to Mt Murray and the Samberigi and Kerabi Valleys, being the fourth expedition to do so. He saw 'pole axe' shaped tomahawks in the Samberigi branded *Harrison No.8* which he was told came from the people of the lower Kikori who were said to get them from the Goaribari. (This brand may have been distributed by Butcher from Aird Hill.) The Kerabi people were not interested in beads or cloth but were keen to add to their supply of tomahawks and knives (Kikori PR April 1925).

While visiting the headwaters of the Wai-i and Era Rivers in 1926, S.H. Chance ARM learned that the Ipikoi people living between there and Purari traded with the Harahu to the north and with the Koriki speakers of the lower delta (Kikori PR 14.5.26). In the same year he reported that the Mubi River people west of Mt Murray still favoured stone adzes for hollowing out canoes though they had plenty of steel axes (AR 1926-7:36; cf. Field observations of stone tools, in Chapter 6).

By now some Europeans were involved in indigenous trade in quite another way: sitting in judgment on many civil disputes involving claims about unpaid armshells and pigs moved Austen to comment wearily that the Purari tribes had a complicated system of exchange (Kikori PR 9 1928-9:12.11.28).

FIRST PENETRATION FROM THE SOUTH, 1929

B.W. Faithorn ARM and C. Champion PO were the first to enter the study area anywhere south of the Ramu fall. In 1929 they followed the customary route from Kikori over the western shoulder of Mt Murray to the Samberigi Valley, followed the Erave River down, partly by raft but mainly on foot, to its confluence with the Tua (which they thought was the Iaro, having missed that river while forced away from the Erave by cliffs), walked down the right bank of the upper Purari past the Pio junction and were guided past Hathor Gorge by local Pawaian speakers. From there they canoed down to the delta. They were the first to contact the Foraba speakers within the study area living along the lower Erave River as well as the Pawaians living above Hathor Gorge. Five of their steel tomahawks were stolen by previously uncontacted Kewa just north of the Erave River. The Foraba gave a stone axe in exchange for a steel knife and cloth and were seen to possess a few disc shaped stone clubs. They

[1] When report numbers or precise dates are missing from these references it is because they were missing from those documents or portions of documents preserved in the Administration archives or seen at District Offices or outstations.

found that the Pawaians above Hathor Gorge were keen to get steel knives and that one man had already acquired red cloth from the previously patrolled downstream Purari (Kikori PR 19 1928-9). Patrol correspondence included the following list of trade goods, a large one in keeping with a long exploratory patrol and typical of the types and quantities of goods being distributed at this time by administration patrols. Probably most of the items were expended but they were distributed over a distance of some 400 miles and many were used among the large steel-hungry population of the Samberigi area.

Tomahawks	24	Mirrors	12
Knives 16 in.	18	Print red	84 yds
Knives 5 in.	27	Matches	24 doz.
Tobacco	62 lbs	Handkerchiefs	2 doz.
Salt	70 lbs	Fish hooks	1 box
Beads	10 lbs	Fish lines	1 doz.

All of the goods were factory products, yet within five years some of the most significant trade items to be carried inland by white men were traditional New Guinea valuables, shells, and they were taken in large quantities.

THE 'PUSH' OF THE THIRTIES

Once exploration of the centre of New Guinea began it proceeded quickly and within the next five years long pioneering journeys transected all of the area with which we are concerned. The routes were widely separated and in all but the main highland valleys the journeys were well spaced in time, so that in most parts there was no question of establishing government influence. Nearly all were orthodox 'first-contact' patrols. Nevertheless, these travels brought the shock of the first experience of white men to thousands of New Guineans, and by local traffic, brought rumours of white men and the first steel tools to many more.

The surprise to the whites was also considerable, for in these few years the number of people that they were obliged to administer doubled. They also found for the first time that away from the coast and its immediate hinterland it paid to adopt the medium of exchange of the country, shell valuables. They tried to adopt traditional standards of value and rates of exchange but these varied spatially and changed quickly over time and Europeans never succeeded in adjusting to the standards of local communities.

Exploration in Papua continued as planned government patrols but in New Guinea the new drive began with and continued to be stimulated by miners and missionaries.

Miners from the East

Miners from the Wau-Bulolo-Edie Creek gold-fields were already seeking new prospects. Lutheran missionaries returning from the Dunantina in 1929 had met Rowlands prospecting the upper Ramu (Willis 1969:36) and for part of that year Levien had been with him (Healy 1967:41). Rowlands' friends at Edie Creek knew of his finds and in 1930 a group of them subscribed money and gold to send M.J. ('Mick') Leahy and M.I. Dwyer to 'find more Edie Creeks'. This outline of the second penetration of the study area is drawn from Leahy (1936), Leahy and Crain (1937), affidavits made by Leahy and Dwyer to the ARM at Kikori in 1930, Leahy's 1930 diary, and interviews with him, and was aided by my travelling over most of the route.

In the middle of the year the two men with a large line of carriers crossed from the Ramu headwaters into the Dunantina Valley and followed that river to its junction with the Asaro. Such was the division of the population that no one would accompany them more than a mile or two. Both smoking and betel chewing appeared to be unknown and there was no pottery south of the confluence. The profusion of cowrie shells seen in the upper valley gave way to a few old and broken ones; *tambu* (MP for *Nassarius* sp. or spp.) shells sewn onto a strip of bark, beads and small knives were accepted in return for food but steel axes and plane-blades were refused (Leahy 1936:230, 232). They were surprised at the number of people along the lower Asaro, and to the west from

where a huge river came to join the one they were following, the lights of many fires at night indicated an even larger population; this was the lower Wahgi. A man wore an old tin as a wristband and south of the Wamu River (below the Asaro-Wahgi confluence) a couple of very worn steel tomahawks were seen (one with less than an inch of blade left), together with the sharpened handle of a knife. All were said to have come from the east.

Leahy and Dwyer's impact was such that at one village they were met by men playing a dozen long bamboo flutes, and, though they did not yet recognise it, they were being received as spirit-people, an experience that was to be repeated in the valleys to the west three years later. Dwyer commented (Leahy and Crain 1937:77)

> I realise now that we have been getting by on bluff since we struck these new people...I suppose we may as well keep it up. But it makes me sick to think what would happen if these Johnnies ever got over their astonishment long enough to attack us.

On more than one occasion they felt they had walked out of a trap and that if they had turned back and retraced their steps it would have been 'fight all the way...the natives would be less in awe of us on a return trip'. As they continued along the south-east side of the Tua River, alternating between the left bank and the steep ridges, many corpses were seen floating or rotting on the stony beaches and were assumed to indicate fighting between large numbers of people upstream.[1]

Passing over the volcanic plateau west of Mt Karimui through Daribi territory they occasionally saw a worn down steel axe but no other European goods and were able to buy food and carrying assistance with inch-wide strips of red cloth. These people had few ornaments (Leahy 1936:229). The only list of trade goods mentioned in Leahy's diaries for that year mentions a roll of cloth, 12 large tomahawks, 6 small tomahawks, 2 knives, some small knives, beads, fishing line and *tambu* shells.

Guides took them south of Mt Karimui to a crossing place on the lower Pio River, and while waiting for the flood to recede proudly showed a very worn knife made out of the handle of a 'butcher's' (a misprint for 'bush'?) knife. In a house on the ridge between the Pio and Purari they found the bottom of a glass bottle, presumably traded from the Purari or from the nearby track of Faithorn and Champion's journey of the previous year. In a house beside the Purari was an empty meat tin, almost certainly left by that patrol. After being stopped by Hathor Gorge and shown an alternative route, the party arrived at a river village where one man was wearing cloth and where they thought they heard Motu words. Tomahawks and knives were exchanged for canoes and the group made their way uneventfully to the coast. In the opinion of E.W.P. Chinnery, then government anthropologist, this was

> ...one of the most remarkable journeys in the history of New Guinea exploration, and it speaks well for the experience, tact, and patience of the prospectors that they were able to traverse such a large area of unknown country without conflict with the natives (1934:406).

Late that year they were back in the highlands retracing their steps to the Asaro Valley. They crossed the Benebena River near Korofeigu and keeping to the north of the Asaro River travelled north-west up the valley and north over the Bismarcks into the headwaters of the Tauya River.[2] In the Asaro there was no steel of any description (Leahy 1936:239) but on the Ramu Fall they saw 'a bit of trade' (i.e. imported European trade goods) though some men still had stone axes (Leahy Diary:10.11.30). They could see the Ramu Valley the day they crossed the pass but two days hard travel found them still 300 m above the Ramu

[1] The river was a customary means of disposing of one's own dead if they were of no account, as well as getting rid of lepers and captives. It was a favoured method of suicide, especially for females, and this custom and accidents still supply corpses to these rivers. I saw two in 30 miles of this tract of the Tua River in 1968, and there were probably more.

[2] Howlett thought that they had probably gone through the Bena Gap east of Mt Otto, since Leahy mentions that the pass was only 7000 feet (Howlett 1962:55), and says that they were west of Mt Helwig (1936:238). However, at least one of the three routes into the Tauya Valley from the upper Asaro has a pass at about this altitude and the locality names and other details in the Leahy diary show that they crossed the Bismarcks west of Mt Otto.

Valley floor. (Their guides appear to have led them away from most of the settlements in the lower Tauya Valley.) Finally they reached the flats below and crossed the Maria River to camp on the Ramu bank where they met the *Luluai* (MP; appointed village headman) from Koropa on the north side of the river. After visiting his village, which boasted a government resthouse, they recrossed the Ramu to prospect streams north of the Bena pass, finally returning to the Dumpu side to follow the well established track to the Markham Valley and Lae (Leahy Diary:9.11 to 22.11.30).

Leahy's photographs of the upper Ramu, Gafutina, Dunantina and Benabena Valleys in 1930 show a general paucity of shell ornament, a few headbands of up to three rows of gold-ring cowries (*Cypraea annulus*), money cowries (*Cypraea moneta*) or *tambu* shells, an occasional necklace or baldric of these shells, breast or ear ornaments of a single egg-cowrie (*Ovula ovum*, not a true cowrie) and rare small pieces of what appear to be green-snail shells (*Turbo marmoratus*) and broken egg-cowries. Two young men wear headbands of what could be either small olive shells (*Oliva* sp. or spp.) or cowries. One photograph from the upper Asaro Valley shows small 'rosettes' of *tambu* shells worn by a young man on small pegs in the nasal alae - a style later seen to be common among the Chimbu. Conspicuously absent are mother-of-pearl shells (*Pinctada* spp.), baler (*Melo* spp.) and cone shells (*Conus* spp.), or any parts of them.

'Pacification' in the South

In the south, even in the long-contacted area of the middle Purari-Pie River-Era River, trading for the increased supplies of steel and cloth now available from the delta was not preventing the continuation of inter-group fighting, and in 1930 and 1931 Speedie and Hides were separately engaged in pursuing raiders through this sparsely populated maze of ridges and swamps (Sinclair 1969:70-5; Hides Kikori 2 and 4 1931-2).

Some Sirebi River villages already had village constables (who combined the roles filled in New Guinea by *Luluai* and *Tultul* - headman and MP-speaking assistant) and when Austen visited one in 1930 he found that his man was away upstream where there was said to be a great trading site for visiting Samberigis. He was told that in return for tobacco the Sirebi middlemen passed on (*Conus*) armshells, crescents of pearl shell, cowries and the cylindrical portion of old enamel mugs which were now being worn as armshells, and he was reporting this, he said, so that future patrols to the Samberigi could take useful items with which to buy food (Kikori 5 1930-1). At this time people of the Mubi River north of the middle Kikori were keen to get beads, though steel was welcome too (C. Champion: Kikori 16 1929-30:10.3.30).

Between the Purari and Era Rivers in 1932 killings were said to have occurred because some people were too friendly with the government. Supplies being used by administration patrols were still factory goods - tomahawks, 18 in. and 10 in. knives, beads, mirrors, fish-hooks (Cowley:Kikori 3 1932-3) salt and tobacco. The hire of a Goaribari canoe for a patrol up the Purari and Subu Rivers in 1933 cost 20 sticks of twist tobacco. The value of some of these goods at that time (and probably the total cost of purchasing all the vegetable foods and possibly some pork used by the paddlers and carriers for a short patrol) was given as (Cowley:Kikori 2 1933-4):

2 pkts beads	6.0
2 tomahawks	10.0
2 fish lines	2.0
6 fish hooks	1.0
Qty beads	1.0
	£ 1.0.0

For the LMS mission, the twenties and thirties were a period of consolidation of influence in the deltaic part of the Gulf and by the time Butcher left in 1938 he had only once met people of the hinterland in the middle reaches of the Era River (Butcher 1963:236, 237).

The Asaro Valley and the Wahgi Divide

Two prospectors, thought to be Exton and Green, cut through the north-west corner of the study area in 1930 or 1931, so the Leahy brothers and J.L. Taylor were told when they visited the lower Jimi Valley two years later. They had come up the Yuat River, kept to the north side of the Jimi, and crossed the Bismarcks to the Ramu en route to Madang, black and red glass beads being the only mark of their passing (Taylor 1933:167; Leahy Diary:14.6.33).

The first missionaries to open stations in the study area south of the Ramu River were Schaefer and Baas of the Catholic Society of the Divine Word, who settled in two villages of the Gende people above the Inbrum tributary in 1932 (Ross 1969:59). At that time the Rheinische mission still had only five stations; those that they described as 'inland' were in fact in the hills not far from the sea (Flierl 1932:168; Rowley 1958:259).

Mick Leahy, accompanied by his brother Dan and backed by New Guinea Goldfields Limited, returned to the highlands in 1932 to prospect further west and on their way to the upper Ramu had their first 'trouble' with the highlanders (Leahy and Crain 1937:142). Later in the year they built a forward airstrip in the Benabena Valley and with the company geologist Kingsbury, his assistant Whyte and surveyor K.L. Spinks, prospected and mapped the surrounding area (Spinks 1934:413). Early in 1933, after another surveyor, Marshall, was flown in, they set off across the Asaro Valley. The fullest account of this trip is in Leahy (1936:245, 246); Leahy's 1933 diary gives additional ethnographic details and Salisbury checked the route with his Siane informants and has described their view of this and subsequent visits (1962:112-22).

The party climbed the Asaro range into south-eastern Siane territory and passing north of Mt Elimbari (Irimbadi on Spinks' final map, 1936) came to Dene speakers near the Mai River (called Marifutika by Leahy). They thought that the many men who followed them leading pigs wanted to sell them (Leahy 1936:245; cf. Salisbury 1962:115) and although at this stage it does not seem to have been clear to them that they were regarded as 'men possessed by spirits' (Salisbury 1962:113) it was beyond doubt on the next visit. From the top of the Elimbari ridge they saw a broad valley behind the hills of Sinasina to the west.

Near the Mai River the (presumably Dene) people were 'fantastically arrayed in bird's feathers, possum skins and bits of leaves - anything with a bit of colour...'. There was no steel anywhere in the area. Among the Dene they saw the first example of a new type of stone axe, tapering flat and thin and 'a work of art' (Leahy Diary:15.2.33), which they called 'battle axes' for they were 'much too sharp and light to serve as work-axes'; later they got some unhafted and were told that they came from the west (Leahy and Crain 1937: 159, 160). These were the ceremonial axes from the Jimi and Koronigl Valleys which Europeans today call 'Hagen' axes. Unable to cross the flooded river, they made their way up the Mai Valley where a local fight leader guided them for part of the way up the west bank, leaving them at a pass of more than 2750 m because he could not safely go further (Leahy Diary:18.2.33). Subsequent expeditions used this route (Salisbury 1962:113).

Near their Benabena base they met J.L. (Jim) Taylor, ADO from the recently established Kainantu Patrol Post. They had already talked of the unexplored valleys to the west and now told him of their latest adventure. Taylor recalled; 'I was elated of course; we were all tremendously excited. In fact that whole period of our lives was one in which we felt we were taking part, or were likely to take part, in some wonderful discovery' (Morphett n.d.b:6).

It was at Benabena that a revolution occurred in the economics of European exploration in New Guinea, a change that Austen in Papua had begun to consider in 1930. In Taylor's words:

> We were the first to realize the real nature of shell in the highlands. A Kukukuku first taught me the secret by the way he examined a rope of *girigiri* (MP; ring cowries and money cowries) that I had. I realized that it was *money* - he looked as I might have looked at a guinea as a child, first thinking that it was brass then realizing that it was real. When Mick was going through Kainantu I gave him a few handfulls of *Nassa* (*tambu*) saying it might be useful and a week or so later got a note saying 'send some more'.

Mick Leahy put it as follows:

> Shell adornment was the only and natural trade, you could say. It was traded in village by village over the mountains and rivers and ranges, in from the coast on both sides...That gave us the clue. Well, we discovered that the principal ornament here was the *tambu*, a small shell. The main adornment and of course the most prized, appeared to be a white *gam* shell (MP, in this case the egg-cowrie) which they were wearing either around their necks or on the end of a piece of stick which was held in their mouths to further intensify their ferocious appearance, I suppose, when the war was on.
>
> So we bought one or two as a sample and immediately made plans to have that particular trade flown in to the Bena. We used this to hire workers and to pay them off. They were also very interested in *girigiri* here. We bought it for about sixpence a pound on the coast, that is between 200 and 300 dead and dried shells. Freight then was from £112 to £150 per ton from Lae to Bena by air. But because shells were so scarce some of these natives would work all day for about six of them. And for longer and bigger jobs we bought *gam* shells for about a shilling each on the coast and got up to a month's work for one of them. (Morphett n.d.a).

The maximum cost of a day's labour for one man at these rates was about a halfpenny using *girigiri* or *gam*. Commercial supplies of *tambu* were not yet being used by Europeans in mainland New Guinea, but within a year they were being used in large numbers.

Taylor wrote that the principal articles of Benabena wealth were the large white egg-cowrie, *tambu* shell and ring cowrie, with feathers and bark-cloth as minor valuables. The supreme ornament was the egg-cowrie worn as a neck pendant, rarely more than one (1933:16, 18). A man in a photograph taken shortly afterwards by Chinnery appears to be wearing a headband of small olive shells (Chinnery 1934:411). There were already maize and tomatoes among the subsidiary crops and those close to mission outposts were beginning to get potatoes and cabbages; they were eager for any kind of new seed. Near the missions and the camps of miners and administration personnel steel tomahawks and knives were the rule but salt was still got locally from saline springs (Taylor 1933:36-45).

The Wahgi Valley[1]

Persuaded to support further exploration, the company chartered an aircraft in which Harrison, the general manager, and Mick, Dan and Jim Leahy flew over the new country as far as the middle Wahgi Valley, which impressed them by the size of its alluvial terraces, potentially gold bearing, and, judging by the gardens and houses, had the largest single concentration of population they had seen. Mick made a diary entry that on this first flight there were no people to be seen and that they were probably hiding (Leahy Diary:8.3.33). Later in the month another aerial reconnaissance by Taylor, Mick and Dan Leahy and Spinks flew almost to Mt Hagen. Taylor remembered; 'the impression was that we had flown over the Elysian Fields. We came back and we were ready for anything' (Morphett n.d.b:6).

The Administration agreed that Taylor should explore the new valley so he and the miners joined forces, and, as Mick Leahy expressed it, 'the combined party left Benabena and headed back over the range into the promised land' (Morphett n.d.b:1). As a result of their experiences in the Kainantu and Benabena area they took shells as well as European trade goods to buy food. Taylor observed their Benabena carriers exploiting the locals by getting items of traditional wealth for trifles like empty tins; one got a sucking pig for a box of matches (104, 105). Some of the carriers and Mick Leahy were taken as the returned spirits of dead relatives. In the central valley of Siane territory egg-cowrie shells and knives were eagerly sought, a man was seen

[1] In order to save repetition in the remainder of this chapter, references to Taylor's Patrol Report (1933) will be given simply as page numbers, and references to Leahy's diaries will be given simply as dates. Unreferenced information was obtained in interviews with Taylor and the Leahy brothers.

making a stone axe and some of the new thin-bladed type were obtained in return for plane blades (106-9).

Close to the Mai River bandeaux of small cowrie shells (ring or money cowrie in the photographs) were common on foreheads, *tambu* shell stitched to short lengths of string were draped over pegs set in the nose, a number of people wore pigs' tusks through the septum and a few had very valuable narrow curved pieces of mother-of-pearl shell joined together to form a long curve framing the jaw under the chin; some faces were painted with 'powdered graphite' (now known to be specular hematite). A few 'battle-axes' later recognised as characteristic of the Wahgi Valley were seen - the first axe blades seen mounted in the same plane as the handle - and in general, axes improved. The white egg-cowrie retained value as far as the Mai River but beyond it was replaced by pearl shell (34, 48-50). A photograph published late in 1934 captioned 'Mairifuteika headman' shows a man wearing 14 large egg-cowries as a necklace and a headband of what appear to be olive shells (Anon 1934:17). This number of egg-cowries represented exceptional wealth in the Mai Valley in 1933 and the picture may date from one of the 1934 journeys or be labelled in error for the Asaro Valley. Mick Leahy wrote in his diary that some women wore long necklaces of money cowrie and a few had pendants of small pieces of pearl shell. Tomatoes and cabbages had not yet reached here (30.3.33). These people too, 'recognised' members of the party as dead relatives, collected hair from the strange dogs and seized scraps of waste paper and offered women to the police and carriers (111).

West of the Mai in the territory of the China Shiva (now called Sinasina) there was no steel, shells were said to come from the north and the wings and skulls of the dollar bird and the plumes of the red and white birds of paradise were prominent adornments (1.4.33). Maize was still to be seen but was poorer in quality. The general reaction was one of astonishment - people stared open mouthed; though they were very friendly, helpers refused to go beyond their tribal boundaries. Here it was the small *annulus* cowrie[1] which was the most appreciated shell. In the Sinasina photographs not all men are wearing ornaments but some have a short length of *tambu* shell 'rope' draped over the nose, two wear a headband of small cowrie shells, and one young man is wearing a small piece of shell on the tip of his nose and a necklace of what are thought to be possum teeth. Towards the Chimbu River they saw a head-dress which included the plumes of the King of Saxony bird of paradise and here, for the gift of a knife, they received a 'large plate of native salt' (51, 112-14).

West of the Chimbu River were the most highly decorated people they had seen. In retrospect, Taylor described them as rococo, wearing ornaments of feathers and shell constantly. At that time the most common feathers in Chimbu head-dresses were the pale blue and deep blue wings of the dollar bird, now rarely seen; every man of importance wore them and many had necklaces of pig tails. The egg-cowrie was not to be seen and when offered was unwanted. Some had headbands of small rings of cone shell said to have come from over the Bismarck Range. Photographs taken in Chimbu in 1933 show some men without ornament and among those that are decorated, the short 'nose-ropes' of *tambu* shell and headbands of small cowrie shells (either across the forehead or framing the face) are the most common. Others wear a single small pearl shell on the breast, often broken, chipped or rejoined with stitches and gum, a few have joined slivers of pearl shell or boar's tusks in the septum and still fewer have a septum disc formed from the spire of a large cone shell.

A day further west (3.4.33) as they were descending towards a large tributary steam coming from the north [Koronigl] they saw among the ornaments a few beads, pieces of tin, a belt-buckle and the frames of small round mirrors which were said to have come from the north (117). Traditional ornaments included *tambu* shell and some pearl shell, this last item being greatly prized and in demand. The party was handicapped by having only a few of the former and none of the latter. Two pigs were 'bought' after some argument,[2] for steel

[1] Taylor used this specific name for the ring cowrie and did not differentiate between it and the money cowrie, its close relative. Both are subsumed in the MP term *girigiri* and both are common in the ornaments here described. It is not always easy to tell one from the other when the dorsal surface has been removed, as it usually is before mounting. One or two other common species also resemble them.

[2] Cf. Salisbury (1962:115) on the European view of purchase and native view of gift-exchange of valuables. Misunderstandings were especially common over the main *consumable* valuable, pigs.

goods and mirrors, Taylor commenting that the bargaining instinct here seemed to be more developed and all indications were of a well-defined trading route through this valley towards Madang. Further indication of a lowland trade link was an old tomahawk worn down to two inches, of a pattern similar to those distributed by missionaries (117) and a few tiny pieces of broken knife blade the size of a fingernail, mounted on wood.

Another day's march west [near the Gar River] were a few more old knife pieces said to have been obtained from the group they had just left. Here, as spirit people, the whites were associated with the aircraft flights of the month before (3.4 and 4.4.33; Leahy and Crain 1937:170). Less ornament was worn than in Chimbu and Taylor noticed that bird life had been scarce all the way up the valley. One of Leahy's photographs shows that the central shells in rather poor necklaces of cowrie shells here sometimes belonged to a species slightly larger than ring and money cowries (Spinks 1934:facing 416).

In the middle Wahgi, head decorations commonly consisted of rows of ring or money cowries stitched to bark cloth worn over the top of the forehead and over the temples, framing the face, in Taylor's Dickensian description, like Dolly Varden bonnets. When asked where they got their few European articles, they pointed north across the Bismarck Range (55). Though personal adornment was still a passion, less shell was used than in Chimbu (Leahy and Crain 1937: 172). The photographs show some people wearing joined pieces of pearl shell framing the chin and pieces of either pearl shell or green-snail shell at the waist and on the pubic apron, others with a cone-shell disc in the septum and a necklace of small cowries, and another with a single boar's tusk pendant. Many are undecorated.

Taylor bought ground for an airstrip which was quickly levelled and an aircraft made two trips bringing fresh supplies, including shells, and a visit from the company geologist (122, 125). The party pressed on to the west, the route keeping close to the northern foothills. Here steel was quite unknown (14.4.33; 127).

South-west towards Mt Hagen the tracks became ill-defined and guides were needed through the swamps of the upper Wahgi and its tributaries where the main roads avoided all settlements. The first really hostile demonstration occurred after crossing the Gumantz River but another landing ground was built near Ogelbeng. (This upper Wahgi base was beyond the western limits of the present study.)

Leahy's diary for late April and the first few days of May contains a number of references to the patrol's inability to buy pigs because of the lack of the main valuable ornaments of the area - pearl shells and baler shells; there was no sign of European trade goods, no knowledge of steel and gifts of steel were repeatedly refused, the only items acceptable in exchange for artifacts being pieces of broken cups and plates. A shell (of the wrong type) and a knife were refused in return for a stone axe but a saucer was accepted, so Leahy wrote a letter in readiness for the first aircraft asking for more crockery (127-34; 17.4.33-30.4.33). In return for vegetable foods, however, the small cowries were acceptable (133). By 6 May an assortment of shells had arrived by air (though not the two most desired varieties) much to the excitement of the local people. Pigs were brought as offerings to the aircraft itself, a phenomenon reported elsewhere in New Guinea (e.g. McCarthy 1963:121; Hurley 1924:259; 6.5.33). Many men of the upper Wahgi Valley wore cone-shell discs in the septum and a few important ones had broad half-moon shaped pieces of gold-lip pearl shell [*Pinctada maxima*] - 'a possession connoting great wealth' and 'much sought after'. Closer to Mt Hagen itself a popular forehead ornament for men was a broad band of *tambu* shells stitched to bark-cloth and women wore necklaces of small cowries. Even more valuable than pearl shell and very rare were shield shaped pieces of whitened baler shell worn on the breast - two appear in the photographs, both broken and carefully repaired; one was worth two large pigs. Contemporary photographs also show youths wearing small cowrie shell necklaces, variegated leaves on the forehead and head-dresses of short black and white feathers occasionally crowned with the tail feathers of the ribbon-tailed bird of paradise. Hawk wings appear on the heads of some men, one wears a piece of baler shell on his forehead, another a tooth necklace and baldric of Job's tear seeds (*Coix lachryma-jobi*). One breast ornament consists

of a very large pearl shell mounted on a circular backing as used in Melpa ceremonial exchanges and pendants over the temples appear to be pieces of green-snail shell. Tiger cowries (*Cypraea tigris*, commonly called leopard cowries) and Arabian cowries (*Cypraea arabica*) were also valued.

Although the travellers had seen a little tobacco growing in house gardens in the upper Wahgi and a few fowls of European origin, under Mt Hagen itself the people had neither tobacco nor fowls though they knew of both and had words for them. Steel was unknown 'and it was only with greatest difficulty that natives were induced to accept it in payment for food'. Stone axes were of high quality and the 'battle axes' were 'works of art'. One could be obtained for a length of *tambu* shell 'rope' as long as the axe blade (56-68).

When E. Taylor DO flew in from Salamaua to visit them late in April he 'immediately recognised the crescent shaped shells worn by the natives as being gold-lip which is obtainable in Manus' and arrangements were made to get some (135).

The police and carriers who had been left with stores at the first airstrip in the middle Wahgi were now brought to the upper Wahgi base by a route which took them along the south side of the river. Near the Tuman River tributary Taylor bought a stone axe but 'had the greatest difficulty to induce its owner to accept a steel one in return' (137-9).

The Jimi, Nebilyer and Kaugel Valleys

In May and June the party made two journeys to explore the Jimi Valley. The first crossed the Wahgi-Jimi Divide near Mt Jaka, descended to the Tsau River and returned up the Ganz River, southern tributaries of the Jimi. It was no surprise now that steel was of no value and that shells were needed; they were used to make friends on the Tsau and when they reached the Ganz River axe factory (see Chapter VI) the makers were keen to trade but only for shells - steel was refused (10.5.33-18.5.33; 150, 152). The second journey went down the Baiyer River to where the Gai and Jimi Rivers became the Yuat at less than 500 m MSL, and returned up the Mogulpin River. Taylor thought the sparse population showed that malaria had 'placed a cordon around' the great populations of the highlands (165). The people of the lower Jimi, too, had no steel tools (3.6.33) and attempts to give steel in payment for food failed; pointing to *tambu* shell they said 'this is what we want, we have axes of our own', and Taylor gave shells in exchange for a pig (166; 14.6.33).

Back at the upper Wahgi base men were anxious to accompany them out of the valley to see the trees on which the pearl shells were thought to grow, a widespread belief in the inland, and by now steel tools had begun to be appreciated (168, 170; 18.6.33). Near the summit of Mt Hagen people were carrying trade goods to and from the valley to the west (see Chapter V) and the party realised that the people from near their base camp had been to the top of the mountain before (5.7.33; 6.7.33; 173, 174, 177). Sufficient supplies of shell had arrived by aircraft for the men in the immediate vicinity of the base to become selective, refusing pearl shell with sea-borer holes in it (8.7.33). There, interest in steel continued to grow (16.7.33).

Across the southern watershed overlooking the Nebilyer Valley they saw a steel axe in native hands and were told that it had come from Papua; near the Nebilyer River itself there were more and still more as they approached the Kaugel River, all very worn. The most common brand was 'Plumb', one of which was marked with an 'L' according to Taylor and a 'U' according to Leahy (179, 180; 18.7.33-21.7.33; 1936:202). By the time they returned to their base camp at the end of the month the demand for tomahawks and knives had become very keen (188).

While the Leahy brothers remained to prospect the nearby streams Taylor and Spinks returned east to Benabena, noting as they passed through the middle Wahgi Valley the presence of corn growing south of the river. North-east of there and again in southern Sinasina they were attacked by confident warriors and in each place a man was shot. Bloodshed was only just avoided in the Mai Valley, thanks partly to communication made possible by a local man who had accompanied them to the upper Wahgi. Despite the aggressive displays they were able to buy food without difficulty, and Taylor explained (190, 192):

> It may seem strange that these people, whilst they are hostile, should supply us with food, but the point is firstly, that they want our shell money, secondly, that it is quite customary to trade with the enemy, and generally in New Guinea a trading party in an uncontrolled area takes its life in its hands. Then again, we were an unknown quantity, and there was the desire to find out as much as possible about us before beginning hostilities.

During their return to Mt Hagen a month later and their departure with the Leahys in October, all the groups formerly hostile were friendly, to the point of returning goods stolen along the way (199-206). Catholic missionaries safely visited the Chimbu Valley and the Wahgi as far west as the Koronigl River during the following month, entering from their new mission on the Ramu Fall with an escort provided by an upper Chimbu leader with Gende affines (Ross 1969:59, 60).

Early in 1934 the Leahys returned to the upper Wahgi travelling on the south side of the river for the latter part of the trip. There, in the middle of the valley, they noticed two steel tomahawks (11.3.34), which later that year while travelling south of the Kubor Range, they decided had probably come from the Kaugel Valley (Leahy and Crain 1937:278). Five Catholic missionaries visited their base camp, three *gam* (baler) shells in the possession of one of them, Father Ross, greatly exciting the Hageners (31.3.34). There, the exchange value of shells in terms of pigs had already deteriorated. The Leahys thought Taylor's earlier prices had been too high. 'We have a price war on our hands' wrote Mick; 'they are demanding two gold-lip pearl shells or one gold-lip and a tomahawk, which is impossible - a gold-lip costs 2/6d in Salamaua and 4/6d airfreight, so needs a reasonable sized pig' (31.3.34; 3.4.34). The mission party left, three to build a mission station at Mingende in central Chimbu and two for their Gende mission near Bundi.

The Leahys prospected the upper Kaugel Valley where there was 'a steel tomahawk or two' said to have come with pearl and baler shells from the south (6.4.34; 25.4.34). Here pigs could be got for one shell but downstream, east of Mt Giluwe, two were demanded. This rate continued as they travelled south between Mt Giluwe and Mt Ialibu and they refused to buy. Here too, there were 'plenty' of tomahawks. South-west of Mt Ialibu good knives were evident and one man had a spoon pendant (1.5.34; 2.5.34; Leahy and Crain 1937:240). As they circumnavigated Mt Ialibu to the south and east fewer shell ornaments were seen, they were offered two small cassowaries for one pearl shell and there was no steel at all (5.5.34; Leahy and Crain 1937:140).

Back at their new Kuta base on the southern Wahgi watershed an old man told them that the first steel axe in the area had come from the south about a year ahead of the white men (Leahy and Crain 1937:247). However, the diary entry for 24.5.34 suggests that it may have been two or three years earlier than that, as it was judged on the age of the informant's child. In June a journey west into the Lai Valley of the Enga people showed that steel tools had not yet arrived there and that the number and quality of shell valuables were much poorer, whole pearl and baler shells probably not having been seen before (Leahy 1936:254; Leahy and Crain 1937:256).

Meanwhile the Catholic mission centre at Mingende was completed by the end of May with the aid of thousands of helpers paid a few cowrie shells per day. There pigs could be got for a bush knife or tomahawk and large ones for a green-snail shell - stone tools were usual still (Ross 1969:60). This seems to have been the first use of green-snail shells for payments by whites and they were doubtless the first whole ones seen in the highlands. Also in May the first Lutheran missionaries arrived in the Wahgi Valley, began an airstrip and mission station in Chimbu and travelled up the south side of the Wahgi River to the Leahys' base of operations. They crossed the hills at the western end of the Kubor Range overlooking the Nebilyer and Kaugel Valleys in sight of Mt Ialibu and Mt Giluwe before returning east (Bergmann n.d.:13, 14).

Early in 1934 a party of four gold prospectors had come up the Wahgi and continued on to the Yuat; in the middle of the year construction began of a Catholic mission near the Leahy brothers' upper Wahgi base and six more prospectors arrived (Ross 1969:61; Souter 1963:187). Two of these, the Fox

brothers, accompanied the Leahys in an attempt to traverse the southern slopes of the Kubor Range but lack of food in this sparsely settled area forced them back (Leahy 1936:256, 257). On the second attempt the Leahys were joined by J.L. Taylor and the combined party continued east along the southern slopes then turned north over a high pass to the middle Wahgi, thinking it likely that this was a second southern trade route (Leahy and Crain 1937:278).

These journeys by miners, patrol officers and missionaries were the means of widening the horizons of many highlanders by another method - they were able to become travellers themselves. Employment as carriers was the means by which many of them were able to travel beyond the territorial limits of their own clans and tribes for the first time. Competition for places was high 'as usual' when the Leahys set off on their final prospecting trip in October (Leahy 1936: 258). By now the people of the upper Wahgi near the mining and mission establishments were trading tin scraps and spent cartridge cases as ornaments to the less sophisticated people further away - and getting traditional ornaments in return. North-east of here baler shells were still unknown (8.10.34). In Sinasina the prospecting party turned south and crossed the Wahgi River (not far from a salt spring, see Chapter V), passed through a small area of Gumine land and recrossed the river to go north to Mt Elimbari and familiar territory at the Mai River (21.10.34-24.10.34; Leahy 1936:259, 260).

By the end of the year Lutheran and Catholic missions were established in the upper Wahgi, the latter with several scattered outstations (26.11.34; Ross 1969:61; Black, Benabena PR 16 1934-5:12, 13) and an administration base camp opened in Chimbu. The isolation of the Asaro, Wahgi and Chimbu Valleys had finally ended and frequent journeys by missionaries, government officers and miners to return coastal contract labourers and obtain food supplies rapidly increased the numbers of steel tools and unfabricated shells throughout the central highlands. The surrounding valleys remained isolated from direct white contact but a dramatic reversal of direction of flow began to send a few European introduced shells and steel axes out of the Asaro and Wahgi Valleys.

The Highlands Fringe

It was not until the exploration patrol by the Papuan Administration officers I. Champion and Adamson in 1936 that the southern fringe of the central highlands received more contact with white men. Coming from the south-west this party crossed the Mendi basin, the northern shoulders of Mt Giluwe and Mt Ialibu, the northern part of the Poru Plateau, crossed the lower Kaugel River south of Mt Au (Suaru) and the Tua River north of Mt Karimui, continued east of Mt Karimui and turned south to cross the Pio River and return down the Purari River to the Gulf. As they approached Mt Giluwe the number of pearl shell ornaments increased, the quality of stone axes greatly improved and the steel ones were old and blunt (I. Champion Bamu-Purari PR 1936:84). Strips of red cloth and small cowries were in great demand in exchange for food, and a piece of tin cut to the crescent shape favoured for pearl shells and said to have come from the Kaugel Valley provided evidence of new exports from the north (ibid:86). East of Mt Giluwe small cowries were in demand but Champion like the Leahys before him, thought the people hard bargainers. Two wore bracelets of salmon tins and tins were asked for; stone axes were very good and many men had steel ones, all said to have come from the Kewa people south-west. This route they were urged to take but they continued south-east to the Poru area. Here the gardens held manioc (presumably a recent introduction from the south) and Adamson noticed that smoking, absent in the Kaugel, had recommenced; many very old steel axes had come from the Kewa in the south-west and some men had baler shells on their chests. (Two years earlier the Leahys had seen no steel in the less populous Poru area just west of here.) Judgments of 'hard bargaining' here (ibid:91-9) appeared to be due to a total disbelief that steel knives would be given for foodstuffs.

They were unable to get guides to continue east but followed hunting pads and stream beds until they came to the sago stands and outlying bush gardens of the Daribi near the Kaugel-Tua confluence. Men with stone tomahawks, eager to get steel, led them to the Kaugel River. South of Mt Au others guided them past gardens which included corn, said to have come from the direction of the

Pio River, to a bridge over the Tua. Near Mt Karimui, Leahy and Dwyer's journey six years earlier was well remembered and a few people had glass beads and steel axes, said to have come from the south-west. In the Tundawe (Pawaian) settlements north-east of the mountain were many pearl shells and small cowries and from there a volunteer accompanied them south to Kikori (ibid:101-20).

This was the last pre-war pioneer journey within the study area. In 1938 the government opened a patrol post in the upper Wahgi and patrols from there and Chimbu consolidated government influence in the Wahgi Valley and its tributaries. The war interrupted even this program and it was not until the late forties and fifties that direct white contact began again in the fringes of the central highlands. Patrol reports of the fifties show that very many men in these parts were still dependent on stone axes and the demand for steel had everywhere become great.

IV RESOURCES, PEOPLES AND REGIONS

INTRODUCTION

The area of this study exceeds 7000 mi^2 (18400 km^2) and encompasses an altitude range of nearly 4500 m from near sea level on the Ramu and Purari Rivers to the summit of Mt Wilhelm in the Bismarck Range. The resources exploited by the inhabitants are distributed over 4000 m of this range and permanent settlements and garden land reach as high as 2750 m MSL at the head of the Chimbu Valley.

Varied geological and geomorphological characteristics have affected the environments and economies of different groups of people. Except very locally, this has not been through the effect of lithology on garden soils, for fertile soils have developed on a wide variety of parent materials; wide differentiation has resulted from the contrasting primary land forms produced by varied tectonic events, the different weathering characteristics of the main rock types, different erosional histories, and the presence or absence of minerals suitable for the manufacture of artifacts, pigments and comestibles. High and low fold mountains, prominent fault scarps and volcanic cones and plateaus are all intensely dissected. While the structure often controls the drainage and the precise location of trade routes and is a principal determinant (through altitude, aspect and internal relief) of the diversity of habitats, it is noteworthy that the main flows of trade goods cut directly across the strike of the massive central cordillera. This fact highlights the fundamental importance of two factors in determining the resources exploited for trade - the proximity of the sea and the vertical zonation produced by altitude. The third main determinant is the presence in the central mountains of hard, fine-grained metasediments suited to the manufacture of stone tools.

In New Guinea mean annual temperature declines with increasing altitude at the rate of 3^oF (1.67^oC) per 1000 ft (305 m) of altitude both in the lowlands and in the highlands (McAlpine 1969:53; 1970a:73) so that in contrast to the hot tropical rainforest climate of the lowlands, the climate of the highland valleys approximates a moist temperate regime, except that monthly mean temperature varies by only 4^oF (2.22^oC) and the average diurnal range is about 20^oF (11.12^oC). Monthly mean maxima rarely exceed 80^oF (26.7^oC) and monthly mean minima rarely fall below 50^oF (10^oC) (McAlpine 1970a:66, 72, 73). Measurements carried out by others in the middle Jimi and lower Simbai Valleys show that in some places, probably many, the monthly mean varies by less than 2^oF (1.11^oC) (Clarke pers. comm. 1970). Mean annual rainfall varies from less than 80 inches (2030 mm) in the Asaro Valley to more than 180 inches (4572 mm) in the Lake Tebera-Purari River lowlands and at the western end of the Ramu Fall of the Bismarck Range. The north of the study area experiences a January-April maximum and the south a May-August maximum, but nowhere is the seasonality pronounced and even in the Asaro Valley prolonged dry spells are rare (Brookfield and Hart 1966:9-12, 20, 22, Maps 5-9; McAlpine 1970a:68-73). However, the drier seasons are significant for this study because by facilitating burning they help to maintain the extensive short grassland habitats of the Asaro and Ramu Valleys (Saunders 1957:62-6; Robbins 1960:317-28; 1970:116; McAlpine 1970a:76-8). In the Ramu Valley, where grassland is typically encircled or interrupted by patches of forest, burning maintains a habitat favourable to such economically important forest-edge species as feral pig and the Lesser Bird of Paradise.

The study area includes part of the inland Gulf District which locally has population densities of less than one person per square mile (0.4 per km^2) of arable land, but it also includes the area of greatest population concentration in the whole of New Guinea - the highlands from the upper Asaro to the middle Wahgi Valleys where local population densities exceed 500 per square mile (193 per km^2) (Brookfield and Brown 1963:4, 119; Hughes 1966:111). When first contacted by whites, these people were organised in large political units, forming tribes of up to 5000 strong (Brookfield and Brown 1963:122) and living in orderly, relatively stable settlements which in the east were nucleated villages of more than 200 people (Howlett 1962:43; Salisbury 1962:9) and in the

west were dispersed homesteads (Leahy and Crain 1937:172). In contrast, some of the isolated hamlets of the Gulf District lowlands still consist of a single clan of as few as 20 people who in pre-contact times occupied one communal house, the location of which was often shifted within clan territory (see e.g. Hughes 1970:9).

These two areas represent extremes of man-environment relationships; in one, man has been the ecologically dominant species for thousands of years, in the other he is still relatively unimportant. In the highland valleys, the primary forest has been destroyed, there is minimal hunting for food, and the agricultural system is labour intensive with a high degree of crop separation dependent on large fields of sweet potato and small mixed gardens. Here pig husbandry is well developed and consumes much labour, and a few domestic boars are kept for breeding. In the Gulf lowlands there are many hundreds of square miles of primary rainforest where hunting supplies much of the protein, sago forms the carbohydrate staple of many groups, gardens are small ephemeral forest swiddens and pigs are semi-domesticated, being raised from captured feral young. All the other groups visited fall between these two extremes and have a variety of local strategies for exploiting their environments, strategies which, because of the special roles of luxuries and valuables, are reflected in trade patterns more strongly than in subsistence activity.

More than 30 languages are spoken, and dialects, different traditions of origin and variations in custom and material culture are further divisions, but the ecological phenomena most relevant to trade usually transcend these boundaries, even those main determinants of trading advantages - access to marine and mineral resources of limited distribution.

Access to special resources tends to coincide with 12 physiographic units, which, listed from north to south, are the Astrolabe Bay-Gogol River plains, the sub-coastal hills (a north-easterly extension of the Finisterre Range), the Ramu River plains, the north-east fall of the Bismarck Range, the high mountains of the Bismarck, Sepik-Wahgi Divide and Kubor Ranges, the high valleys between them (particularly the Jimi, Wahgi and Asaro Valleys), the southern slopes of the Kubor Range draining to the Kaugel River, the Poru Plateau south-east of Mt Ialibu, the volcanic plateau around Mts Au and Karimui, the lower Erave River-Lake Tebera-upper Purari River limestone karst (this surrounds volcanic Mt Murray and with other sediments surrounds volcanic Mts Duau and Favenc), the low sub-coastal hills, and the Kikori-Purari delta. The first of these and the last two are outside the study area but affect it, contributing some products and receiving others.

The physiographic units that lie partly or wholly within the study area provide the basis for model regions that aid the understanding and exposition of trade in this diverse area; for this purpose each can be regarded as a large, complex ecosystem. But they are modified by three factors, the sharing of some resources, the existence of local mountain barriers, and the arbitrary limits imposed on the data collection area. The high mountains are uninhabited and largely forested and are exploited by people living on all sides of them (Map 1). Where high watersheds make it difficult for groups on one side to exploit the products of the other side except by trade, the mountain chains form the boundaries between resource access regions. They also form part of the line of the 'cultural divide' between the Asaro-Siane area and the valleys to the west. This division between the Central and East Central Language Families (Wurm 1964) is reflected in material culture, including those important trade goods, axe-blades and ornaments. The distinct histories of cultural evolution and borrowing that these traits imply may owe much to basic differences in migration and settlement histories, but arise in part from the eastern location and orientation of the Asaro Valley and the resulting trade connections peculiar to the Gahuku and Benabena people. Access to some of these outside resources is bisected by the study's eastern boundary but for our purpose it is useful to treat the upper Asaro as an entity. In the same way, that part of the Jimi Valley that lies within the study area forms a distinct unit because of its important trade connections with the lower Jimi and Yuat Valleys and with the people of the Schrader Range. The middle Jimi has its own connections over the low north-western extremity of the Bismarck Divide with colinguals in the Simbai Valley of the Ramu Fall.

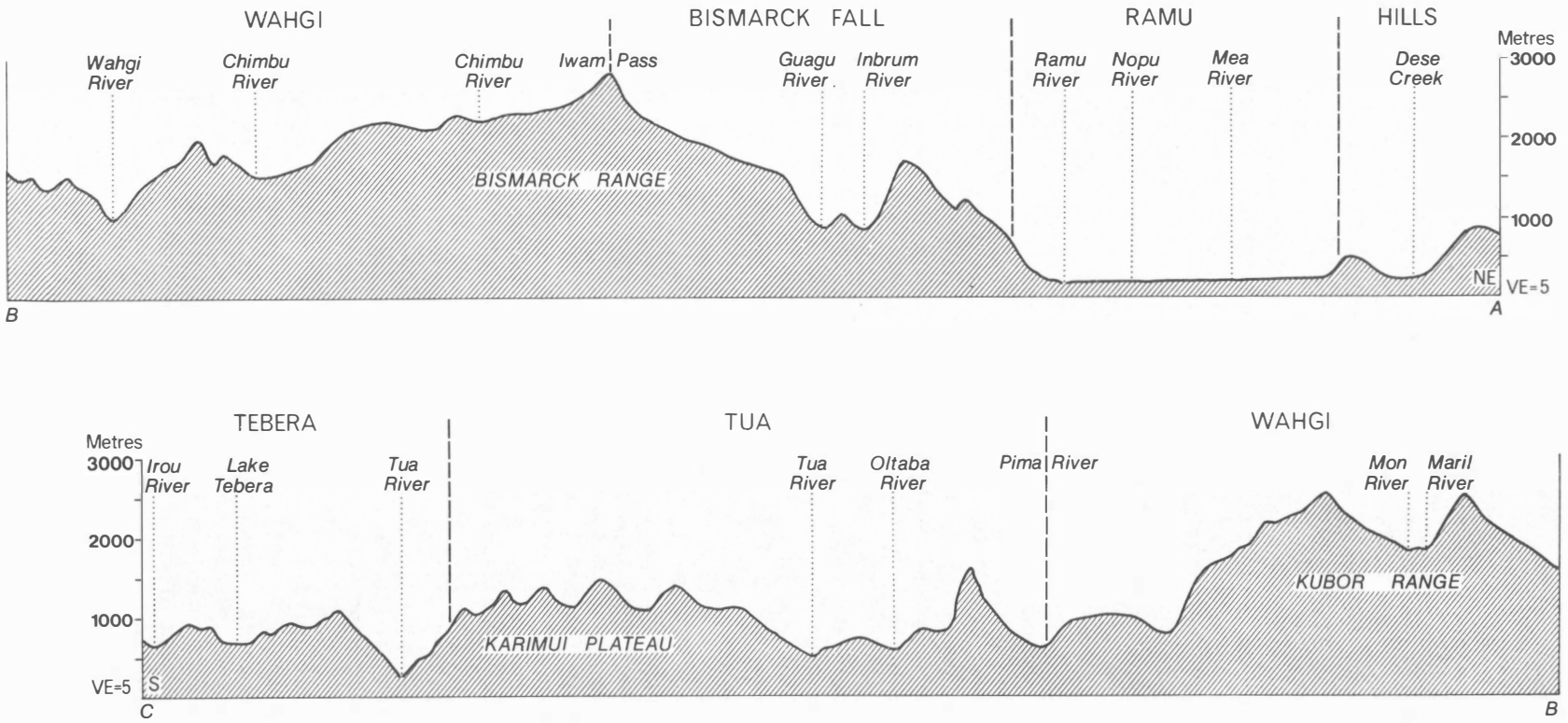


Fig.1 Section through study area NE-S

This yields ten divisions within the study area, each with its own trading advantages and disadvantages: the northern sub-coastal hills, the Ramu plain, the Ramu Fall of the Bismarck Range, the Jimi Valley, the Asaro Valley, the Wahgi Valley, the southern slopes of the Kubor Range usually referred to as Kambia, the Poru plateau, the Au-Karimui plateau bisected by the Tua River, and the low Lake Tebera karstland. For brevity, these will be called Hills, Ramu, Bismarck Fall, Jimi, Asaro, Wahgi, Kambia, Poru, Tua and Tebera: they are shown on Map 1. Fig.1, a section through the study area from north-east to south (line A-B-C on Map 1), gives some idea of the differences in altitude, relief and aspect within and between six of these regions, the highest points of the profile being not mountain summits or high ridges but the passes of regular trade routes. The following descriptions of each region mention the most important resources for trade and the main flows of trade goods but detailed discussion is found in Part Four. Apart from the historical material already cited, published references which bear directly or indirectly on the people of the study area and their environments number more than 300 (see especially Reeves and Dudley 1969; Anon 1968; and Anon 1968-70). Only the most important will be mentioned in this chapter.

HILLS

This extension of the Finisterre Range rises to only 900 m MSL and although settlement extends from 150 m to 750 m, most villages and hamlets are between 250 and 600 m MSL. The unit's limit on the inland side was mapped as the southern edge of the Kubari and Bagasin land systems by the CSIRO, LRRS (1957), though little of the Kubari land system is included in the present area. The CSIRO 1957 Upper Ramu report and the 1959 Lower Ramu report describe the hills as consisting of mudstones and sandstones with local volcanic intrusions and limestones, showing steep unstable slopes with variable, mostly immature, clayey, often shallow, well to excessively drained soils. The hills are covered in secondary forest and younger garden regrowth with some pockets of climax lowland hill forest. Anthropogenic disclimax grassland is increasing and is associated with soil degradation and seasonal burning (1957:58, 59, 62, 63; 1959:103, 104).

The people visited in this area were speakers of the Garia and Kopoka languages (Lawrence 1964:map IV, 24) which Z'graggen has called Sumau and Urigina respectively. He tentatively groups these with Usino (Lawrence's Sopu) to form an Usur Stock (1968:7, map). Claassen and McElhanon add a fourth language, Bagasin, to tentatively form an Usino family which they group with three other families to form a Rai Coast Stock (1970:57-61). Lawrence is the authority on the Garia, which Kopoka society appears to resemble closely. He gives their territory as 35 mi^2 (90 km^2) and their population as 2500 (1964:24). Z'graggen numbers Garia speakers at only about 800 although the Garia villages he lists (1969:61, 62) occupy almost as much territory as those shown by Lawrence; Z'graggen numbers Kopoka (Urigina) speakers at about 1600. Their population density is less than that of the Garia.

Lawrence has described the Garia as being organised in bilateral kindreds of cognatic groups, each with an agnatic core linked through descent, marriage and trade and exchange partnerships from hamlet to hamlet, extending to affines outside the language group; a family's garden land is dispersed and residence flexible (1964:24, 25).

The special product of the Garia and Kopoka (and the Girawa to their north) was and is clay pots. Access to shell ornaments from coastal neighbours was also important for their inland trade. As already mentioned, this area and the Ramu plains were the earliest parts contacted by whites, nearly three generations ago and memories of stone tool technology are now almost completely lost, but the people know that they were dependent on inland sources of good stone axe blades. In earlier times some of these were passed on towards the coast, and polished stone blades of central highlands type appear in the early collections made around Astrolabe Bay.

In spite of extensive forest destruction these hills have some of the birds that elsewhere are traded, such as the hornbill, white cockatoo, palm cockatoo and various parrots, but at the time of field-work these did not

figure in trade here and there was little recollection of them having done so. Old men remembered, however, that shells had once been much more valuable, and that earlier still, dogs' teeth had been highly valued.

Formal interviews were conducted at four centres. All main interview sites are shown on Map 1.

RAMU

Here the strikingly linear flood plain of the Ramu River is from 5 to 15 miles (8 to 24 km) wide and varies in altitude from 75 m to 225 m MSL; rare outlying settlements of the southern Ramu people are as high as 650 m MSL in the Bismarck foothills, and lowland rainforest is regularly exploited to 950 m MSL. Tributary streams, especially those from the Bismarck Range, emerge from gorges over sloping outwash gravels, those of the smaller streams being quite steep fans; here they are strongly braided in banks of rubble, coarse gravel and sand. Where the Ramu enters the area it is similar, but most of its course has high banks of medium and fine silt, as do the lowest parts of the tributaries.

There are large differences in relief and slope and in the texture of the alluvial and colluvial deposits; some parts are never flooded and others have a wide variety of flooding regimes, including some permanent swamp. A large number of contrasting vegetation communities result, including primary and secondary forest, induced grassland, young garden regrowth and gardens as well as swamp communities - the CSIRO survey divided this part of the valley into eight land systems. The climax rainforest is structurally and floristically complex, including many economically useful palms, lianes and canes, valuable timber trees and fruit trees. Established secondary forest and young garden regrowth also include the breadfruit tree.

Grassland is extensive in the east and in many places has extended up the lower hill slopes; apart from swamp and stream bed communities, it is all a result of gardening and annual burning for hunting. Much of it is short grassland, but where there is more soil moisture, deeper soils and less frequent burning, tall grasses predominate. The unstable stream beds are dominated by giant grasses or tall casuarina trees. Fifteen square miles (39 km^2) of poorly drained and frequently flooded land are dominated by *Phragmites karka* with some permanent swamps and relict and dead stands of the original forest, and 20 square miles (52 km^2) of seasonally fluctuating swamp carry swamp forest or swamp woodland which includes pandanus and sago (CSIRO 1957:57-66, 87-113). Because of the variety of highly differentiated habitats within this narrow belt of country, animal and bird species of the forest, forest edge, grassland, garden, swamp, lagoon and river are all present.

Since much of the valley floor is flooded during the wet season and a large area north of the Nopu River and many smaller areas become back-swamps of the Ramu itself, villages are built on the levees and on the pediment of the foothills. The wet replenishes a number of billabongs and leaves others for a time in old stream channels like the lower Nopu. Late in the dry season when its lower reaches have dried up, the upper Nopu is dammed by the Kopoka speakers of the Sausi-Koropa district together with villagers from Yonapa on the Ramu, and its flow diverted into a short flood channel to the Ramu. Men and boys with fishing spears wade back and forth stirring up the fine grey silt which smothers the fish and makes them easily caught by hand. It is a popular family event, and at this time the intake of protein reaches an annual peak.

Wild pigs are common, emerging from the forest at night to root in the grassland, and lowland marsupials are caught for local consumption and trade. Birds which contribute to trade include the cassowary, Lesser Bird of Paradise, Goura pigeon, hornbill, and cockatoos and parrots. Natural products of lowland forest and grassland together with carved wooden bowls were the most important locally produced trade goods. Although the plains people controlled a salt spring in the lower foothills of the Bismarcks and were taught by their affines of the Bismarck Fall to prepare dry salt from it, they traded it but little. Significant transit goods were shells and pots from the sub-coastal hills and stone axe blades from the Bismarck Fall.

The valley is sparsely populated and most settlements are isolated, and the people and their languages have not been studied in detail. Downstream, the north-west portion contains much uninhabited forest, and the few scattered hamlets there were not visited. In the centre, the Usino language area extends to the south-west bank of the Ramu River, as does the Kopoka (Urigina) language area upstream of it (Z'graggen 1969:61, map). In the south-eastern part at least two languages are spoken, Koropa and Kaikovu, members of the Evapia Family (Claassen and McElhanon 1970:59, 61, map) which extends south of the river at least as far as Korigi on the Maria River. The people living where the Tauya River debouches onto the plain appeared to speak either Kopoka or Koropa and in modern times have extended their connections by marriage from the upper Tauya River into the upper Asaro.

Interviews were conducted at nine places, one at the mouth of the Tauya River, one at Korigi, one north of the Ramu at Kesawai, two in the Koropa language area and four in the Usino language area.

BISMARCK FALL

This unit encompasses the entire north-east fall of the Bismarck Range from 225 m to 4500 m MSL, but the lower 700 m of this is more used by the people of the Ramu region and the higher altitudes are used only for hunting, the upper parts of the montane rainforest and the alpine scrub and grassland of the watershed being more regularly exploited by the people of the highland valleys. The high mountain forest is less used on the north side of the watershed than on the south; Wade and McVean (1969:57) noted that this was marked in the Mt Wilhelm area but it is true of all the Bismarck Range. Observations of the upper limit of the montane forest suggest that it is generally 300 m higher on the north-east side of the mountains - in the Mt Wilhelm area this is supported by Wade and McVean (1969:17, 54, 57). It may in part result from moister conditions (Wade and McVean 1969:57; Robbins 1970: 104) and partly from the lowering of the upper forest limits on the southern side by hunting fires (Wade and McVean 1969:58). In the lower Simbai Valley some gardens are as low as 700 m MSL but in most of the region effective occupation, both for gardening and forest utilisation, ranges from 900 m to 2250 m MSL with most settlements and gardens lying in the 1200 to 1900 m zone. This is 350 m lower than in the upper Jimi and upper Asaro Valleys and 700 m lower than in the upper Chimbu Valley, reflecting a lack of pressure on resources, but also perhaps influenced by more regular cloud cover on the north-east side of the Bismarck tops. Clarke has said that persistent cloud on a similar aspect of the Bismarck Range in the lower Simbai Valley has kept gardens below 4000 ft (1220 m) (1969:1). On the Ramu side of the 2870 m Iwam Pass at the head of the Chimbu Valley, some of the land above 1800 m is occupied by two groups from the upper Chimbu.

The region fits the popular concept of New Guinea terrain, falling from the watershed to the Ramu plain at the rate of 300 m per mile and consisting of steep ridges and deep 'V' shaped valleys with an internal relief nearly as great as the total altitude range of the occupied zone itself. Communication across the main north-east slope is aided in the central part by the Bundi Fault Trough which separates the foothills from the Bismarck Range (see Fig.1). Many of the settlements of the Bismarck Fall are located here, including those of the Gende and the people of the Simbai. There, the lowest settlements of the Maring speakers occur in forest of the lowland type and all along the Fall some use is made of this forest. Nearly all of the region lies within what the CSIRO 1970 publication has called the Bismarck Land System, the exceptions being mainly uninhabited mountains above 2750 m bearing alpine grassland and montane forest (29, 31, 49). Most of the inhabited zone is covered by lower montane mixed rainforest less complex than the lowland forest, and what Saunders has called degraded mixed forest, largely because of human use (1970:124). In Gende territory there are large areas where, when the 1955 aerial photographs were taken, more than half the vegetation was man-induced regrowth or gardens (cf. Schlechter's observation 53 years earlier, discussed in Chapter III, above). The middle tracts of most other valleys are covered by secondary forest with a very low percentage of land in current use (McAlpine

and Saunders 1970:map; McAlpine 1970b:131; Robbins 1970:116, 117). Aerial photographs show the lower Simbai valley to be in the second of these categories; the upper Simbai resembles the territory of the Gende but with a higher percentage of grassland.

The Gende area is the first so far where sweet potato forms at least a co-dominant staple food and where sweet potato gardens tend to be separated from other crops. Both of these characteristics increase with altitude, and, with minor variations, are typical of the rest of the regions to be described, except the final one, Tebera. Separation of sweet potato or other starchy staples into single-crop gardens is not characteristic of the Maring (Clarke 1966:348-52). Although the Maring living in the Jimi Valley were visited in the course of the present study those in the Simbai were not. They are the northernmost group speaking a language of the Central Language Family, being placed by Wurm (1964) in the Jimi Sub-family. They have been studied by Rappaport (1967[1968]) and Clarke (1971). Rappaport records the following protein foods among the wild resources exploited: wild pigs, cassowaries, marsupials, rats, snakes, lizards, eels, birds and their eggs, bats, grubs, insects and spiders (1967[1968]:273-7). Bird feathers, animal skins and fur were important to trade, many of these items being received from northern neighbours and many in turn being sent south in return for stone axes, pigs and shells. However, the local speciality was salt made from springs in the Simbai Valley (ibid:78, 103-9). A minor item was the export south of the stems of the *Dendrobium* orchid (yielding a yellow ornamental fibre) in return for black palm wood (Clarke pers.comm.). The Karam speakers of the upper Simbai also produced salt; most of this language group live south of the watershed as described in the section on Jimi.

Wurm (1964) puts Gende in a Gende-Biyom Sub-family of the East-Central Language Family. Gende speakers have been described by Aufenanger and Höltker (1940). Their access to lower altitude forests and their lower altitude gardens provided them with their main locally produced trade items - raw and fabricated forest products and lowland fruit and vegetables. They also produced sodium salt and two mineral pigments, which, like most of their special products, went mainly to the highland valleys. Potassium salt made from plants was traded to the Ramu plains. However, the most important items in their trade were stone axes and axe blades from the highlands and shells from the Ramu plains. Second in importance in imports and transit traffic were pots and the plumes of the Lesser Bird of Paradise from the plains, and sodium salt, plumes of the Red Bird of Paradise and pigs from the highlands.

South-east along the Fall are people speaking other languages of the East-Central Family. The nearest neighbours of the Gende speak the closely-related Biyom, and this may extend to the middle Tauya Valley. The people of the Tauya River headwaters say that they speak the language of their kin in the Asaro Valley, which is Gahuku of the Gahuku-Benabena Sub-family. The people of the valleys draining the northern slopes of Mt Otto probably also speak a language of that Sub-family; they were not visited. Except for the absence of local salt and pigments, the people of the Tauya Valley traded the same categories of goods as the Gende, though some shell species and most axe types were different. They received relatively few stone axes from the highlands, many of their axes being made from local river boulders.

From the descriptions given by the authorities cited, from the remarks of other observers and from superficial observation in the field, Maring and Gende social organisation and culture seem similar in essentials to the larger societies of the highlands valleys. This is true, too, of the people of the Tauya Valley. It is not surprising, since language distribution, settlement patterns and traditions of migration suggest that these people share common origins with highlanders and in most cases migrated directly to their present locations from the highland valleys. Maring traditions and settlement patterns show a northward migration from the middle Jimi Valley (Rappaport 1967[1968]:12). The Inaugl clans living above the Gende, many of whom now speak Gende as their first language, moved from the upper Chimbu Valley many generations ago, and their Dengla-Maguagu neighbours shifted over the pass within the last 30-40 years (Nilles 1943:105; McNamara Bundi PR 1 1956-7). Four of the six groups have some of their members living within the highland valleys, the exceptions

being the Gende and the Biyom. For the purposes of this summary these societies can be characterised as being of the highlands type, sharing the main features of their subsistence, material culture and social organisation with the people of the Asaro, Chimbu, Wahgi and Jimi Valleys, as well as with the people of the Kambia and the Poru Plateau; the variations are no greater than those between one end of the Wahgi Valley and the other. They are organised in putatively patrilineal, usually exogamous, landholding clans and sub-clans, usually uniting in larger groups for the most important ceremonies and sometimes for war; groups and individuals regularly make opportune use of the connections provided by affines and trade friends for achieving economic and political success.

In central Gende, population densities on arable land exceed 100 per mi^2 (39 per km^2) and locally are double that figure, the Maring of the middle Simbai Valley are less than 100 per mi^2 of arable land (Rappaport 1967[1968]:286), as are the Karam of the upper Simbai; elsewhere on the Bismarck Fall population densities are low to very low.

Interviews were held in eight Gende settlements, in two settlements in the Tauya Valley and in three settlements of Karam speakers in the upper Simbai Valley.

JIMI

Only the upper and middle Jimi Valley were included in the survey area but some account must be taken of the Jimi's lowest tract as well, because of its importance to the trade of the whole valley and of neighbouring valleys. One of the traverses passed close to this low tract, crossing the main stream at 460 m MSL in Karam territory, on the way back from a brief visit to other Karam speakers in the upper Kaironk Valley, a tributary of the lower Jimi. Wurm places this language in a Family only distantly related to the large East New Guinea Highlands Stock. The rest of the Jimi Valley is occupied by people speaking languages of the Central Language Family of this Stock. East of the Karam speakers are the Maring, already discussed, east of them again are Narak speakers and the head of the valley is occupied by Kandawo speakers, the three languages forming a Jimi Sub-family of the Central Family. The south-west of the valley is occupied by Melpa speakers (called Hagen by Wurm) and the south-central section by Wahgi speakers (called Kumai by some), both of them languages of the Wahgi Valley and in separate Sub-families of the Central Family (Wurm 1964).

The Jimi River rises in the alpine grasslands of the central massif of the Bismarcks and drains north-west through a wide range of habitats before leaving the survey area at around 450 m MSL to join rivers from the western highlands; together they become the Yuat and continue to the Sepik. Its tributaries drain the forested north-western end of the Bismarck Range, here generally lower than 2500 m MSL, and the Wahgi-Sepik Divide, whose peaks decline from 3700 m in the east to below 2500 m in the west. (This divide is the watershed between the Sepik and Purari catchments, Jimi waters ultimately reaching the north coast and Wahgi waters reaching the south coast.) The main valley averages 8 miles (13 km) in width and is 45 miles (72 km) long within the study area, its shape and orientation being largely determined by faulting. It is developed largely in greywacke, shales and sandstones, mostly flat lying or gently dipping, which has produced a topography of deeply incised rivers separated by broad, flat interfluves standing 1800 m MSL in the south-east and descending gradually north-west to the plain of the lower Jimi below 400 m MSL (Dow and Dekker 1964:7, 8, 29, 33, 35, plate 10). There are many large and small Tertiary intrusions which have contact-metamorphosed part of the sediments, a fact of great economic significance for the people of the valley, for it is these metasediments that have been quarried for axe stone (Chappell 1966:96; Bain *et al.* 1970:78, 79).

The Karam and Maring have a number of routes, most remaining below 2250 m, leading north to the Kaironk and Simbai Valleys. The Kandawo and Gende use the Jimi Gap north-west of Mt Herbert, which at 1830 m is the lowest of the many passes into the Ramu, and they also use a track passing between Mt Herbert and Mt Wilhelm at 3450 m. Sometimes the Kandawo use a route high over the southern

shoulder of Mt Wilhelm to reach the Chimbu Valley but their main route to the Chimbu and Wahgi Valleys is over a 2970 m pass into the Koronigl Valley, where they have many kin. The Melpa and Wahgi language speakers are linked to their southern relatives by tracks rising to between 2000 and 2500 m and crossing the Wahgi-Sepik Divide in several places.

The CSIRO survey (1970) does not include the Jimi Valley but soils and the patterns of natural and induced vegetation resemble those of similar altitude in the nearby Wahgi Valley. There are extensive stands of lower montane forest below 1250 m as well as lowland rainforest. The lowest part of the valley has large expanses of grassland which comparison with other similar areas suggests is anthropogenic (Robbins 1970:107; 1963:50; 1960), though the present population is sparse and the occupation sites of earlier inhabitants are not prominent; these grasslands add to the wildlife habitats affecting Jimi trade. Human occupation has also affected nearly all the vegetation of the middle and upper valley, and climax forest is restricted to ridge tops above 2000 m MSL and a few deep gullies. Most vegetation is secondary forest, planted fallow trees, other woody garden regrowth and both tall and short grassland fallow, gardens and planted ornamentals. The north side of the valley and northern tributary valleys have large areas of short grassland maintained by burning. Sweet potato as the dominant staple is evident in the upper and southern valley; population density decreases below 900 m MSL.

The range of altitude and vegetation provides a wide variety of bird and animal habitats: the lower valley has feral pigs and is an important source of marsupials and cassowaries for trade south to the Wahgi Valley as well as supplying skins of the Lesser Bird of Paradise and the feathers of other lowland birds; the middle tract also has the Lesser Bird of Paradise and the upper valley has birds of paradise of the higher altitude forests.

Good quality stone axes were the special product of the Jimi, made by Melpa speakers using fine grained hornfelsed metasediments; they traded them in every direction. Vital imports, many of which were re-exported, were shells, nearly all from the north-west and north. Salt was imported from the north and west and the upper Jimi received some stone axes from other quarries many miles south and south-east of the Wahgi-Sepik Divide.

No monograph has been published on the people of the Jimi but those describing neighbouring peoples of the same language groups are relevant. In separate papers, R. Bulmer has published some aspects of the life of the Kaironk Karam, especially in the field of ethnoscience (see bibliography). Maring studies have already been cited. The principal monographs on the Melpa as they were immediately after contact are Vicedom and Tischner (1943-8) and Strauss and Tischner (1962), and Reay (1959) has described the Wahgi speakers. Post-war Melpa society has been described by A. Strathern (1971; 1972) and A. and M. Strathern (1971) and there is an unpublished monograph on Narak social organisation by Cook (1967).

Eighteen interviews were carried out in the Jimi Valley, four among the Melpa, two Wahgi, two Chimbu, three Kandawo, three Narak, two Maring and two Karam. One Karam interview was also held in the upper Kaironk Valley, in addition to the three already mentioned in the upper Simbai Valley.

ASARO

On the south-east side of the central massif of the Bismarck Range rise the Chimbu and Asaro Rivers, separated by Mt Kerigomna, the high point of the Asaro-Wahgi Divide; for half of its length this divide forms the boundary between the Asaro and Wahgi regions. Across the Asaro to the north-east Mt Otto is the centre of the last remaining large forested area of the eastern Bismarcks and caps the divide between the Asaro and Ramu; this divide separates the Bismarck Fall and Asaro regions.

The Asaro River flows south-east then south-west through mainly metamorphic and sedimentary formations which have been penetrated by a number of minor intrusions (McMillan and Malone 1960:12-53; Bain *et al.* 1970:plate 1) one of which has hornfelsed the metasediments exploited by axe makers living in a small western tributary valley. The small Ayondo River parallels the middle Asaro and drains the steep valleys between the Asaro Range and the Elimbari

Range. The Asaro-Wahgi watershed is inhabited by people speaking languages of the East Central Family - they live in the headwaters of the Mai River, a Wahgi tributary, as well as in the Ayondo and Asaro Valleys. The cultural division between speakers of languages of this Family and those speaking languages of the Central Family has already been remarked and it is realistic to draw the regional boundary to separate them.

The region is nearly all above 1500 m MSL except for a small pocket in the south-east descending to 850 m along the lower Asaro River. Much of it is a man-made landscape. Some 200 mi^2 (518 km^2) of lower montane mixed forest survives,[1] most of it above 2250 m, but a third has been affected by exploitation. Disclimax short grassland covers 50 mi^2 (130 km^2) of the lower slopes but is now rarely gardened. Another 50 mi^2 is only lightly used, more than half of it being under climax vegetation, mainly forest. Of the remaining 250 mi^2 (650 km^2), a quarter was intensively used, most of the aggregations of continuous garden being located on the flood plain and alluvial fans of the upper Asaro Valley (McAlpine 1970:134, 135).

Gahuku speakers live mainly north-east of the Asaro River and Asaro speakers south-west of it (Wurm 1964; Salisbury 1962:8). Some clans of the Inaugl tribe, bilingual in Asaro and Chimbu, have been living on the western side of the upper Asaro for several generations. There are conflicting stories about the length of their residence and their pattern of migration, though, like all Chimbu speakers, their oldest traditions place their origin in the Chimbu Valley. They have close relations in the upper Chimbu Valley and on the Bismarck Fall with whom they maintain regular contact.

Wildlife is restricted to high altitude species of which the most valuable are birds of paradise. Cassowaries, presumably of the dwarf species, are said to still exist in the Kerigomna-Bismarck area but must be rare. The Red Bird of Paradise frequents planted groves of trees; there are no feral pigs and domestic pigs are an important export. Lowland birds and animals are received from the Bismarck Fall, as were shells and a few pots, some of the former being traded south-west for salt. Good axes were made by Asaro language speakers near Koreipa in the middle of the region and traded in all directions, but they did not go far west, for other axes came from that direction and from the south-west. A few of these, together with some shells, were received from the upper Chimbu via paths crossing the northern shoulder of Mt Kerigomna. Direct routes to the Bismarck Fall have already been mentioned. Upper Asaro links to the south-west crossed Kerigomna high on the south side, avoiding the more populous parts. The people of the middle Asaro had many paths to the south-west, especially over the low Asaro Range, and the Siane travelled both west and south around the Elimbari Range through areas of contiguous settlement.

The best general geographical description of the Asaro Valley is by Howlett (1962), while Read (1966) conveys a vivid picture of the middle Asaro environment, people and their way of life. Newman (1965) has described a group in the upper Asaro and Salisbury (1962) has described the Siane.

Four interviews were carried out in the upper Asaro and three among the Siane.

THE WAHGI

This is the largest region, extending through 80 miles (130 km) of the Wahgi Valley from near the head of that river to where it is joined by the Asaro and becomes the Tua. The populated part of the valley is about 12 miles (20 km) wide for its full length but the region also includes the tributary valleys (the most important being the Chimbu) and the headwaters of the Pima River in the south. The sparsely populated western end of the Kubor Range and the country south-east of the Tua River were not visited but without them the region includes more than 1400 mi^2 (3600 km^2) of occupied land. All of this has been settled by people speaking languages of the Central Family, who, in broad terms, have agricultural, forest and grassland resources, subsistence

[1] Vegetation and land use measured planimetrically from the McAlpine and Saunders map (1970), with crude percentage additions based on mean slope estimates of 30° in forested mountains, 10° in the dissected alluvial fans, terraces and plains, and 20° in the rest. The map is based on 1955 air photos and field data from 1957, 1965 and 1967 (ibid:16, 17).

economy, settlement pattern, social organisation and general ethos of remarkable homogeneity.

The region is oriented by the dominant north-west/south-east geological structure, the inhabited part of the main valley being underlain by sedimentary and metamorphic formations and the north-western half filled by extensive deposits of Pleistocene gravel and Recent alluvium. Intrusive rocks occupy a relatively small area (in contrast to the mountain ranges) but their presence has had great economic significance in localities where they have metamorphosed adjacent rock into excellent stone axe material. The floor of the middle Wahgi Valley consists of moderately dissected alluvial fans, and with adjoining higher river terraces, this tract forms a physiographic unit distinct from the wide flat plain of the upper Wahgi and the steep ridges of the rest of the valley. Entering the region at 1550 m MSL, the river and its present flood plain are incised with increasing depth along their south-easterly course and after the Koronigl confluence the river ceases to meander and enters 'V' shaped valleys; between the Marigl and Mai Rivers it has cut a gorge 200 m deep but it enters another tract of 'V' shaped valleys before its junction with the Asaro.

The languages of the upper and middle Wahgi Valley, Melpa and Wahgi, are placed by Wurm (1964) in separate Sub-families; the rest he regards as belonging to a Chimbu-Chuave Sub-family. Chimbu, known to many scholars as Kuman, occupies the Koronigl and Chimbu Valleys and the area between them and extends in a narrow wedge south of the Wahgi River to the mountains. Dom speakers live to the south of them, mostly on the south-west side of the Wahgi River, and extend to the headwaters of the Pima River. To the east, between the lower Chimbu River and the Mai River, are Sinasina speakers and Chuave speakers, the latter living on both banks of the Mai; south-east are Elimbari speakers and further still, in the Wahgi-Tua bend are Nomane speakers, a small group of 4000. Only a few thousand Melpa speakers live within the study area but Wahgi speakers in this region number 34000; speakers of Chimbu-Chuave languages total 145,000. With 180,000 people and a mean density of about 150 per mi^2 (58 per km^2) of arable land, it is not surprising that the Wahgi region impressed the first white visitors as a vast landscape entirely dominated by man, a phenomenon not previously seen in New Guinea.

Except in the Pima Valley where habitation goes as low as 750 m MSL, all settlements are above 1250 m; most are above 1500 m, even near the Tua River. In the upper Wahgi the lower hill slopes, fans and higher terraces are favoured for habitation in preference to the low, flat, swampy valley floor, but this is characteristic only of the last 100 years. In the upper and middle Wahgi, settlement rarely goes higher than 2000 m MSL; in the densely populated middle Chimbu and in Sinasina it often goes another 100 m higher, sometimes to 2250 m. In these parts population densities are commonly above 200 per mi^2 (77 per km^2) and some clans locally exceed 500 per mi^2 (194 per km^2) (Brookfield and Brown 1963:119, 122; Hughes 1966:77, 110). The upper Chimbu Valley is most densely populated, and largely because of the long growing season imposed by high altitude its occupational capability is lower, producing acute pressure on resources - gardens there are as high as 2700 m MSL. Between the Mai River and the Wahgi-Asaro confluence population densities are less and arable land encompasses an ideal cultivation range of from 2150 m down to 750 m MSL. The Dom language area in and north of the Maril Valley (Dom and Gumine dialects) is notable for its steep slopes, and most of the land has been used to 2200 m MSL. South of there, the Nondiri dialect Dom and the Nomane speakers form an expanding frontier of the Chimbu-Chuave Sub-family of languages and have access to the last remaining area of rainforest below 2000 m MSL.

Most of the remaining rainforest is restricted to mountains and ridges above 2100 m and the lower edge has been much disturbed. Sheltered areas above this altitude contain groves of nut pandanus. The rest of the landscape is a patchwork of gardens and fallow, large fields of sweet potato being prominent and fallow consisting mainly of tall sword grass, woody shrubs and planted casuarina. Groves of trees are mainly casuarina and ornamentals with a few pockets of remnant forest in inaccessible locations. At lower altitudes, usually below 1750 m and close to houses, small orchards of oil pandanus can be seen. The only stabilised short grassland of any extent occurs in the

south-east, mainly below 1100 m MSL, and on the gravels of the middle and upper Wahgi between 1500 and 1700 m MSL where it covers more than 100 mi^2 (260 km^2). McAlpine mapped more than 250 mi^2 (648 km^2) of the region as intensive land use (more than 75 per cent covered by anthropogenic vegetation of which more than 20 per cent was used during the last 5 to 10 years) (McAlpine 1970:map, 131, 134), and another 50 mi^2 (130 km^2) of intensive land use lies off the southern boundary of his map.

As in the Asaro Valley, remaining wildlife is mainly restricted to higher altitudes, the most valuable being birds of paradise. At lower altitudes the only valuable species is the Red Bird of Paradise, common in groves of planted trees throughout the valley. Nondiri dialect speakers in the south have access to lower altitude forest near the Tua River; there feral pigs and cassowaries can still be found. Everywhere domestic pigs are a principal factor in subsistence and exchange and are an important export. Forest products from lower altitudes (of which the most important are cassowaries, marsupials and their skins, and the feathers of lowland birds) are imported from the Bismarck Fall, the Jimi Valley, from Kambia in the southern Kubor Range and from the Tua region. Shells were imported mainly from the north, though some came from the west and a few over the Kubors. Pottery entered the Chimbu Valley from the Bismarck Fall but did not penetrate far. The upper Chimbu and southern Dom seasonally received lowland garden products, mainly oil pandanus, from the Bismarck Fall and Tua respectively and the people of the middle and upper Wahgi received smaller quantities from the Kambia region and lower Jimi.

Pigments were important in internal trade and some were imported from the Bismarck Fall. Sodium salt from a source near the lower Wahgi was traded out of the region to the north and south. The most important product was stone axes, most of them from two quarries in the foothills of the Kubor Range, one near the Tuman River close to the Melpa-Wahgi language boundary and one in northern Dom. These were traded far and wide into all the neighbouring regions and beyond. Axes from minor quarries on the north side of the Wahgi River, including the upper Chimbu, were traded to a lesser extent. Axes from the Jimi quarries were received in quantity in the north and west and some reached the Tua region in the south-east. Shells provided the only true transit trade in products from outside the region, most moving from north to south but some coming from the south-west and continuing north. Overall, the people of this region were uniquely self-sufficient, even for such relative luxuries as the best quality stone axes and sodium salt, and were dependent on their neighbours only for durable ornaments of sea shell.

The people of the Wahgi Valley have been studied more than any others in the central highlands and there are more than 250 published references to them. The monographs on the Melpa and Wahgi speakers have already been mentioned. Brookfield and Brown (1963) have described the Chimbu, especially the central Chimbu, in the only full length geographical analysis of a central highlands society, and Brown has published a volume on these people (1972). Many articles by Nilles (see bibliography) provide data on material culture, especially useful because of the continuity of his observations since soon after contact, and a valuable four-volume ethnography has been privately issued by Bergmann (1970; 1971). Criper (1967) has an unpublished monograph on aspects of ceremonial exchange in upper Chimbu. No monographs have been published on traditional culture in Sinasina and until R.L. Hide publishes the results of his present intensive research Chimbu data are most relevant. Hatanaka (1972) has published a study of social change in Sinasina and Sinasina land use is discussed in Hughes (1966). There is little published material on the Dom and Elimbari speakers and nothing on the Nomane.

In the Wahgi region, interviews were carried out at four sites among Melpa speakers, six among Wahgi speakers, nine in western, central and southern Chimbu, seven in upper Chimbu, five in Sinasina, seven in Elimbari, ten in Dom (two each in the Dom, Salt and Nondiri dialects and four in Gumine) and four in Nomane.

KAMBIA

This extremely rugged region has a small population speaking languages of

the Central Family but separated from the main body of that Family to the north by the high Kubor Range. Forty miles (64 km) long, 15 miles (24 km) wide and 2 miles (3.2 km) higher than the surrounding valleys, this great range marks the line of a north-west to south-east anticline which is one of the main elements of the central cordillera within the study area. The eastern part consists mainly of metamorphic rocks which have been intruded by the granodiorite that forms most of the western part.

Although both northern and southern faces are deeply dissected, no gaps are lower than 3250 m MSL and much of the bulk of the range has been left standing as high ridges extending south for several miles before plunging down to the forested lowlands of the Kaugel River, here 1000 m lower than the Wahgi Valley. Only four of the many valleys have any permanent population and one of these is a very small group indeed. The western part of the main range is even more sparsely inhabited; it was not visited but the few small settlements are located on ridges rather than in valleys and are at higher altitudes than in the east. Except in the Monogo Valley, settlement is restricted to the 900 m to 1250 m altitude range, with the highest gardens meeting the forest at 1500 m MSL. People live as high as 1850 m at the head of the Monogo River and the forest edge has been pushed up to 2000 m. Map 1 shows the approximate position of the edge of the virgin forest above the gardened area but does not show lowland forest. The lower montane type grades into the lowland type which fills the lower parts of all the southern Kubor valleys and covers the lower ridges as well as the wide valley of the middle Kaugel River.

Highland and lowland birds and animals, including birds of paradise, cassowaries and feral pigs, are regularly exploited, and skins and feathers and other forest products are traded north-west, north-east and east to the Wahgi Valley and its tributaries. Previously this trade was mainly in return for stone axes, salt and shells. Some shells were received from the west in return for re-exported stone axe blades.

Nothing has been published about these people but in material culture and social organisation they resemble their relatives in the middle Wahgi Valley and the ethnographies cited for the upper and middle Wahgi are relevant. The largest group are the Wahgi speakers inhabiting the Monogo Valley who have moved there from the Wahgi Valley. The small central Kambia group also has links with the middle Wahgi but in addition has stronger and perhaps older links with Gawigi speakers (a language of the Hagen Sub-family) to the west. Wurm calls their own language Aua, classifying it as a separate member of the Hagen Sub-family. These people and some in the lower parts of the valleys to the east have a tradition that some of their ancestors came north across the lower Kaugel. Today there is no communication in this direction and no connection except via the Gawigi speakers to the west. However, the people of the lower Monogo Valley and those living on the volcanic plateau north-west of Mt Au maintain marriage and trade links with speakers of a Mikaruan language south of Mt Au in the Tua region. Kambia gardens are usually less intensive than in the highland valleys and some resemble the partially cleared mixed-crop forest swiddens of the Tua region.

Interviews were conducted at eight centres.

TUA

This region is dominated by the dissected cones of two Pleistocene volcanoes, Mt Au (called Suaru by those living south of it) and Mt Karimui; they rise to about 2600 m MSL. Most of the people live in the 900 to 1250 m altitude range on the gently sloping volcanic plateaus. These have been intensively eroded by streams draining radially from the two mountains, with gorges of up to 300 m deep and 2 miles across. The great Tua River divides the region in two, entering from the north-east at about 600 m MSL, passing between the two mountains and leaving in the south-west at about 400 m, near its confluence with the Poru River. It is a barrier to travel, especially after rain on the highlands to the north, and has been bridged regularly only in the far north-east and south-west. These long cane suspension bridges are not regularly maintained and are sometimes intentionally destroyed. In its middle portion the Tua is crossed by raft (though on at least one occasion a

bridge was built there) and in the south-west, by canoe. Most of the population of the region lives south of the river.

East of the plateaus are ridges and 'V' shaped valleys of sandstone, siltstone and shale with ridge tops averaging from 1500 to 1800 m MSL. To the south-west similar formations are overlain by precipitous limestone ridges and pinnacles between 1250 and 1500 m MSL with valley floors between 900 and 1000 m MSL. Where the valleys are filled with volcanic material and alluvium they are well watered but many are drained by the ephemeral and underground streams typical of karstland.

Two language Families are represented, one of them, Mikaruan, being distantly related to the East New Guinea Highlands Stock (Wurm 1964); it is represented by Daribi: the only other language present is Tundawe, a member of the Pawaian Family (Wagner 1967:4, 5; 1972:11; Franklin 1968b:24, 25, calls these languages Mikaru and Pawaia). Nearly all the people speak Daribi, Tundawe being restricted to a small group north-west of Mt Karimui, many of whom also understand Daribi, and a scattered population on the Pio River in the south-east. Both groups have traditions of migration from the west.

Wagner's 1967 monograph describes the people and their environment and it is clear from his account and from this present study that many aspects of their material culture and way of life have been borrowed from the highlands during the present century, some of them since the extension of 'pacification' that followed the second world war. Growing sweet potato and keeping domestic sows postdate initial contact with the peoples of the Wahgi region (Watson 1965a: 301; Wagner 1967:15) and it seems likely that this occurred within the past 100 years, Wagner suggesting that it was as late as 1900; before this, for example, stone axes were made from local river stone, inferior to the highlands axes being used at the time of white contact (1967:6). Other aspects of Daribi culture are discussed in Wagner (1972).

North of the Tua River and along the Pio River the population density is only about 2 per mi^2 (0.8 per km^2), and even with a generous allowance for uncultivable land the figure is still less than 3 per mi^2 (1.2 per km^2). On the northern and western slopes of Mt Karimui, where 6000 people live, the density on arable land is less than 20 per mi^2 (8 per km^2). Nowhere is there pressure on land and traditionally gardens were small forest swiddens, incompletely cleared and untilled. Settlement was dispersed, sometimes in large two-storey defensive houses containing a small clan or part of a clan, and sometimes in one-storey houses containing typically a group of brothers and their families. Planted sago and breadfruit were an important part of the diet, as were forest fruits and nuts, birds and wild animals, including marsupials, feral pigs, cassowaries, reptiles, fish and insects. In addition to the recent practice of keeping domestic pigs, the southern Daribi had a technique of maintaining semi-domesticated pigs in isolated plantations of sago, a method also used by the people of the Tebera region (Hughes 1970). Forest products were exported but vigorous northern trade in skins of marsupials and birds of paradise and parrot feathers developed only as contact with the people of the Wahgi region increased (it has expanded greatly since 1950). Good stone axes, salt, shells and young pigs were received in return. In the past shells were obtained from the Tebera region to the south, largely in return for re-exported stone axes, but during remembered times this became completely overshadowed by trade with the north.

In this region interviews were conducted at ten Daribi and two Tundawe settlements.

PORU

Like the Tua region, most of the Poru consists of a volcanic plateau and protruding limestone ridges, the pyroclastic material having come from the nearby Pleistocene volcano of Mt Ialibu; the north-eastern portion, as in Tua, consists of shales, siltstones and tuffaceous sandstone. However, as a whole this region presents a very different appearance, for the mean altitude of settlement at 1500 m MSL is 450 m higher than in Tua and the internal relief of most of the area is less than 300 m. It has been settled by highland people speaking Wiru, a language of the widely distributed West Central Family. Wiru

is the most easterly language of this group, and Wurm (1964) places it in a Sub-family of its own.

The 16000 Wiru have occupied only about 300 of the habitable 500 mi^2 (1300 km^2) of the Poru region, giving an effective population density on occupied land of about 50 per mi^2 (19 per km^2) and a density per total available arable land of about 30 per mi^2 (12 per km^2). It is likely that much of the unoccupied arable land is regarded as unsuitable because of its low altitude. Fear of disease, especially malaria, may be the principal reason, as this has been given as a reason for the limitation of the frontier of highland settlement on the Bismarck Fall, in the Wahgi and Tua Valleys, and among the Kewa, the Wiru's south-western neighbours (Bundi PR 6 1953-4; and 2 1956-7; Brookfield and Brown 1963:76, 77; Franklin 1968a:7; numerous reports of patrols to Bomai Census Division from Chimbu, Chuave and Karimui Patrol Posts, 1950-67).

The inhabited area lies mainly between the Poru and Iaro Rivers which rise on Mt Ialibu and flow south-east to the Tua and Erave Rivers; within the southern part of this zone sink-holes are common and drainage is largely internal. Much of it has been converted to grassland, the remaining climax forest being restricted to the upper slopes of Mt Ialibu, the uninhabited north-eastern lowlands and the tops and further slopes of the southern and south-eastern limestone ridges. Within the settled area, regrowth forest occurs on ridge tops and in the deeper and steeper gullies.

There is no published monograph on the area or its people, but A. Strathern (1968) has briefly sketched the similarities and differences between the Poru and the upper Wahgi environments and people, and further details are given in M. Strathern (1969). Perhaps because of the greater supply of land, the Wiru did not plant as many trees; their settlement pattern tended to be one of nucleated hamlets in contrast to the scattered homesteads of the middle and upper Wahgi Valley (M. Strathern 1969:312). Both societies depended on sweet potato, had subsidiary gardens of mixed vegetables and emphasised the breeding of domestic pigs as valuable items of exchange (A. Strathern 1968:545). These authors have suggested that the differences between the exchange systems of the Melpa and Wiru may be explained by their relative location in regard to sources of valuables; the Wiru were off the beaten track (A. Strathern 1968:551) and had no specialised exports of their own (M. Strathern 1969:325).

Some Wiru had access to the resources of the lower montane forest and others were able to exploit lowland forest also; all were able to take birds of paradise which frequented copses in garden land. But their trade in these items, though it was significant, was handicapped because their main customers to the north had closer supplies available. Pigments, especially a blue pigment, and mineral oils were exchanged only within the region. Although their two salt springs were capable of yielding dry salt they were not used for this purpose and there were no local sources of good axe stone. The most important exports were domestic pigs though some imported salt and stone axe blades were re-exported. Axe blades came from the main highlands valleys, mainly via the western Kubor Range but some via neighbours near Mt Ialibu; there was also an intermittent connection east across the lower Kaugel River to near Mt Au. Shells were imported from the Kewa, mainly from the west though a few were received from the southern Kewa across the Iaro River. The same is true of a cosmetic vegetable oil even though some oil-yielding trees must have grown in south-eastern Poru. Salt was imported from the west. Important changes occurred in the nature of the shell trade after Europeans first entered the Wahgi Valley but before direct European influence was significant in the Poru region.

Interviews were conducted at ten places.

TEBERA

This remaining division is one of the regional extremes in man-environment relationships, for it is the least populated, the most rugged within a relatively small altitude range, the least (though not the last) contacted by whites, and the region where hunting and sago gathering are important means of subsistence. The entire area consists of limestone ridges trending roughly east-west and averaging 1000 m MSL in the north and 750 m in the south; the floors of the tributary valleys, some of them developed in siltstones, marls and shales and

sometimes filled with alluvium, generally average about 600 m MSL, and the banks of the main streams, the Erave, Pio and Purari, descend from about 400 m to 200 m MSL.

Lake Tebera itself partially fills a shallow limestone depression, the water surface in normal seasons being 5 miles (8 km) long by a mile (1.6 km) wide; it is about 630 m MSL. In most places it appears to be only 2 to 3 m deep though the first white visitors in 1938 found a place that was 15 m deep (Foldi Kikori PR 11 1937-8:14). The main source is a stream at the eastern end and the lake is said to have an outlet at times of high water through a cave in the precipitous ridge which forms its northern wall. The eastern end is being filled by an active delta where the people have lived from time to time. Residual pinnacles of limestone jut out of the water in several places, the two largest being the site of a defensive hamlet.

It is on the alluvium of the valley floors and on the structural benches and alluvial terraces beside the main rivers that people have most of their settlements, sago and gardens. Massive cliffs overhang the rivers in many places and the landscape in general consists of blind valleys and enclosed depressions separated by the sharply weathered edges of bare limestone; internal relief varies between 90 and 250 m, much of the terrain consists of kegelkarst, and dolines and blind valleys are the rule. Some of those with blocked drainage have been planted with sago, as have a few artificial swamps created by damming creeks. Many regular routes require the use of ladders. Almost the whole area is covered in lowland forest with minor occurrences of swamp.

Overall, the population density is less than 2 per mi^2 (0.8 per km^2) but much of the region lacks any permanent population - depending on the hunting, sago-making and gardening pattern of each locality, people effectively occupy clan territory at anything from 1 per mi^2 up to 5 per mi^2; settlements of from 50 to 100 people separated by from one to three day's travel are normal. Since pacification, nucleation has occurred at two centres in the south-east but this has been balanced by dispersion from other places because it is less necessary to gather together for protection in large fortified houses. In the north-west there has been less change and there feuding was normal 10 years ago, some deaths occurring in the two years prior to this field-work. In the south-east small family groups can be found living in isolated houses surrounded by small gardens close to patches of sago. Throughout the region, relocation of settlement by individuals and groups is common; residence appears to have been even more ephemeral in the days of active warfare for small abandoned gardens and rarely used sago stands are scattered in the bush. Mixed gardens are planted in small patches of semi-cleared forest and in the recent past the only pigs around settlements were captured feral young, killed before reaching breeding age. As in the southern Tua region, some groups control semi-domesticated pigs in sago patches isolated from settlements and gardens by barriers of limestone or water. Hunting and trapping continue to supply much of the dietary protein, fish are caught in the main rivers and in Lake Tebera and forest fruits and nuts are gathered in season.

The people have not been described in any publications. They speak languages of the Mikaruan and Pawaian language Families (Franklin 1968b:24-6); those in the north-west speak Foraba and those in the south-east speak Tundawe (Wagner 1967:5, 242; 1969b:91; letter, 1969). (Franklin calls the latter Pawaia and the former both Polopa and Kewah.) The way of life of the Foraba speakers within the region is very different from the people to their north, though some of their characteristics are shared by the outlying Daribi groups and the Tundawe of the upper Purari and lower Pio. The northern Tundawe show a gradual grading into many of the characteristics of the Tua region. Both Tundawe and Foraba tend to have a lighter physique than their northern neighbours, and though all build large fortified communal houses, those of the Daribi are distinctive (see Wagner 1967:18). In the past, some Tundawe built in the same style.

The region had no exclusive products; there is at least one saline spring but it was not used for salt-making, sago and forest products were ubiquitous and the people of surrounding areas had access to their own supplies. Some animals and bird feathers were used in exchanges but only shell ornaments and stone

axes were valuable and trade tended to be local and on a small scale. Shells were received mainly from Pawaian speakers to the south-east on the middle Purari River though a few came from the Kewa to the south-west and west and from small groups in the bush to the south. Some of these were re-exported north to the Tua together with a little locally produced cosmetic vegetable oil; in return they got stone axes, some being re-exported south. After Europeans entered the highlands, small amounts of salt were received from the Tua region, and the small quantities of shell ornaments coming from the south were greatly outweighed by new supplies of shell ornaments from the north.

One formal interview was held with Foraba speakers at Lake Tebera, one with Daribi living on the lower Tua and three with the Tundawe of the lower Pio and upper Purari Rivers.

V MINOR MINERAL PRODUCTS

INTRODUCTION

The main products exchanged, their general regional location and their inter-regional movement have been mentioned in the preceding chapter. In this chapter and the next, each trade good dependent on the exploitation of a mineral resource will be described, together with its location, method of extraction or collection, processing and manufacture, and where appropriate and known, its packaging, storage and method of transport. However, it is impossible to completely compartmentalise description of individual products and details of their transfer, and in any case it is not desirable to do so, for some goods exemplify wider aspects of the overall traffic better than others; hence, while these chapters are primarily concerned with the productive technology and reasons for trade of particular goods, more general questions are discussed where fitting.

As said in Chapter I, mineral products include three types of goods - stone tools, pottery and pigments - that satisfy all four sets of criteria imposed by the need to answer geographical, ecological, economic and historical questions, and one good, salt, which meets three of the sets. In the case of stone tools and pottery, the raw materials, shape and ornament are diagnostic of their source. In the future it may be possible to trace mineral pigments to known quarries by the use of X-ray diffraction techniques, for natural occurrences of the rarer and better examples are few and only these travelled far from their sources.

The other items to be considered are salt, mineral oil and a tonic for domestic pigs - the last a fine example of entrepreneurship. The trade areas of mineral oil in the study area were parochial but within each it was significant as a cosmetic and medicinal unguent and as a competitor for costly imported vegetable oil; elsewhere it was traded widely.

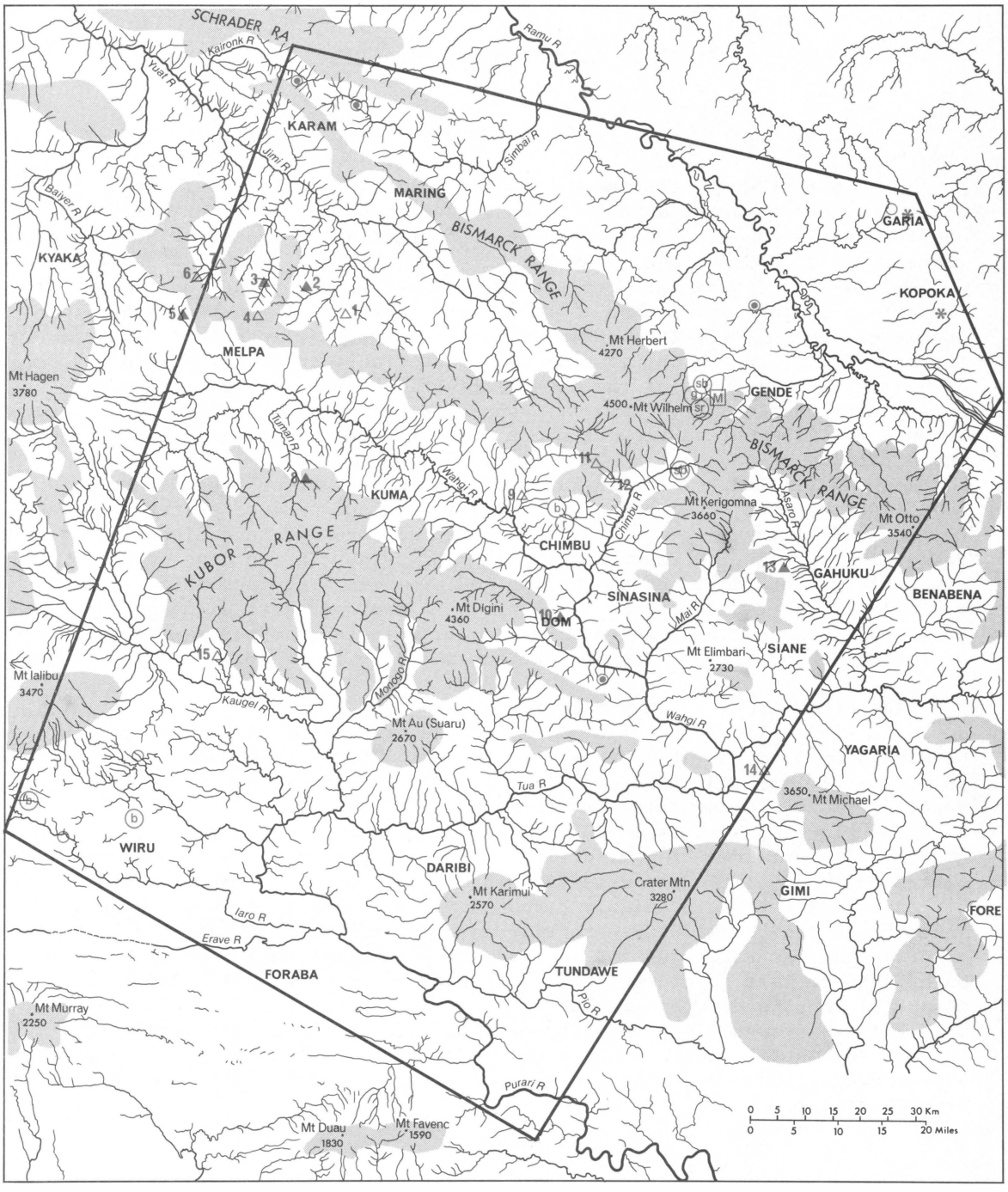
The place of salt is more complicated. There were two main categories, sodium salts obtained from mineral deposits and potassium salts extracted from plants but most of the processes for obtaining the former involved the addition of organic matter, particularly carbon compounds, and in many of the plant salts the organic compounds were reduced by processing. In each case it was a mineral that was recovered and refined, and the close relationship between both kinds of salt in production, distribution and consumption makes it essential to consider them together.

This chapter deals with salt, mineral oil, pigments and the pig tonic; the next deals with pottery and stone axes. Map 2 shows the location of the salt springs, sources of notable mineral pigments and the tonic, potteries and stone quarries.

SALT

The patterns of production and use of such an ancient condiment as salt are deeply imbedded in the complex cultural history of New Guinea. Freund *et al.* (1965:19) have suggested that the main plant used in making an important trade salt in the eastern highlands, *Coix gigantea* Koenig ex Roxb.,[1] may have been introduced from south-east Asia for this purpose. So far it has been collected by botanists only from sites where its presence could be explained by escape from cultivation. Where it is used for salt making it is cultivated in naturally marshy or specially irrigated fields of up to 30 acres (Freund *et al.* 1965:17; Clarke and Hughes 1974). The manufacture, use and exchange of different kinds of salt has wide physiological, economic and social ramifications. As salt water, and as a prepared condiment sodium salt was important in diet; its iodine content appears to have prevented goitre and endemic cretinism (P. Pharoah pers.comm.). Much work is now in progress on

[1] The Index Kewensis (581) and Burkill (1935:637) regard this as a variety of *C. lachryma-jobi* L., but amongst other distinguishing characteristics Henty (1969:53) describes *C. gigantea* as a tall perennial and *C. lachryma-jobi* as a short annual, noting that the former is the one cultivated for salt making.



Salt springs ○

Salt springs and salt factories ◉

Pigments: red ⓡ

green ⓖ

blue ⓑ

shiny red ⓢⓡ

shiny black ⓢⓑ

Mondono Ⓜ

Potteries *

Major stone quarries ▲

Minor stone quarries △

1 Maegmul 2 Tsenga 3 Ganz River 4 Mala Gap

5 Mbukl 6 Pukl 7 Yambina 8 Abiamp

9 Kerowagi 10 Dom 11 Yendegle Mauglwa

12 Kumanigl 13 Kafetu 14 Mopa 15 Dabiri

(location of most stone quarries from Chappell, 1966)

Map 2 Salt springs, notable pigments, potteries and stone quarries

the role of common salt in the physiology of animals, including humans, and its place in New Guinea diets has recently begun to be studied. In its dry form the best salt was a luxury to be used on special occasions and offered to visitors; it was essential for ceremonial foods like pork, when it was often chewed together with garden ginger (regarded as spiritually powerful all over New Guinea) or with the leaves of a variety of forest ferns, vines, shrubs and trees. The Sinasina, for example, listed the following plants (R. Hide pers. comm.) - *bigegol* (fern or shrub), *bomuge* (shrub), *bonasigikan* (vine), *bogorekan* (vine) and *duwidame* (tree) - all eaten raw with salt. It was widely used in magico-religious ritual, ceremonial gift exchange and in marriage payments, and everywhere it was a highly valuable, semi-durable, divisible commodity.

New Guineans do not use the categories of sodium and potassium salts, though they distinguish between the tastes of these two types, often without knowing the nature of the raw material or the process of manufacture. Within the study area and to the west of it salts which we now know were sodium salts were more highly valued and commanded much wider trade areas than potassium salts, the ranges of the former greatly exceeding even the widely traded plant salt prepared by the Kukukuku. The exchange value and relative importance of the Kukukuku salt within its own sphere, however, was very similar (see Freund *et al.* 1965; Sinclair 1966:56-62; Godelier 1969; Clarke and Hughes 1974). When early white travellers offered modern store salt to New Guineans it was at first often rejected, but the degree of revulsion described by Sinclair, when Kukukuku people spat it out in disgust (ibid:59), may have been experienced only by people unaccustomed to the taste of sodium salt. In places where native sodium salt had previously been eaten, initial suspicion of the new white substance was usually replaced by eager acceptance immediately it was tasted, and in these areas store salt could be exchanged for vegetable foods by the first exploratory patrols. This was the experience, for example, on the Bismarck Fall (Wakeford Kundiawa PR 2 1949-50:2), in the Kambia region (Corrigan Minj PR 3 1951-2:5), in the Poru region (Sheekey Mendi PR 5 1952-3: 7, 8), among the Kewa north of and along the Erave River (Faithorn and Champion Kikori PR 19 1928-9:16, 19; Clancy Kutubu PR 2 1949-50:31, 32) and the Foraba of the lower Erave (Faithorn and Champion op.cit:21; Sheekey op.cit:13, 14).

Kinds of salt are named for their source, whether it is simply the water from a particular spring or salt prepared from water from that spring or from a certain plant or acquired from a particular group, the original source being unknown. While describing these salts in terms of native and scientific categories, comparative data from other areas will be examined. The final section discusses the overall pattern of salt manufacture and exchange and suggests an explanation for the complex pattern of demand for salt of different types.

Springs in the Hills Region

There is no evidence that salt made from sea water ever entered the area, though it is possible that it reached the Hills region unrecorded in the nineteenth century. Mikloukho-Maclay reported that salt-impregnated driftwood was carried from Astrolabe Bay into the hills as gifts to friends; apparently it was burned and the ash used as salt (cited by Harding 1967:35). However, Garia informants could not recall using salt in pre-contact times and said that they were sure they had not made it locally. They collected the heart-shaped leaves of a yellow flowered plant called *poko*, possibly a pepper, dried them inside the house and used them as a spice with meat, regarding it in some ways as equivalent to modern salt.

However, they had a saline spring near Ipinolo and another is said to have recently been exposed by an earth fall near Yonipa. An old man said that he had heard when young of another spring in Sopu territory and years later, after a mission worker settled in Garia territory (not before the late 1920s by Lawrence's account [1964:54]), he saw it near Umiak. A saline spring typical of those in the north-eastern Hills region was seen just north of the study area. Salt water and inflammable gas bubbled slowly out of the ground forming a tiny tributary of Waia Creek, itself a tributary of the Nokun River. The flow was said to be greater in the wet season (as was said of most salt springs) but then the salt content may be diluted. A Girawa sago stand was nearby and

as the spring was near the border of Girawa and Karue land, in earlier times members of both language groups collected water from this spring for cooking. Now that store salt is available only those living close to such springs use the water for cooking or as a medicinal drink.

Springs in the Ramu and Bismarck Fall Regions

Use by members of two language groups was also normal for Korakura salt spring at 400 m MSL near Mondisipi in the lower foothills of the Bismarcks. It is the only spring reported in the central and eastern part of the Ramu Valley or Bismarck Fall, and although it was in the territory of the Ramu people, nearby Gende speakers also used it. Kandawo informants in the upper Jimi Valley said that they knew of two other saline springs lower down the Ramu Valley, one on Igili Creek which joins the Marum River and another near the Mambu River used by the Aindem villagers; they thought that they had not been used for making salt. Springs in the upper Simbai Valley were mentioned in the previous chapter. They are on the north side of the valley and were used by both Maring and Karam speakers for drinking and cooking and for making salt evaporation over fires. The Jimi Valley Maring said that they called the product *kura* (cf. Korakura) and the Karam of the Simbai said they called it *tumbëi*, the name of a place near one of the springs. Those of the Jimi offered *indek*, perhaps the word for store salt. The Simbai Karam were still making it in quantity in the late 1950s. Attenborough saw men in more than one hut near a spring on the main route to the Asai Valley evaporating the water in 'cauldrons' of wet mud lined with banana leaves set on top of rough stone ovens (1960:90). He was shown a small leaf package of wet grey salt which it had taken a week to make. It is no longer traded but the Karam said that old men still occasionally make it for ceremonial use.

The Maring of the lower Simbai told Clarke that they used Kangarau spring in the middle Simbai. Water was evaporated in leaves on stones over a fire, slowly drying into 'rocks', when it was stored in *yibona*, the bottle gourd (*Lagenaria siceraria*), the commonest storage container in that area (pers.comm. 1971). Rappaport has said that the Maring ceased to make salt 'some years' before his field-work began in 1962. Although it had not been analysed he was certain that it was a sodium salt.[1] It was the Maring's most important trade good, fetching stone axes, shells and pigs from the south. (Rappaport 1967:23; 1967[1968]:xv, 105, 136, 137.) One of the Simbai Karam said that their salt had sometimes been traded north to the Asai in return for feathers.

The Ramu people call the water from their Korakura spring *totanam* and say that long ago, before anyone now alive can remember, they did not know how to make salt from it, though they drank it and cooked with it. The Gende call the water *weru nogai*, *nogai* also being the name of a red flowering plant from which they made a salt; it is not in the list of plants used in salt manufacture given by Aufenanger and Höltker (1940:57).

The story of the creation of this spring is typical of the myths attached to the discovery of such important resources elsewhere in the study area. Many generations ago a Ramu man called Erinowai was hunting in the forest and collecting fruits and edible leaves when late one afternoon he came to Korakura. There was no spring there in those days. At dusk, a woman called Yombrindi from Womkama in the upper Chimbu Valley came wandering by. Erinowai asked her what she was doing and she said that she had become lost and that it was dark and there were no houses near, so they slept together and copulated several times. Next morning he went off a short way but when he looked back was unable to see her. Hurrying back he scraped away the pile of leaves on which they had slept and exposed a rock embedded in the ground in the centre of which was a vulva shaped hole oozing water. Dipping his finger in it he tasted it and found it to his liking, so twisted a leaf into a cup and drank some more. The present Ramu inhabitants of the locality are all descended from these two, it is said, and ever since have drunk from this spring. Years later their Gende relations came and taught them to evaporate the water over a fire and collect the salt. As in most of these tales, no one is bothered

[1] It has now been analysed by P. Pharoah and is indeed sodium salt. All salt springs analysed in central New Guinea have contained significant sodium.

by the paradox of Yombrindi's disappearance and their descent from her.

On the banks of the Ramu this story was repeated almost word for word with the added detail that the spring water was the genital emissions of Erinowai and Yombrindi. At Mondisipi and by the Ramu, the male ancestor was said to have come from Ingoi near where the Garia now live. In the past the river people married mainly with the Gende, they said, but now most of their marriages were toward the north-east, both in the getting and giving of women.[1]

It is of interest that the female ancestor was a Chimbu and not a Gende and that she came from Womkama, the place given by all the speakers of Chimbu-Chuave languages as their ancestral home. An origin myth collected in the upper Chimbu Valley in 1955 included a reference to the magical occurrence of this salt spring. The woman's name was given as Yombogange, wife of Mondo, both founding ancestors of some upper Chimbu tribes. She had fled over the pass to the Bismarck Fall in shame after helping to eat Inaugl, one of her own sons who had been killed by his brother, Kukane (Wolsey Chimbu PR 6 1955-6.) A version collected at Womkama by Criper (1967:35) gave her name as Gainagle and said that at that time Gende territory was uninhabited, Gainagle being found by two hunters from the Ramu.

The Gende of the Baia and upper Inbrum Rivers who are closest to the Korakura spring are separated from the Chimbu Kukane and Girai-Tamagl tribes near Womkama by other Gende groups and the entire Dengla-Maguagu tribe, all enemies at various times in the past. In former times, marriage beyond one's immediate neighbours was rare. Perhaps the identity of Yombrindi is a folk memory of the Dengla-Maguagu's own migration north from near Womkama, reported by Brookfield and Brown (1963:80, 81) or of a time before direct Chimbu-Ramu contact was broken by a north-westerly movement of Gende from the Asaro. The Gende are an extreme outlier of the East-Central Language Family and such a movement would fit the story of the later arrival of 'Gende relations' with the technique of salt-making.

Today old army jerry cans and cooking pots lie near Korakura spring, for salt was made there until about 1958. The water still wells out of the rock[2] over gravel and into a shallow pool some 3 m^2 in the dry season, the muddy bottom a wallow for feral pigs. Now, apart from occasional medicinal use, it is used only as a hunting lure, for birds drink from it throughout the day in the dry season and flock to it near sundown. It tasted slightly salty and sulphurous.

About 250 ml of water was collected from near the source for analysis and found to contain 5 grams per litre of sodium and 16 grams of chlorine, and a little calcium, magnesium, potassium and iodine. (Details of the analysis of water from three springs are given in Table 4.)

Salt prepared from Korakura water was called *kwanaua* by the Ramu people, *gia* by Usino speakers, *toru* by the Gende, *togl* by the Chimbu and *tol* by the Kandawo. The Ramu people call modern store salt by the same name though the other groups have separate names for it. A week's boiling in an unspecified number of metal containers would produce enough salt to fill four or five bamboos, indicated as about 7 cm diameter and 60 cm long. Using the old technique of boiling in containers of banana leaf would take three weeks. This would yield about 10000 cm^3 (610 in^3) of salt presumably with much moisture still in it and probably weighing close to 13.5 kg (30 lbs). By all accounts, and from the evidence of salt seen in the Poru, it dried further while stored suspended from the rafters of houses in the smoke of cooking fires, but in conditions of high humidity it absorbed moisture readily. Well made, it was said to be 'white' in colour but would blacken if over-drying was attempted.

Aufenanger and Höltker say that gourds about 17 cm x 10 cm were used for storing salt and fat, but do not mention the much larger bamboo containers

[1] It may be rewarding to test the Ramu area for asymmetry in marriage exchanges, past and present, for it was one of the regions most dramatically affected by the arrival of European wealth. From a complete dependence on the inland for stone axes, it suddenly became dependent on the northern hills for steel axes, and very early received steel from the hands of Europeans themselves. This region also long ago received the increased supplies of shells that followed pacification near the coast (cf. Salisbury 1956b).

[2] Folk tales commonly describe cleft rocks as gynecomorphic but in support of the Korakura creation myth I record the observation that this one is exceptionally vulviform and vaginate.

	Korakura	Aria	Kenkeren
Chlorine	16.19	9.535	5.72
Sodium	5.548	4.58	2.691
Calcium	0.82593	0.06721	0.09069
Magnesium	0.4127	0.02824	0.03709
Potassium	0.0746	0.03036	0.0216
Iodine	0.0059	0.0038	0.0089
Sulphate	0.00357	0.01461	0.0035

Analysis by Miss B.J. Stevenson,
Research School of Chemistry, ANU

(In response to a query from another research chemist who observed that these figures represented an excess of anions, Miss Stevenson has suggested (1973) that the excessive anions would be balnced by cations in elements and groups not analysed for.)

Table 4 Analysis of salt water from three springs (soluble solids, grams per litre)

(1940:57). Such a gourd would hold about 1250 cm^3 and weigh about 1.6 kg (3.5 lbs). As these observers first worked at Guiebe near the Gende clans who actually made salt and less than 10 miles from the spring, their observations suggest that the bulk packages had already been broken down to an eighth of their original size soon after leaving Mondisipi and that perhaps smaller batches and packages were made more often than today's informants cared to mention. In spite of their proximity to Korakura, these early missionaries apparently were unaware of the spring and salt making process and believed *toru* was one of many plant salts (ibid). (*Onoru*, also in their list, was not a plant salt either, but they could not have known that, for it came from far away near the Wahgi River.)

Most salt left the manufacturers in bulk in the original bamboo and gourd containers, a single bamboo fetching a medium sized pig or good stone axe, values which increased with distance from the source. In upper Gende such a quantity already brought a very large pig. From the Ramu people across the river and from the nearer Usino speakers, salt brought shells and forest products useful for trading into the mountains. A gift of salt to a relative would be sometimes matched by a pot in return. Gende speakers of the middle Marum River who were not related to the Mondisipi people said that although it was highly dangerous they had occasionally gone to make salt at Korakura themselves but did it badly and were in constant fear of attack.

Korakura salt was traded to the Kandawo of the upper Jimi, mainly for stone axes, but did not reach the Narak. It was known in gourd-sized quantities in the upper Chimbu, where axes and pigs were given for it, and in small quantities reached as far as the middle Chimbu Valley. From the upper Chimbu and upper Jimi, small quantities occasionally reached the upper Koronigl. Inaugl tribesmen sometimes gave it in small amounts to their relatives in the upper Asaro but it was not used in the Tauya Valley of the Bismarck Fall. The lower Tauya River marked its eastern limit in the Ramu and it did not reach the Hills region.

The extent of local knowledge of such valuable resources as salt springs raises questions of the intensity and history of forest use in general. This region has many square miles of uninhabited forest that has never been gardened. If all such springs are known it implies that it has all been hunted over and prospected for fruits, leaves and fibres, men or women having at some time or another walked over every ridge, watercourse and hillside. A practical man from upper Gende with little respect for the creation story said that it was probably birds that led Ramu hunters to the spring. Some western highlands

salt-makers say that birds led them to their spring (Anon 1972:11). The comprehensiveness of resource knowledge and resultant trading advantages are examined again in relation to stone quarries. As far as salt springs are concerned, the evidence suggests that all were known.

Springs in the Poru Region

The Wiru have two salt springs one of which has been developed as a lure for trapping wild life. The other occurs in the far north of the territory in the bed of a creek flowing towards the Kaugel River. It is claimed by the people of Aria, the nearest settlement of any size, but water from it is also collected by the related people of Moro and Moria, by permission, it is said. The salt water is called *lora* and was used medicinally and for cooking. It was not traded but given freely to relatives and friends and rarely went further than Ibei Creek, just south of these settlements.

For a detailed description of the site itself and for a sample of the water I am indebted to Mr Peter Andrews, in 1968 Patrol Officer, Pangia Patrol Post. The spring occurs as a dozen outlets in the bed and lower bank of a creek, itself known as *Lora*, three hours' walk north of Aria. Mr Andrews and his companions diverted the main stream to expose the places where salt water and gas bubbled from the gravel and rock. Some openings emitted mainly gas but others flowed strongly, and when widened, provided jets of water 'like a weak garden hose', opaque and milky with little odour. Analysis showed the water to contain 9.5 grams of chlorine per litre and 4.6 grams of sodium; other elements including potassium and iodine were present in traces only (see Table 4).

The second source is in the south-west at 1770 m MSL near the top of a hill close to Kenkeren village. Separate outlets emerge over an area of five acres of open forest, much of it swampy, some discharging mainly a grey muddy liquid and inflammable gas, a few being slightly oily. Typically they are grouped on grassy mounds, each outlet with its own mud pool of from 20 cm to 1 m across. During the wet season the flow increases. The vegetation has been killed within 25 m of each spring and dead and defoliated trees extend further on the downhill side. The oily grey mud is applied to skin sores on humans and pigs.

Nearby are two ponds of yellowish water totalling some 200 m^2, each fed by its own spring. They are 2 m deep at the deepest part and each is dotted with about 100 snares for flying fox,[1] cane loops forming nooses about 13 cm in diameter being set on stakes close to the water surface (Plate 1).[2] They were said to take two or three a night and during the wet season had been known to take as many as 30 in a single night.[3] Birds are sometimes snared at the smaller Kenkeren pools. Hunting is economically unimportant among this group of Wiru speakers but like the Ramu people of Mondisipi they have exploited their salt springs to get high-protein food.

A hundred metres to the west is a swamp of clear water which forms the source of *lora* for drinking and cooking. A timbered well about a metre square has been sunk into the centre and a bird snare is set beside it (Plate 2). The salty taste is not strong and an Aria man present said that his *lora* was stronger; a minimum of 250 ml was collected and analysis showed that he was correct (Table 4). The Kenkeren spring had 2.7 g/l of sodium, 4.7 g/l of chlorine and traces of other elements including iodine. It is used for cooking and drunk medicinally. Salt was not made from it nor was the water itself traded, neighbours at peace with the owners being free to collect *lora*

[1] Presumably *Dobsonia* sp. (Laurie and Hill 1954:40-2; Lidicker and Ziegler 1968:28-33).

[2] The related *Pteropus* spp. drink regularly, usually while in flight, lapping the water as they glide over its surface (Troughton 1941:334), and *Dobsonia* is thought to do the same.

[3] In the wet season blossom food is abundant and flying foxes congregate in large camps in a permanent location (Ride 1970:177, 178). It is not known if the success of this snare site is due to its proximity to such a roost, but the animals have a feeding radius of from 10-20 miles (16-32 km) (Troughton 1941:334). It is clear, however, that many alternative drinking places are available, especially in the wet season, and that these include favoured open sites. These bats have the usual high potassium and low sodium intake of vegetarians and may be demonstrating a preference for water with some sodium content.

Plate 1 Large spring-fed salt pool covered with noose snares for flying fox; Kenkeren, Poru region

Plate 2 Salt well, Kenkeren, source of *lora* for human consumption

without hindrance. In this way it was used in Karani and Mamuane 4 miles west and east of Kenkeren and occasionally it was passed on in bamboos and gourds as far as Undiapu and Laue 10 miles away.

The Tebera region has a salt spring near the bank of the Purari River below the confluence of Ida Creek opposite the modern village of Gurimatu, and there are probably others in parts not visited. The water is drunk and used for cooking but salt is not made.

No saline springs were reported in the Jimi Valley but Karam speakers there received salt from the Kaironk Valley Karam. The latter said that there were about six springs in their valley and that in addition to using the water, salt was made in the same way as in the upper Simbai Valley and traded south and down the valley to the west. The Kobon language group in the lower Kaironk Valley were said to have their own salt spring.

The Wahgi Valley Springs

Beyond the bounds of the salt spring owners, rapidly decreasing locational knowledge illustrates well a phenomenon observed many times in the course of this study and stated explicitly by many men - before the *pax colonia*, individuals and groups receiving trade goods usually knew only what could be got from specific immediate neighbours. If a product was not produced by those neighbours but merely passed on, the recipients were aware that the goods had come from a certain direction but knowledge of further trade routes was rare and vague. For those who received regular patrols from administration outposts this situation began to change in the late 1930s and early 1940s, and as control was extended after the war, the range of travel and knowledge increased.

In the 1950s, after 20 years of intermittent white contact, Reay's Kuma informants near Minj in the middle Wahgi Valley said that the salt that they received from the south-east was made near Kup, about 8 miles away (1959:105). In 1968 some of the Minj people knew that part of the salt that had come from the south-east had been made at the main Wahgi spring 20 miles further away. At this time, too, an old man in central Chimbu said that he had heard since the war of a salt spring somewhere near Minj, which can have been only the Kup spring. Production at Kup was low and the trade area small, especially to the south-east, for in that direction even close neighbours regarded other salt as more important. When Gilliard was collecting birds near there in 1952 he was told of salt being made nearby. His description (1953:453) suggests that he saw the product but not the process, which is vaguely described. Bundles of dried grass were soaked in salt water and burned; a salt cake formed in the ashes 'amid the lye' and when thick enough was removed and bound with others into discs about the thickness of three or four phonograph records. Wills found a sample of salt from Kup to be mainly sodium chloride with a little potassium (1958:172).

There is said to have been a small salt spring at Ku, 2 miles east of the lower Chimbu river (Bergmann 1971:136) but the only important salt spring in the region is at the bottom of the Wahgi gorge on the right bank of the river in the territory of speakers of the Salt dialect of the Dom language, the Boganggauma clan of the Kere tribe, but is also claimed by the Eremere clan of the Gunanggi tribe across the river. This Kere is not the Sinasina-speaking Kere who live 6 miles further north, though they too were involved in the spring, by most accounts having helped discover it. It is said that when the spring was first revealed the Boganggauma and Eremere cemented their existing links with a pig-killing ceremony and feast, agreed on joint control of the spring and made salt together. Those living close to the spring also used the water for drinking and cooking.

Later, clans living 2 or 3 miles further away were allowed to make salt, for a price, Gunanggi coming from as far as Onimogma, the Kia coming from near Omkalai and all the allied Kere clans coming from the south. The Kia and Kere have a tradition of common descent in the distant past and the others were linked by marriage. A clan or group of clans would take it in turns for some of their number to spend up to three months living in houses built on a terrace near the spring. The Sinasina Kere said that salt-making was a time for ceremonial feasting which required the making of peace. On rare occasions they, the Kebai tribe, and the southern clans of the Nimai and Tabari tribes

with Gunanggi marriage ties, managed to end hostilities long enough to make salt, all bringing their own subsidiary raw materials as well as pigs and vegetable foods to feast the proprietors. Usually they were dependent on trade and ceremonial exchange to acquire salt.

Salt-making was arduous and the owners could increase their economic and political benefits by replacing some of their manufacturing monopoly by the sale of limited rights to manufacture salt under licence. Both locally and regionally demand exceeded supply, yet there was no move towards specialisation of labour; all made salt together, important leaders, men of no account, women and children.[1]

This was the most important salt source in the study area and perhaps in all of the central and eastern highlands; salt made here was traded for more than 50 miles (80 km). Its manufacturing process was unique in that it combined techniques from the simple evaporation method used on the Bismarck Fall and in the Kaironk Valley with techniques widely used in making plant salt. It may have been unique in the whole of eastern New Guinea, for it differed from the salt water and plant material methods of the western highlands and sub-coastal peoples, who used wood to absorb salt from the water and did not use a filtration process (Meggitt 1958b; Harding 1967:34, 35). The Wahgi process was lengthy and exceptionally elaborate but it produced a very good product.

Legends of Discovery

Accounts of the spring's discovery and use were collected from the Kere and Gunanggi as well as from their neighbours. Early patrol reports also described it and accounts have been published by Vial (1941), Maahs (1950; 1955) and Gaisseau (1957:58-66), all of whom photographed some of the manufacturing process.

Legends about the finding of the spring vary in detail between different informants and with the vested interest of the group telling the story but most agree in essentials. The earliest extant account is by J.A. Costelloe, ADO (Chimbu PR 7 1946-7) collected during a visit to the spring in March 1947. (An earlier record by ANGAU Lt J.C. Dennis in March 1945 [referred to in a letter to the DC Goroka from K.W. Jones, a/ADO, Sub-district Office, Kundiawa, 2.11.1951] could not be found.) This was one of the first if not the first administration patrol to the area since the ANGAU interregnum of the war.

He was told that the spring had been discovered long ago by two young men, Kobuludumana and Gorunubi, who had come from the hamlet of Igidi to attend a customary courting ceremony at Daua near Deri. Gorunubi slept alone but his companion spent the night with a local girl, Goingingamae. Next morning the two youths set out for home across a cane bridge over the Wahgi River. As they climbed out of the gorge they paused for breath and looking back saw two attractive girls dancing on the far bank of the river, the sun reflecting brightly on their pearl shell ornaments. Kobuludumana hurried back to the river but when he crossed he could see no sign of them and called back to Gorunubi on the slope. Gorunubi replied that he could still see the girls and that his friend must be blind; he hurried down the hill but he too could not find them. Seeing a spring flowing from a rock near their feet, Kobuludumana took a leaf of the *bomanakain* vine,[2] twisted it into a cup, filled it with water and handed it to his friend. Goronubi remarked on the taste and when Kobuludumana drank he recognised that it was no ordinary water. Cutting a length of bamboo they filled it and carried it up the hill to Igidi. All there tasted and rejoiced, and, collecting sweet potato, taro and yams, and fowls,[3] dogs and pigs, they went down to the spring and had a great feast, the other Gunanggi being asked to join in.

[1] Cf. the Dugum Dani in the Baliem Valley, where salt-making was women's work (Gardner and Heider 1969:43).

[2] The *bomakan* has magical associations. Nilles (n.d.:29) says that the leaves of this climber are given with other food to boys at initiation and girls at first menstruation to make them grow tall like the vine.

[3] Fowls are a modern element in inland New Guinea, prior to European contact here, post-contact further south; but modernisms are rapidly assimilated to legend.

A spirit called Nalinae, in the form of a snake, lives in a hole in the rock and guards the spring. He is half red and half white and decorated with valuables, pearl shell, green snail shell, *tambu* shell and the plumes of the Red Bird of Paradise, and along his back from head to tail are white cockatoo feathers. On some days he emerges and anyone having the misfortune to see him can avoid death only by sacrificing pigs at once (Costelloe Chimbu PR 7 1946-7: 5, 6). An old man is said to have earned undying fame by using his hand to clear the opening of the spring after it had been blocked by an earth-tremor (Costelloe, letter from Kundiawa to DO Goroka, 5.6.1947).

Belief in similar dangerous creatures requiring similar antidotes is widespread. In the Tua region the southern Daribi speak of a snake with a red and white erectile crest living in a small lake; the sight of it causes people to turn yellow and die (R. Wagner pers. comm.). The ritual sacrifice of a pig is required to avert disaster caused magically or by contact with a large earthworm of the forest near the Wahgi spring. It feeds on human exuviae, it is said, and causes disease and death, without actual physical contact if the taboo against copulation in the forest is violated. Such a worm that I was about to collect, to the terror of my companions, was 'half red and half white' and about 25 cm long. Hide reports the same belief among the neighbouring Nimai, though they described the worm as 'dark/black' (1969:149-51).

The story told to Maahs soon after Costelloe's visit was similar, except that the spring was found by the Kere tribe who live at Sua south of the river. However, in the legend he recounts, the two young men came from Du (1950:16) which is the central settlement of the Sinasina Kere to the north.

A Gunanggi version from Onimogma in 1955 elaborately claimed prior right of discovery and ownership, complete with the genealogy of the claimants who were ancestors of the story teller. One of the youths who found the spring was Emuri, and he and his brothers, Mau, Ierua and Marime were the first owners of the site and the manufacturing process, it was said. Their father was Kobile and their mother Gon, an Olin woman. (Olin is the name used by the Sinasina Kere for the spring site and Onimogma may have been claiming rights through matrilineal land as well as by discovery.) Emuri's grandfather was Goi of Onimogma and his great-grandfather was Urime of Igidi. For a long time they did not know how to make salt and only the water was used. The man responsible for the manufacturing process was an ancestor of the *Luluai* of Du (Haywood Chimbu PR 8 1955-6).

Kola, former *Luluai* of Du, my landlord during residence with the Kere in 1966, told a somewhat different story. One of the youths was Kora, a Kere, and the other was Kubilidimanin, a Gunanggi. (These are in effect the same names as Costelloe was given 20 years earlier.) After searching unsuccessfully for the two girls and drinking from the spring they lay down in the heat of the morning to sleep. In their dreams the guardian spirit of the spring appeared, told them its name was Kogeme Gename and instructed them to clear away the undergrowth, dam the water, kill a pig and pour its blood over the rock, and make salt. They awoke, filled a bamboo with water and took it home. Their people sacrificed a pig, smeared its blood over the stone, and had a great feast. The spirit told them to watch for *perere*, a little black and white bird, and note the way it built its nest of mud.[1] They should make a similar container on a flat stone in which to boil the water. Maahs was told that the bird was a *gararawang* (1950:16).

When the site was visited in 1966 a grass-roofed shelter covered a rock hole fed by the spring and putrid grass lay in the water, relics from when salt had been made for a recent Agricultural Show. There was little sign of the factory 'village' of some 80 houses that Vial's and Maah's photographs show occupying the talus slope and small terrace near the spring (1941:19; 1950:15). The rectangular shape of most of these contrasts with the round and oval shapes of proper traditional dwellings. Gaisseau said that most of the shelters were roofs without walls (1957:58) and gave the name of the 'village' as Pellimi. This may have been a misunderstanding, for the salt itself was known as *pilin* to the manufacturers. The southern Dom speakers called it *pirin* and the Sinasina called it *pil*. To the Chimbu it was *onogl*.

[1] In Chimbu *doropere*. Probably the Torrent Lark, *Pomareopsis bruijni* Salvadori, whose sole habitat is rocky streams. It builds a cup-shaped nest of mud and roots (Rand and Gilliard 1967:452).

The Wahgi Manufacturing Process

The following description is based on field notes and the references already cited, Costelloe (Chimbu PR 7 1946-7; letter 5.6.1947), Haywood, Jones, Vial, Maahs (1950; 1955) and Gaisseau.[1] Basically the process consisted of soaking plant materials in the salt water, drying them, slowly burning them, passing fresh water through the ashes and collecting the solution and evaporating it for its salty residue. There were variations in the first two stages which may have affected the composition of the product, as well as a few minor variations in later stages.

Over a period of about a month a variety of grasses, including *Imperata* spp. (= MP *kunai*) and *Themeda australis*, were gathered from old gardens (which because of the terrain, were usually a long way from the spring) and dried in the sun. When quite dry they were taken to the factory site and soaked in the salt water. When the small quantity was made for the Show in the 1960s the grass was put directly into the spring-fed rock pool, but when large quantities were made in the past salt water was collected in bamboos and poured over the grass in pits dug in the soft shale and in raised earth dams lined with clay. Jones says that it was soaked for about a month but Maahs says that it was for five months (1950: 15); my informants said that the length of time depended on who was making it and who was waiting to make it but that it was better if left for a long time. Gaisseau refers to a clay basin (1957:60) and Maahs to a clay dam to catch all the water from the spring (1950:17); in 1966 the lower side of the main pool had been raised with clay and in its heyday the whole rim was built up in this way.

At this pool Gaisseau saw two men using small bamboos to fill large diameter bamboos 15 feet (4.6 m) long, other men carrying these away and emptying them over the grass. Maahs saw water also being taken direct from the spring at the rate of three pints (1.7 litres) in four minutes (about 135 gals [613 litres] per day) in addition to the small flow over the rock to the pool; the pool took all night to fill and a watchman remained to check the level and fill the bamboos whenever possible (ibid). Costelloe estimated the flow of the main spring (called Aulumu) at about 8 gals (36 litres) per hour. All agreed that there was no long-term variation between wet and dry seasons, and, allowing for short-term variations, an estimated mean daily rate in excess of 150 gals (682 litres) is reasonable. Costelloe found 15 other tiny seepages each named and operated by individual owners, not as communal property (Costelloe letter 5.6.1947).

The grass turned black as it rotted. No salt was precipitated onto the surface of the grass seen in 1966, and others have not reported this happening. The dried grass would absorb its full complement of water within a few days, probably much less, so the manufacturers evidently regarded the process of putrefaction as desirable.[2] Bacterial action and fermentation may have brought a useful change in the chemical composition of the grass-and-salt raw material; Baas-Becking (1931:440-3) pointed out that bacteria and yeasts have been prominent in the brine used for salt-making for 4000 years.[3] The rotten grass was taken from the water and dried in heaps under nearby shelters for up to three months. During this stage the village smelled, in Maahs' words, like a 'well ripened manure pile'. That the grass was slowly shade-dried rather than sun-dried as before, suggests that further particular bacterial conditions may have been sought; on the other hand, sun-drying large quantities of putrid grass may have needed too much labour, for even in the dry season it would have had to be moved under shelter each night and during the wet season it would have needed constant attention. Any rain would have leached out salt.

When dry, the entire heap was put on top of a wood fire so that it burned slowly from the inside taking up to two months to be reduced to ashes,

[1] An outline description of some of the process by Seefeld (Chimbu PR 16 1956-7) was quoted by S.E. Bulmer (1966a:78).

[2] The Enga process soaked soft wood until black (S.E. Bulmer 1966a:163) which apparently took from two to three months (Meggitt 1958b:311).

[3] I am obliged to W.F. Straatmans for drawing my attention to this interesting historical account.

presumably to achieve maximum combustion of unwanted carbon compounds. A photograph shows such a heap more than a metre high and 3 m in diameter (Maahs 1950:16). The fine grey ash, 'not a light powder but firm', was carefully scooped into a large mat of sewn pandanus leaves, rolled into a cylinder, tied to a long pole like a trussed pig and carried home by two men. Maahs' photograph (ibid:17) shows a cylinder more than 2 m long and 40-45 cm in diameter, which would hold at least 0.25 m^3 - a third of a cubic yard. The leaves of the mat have been sewn longitudinally unlike the common rain capes and sleeping mats, supporting statements that they were specially made from selected leaves of the wild 'white' pandanus. Wicker baskets 24 inches (61 cm) in diameter and 18 inches (46 cm) deep lined with banana leaves were also sometimes used (Jones letter:1), which would have held about half the quantity of a mat. Gaisseau found the ash 'extremely salty' (1957:61). A feast was held to celebrate the completion of this stage (Jones letter:1) and the ash was sometimes stored for a few weeks (Costelloe Chimbu PR 6 1946-7).

The lixiviation process was called *kali* (ibid) and is well illustrated by Vial (1941:19) and Maahs (1950:18). Sheets of bark were cut from the *kwiba* tree (? *Trema* sp.), shaped into 3 or 4 conical funnels (which in the photographs are 25-50 cm diameter at the top) and suspended in a row between 2 horizontal poles mounted on stakes, the tops about a metre from the ground. More parallel poles underneath supported a sloping trough of bark or banana stalk. A handful of plant fibre was put into each funnel as a filter and the funnel filled with ash, and as fresh water was poured into the top a large bamboo was held at the trough to catch the solution.

The evaporation stage was called *nilae* (Costelloe Chimbu PR 6 1946-7) and took place inside the men's house. Gaisseau said that women were not allowed to view this stage (1957:65) but this is unlikely, for other observers do not remark on it and this type of exclusion is usually one of the first things stated by highland men: they now say that their houses were not taboo to women at such a time. Large flat river stones were supported by the earthen walls of a fire trench, a hoop of casuarina bark placed on each and packed in clay, and a large banana leaf put inside. Any leaks were stopped with damp ashes. Two of these evaporators, 40-50 cm in diameter with clay walls 12 cm high containing liquid to within 5 cm of the top, are shown inside a house in one of Maahs' photographs (1950:16). These determined the final size of the salt cake, for the residue was carefully lifted out intact. As evaporation proceeded more water was added, one evaporating dish ultimately receiving the contents of between five and ten long bamboos over a period of 12 to 18 hours, the process being kept going through the night (Jones letter:2). Costelloe was told that if the container leaked the operator would die unless he killed a pig without delay (Chimbu PR 7 1946-7:6). The thick stones prevented burning and were re-used repeatedly (Maahs 1950:15).

Finally the salt tablets, called *murukakali* (Costelloe Chimbu PR 7 1946-7: 6), were packaged for display in special wicker containers decorated with a variety of fibres and weaving patterns. The photographs by Maahs (1950:16) and Gaisseau (1957:facing 80) show the individuality of the packages, that seen by Gaisseau even having an ornamental string-figure annulus set inside the lip of the container. The craters left by the final boiling are clearly visible.[1] Vial saw a salt cake about 9 inches (23 cm) in diameter in central Chimbu and remarked that the care with which the basket container had been decorated showed that it was classed as a valuable (1941:20). For storage and transport the basket was wrapped inside large strong leaves, usually pandanus, to form a disc-shaped package. Vial does not mention the thickness or weight of the tablet he saw but Jones (letter:9) gives the weight of a tablet as 4½ lbs (2 kg). Those in the photographs look to be at least 30 cm in diameter; if only 5 cm thick they would weigh about 10 lbs (4.5 kg). The Siane described Wahgi salt tablets of about this size (Salisbury 1962:87). In the western highlands Enga salt tablets complete with wrapping ranged from 2 lbs (0.9 kg) to 12 lbs (5.4 kg) with an average weight of from 5 to 6 lbs (2.3-2.7 kg) (Meggitt 1958b:311).

From the various descriptions, the bamboos of salt solution, like modern

[1] Cf. the Kukukuku method, wherein the evaporating solution was said to be kept at a temperature of between 55 and 65°C (Godelier 1969:11). No reason has been suggested for such a low temperature but W.C. Clarke confirms that it is not too hot to touch (pers.comm.).

water-carrying bamboos, averaged about 13 litres (3 gals), but it is not possible to reconcile the production figures given by different observers for the various stages of the manufacturing process. Jones (letter:9) said that the 4½ lbs (2 kg) of salt resulted from 4-5 bamboos of salt solution (nearly 60 litres or 13 gals) for which 6-8 baskets of ash (about 900 dm^3) were required. Maahs on the other hand said that one good batch of grass (it is not clear if this means one clan's productive effort on one occasion) produced one large mat of ash (about 240 dm^3) which yielded five cakes of salt, apparently large ones (1950:15). Maahs was told that it would have been possible for one man working full time to produce five mats of ashes yielding 25 cakes of salt in one year but that most of the manufacturing process was a part-time operation and these figures would represent the normal yearly output of one village (1955:354). Typically, garden work was done in the morning and grass taken down to the factory village in the afternoon. At the time of his visit (about 10 years after Vial's 'first-contact' patrol)[1] it was said to be possible for a comparative stranger to 'rent' a house in the salt village and make salt for the price of a gold-lip pearl shell, a green snail shell or a stone axe; this enabled him to share the use of a soaking pit and shelter with the 'owner' (1950:16, 17): presumably he was referring to the small seepages which Costelloe described as individually owned. At that time, too, a salt tablet had a cash value of ten shillings (1955:354).

Maahs' statement in his later article that the entire production process took two months (1955:354) is contradicted by several figures in his first article including a bald statement that it took about one year (1950:15). It may have been possible by working full time to make a small batch of salt in less than three months, but informants said that the manufacturing process varied from five months to nearly twelve, depending on the intensity of work, the size of the batch being made and the seasonal humidity during the drying stage.

The Wahgi Salt Trade Area

By the late 1940s, whole salt tablets were traded as far as the middle Asaro and upper Wahgi and people came to the salt-makers from some distance to get them. At that time, typical prices for a tablet near the point of manufacture were one bird of paradise plume or a pig, or a number of ornaments together, such as shells, hornbill beaks and cockatoo feathers. The product was preferred to the introduced white store salt (Maahs 1950:17, 18). The Siane told Salisbury in 1953 that important men would, on occasion, organise a party about ten strong who would take pigs to the 'producers' village, kill them there and feast the salt-makers. The spring site was said to be a 'closely guarded secret'. Return visits by salt-makers were less frequent. Although no visit occurred during his field-work this salt was still in use and the rate of one salt cake for each pig killed was relatively fixed (Salisbury 1962:87).

The salt 'producers' village' was in fact a number of hamlets spread over 50 square miles (130 km^2) and up to 5 miles (8 km) away from the spring and factory settlement where the first two processes were carried out; all within this area knew the location of the spring. The Siane lived from 15 to 20 miles (24 to 32 km) away, and although by 1953 the 'radius of travel and knowledge of other groups' was about 20 miles (ibid:25) they still did not know the location of the spring. In former times few groups living at this distance travelled as far as the salt-manufacturing villages. The people of the middle Chimbu Valley (about as far away as the Siane) occasionally made an armed expedition as far as the Gunanggi salt-makers in southern Sinasina but more often they got only as far as the Dingga tribe.[2] Sometimes they received salt tablets from their nearest neighbours. Even less frequently did the Gunanggi manage to return visits as far as 15 miles away, though when they were building up their pig herds for a major festival they sometimes took salt that far. Salt,

[1] The Leahy brothers were near this spot five years before Vial, see Chapter III.

[2] It was near Dingga territory that the Leahys and Taylor were presented with a tablet of this salt in return for a knife in 1933.

like other goods, usually travelled through intermediaries. Even so, it travelled with ceremony when it was in the original package; word was sent ahead that the salt was coming and it was borne to the ceremonial ground of the receiving group decorated and paraded like bride-wealth.

Before 1933 the original packages usually were intact by the time they reached the Siane, the middle Chimbu Valley, the Koronigl Valley, the western limits of the Chimbu language on the south bank of the Wahgi River, the head of the Marigl and Pima Valleys and the Nomane speakers of the Wahgi-Tua bend. By the time it reached the upper Chimbu Valley it was usually in gourds and small bamboos but still worth a pig. Small quantities reached the Gende on the Bismarck Fall, often in exchange for their own *toru* and sometimes for shells. The Gende called it *onoru*. Very rarely it reached as far as the upper Marum River.

In small quantities it reached the upper Asaro Valley, to Gahuku speakers via the upper Mai River and the Siane, to the Inaugl tribe of the upper Asaro via the upper Mai River, the middle Chimbu and occasionally via their relatives in the upper Chimbu. It did not reach the Tauya Valley of the Bismarck Fall. To the Elimbari speakers near the lower Asaro River it was *gainor*. *Gaina* is the name of a cane grass among their Siane neighbours (Salisbury 1956a:9) and it is possible that these more distant consumers believed it to be simply a superior plant ash salt.

To the north-west, whole tablets were rarely seen in the headwaters of the Kon River in the upper Jimi Valley; these people and their neighbours usually received small quantities in return for young pigs and bird of paradise plumes. Kandawo speakers related to the Koronigl Valley Chimbu knew it by its Chimbu name of *onogl*. Others called it *ab kusa*.[1] Very rarely did it reach the north side of the upper Jimi River, but it may have been the salt known to Narak speakers as *awi kudja* and to southern Maring as *bombagl*, though this last identification was dubious. Small quantities reached the Wahgi speakers of the upper Jimi, who, like those of the middle Wahgi Valley called it *ab kusa*. Bird of paradise plumes, especially of the Lesser Bird of Paradise, were a common payment here, together with occasional stone axes.

The middle Wahgi people most commonly exchanged stone axes for it though some return gifts included pearl shell and pigs. Only tiny quantities ever passed west of the Wahgi-Melpa language boundary in the Wahgi Valley until after 1933 and rarely entered the tributary valleys. The Melpa near the Wahgi-Baiyer River Divide just west of the limits of this study told A. Strathern that Wahgi salt and salt from the Jimi Valley reached them in the past, but his impression was that it was exceeded in quantity by salt from west of Mt Hagen (1971:111). As *ab kusa* this salt reached its south-western limit in central Kambia, small quantities being received from the Wahgi Valley and from east Kambia. It arrived in east Kambia in small bamboos from the head of the Monogo Valley but more often quantities of this size as well as occasional whole tablets were received from the Dom speakers of the upper Pima River.

To the south, Daribi speakers north of the Tua River received small quantities from the upper Pima River in the days before white contact, though they say that the trade had not long been established. Very rarely salt crossed the Tua River to the Daribi north of Mt Karimui. After the second world war, small bamboos of it reached as far as the southern Daribi (who called it *bware*) and minute quantities were said to have been given by them on one or two occasions to affines at Lake Tebera and by the Tundawe speakers of the lower Pio to their relatives on the upper Purari. Informants at Lake Tebera made the same statement nearly 20 years earlier to a visiting patrol officer (Johnston Kikori PR 7 1951-2:29). Feathers and marsupial skins entered the Wahgi Valley from the south in return for salt.

Analysis of the Wahgi Spring and Prepared Salt

In 1939 when Vial and the geologist L.C. Noakes (Kundiawa Station Diary 19.5.1939) made the first visit by whites to the spring itself, they noted

[1] 'Foreign salt'. The probable derivation of *ab* from the Melpa *eip* and ultimately from the Enga *aipi* may indicate earlier or greater experience of that western salt, or that the products were similar and the distant sources indistinguishable.

that the water tasted salty and very bitter and smelled of hydrogen sulphide; the solution collected from the ashes was not as bitter and had no offensive smell. Noakes thought that sulphur compounds had probably been removed, possibly together with harmful salts (Vial 1941:20). They collected samples of spring water and salt for analysis but no record of the results can be found. (Noakes was then Assistant Geologist stationed at Wau and many of his records were destroyed with other official documents in 1942 in expectation of a successful Japanese attack [Noakes pers. comm., 1970].)

In 1947 Costelloe collected samples of the water, salt-impregnated grass and prepared salt and sent them to Goroka (Chimbu PR 7 1946-7:6). Sending them on to the DASF in Port Moresby, J.L. Taylor a/DO wrote that he hoped that if a simplified process could be introduced it might be possible to supply the District's salt needs, which 'would save the Administration, at the present rate of potential consumption, about £1000 per annum in air freight'. The purpose of the grass part of the process was not clear, he said.

> It may be that certain insoluble salts are removed or that some substance is obtained from the grass which improved the product in some way or another, or again that it is merely, that a more primitive process of obtaining a substitute for common salt from grass, known in many parts of New Guinea, has been combined with that of production from natural water because it was customary (DASF File 19-1-11).

The samples were sent for analysis to the Queensland Department of Agriculture and Stock in Brisbane. Unfortunately the grass was thought to be packing material and was burned in accordance with regulations for destroying imported plant material. The water was analysed and the soluble solids were found to consist of about 62 per cent potassium chloride: details are reproduced in Table 5.[1] The analysis of the prepared salt showed that the calcium salts had been largely eliminated, the final product being nearly 77 per cent sodium chloride and 20 per cent potassium chloride: details are in Table 6.

The analyst went on to say (letter to DASF 25.7.1947):

> Our explanation is as follows.
>
> (i) The grass takes up the saline water.
>
> (ii) The ignited material, because of the salt impregnation, does not reach a temperature sufficiently high to evaporate much salt.
>
> (iii) The plant ash contains carbonates of soda and potash.
>
> (iv) These react with the $CaCl_2 + Na_2CO_3 \rightarrow NaCl + CaCO_3$
>
> (v) The $CaCO_3$ is not soluble and is therefore left, on treatment of the ash with water.
>
> Loss of the grass gave us no opportunity to prove this sequence but it seems quite logical.

Instructions were sent to collect further samples of the grass both before and after steeping and in mid-1947 Costelloe evaporated a gallon of the spring water and sent the precipitate for analysis (letter 5.6.1947). No further reference to the matter has been traced.

Another salt sample from Chimbu was analysed at the Institute of Anatomy in Canberra in 1951 and found to contain 38 per cent sodium, 56 per cent chloride and 2.4 per cent of potassium carbonate (Wills 1958:173). A later sample analysed by Wills gave sodium and chloride figures almost identical with the Brisbane ones, with slightly less potassium. Although the 1951 Institute sample had more sodium and less potassium than either of the others, Wills believed that it may have been made at the same spring (ibid:170, 173). It is reasonable to conclude that small variations in the relative proportions of sodium, potassium and carbonate were caused by differences in the grasses used, seasonal changes in the salt content of plant species, the length of the period of putrefaction and the care with which combustion and filtration were performed.

[1] I am indebted to Mr K.A. Green, then Chief Archivist, T.P.N.G., for locating the analysis sheets, which were not included in District Office files.

Chlorides	980 grains per gallon
Equivalent to sodium chloride	1617
Total Solids (approx.) (Hypt. calc.)	1600
Total Hardness (Calc. as Ca CO_3)	522
Permanent Hardness (Calc. as Ca CO_3)	519

Hypothetical compounds		Milligram equivalents per litre	
$Ca(HCO_3)_2$	3	Ca^{++}	149.2
$CaCO_3$	1	Mg^{++}	0.2
$CaSO_4$	4	Na^{+}	241.2
$CaCl_2$	574	K^{+}	5.3
$MgCl_2$	1	Cl^{-}	394.3
K Cl	28	$CO_3^{=}$	0.4
Na Cl	989	$H CO_3$	0.6
Total	1600	SO_4	0.9

(Analysis by Montgomery White, agricultural chemist, Queensland Department of Agriculture and stock, Brisbane, 1947, lab. no. 1363.)

Hypothetical Compounds as Percentages of all Soluble Solids

(by extrapolation of above)

Na Cl	61.80
$Ca Cl_2$	35.90
K Cl	1.75
Balance	0.55
	100.00

Table 5 Analysis of salt water from the Wahgi spring

Moisture	16.5
L.O.I.	1.2
Insoluble in water	0.1
Ca	0.71
Mg	0.06
Na	24.6
K	8.8
SO_4	1.4
Cl	46.9
	100.27

(Analysis by Montgomery White, Agricultural Chemist, Queensland Department of Agriculture and Stock, Brisbane, 1947, lab. no. 1363.)

Hypothetical Compounds (by extrapolation of above)

Na Cl	62.6
K Cl	16.8

As a percentage of soluble solids

Ma Cl	76.7
K Cl	20.6

Table 6 Analysis of the Wahgi salt

Potassium Salts

Simple plant ash (without further treatment) was used as a condiment by many of the people of the study area but less so by those living near salt springs. It was a widespread practice in inland New Guinea, Blackwood, for example, collecting 10 different plants used for this purpose by the eastern Kukukuku of the Watut-Bulolo Divide (1939:21; 1940:112). The desired flavour came mainly from potassium carbonate and potassium chloride.

Techniques of leaching the ash of selected plants with fresh water and evaporating the resulting solution to reduce the soluble solids to a dry residue were widely practised in the highlands and have been noted in many parts of the inland, the best reported being that of the Baruya Kukukuku (Godelier 1969; Clarke and Hughes 1974), and the Buang (Hooley and Terit 1972). The work was usually performed by male specialists, as Salisbury noted in Siane (1962:85), but most highlanders knew the method. Some of the products were more valued than others, depending on the plant type, the location of the makers in relation to alternative sources of supply and in relation to the main flows of trade goods. All were consumed on special occasions, given as a luxury to visitors and carried as a gift to relations and friends. Much of the traffic in this type of salt was as gifts between individuals but away from the sources of sodium salt it was sometimes traded or presented as a ceremonial gift between groups. It was probably salt of this type that was seen north-east of Mt Otto in 1923 (Lane-Poole 1925:198) and in a bride-wealth payment in Benabena in 1933 (Taylor 1933:71). Plant salts were more common in the east than in the west, people speaking Gende, Chimbu and languages to the east making frequent reference to salt of this type and using a greater variety of plants with which to make it. Each salt was named, often after the plant.

The most common type was made from *Phragmites karka*, a tall cane grass from stream banks and swamps. The young shoots were gathered, bunched together, plaited, joined into ropes, coiled dried and burned on flat stones. It was the work of specialists. Both plant and salt were called *enggëre* by the Chimbu: the product was pale in colour. Though rarely made near the Wahgi spring, it was known throughout the Chimbu language area. In the upper Chimbu Valley it appeared in ceremonial gift exchanges with some other plant salts, and in this way was given to the Gende. In the upper Chimbu a salt called *kawma* was made from another swamp grass, and Nilles believed that the upper Chimbu most often made plant salt from 'reeds' (1944:9). *Kumba* (*Setaria palmaefolia*) was also sometimes used. A variety known as *konopa* to the people of the upper Chimbu and *konova* to the Gende was also made from a tall grass. Salisbury does not mention this as a condiment in Siane, but gives *konova* as the name of the 'most common form of pitpit reed' (1956:18), suggesting that it may be the ubiquitous fallow grass *Miscanthus floridulus*. The people of the upper Chimbu and Tauya Valleys received this salt in gift exchange from the upper Asaro, as occasionally did the Gende, though they also made it themselves. In the Tauya Valley a salt called *ubo* was made from *larese*, a forest vine.

The people near the lower Mai River used a dark salt called *rumi* which they received from the east; there it was known as *kisme*, and was made from a tall swamp grass. Siane speakers named five plant salts, *lanuna* made from *kunai* (*Imperata cylindrica*), a better one from the leaves of forest trees called *yaire*, and other leaf salts called *nerakuwo*, *makamba* and *komborokwe*. Potassium salts there are collectively known as *kuwo*. Salisbury gives this as the generic term for salt (1956:20) but at the time of this survey the traditional Wahgi sodium salt appeared to be grouped with store salt in the modern taxon, *mundini*, which may reflect recent knowledge of its true nature. Southern Dom speakers described a salt said to be made from pandanus leaves, smoke-dried in the ceiling before burning. However, they called it *yaulume*, and it may in reality be made from an epiphyte found on pandanus, for Sinasina people (R. Hide pers.comm.) and Chimbu made a salt from such a plant, called respectively *yaul* and *yaugl*. In Kambia, Aua speakers had a plant salt called *abru*, strikingly similar to one of the Gende plant salts, *yabru*. The Gende said that this was made from an epiphyte growing on a high altitude pandanus (probably = *yaul*) and that in addition they sometimes received small quantities from their upper Chimbu relations. They also made *denggram* salt from a red flowering shrub

called *nogai*. Aufenanger and Höltker name 13 other 'plants' used by the Gende to make salt (1940:56). Of these, however, *toru* is not a plant but is the Korakura spring sodium salt, and *onoru* is the Chimbu *onogl*, the Wahgi spring sodium salt. *Poko* I understand as the Gende term for the Chimbu *bingga maua*, which is the fern *Papaupteris linearis* C. Chn.[1] It grows above 4120 m MSL on the Bismarck mountains and nowadays is used as a hair ornament by young people. It was rarely seen in former times even by those living near the mountains, for men seldom ventured into the dangerous abode of spirits in and above the alpine grassland. *Kumbukai* is a Chimbu word for garden weeds of the Compositae Family. *Kayakaya* is the equivalent of the upper Chimbu *Kuiya kaye* which Nilles (n.d.:98) translates as 'a small flower'; the word is not known in central Chimbu. The others are *varuvinda*, *izo-vuriki*, *tingu*, *nara*, *moinaka*, *vakavaka*, and *ngoininre*.

The Maring of the Simbai Valley used the ash of several plants including the fern *Polypodium* sp. as salt (Clarke pers.comm., 1971). A potassium salt was made by Kandawo and Narak speakers of the upper Jimi Valley from the leaves of a forest tree. Cook (1967:99) says that the Narak traded a locally made 'salt-laden ash' (presumably potassium) for stone axes, but Narak informants in 1968 said that the valuable salt given for axes was imported from Maring neighbours to the north-west; this was the sodium salt of the Simbai Valley. Another salt of the Jimi Valley occasionally made by Melpa and Maring speakers living near the lower Ganz River was regarded very much as a poor substitute for 'real' salt. It was the ash of tree leaves and grass that had been immersed in a small slightly mineralised spring near the settlement of Kandye. It was rarely made and was not traded, but it is significant in that technologically it bridges the gap between simple plant ash and the unfiltered salt-impregnated wood ash of the Enga and provides a link with the filtered ash of salt-impregnated green plants used in the Wahgi process.

When plant ash was refined by filtration and evaporation, the methods resembled those used for the Wahgi spring salt, but there was considerable variation. The plants were sometimes sun-dried, sometimes smoke-dried, sometimes burned alone and sometimes burned over a wood fire core. Fire shelters were sometimes built but burning tended to be less controlled. Where a wood fire was used, the wood ash was carefully separated from the grass ash and discarded. Leaching was carried out in bark cones, bamboo tubes and wooden troughs. Evaporation took place in cups fashioned from heat-softened banana leaves with their upper edges pierced and tied to sticks. These were laid without stone or clay support directly over a low fire in a fire-trench, typically a metre long and 30 cm wide with space for four cups.

Similar methods were used in the lower Benabena-middle Asaro area (von Fleckenstein pers.comm., 1973), in the southern Saruwaged Ranges (Hipsley 1950:15), in the territory of the southern Kamano speakers (Stevenson Kainantu PR 8 1944-5; Carruthers Bena PR ? 1945-6:App.D), in the Watut catchment (Hooley and Terit 1972) and by the Baruya Kukukuku (called Batiya by Sinclair) of the upper Azana River, a tributary of the Lamari, except that the latter burn the grass on stones and support the banana leaf evaporators on stones (McKee 1955:25; Sinclair 1966:62; Godelier 1969:11; Clarke and Hughes 1974). A variant in the upper Markham Valley is of interest because the ash is stored until salt is needed and then the filtrate is used for cooking without any dry salt being prepared (Hipsley 1950:14, 15).

Some Kukukuku of the upper Tauri River used salt traded to them from the Baruya (Sinclair 1966:22) but others at Menyamya on the upper Tauri and those living on the middle Tauri in Papua made their own salt by a similar process using slightly different techniques. The upper Tauri process has been described by Freund *et al.* (1965:18). The people of the lower Tauri called their salt *aga* and made it from the stalks of *kovega*, a plant 'resembling wild balsam' cultivated near water, and the bark of a tree called *aniawa*. Both were dried on a frame over the house fire and burned together on stones close to a supply of water. The ashes were mixed with added charcoal and placed in a rectangular trough or in a sloping trough made from the fibrous base of a *goru* palm[2] (a type with an edible pith), water was poured through and the solution

[1] Specimen kindly identified by L.K. Wade, then of Department of Biogeography and Geomorphology, ANU.

[2] Hiri (Polis) Motu for a black palm (MP = *limbum*).

caught. This was carried home and evaporated in a bamboo trough over a slow fire of hot ashes in a trench (letter to RM, Gulf Division, n.d. [1938], Correspondence File J 2, Kerema).[1] The Marawaka Kukukuku of the Vailala head waters also made plant salt (Sinclair 1966:59) and it is evident that the method was widely known throughout inland eastern New Guinea.

Analysis of Plant Ash Salts

Baruya Kukukuku salt has been described by Godelier as having a high potassium content (1969:10) and McKee (1955:25) and Ollier *et al.* (1971:38) have said that it was mainly potassium chloride. A sample of the Tauri River *aga* was reported by the Commonwealth Analyst to be 84 per cent ash, 6 per cent organic matter (probably contaminant) and 10 per cent water. The ash itself was 65 per cent potassium sulphate, 19 per cent potassium carbonate and 15 per cent potassium chloride (Memorandum to Comptroller-General, Trade and Customs Department, 6.2.1939). A sample of Kukukuku salt was analysed by Wills, together with six other samples of plant salt from different parts of New Guinea and six samples of salt made from methods incorporating salt water, including the Wahgi salt (1958:170). (Expressed as mg/100 gm, the Wahgi salt was Cl' 55,500; Na 30,000; SO_4" 2,000; and K 6,000.) Wills also provides the only analysis of a plant ash salt known to come from within the study area, a sample from the Chimbu being Cl' 41,000; Na 90; Mg 375; K 49,600. There must also have been some sulphate or carbonate or both.[2]

A sample of plant ash salt possibly from within the study area but with the provenance stated only as '200 miles from the sea at the head waters of the Purari River' was analysed by Dickie and Malcolm (1940:145). It was said to have been leached from the ash of the grass *Imperata cylindrica* and contained 8 per cent water and 7 per cent sand. Made into a clear solution, it tasted bitter and was found to be Cl 19.4 per cent, Na 1.5 per cent, SO_4 25.4 per cent, K 39.1 per cent, Ca 1.2 per cent and had traces of phosphate: the compounds were given as 35.9 per cent potassium chloride, 45.3 per cent potassium sulphate, 4.0 per cent calcium phosphate and 3.8 per cent sodium/chloride. Nomane speakers near the Wahgi-Asaro confluence who made refined potassium salt but who also received Wahgi spring salt said that their product was not as tasty as the import and if eaten to excess made them ill.[3]

Comparing each salt's composition for the purpose of distinguishing between them by raw material and method of manufacture is easier if Wills' figures are converted to percentages. Seven of the results in her Table 1 are comparable in that she tested for the same elements. These have been expressed as percentages in Table 7 below. Also included are the converted relevant components of an Enga salt from Yokonda collected by Elkin and analysed by CSIRO (Meggitt 1958a:326) and the approximate percentages of these elements that occur in normal sea water (AWRC 1966:32). Of the salts made from salt water, only No.4, the Wahgi salt, has been lixiviated. Apart from the higher sulphate content, the specimen analysed by Dickie and Malcolm (1940) resembles numbers one and two.

The sulphate contents of four of the remaining specimens analysed by Wills were not stated. The relative salt contents of these are set out as percentages in Table 8, again with normal sea water as a comparison. (Tables 7 and 8 are not directly comparable.)

Clearly plant ash salts have a high potassium content and their chloride content is low in comparison with salts made from salt water and they all contain much sulphate or carbonate. Salts prepared from salt water, whatever the method used, are high in chloride and sodium, the use of green plants introducing significantly more potassium than the use of wood. This is

[1] I am indebted to Mr K.A. Green for bringing this to my attention, together with the Commonwealth Analyst's report.

[2] This salt contains virtually no sodium, so Wills must be misinformed in saying that it 'was prepared similarly to begin with' as the preceding Wahgi specimen (1958:173).

[3] Though it is difficult to overload a healthy human with potassium, the Baruya (Ollier *et al.* 1971:39) and the Buangs (Hooley and Terit 1972:321) say that an excess of their plant salt will kill. Large amounts of the compound, potassium chloride, can cause heart failure (Sollman, cited by Ollier *et al.* 1971:39).

Chlorine, sodium, sulphate, magnesium and potassium in three plant ash salts, five salts made from salt water, and in ordinary sea water; expressed as percentages (approximate) of the total of these elements in each sample.

	Prepared Salts								Water
	Filtered from ash of green plants			salt springs + green plants	+ wood	sea water + prob. wood	+ wood	+ simple evap.	Normal sea water
	Kieta	Menyamya	Kainantu	Deri	Yokonda	Bogia	Saidor	Wewak	AWRC
	1	2	3	4	5	6	7	8	9
Cl	23.9	32.5	32.7	54.9	59.2	56.7	53.0	59.1	56.0
Ma	0.7	nil	0.1	32.1	37.9	31.2	35.8	35.4	31.3
SO_4	16.1	17.9	10.8	2.1	0.3	8.9	9.3	4.6	7.8
Mg	nil	nil	nil	trace	0.1	0.6	0.3	0.6	3.8
K	59.3	49.6	56.4	6.4	2.5	2.6	1.6	0.3	1.1
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

(Nos. 1 – 4, 6 – 8 are Wills' 1, 4, 6, 8, 9, 11, 12 (1958:170); no. 5 is Elkin's sample (Meggitt 1958a:326) and no. 9 is based on AWRC 1966:32).

Table 7 Analysis of eight prepared salts

N.B. Tables 7 and 8 are not comparable.

Chlorine, sodium, magnesium and potassium in three plant ash salts, one salt thought to be the ash of a palm from brackish water, and in ordinary sea water; expressed as percentages (approximate) of the total of these elements in each sample.

	Filtered from ash of green plants			Ash halophyte	Normal sea water
	Kieta	Telefomin	Chimbu	Bogia	AWRC
	1	2	3	4	5
Cl	25.8	42.0	45.3	61.3	60.8
Na	0.6	0.3	0.1	25.8	33.9
Mg	nil	?	0.4	0.3	4.1
K	73.6	57.7	54.2	12.6	1.2
	100.0	100.00	100.0	100.0	100.0

(Nos. 1 – 4 are Wills' 2, 5, 7, 10 (1958: 170) and No. 5 is based on AWRC 1966:32.)

Table 8 Analysis of four prepared salts

supported, too, by Wills' second Bogia specimen, No.4 in Table 8, which has about half as much potassium as sodium and is made by burning a swamp palm. Her information does not include more details but the high sodium content suggests that the palm was either growing near brackish water or was immersed in sea water after felling. It is notable that this product is regarded at Bogia as superior to sample No.6 in Table 7, which contains very little potassium; the sodium content of both samples is similar. Within the study area, where the trade area of the Wahgi salt overlapped in the west with salt imported from the Enga of the western highlands (like No.5 in Table 7 above), the Wahgi salt, with more potassium, was preferred. This does not negate the general statement that salts containing much sodium were and are preferred to salts containing negligible sodium but much potassium, but it provides a clue to the order of preferences underlying the demand for salt, discussed in the concluding section.

Salt from Western Salt Springs

The salt which still enters the study area from the west is made by the Enga at springs described by Meggitt (1958b). The nearest of these is a small one on the lower Lai River 25 miles (40 km) away; salt from there was traded east to the Kyaka Enga of the Baiyer River. However, most Enga salt was made at the many groups of springs controlled by the Yandapu Enga 30 miles (48 km) further west. Taylor and the Leahys saw a large load of Enga salt being carried east by a woman near the summit of Mt Hagen in 1933, and a group of men and women taking axes and food in the opposite direction (Taylor 1933:173, 174). Some of this was traded through the upper Wahgi into the study area in small quantities. It was probably from the Yandapu springs, for salt from there travelled just as far to reach Lake Kutubu in the south. Champion and Adamson were told that the salt they were given near Lake Kutubu in 1936 came from the north (Champion PR 1936:66) and Williams saw 'flattened spheres' of salt bound in pandanus leaves arriving there from the Augu and Wage Valleys in 1939; he tasted it and found it 'salty' but was mistaken in thinking it to be a 'vegetable' salt (Williams 1940:133). It was probably also Yandapu salt which crossed the Erave River to near Mt Murray more than 60 miles (97 km) away (Lees Kikori PR 14 1944-5:9).

As suggested by the figures in Table 7, Enga salt was made by burning salt-impregnated wood. Billets from 15 to 18 inches (38 to 46 cm) long and 3 to 6 inches (7.5 to 16 cm) across were cut from softwood trees and sun-dried before being soaked in salt pools. They spent two to four months in the water before being drained and burned in special shelters containing shallow fire-pits. The wood was stacked in the form of an annulus 3 feet (0.9 m) in diameter around a central hot fire and took about 24 hours to reduce to ash, which was the final salt [1] (Wearne Wabag PR 1 1949-50:6; PR 4 1949-50:13, 14; Meggitt 1958b:311-12).

In the Poru region, Wiru speakers from the western part said that since the government came to their area they had heard that the salt they received from the west was made at a pond south of Mt Giluwe. This is not so, however for it was Yandapu salt. A package of it, called a *to tili*, was examined in southern Poru. It was a thin rectangular tablet 2.5 cm thick, 38 cm wide and 45 cm long, quite different from the large round cakes described by Meggitt and Williams, and it weighed an estimated 5 lbs (2.27 kg) complete with wrapping. This type of package is called *tili* and the salt is *to*. The wrapping of banana leaves was enclosed in an open net of thin cane, the cane being formed into a carrying handle like a satchel, and the whole parcel was blackened from its anti-deliquescent storage in the house ceiling. The salt tasted strongly of sodium chloride. Some of the large round packages reached the Poru since the Pacific war but in former times all were *tili*. The later arrival of the large ones may have represented a short-lived peace-time expansion of the Enga-Kakoli salt trade north of Mt Giluwe but is more likely to have resulted from the loss of the upper Wahgi Valley market to trade store salt.

To tili were worth a pig, pearl shell or good stone axe and are said now to

[1] In the Baliem Valley Dani salt is the ash of salt-impregnated banana stalks and other vegetable fibre (Harrer 1964:172, 173; Gardner and Heider 1969:43) and at the Wissel Lakes Kapauku salt is the ash of salt-impregnated woody herbs (Pospisil 1963b:253).

be worth $10. The Poru region is unique within the study area in that traditional salt still circulates; it is important as a valuable in prestations and in some localities is still ritually eaten with pork in ceremonial feasts. It enters the region from the west though different hamlets are conscious of getting it variously from the north-west, west or south-west, depending on their location. The Poru region was said to be the end of the road for salt, but in 1969 Roy Wagner was given a tiny piece of black trade salt by a Genabi Daribi from Bumaru on the Tua River who got it from Foraba speakers to the west. He thinks it may have reached them from the Poru (pers.comm.). *To tili* came from south of Mt Ialibu and Mt Giluwe, and people in the Mendi area are now known to have broken the 'wholesale' packages they got from the north, used some salt for their own private and public needs and reformed the balance for export by adding water and resetting the salt in rectangular moulds scooped in the earth. There appeared to be an elaborate terminology for *to* and its role in economic and social life. The neighbouring Kewa to the west, through whose hands the *to tili* passed, also have a highly developed set of terms for salt (as well as for types and measures of oil) suggesting an important cultural domain (Franklin pers.comm. 1967).

What the Melpa speakers of the upper Wahgi Valley call *eip* was the Enga salt which came over Mt Hagen in bundles weighing more than 2 kg (Vicedom and Tischner 1943-8:117), and entered the head of the Kaip Valley (one of the southern headwaters of the Wahgi) from the Nebilyer Valley. It was traded east across the ridges of the southern Kubors as far as Kambia mainly in return for stone axes. These Aua speakers called it *ab mur* and by the time it reached them the large bundles had usually been broken down. It rarely reached as far as the border area between the Aua and Wahgi languages in central Kambia, where it was known as *abi mur*. Some of this salt reached the middle Wahgi and was known as *ab mur* or *ab mural*. From the upper Wahgi Valley it passed north-east into the Jimi Valley, competing in quality if not quantity with the salt from the Kaironk and Simbai Valleys. In return the Wahgi people got stone blades and sometimes bird of paradise plumes and young cassowaries. In small quantities this salt reached the southern speakers of Narak and Maring and may have been the salt which they called *awi mur* and *alo*.

The Dynamics of the Salt Trade

Except that salt water was needed to make sodium salts, there was no simple correlation between the raw material and the salt-production method used. Sodium was consumed as salt water, and dry sodium salts were made by simple evaporation, by the burning of coastal halophytes, by burning salt-impregnated wood and eating the ash, by eating the ash of salt-impregnated green plants, and by leaching their ash and producing a residue by evaporation. Sodium salts have been reported from around the coast, and inland from the Bulolo Valley in the east (Booth 1929:108)[1] to the Baliem Valley (Matthiessen 1963:17; Harrer 1964:172, 174; Gardner and Heider 1969:42, 43) and Wissel Lakes in the west (Pospisil 1963b:253; Wills 1958). Potassium salts were eaten as the untreated ash of green plants, as a filtrate for cooking and as a residue from evaporation. (The group that cooked with the lye were surrounded by neighbours who regularly evaporated it.) Potassium salts have been reported from much of the eastern inland and from Telefomin west of the Strickland River (item 2 Table 8).

The presence of salt water is only a partial explanation of the existence of a sodium salt industry. Within the study area there were three regions, Hills, Poru and Tebera, where salt springs were present but were not used for salt-making; nor did the people there make plant ash salts. And there are salt springs outside the study area in the eastern highlands where plant salts have been dominant. One such spring is used by a local Kukukuku group but the salt made from it by impregnating bamboo and burning it for its ash is not significantly traded (Godelier pers.comm. 1970); another of only local use is mentioned by Berndt (1962:41). Furthermore, in the central part of the study area, where sodium salt commanded a large trade area and was made in quantity, a great variety of potassium plant ash salts were regularly made and exchanged. The

[1] On the eastern edge of the Kukukuku language area (Anga Family) at Koranga Creek, Wau, where there was 'a huge hill of salt, to which natives used to come from miles around'.

largest variety of plant ash salts were made and eaten where people had a choice of two types of sodium salt.

Part of the explanation appears to be the isolation caused by distance. In the sparsely populated Tebera region the general lack of importance of all salt shown by the infrequent use of existing salt springs and the absence of salt-making from plant ash reflects the extreme physical and social isolation of these people from the customs of others. But social distance was significant without the support of physical distance: in the Hills and in the Poru, the failure of groups with salt springs to borrow manufacturing techniques is evidence that while the flow of goods was not inhibited by political fragmentation into relatively small, mutually hostile groups, this insularity was an effective barrier to the movement of persons and ideas.

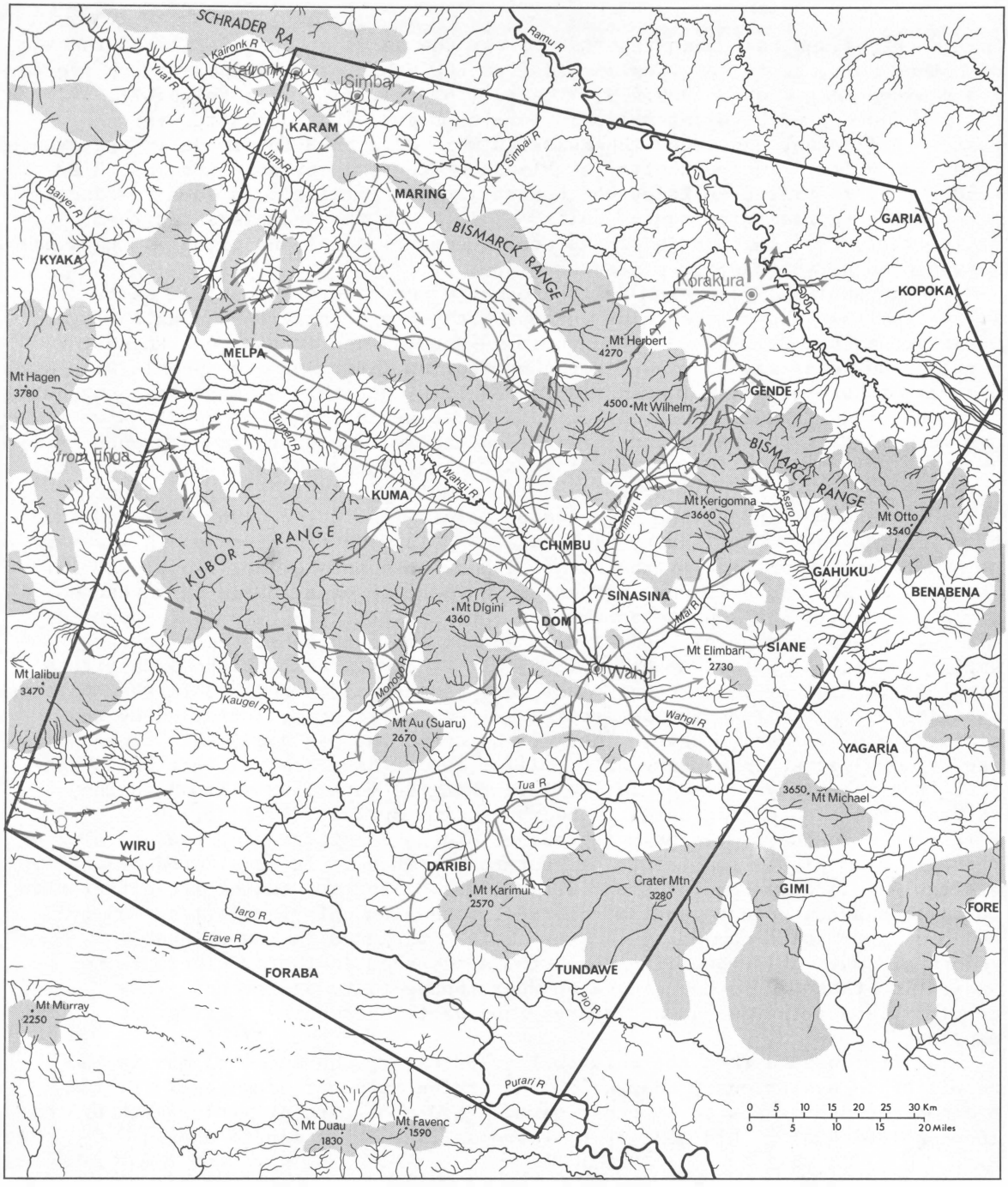
However, in some parts the possession of the technical knowledge in addition to the raw materials was still not sufficient cause to manufacture salt and this is particularly clear in regard to potassium salts. The leached bark ash salt of the Kamano was not made by those northern Kamano who preferred to get it from their southern neighbours in exchange for other goods, in spite of the fact that a costly valuable, one white egg-cowrie shell, would fetch only about an ounce (28 g) of the hard, yellow, bitter salt. Among the southern Kamano further specialisation occurred, one family in each hamlet making salt for the rest and setting some aside for trade (Carruthers Bena PR? 1945-6:App.D).

The explanation lies in the mutual dependency of neighbouring groups: the most important reasons were economic and arose from comparative production and trading advantages; these were modified locally by social and political advantages. Taking sodium and potassium salts together, the pattern of production and trade in general terms reflected the distribution of knowledge of salt-making techniques, the entrepreneurial development of factory sites and trade routes, and the competitive maintenance of trading advantages until some of them became established traditions. Conditions of dependence may be conservative and methods of production often seem to be. In regard to salt manufacture, this was pointed out by Baas-Becking (1931:434), for salt is made in the western world today in much the same way as it was in China nearly 5000 years ago. Antiquity of this order has been demonstrated for other trade items in central New Guinea and there is no reason why New Guinean salt-making traditions should have changed greatly in that time in spite of the changing locations and fortunes of the producers and the consumers.

The trading of salt is certainly correlated with the degree of processing involved in its manufacture. Within the study area, only those materials which were subjected to a reduction in volume and either an increase in sodium chloride or reduction in organic matter were extensively traded. Where available, sodium salts were more highly valued than potassium salts, in marked contrast to the pattern reported for the Kukukuku tribes.

The inland salt trade consisted of long flow lines radiating from the principal manufacturies (Map 3) in contrast to the generally parallel pattern of short movements of coastal salt to the hinterland (e.g. Harding 1967:34, 35). There is a subsidiary pattern of flow from the highlands to the lowlands, especially the southern lowlands, which is partly a reflection of geological control over the location of salt springs. (Insofar as this is so, one would predict a different pattern for the eastern highlands' plant ash salt trade.) It is also in part a reflection of the distance that separates much of the Gulf District lowlands from the sea and alternative salt sources. (For the same reason, one would expect the Kukukuku salt specialists to have traded their products to the south in addition to the reported trade northward to the Markham River tributaries.) Before 1933, unbroken tablets travelled from 20 to 30 miles (32 to 48 km) from the Wahgi spring and had a trade area of about 2000 mi^2 (more than 5000 km^2); the trade area of the salt itself was about twice that. As warfare was reduced, the salt reached a maximum distance of 50 miles (80 km) from its source and the trade area expanded to about 5000 mi^2 (13000 km^2) before this industry was killed during the 1950s by the importation of refined common salt.

The role of potassium salt in New Guinea was not simply that of a substitute for common salt, although most references to plant salts see it in this way. This assumption has also been made in regard to the few American



Map 3 The salt trade

Indian tribes who have been reported to eat the ashes of certain plants instead of common salt, or to use lye leached from the ashes or to evaporate the lye for its residue (e.g. Hodge 1959:419; Steward 1963 Vol.3:16, 326; Vol.6:471, 482). The place occupied by plant salts is more complex. They dominated in the eastern highlands, and among the Kukukuku were developed for trade in preference to sodium salts. In the central highlands which form the core area of this study, they coexisted in roles which were largely parallel; in some instances plant salts supplemented sodium salts - more often they complemented them. It is likely that further inquiries would uncover social and ritual situations in which each type had its preferred place.

In metabolism, potassium salts are not a substitute for sodium salts. It is true that the existence of unusual metabolic adaptations among isolated human groups has only recently begun to be studied and it has been suggested that New Guineans may have a nitrogen metabolism different from people with a history of European diet (Oomen and Corden 1970) but this has not been suggested in connection with salt metabolism.[1] In any case, all New Guinea diets were and are very high in potassium and this is especially true of the subsistence farmers of the Highlands with their low intake of animal foods (Hipsley and Kirk 1965: 78-80; Oomen and Corden 1970:14-16). In normal diet, highlanders consume 200-400 times more potassium than sodium (Blair-West *et al.* 1968:928) and they have been shown to have a very high rate of potassium excretion and a low rate of sodium excretion (MacFarlane *et al.* 1964; Oomen and Corden 1970:21-2, 31). The consumption of additional potassium in the form of a 'table salt' had no dietary benefit. The common assumption that in satisfying his salt appetite man is expressing a physiological need cannot apply to subsistence farmers eating additional potassium salt.[2] Nor will the data sustain the 'substitute' argument in another form - that plant salt eating was a mistake, in that palates unsatisfied in their desire for sodium salt were misled or satisfied by the similarity of potassium salt. There is no doubt that as condiments these salts are to some degree interchangeable; Ollier *et al.* have drawn attention to the fact that the Baruya erroneously believe that the potassium salt which they extract from plants originates in nearby sodium springs (1971:38, 39). Potassium chloride is the main ingredient of the substitute for sodium chloride prescribed to please the palate of western man when it is considered medically desirable (Winthrop Laboratories letter 1970).[3] But the tastes are different; to palates accustomed to sodium chloride, potassium chloride is less 'salty' and has other taste components. Where both circulated in New Guinea, informants were quite specific about the difference in taste. There is no indication that New Guineans have unusual innate taste preferences: the complexities of the demand and consumption patterns require a different explanation.

We must assume that the palatability of salty substances to man is the result of an evolutionary adaptation conferring survival advantage. It is pre-hominid and is shared by other mammals and some more primitive vertebrates (Denton 1967:454).[4] His ability to taste salts enables man to subtly

[1] Innate adaptation to salt deficiency and resulting appetitive behaviour in herbivorous and omnivorous experimental animals, and the relationship of these findings to salt consumption by man insofar as it is known, is reviewed by Denton (1967). See also Blair-West *et al.* (1968), Denton *et al.* (1969), and MacFarlane *et al.* (1968).

[2] Not only in New Guinea, see Hodge (1959:419), Steward (1963 Vol.5:679, 692).

[3] It has been shown that the inclusion of potassium in the diet can reduce to a considerable extent the effect of sodium in producing hypertension in laboratory rats. If this has relevance to humans, the lack of hypertension among New Guinea highlanders may be linked as much with high potassium as with low sodium intake. However, the correlation between low sodium intake and a low increment in blood pressure with age has also been argued from the evidence of such groups as Greenland Eskimos who have a low potassium intake (Denton 1967:453; 1970:2-4).

[4] For a review of the evolution of salt appetite, see Denton (1965). On the speed of genetic change in man, see Rendel (1970); on the established dominance of visual sense over smell in food-gathering hominids before the evolution of hunting man (in contrast to carnivores who depend on smell) see Barnes (1970:2). It was suggested in the late nineteenth century that carnivores did not need additional salt because of the high sodium content of their meat diet (von Bunge cited by Wills 1958:176) and it was recently suggested that they were unlikely to have evolved the neural mechanisms evoking salt appetite (Blair-West *et al.* 1968), but the basic research remains to be done (Denton 1965:265; 1967:456).

discriminate within a wide range of sodium and potassium salts, and probably between most salts. Similar discriminative ability has been shown by rabbits and by wild and domestic ruminants (Blair-West *et al.* 1968:923, 926, 927).

It suggests that this ability evolved in response to a wide variety of naturally occurring salt combinations, not merely to pure sodium chloride, which is relatively rare. Out of 25 potential salt licks, wild ruminants selected three with more sodium bicarbonate and sodium sulphate (ibid), a finding which may have bearing on the preferences for salt mixtures demonstrated by some New Guineans, in particular the admixtures of other compounds contained in the most widely traded sodium salts, those of the Enga and of the Wahgi springs.[1]

It is instructive to look at the salt-use patterns among other subsistence farmers with varying degrees of dependence on cultivated crops and hunting and gathering. The American data has been comprehensively surveyed: only the New Guinea technique of preparing sodium salts or mixed sodium-and-potassium salts from the ash of plant material soaked in salt water seems to be unparalleled and that may have gone unreported. Most commentators have seen physiological need as the cause, though there is no doubt that potassium salt consumption and sodium salt avoidance by humans have aspects quite independent of physiological need. The following citations, unless otherwise stated, are from Hodge (1959) and Steward (1963). A partial correlation between subsistence dependence on meat-rich diets and salt avoidance has been noted many times; these editors also perceive a correlation between subsistence dependence on vegetable staples and the eating of common salt.

To the Eskimo, salt was an 'abomination'[2] (Hodge:419) and in general salt was not used in America north of the 45th parallel (Kroeber 1941-2:map 1). In the far south, the hunting, fishing and food-collecting tribes of Patagonia used no salt (Steward, Vol.1:84) nor did some of the tribes of the tropical and temperate forests who depended principally on hunting and gathering (ibid, Vol.1: 420, 453; Vol.3:103, 326; Vol.4:41, 449). Salt working, consumption and export were important among advanced agriculturalists and were particularly highly developed in the Andean civilisations (Hodge:419, 420; Steward, Vol.1:263, 555; Vol.2:217-939, Vol.4:17-32, 356). In Hodge's opinion (419), in North America the desire for salt correlates with the need for salt and this in turn varies with the degree of dependence on vegetable rather than animal foods. Steward and Faron (1959:184) have said that in South America the comparative importance of salt from place to place was undoubtedly related to biological need present among plant eaters but absent among hunters. McKee (1955:25) implied the same for Melanesia.

However, neither the American nor New Guinean data will support such a conclusion. Many of the tribes who did not use common salt were agriculturalists and many of the 'hunting' tribes depended greatly on forest gardens. Although natural salt occurs in great quantities in much of North America and is easy to collect, Hodge thought that none of the tribes inhabiting the southern United States used salt in pre-European times (419). Steward gives many similar examples for South America (Vol.1:420, 453, 525; Vol.3:16; Vol.4:17, 26, 340, 356, 402, 550). To complete the picture of customary complexity, and again to parallel the findings in New Guinea, those few groups who used plant salts (only one example of mixed sodium and potassium from halophytes) were cultivators, (Hodge:419; Steward, Vol.1:263; Vol.2:706; Vol.3:16, 103, 326; Vol.4:356; Vol.6:471). As in New Guinea, some prepared a dry potassium salt by evaporating lye leached from ashes (palms and a water lily, Steward, Vol.3:103, 326; Vol.6:471, 482) or by cooking with the lye (Hodge:419) or by eating the untreated ash (Steward, Vol.1:263; Vol.2:706; Vol.3:326; Vol.4:356). Similar observations have been made in Africa by Orr and Gilks who also report the eating of earths containing significant amounts of sodium, iron or calcium (1931:24-30, 73, 74).

1 In metabolism, while the supply of sodium is not limiting for potassium exchange, the presence of unreabsorbable anions such as sulphate or bicarbonate will increase the urinary losses of potassium (M. Hobbs pers.comm.), which may affect the salt mixture preferences of such high potassium ingesters as highlanders.

2 Mowat thought that while not using salt, the Caribou-dependent Eskimo satisfied a liking for it with blood (1952:93).

In a survey of some culture traits in Western North America, Kroeber found that the pattern of salt-use and non-use was not explained by a diet rich in meat or seafood or by heat stress due to higher mean annual temperatures. He found, too, that in parts of California and Nevada where natural common salt was used and where the ash of halophytes was also used, the distribution pattern of each custom was not coterminous with the distribution pattern of the natural deposits of salt nor of the halophyte. The patterns were interdigitated, some groups using one or the other and some using both. 'Whatever the underlying urge there may be in physiology as influenced by diet and climate' he concluded, 'the specific determinant of salt-use or non-use in most instances is social custom, in other words culture' (1941-2:1-5).

Similarly, the place of potassium salt in the New Guinea salt trade can be best explained as a specialised cultural adaptation. Is is an adaptation without metabolic advantage but probably also without disadvantage, since the plant salt intake represents only a small increment to a diet already very high in potassium. All the evidence of the economic, social, and ritual roles of salt suggests that the adaptation had psycho-social advantages in addition to economic ones. In the highlands spicy leaves and ginger remain an integral part of ritual feasting, and onions, eschallots and garlic were popular as soon as they were introduced (Nilles 1944:7).

Levi-Strauss has remarked on the strong contrasts in specificity of condiments, both salty and 'hot', among different American societies (in Steward, Vol.6:482). While the natural palatability of condiments to humans is fundamental, it is completely overlaid by established custom, producing a pattern ranging from total avoidance of one or all condiments, through sparing use, to the constant use of a salt-and-red-pepper mix into which every morsel was dipped (Steward, Vol.3:103). It is reflected, too, in the occasions on which salt and other condiments may be taken, ranging from everyday use coupled with ritual abstention to use as a luxury coupled with excessive consumption on ritual occasions.

How can the varied patterns have developed in New Guinea? In the first days of inland settlement the location of salt springs was unknown and since then the exploitation of these relatively rare resources has been firmly controlled by the groups in whose territories they occur. There were practical limits to the distance over which salt water could be traded, as we have seen in the Poru region.[1] The transport of salt-impregnated wood was easier, but relatively little of the load was salt. Transport of the ash itself was much more efficient, and this was the basis of the Enga salt trade.

Roasting tubers in open fires is even now the most common way of cooking morning meals and snacks. It is possible that potassium carbonate in the ashes was found to add interest to bland food, and perhaps by experience, garden ash, mainly grasses, was found to be superior and other plants were selected by experiment. In such a way, with sodium salts unavailable or scarce, a preference for potassium and sodium in association with carbon and sulphur compounds may have been learned. This may help to explain why, when salt was made from sea water, the wood-immersion method was more common than simple evaporation. However, the method probably antedates the invention of clay-and-stone evaporators and the use of pottery and may survive through the conservation of custom. In a region of almost daily tropical rain, natural salterns would be inefficient.

The development of such taste preferences is essential to the explanation of the wide popularity of such plant ash salts as that of the Kukukuku, consisting of up to 84 per cent potassium sulphate and potassium carbonate. Once lixiviation was applied to plant ash and a concentrated residue prepared, trade was further facilitated and more people were supplied with a superior potassium salt, habituation to its use expanding with the trade area of the salt. Such a view would explain, too, why the Wahgi salt trade area was relatively undeveloped in an easterly direction where plant ash salts dominated.

Salt of all types was consumed mainly on special occasions and there is no

[1] In New Britain Wright noted a situation where periodically salt water was carried from the coast to a village four days inland but most of it was consumed on the way. The same people ate the ash of the bark of a local tree (1965:111, 112).

doubt that habituation took place in a learning situation powerfully reinforced by the social importance of these occasions and by the established role of salt as a valued luxury whose production or acquisition by trade required much effort and expense. Among foodstuffs, scarcity and cost have given status and prestige to meat (Clements 1970:111). As a social symbol connected with eating, only salt is more powerful. It was a symbol of friendly intercourse in east and west; its social significance is impossible to overstate. Among peasants, even the giving of salt to draught animals was accompanied by elaborate ritual (e.g. Hockings 1968). Among subsistence farmers of the Americas it had its own taboos and deities and was interred with grave goods (Kroeber 1941-2:5; Hodge 419-20; Steward, Vol.2:309, 311, 550, 551; Vol.3:103). For the most important ceremonies in New Guinea it is combined with meat. To some eastern highlanders, salt is the essence of the ancestral fertility mother and its consumption is protective, vital in times of crisis, and can remove ritual pollution (Berndt 1962:49, 57). The ritual importance of salt consumption among the Maring has been stressed by Rappaport (1967[1968]:135-7).

So far I have begged the question of whether sodium needs contributed to sodium salt consumption. Denton has said (letter 1970) that observations on blood aldosterone levels among the people of the central highlands have shown them to be 'consistent with some measure of sodium deficiency'. Optimum sodium levels appear to be defined by these workers in terms of people on a European diet and sodium-replete hospital patients (Blair-West *et al.* 1968:928; Denton *et al.* 1969:536). So much has been said of late about the maladaptive aspects of modern diet (e.g. Furnass 1970:90ff.; Clements 1970:120, 125ff.; Boyden 1970:199, 202; Denton 1970:3-5) that it seems odd that it should be taken as the optimum standard for salt metabolism. On the available evidence, an emphasis on hunting with its higher intake of animal foods *could* obviate any physiological need for sodium and be reflected in the low consumption of salt water and prepared salt in the sparsely populated Tebera region, but these people's total sodium intake was probably lower than among the farmers of the Bismarck Fall, Jimi, Wahgi and Poru regions, with their access to prepared sodium salts.

There was and still is great areal variation in the mount of sodium consumed in New Guinea, not only inland. There was also considerable variation seasonally, especially away from salt springs and the sea. But consumption was low in European terms, even near salt water. In these terms, it remains relatively low today, even where refined store salt is available, both on the coast and in the highlands (Hipsley and Kirk 1965:148). These observers, as well as Oomen and Corden (1970:16), found no evidence of salt hunger or regular use of salt even when it was present in the house; a low rate of sodium excretion with a very high rate of potassium excretion was maintained (ibid:21-2, 31). Another study showed no change in the characteristically high potassium/low sodium ratios in saliva and sweat, but showed an increase in urinary sodium (MacFarlane *et al.* 1968:5). However, although their salt consumption was still generally low, a group living near a mission trade-store in the Jimi Valley had trebled their consumption between 1965 and 1968, and the researchers found that in New Guinea potassium/sodium ratios in body fluids, especially in urine, were a good index of acculturation to money and European goods, including salt (ibid: *passim*).

During field-work, some of the men eating with me intermittently over a 15-month period shared my salt more frequently than salt was eaten in former times. Those that did so had had at least a decade of access to store salt, and since they were wage earners and coffee growers, probably also had a higher protein intake than traditional highlands society. In the inaccessible Kambia region, where sodium salt had long been known but was rare and costly, it was possible to exchange salt for vegetables and children ran to lick up salt that was spilt. In the Tebera region, because occasional European visitors have carried common salt there over a period of 30 years, it is possible to trade it for vegetables.

The emphatic tone of reports from the north-west corner of the study area suggests an exceptional degree of interest in common salt. W.C. Clarke (pers.comm. 1971) has said that salt was regularly requested by Maring men and that on the special ceremonial occasions when pork feasts were held, salt was

eaten in very large amounts. Rappaport has said that 'most Maring men will eat pure table salt by the handful' (1967[1968]:136). To the north of the Maring, in the Asai Valley, a medical research worker was 'besieged' with people anxious to trade for salt (Stanhope 1968a:60). However, R.N.H. Bulmer believes that these reports merely reflect an early stage of contact-trade, the demand falling again with regular assured availability (pers.comm. 1971).

The conditions of scarcity in which man's salt taste is thought to have evolved were reduced by the development of a salt-making technology and inter-regional salt trade by New Guinea's subsistence farmers, but salt remained a scarce good. Now that cheap common salt has become available over wide areas its consumption is steadily increasing. It is pertinent that after some generations of exposure to conditions of affluence in salt, modern man has so far shown no sign of a suitable cultural adaptation in spite of the growing evidence of the physiological disadvantages of a high intake (Dahl 1958:1154, 1155; Denton, 1970). In New Guinea traditional restraints continue to be removed, the ritual role of salt has been challenged by ready availability, and the biological maladjustments associated with the satisfaction of 'need-free' appetite can be confidently expected. It is doubly unfortunate that, unlike the traditional product, the modern one lacks iodine.

MINERAL OIL

Seepages of mineral oil occur within the study area in the Tua, Poru and Tebera regions; outside the area to the south and west are many more. Some do not appear to have been exploited; the product of others was regularly collected for use as a cosmetic for the hair and skin, rivalling vegetable oil in some parts. It was also used occasionally for skin infections and wounds. Patrol reports frequently refer to seepages, most of which have been investigated by geologists.

A few yield a dark heavy oil but most produce a light oil in appearance like modern fuel oil, usually in association with water and gas. It burns readily but no example of it being used for light or heat in traditional times has been recorded from within the study area. Fifty miles (80 km) to the west, however, a village in the Wage Valley was reported to be cooking on oil and gas in 1954 (Counsel Kikori PR 5 1953-4:1; accompanying an Australasian Petroleum Company survey party). There was a suggestion in another report that just across the south-western boundary of the study area, oil-bearing shale may have been burned, but communication difficulties prevented a full understanding. The patrol officer thought the burning was part of an oil-extraction process (Ford Mendi PR 3 1953-4:20).[1]

Everywhere collection of the oil was extremely laborious. In some places the ground was excavated to improve the rate of flow, up to 20 m^3 being removed in one case (ibid). As the rising oil formed a film on the water surface it was gently swept to one side and scooped up on a sliver of bamboo or bark. A favoured method seen in use in the Poru region in 1968 was to immerse a feather and then strip the oil from it between thumb and forefinger into a bamboo container. To the south-west in the Kugua Valley a simple flotation process was used to extract oil from soft rock, the clay body being mined and carried to a pool and crumbled under water and the oil gathered from the surface (Ford ibid; Counsel Kikori PR 5 1953-4:5). In spite of competition from the popular and more easily won tree oil, mineral oil was highly valued in a number of localities, the ownership of particular seepages being disputed (Brand Kutubu PR 10 1952-3:11). In the west it was traded long distances, for Sinclair saw two gourds of it offered for sale in Tari in 1953 after being brought from the source 25 miles (40 km) further west (1966:113).

Within the study area, trade in mineral oil was developed only in the Poru region and even there tree oil was preferred. Wiru speakers referred to mineral oil as *pero* and most adult men living in the south-west of the region could name at least six varieties, each named for its source. One of these was a dark oil of poor quality called *tuaniga* and came from a single seep near Noiya village in central Poru. It was given to relatives and traded north across the Poru River

[1] In 1965 some men in the Poru region were said to be using local oil in hurricane lamps (Sisely Wiru PR 4 1965-6).

10 miles (16 km) to the limits of Wiru settlement. A small source called *kobio* smelling strongly of kerosene was seen near the salt pools in southern Poru. Its productivity was low and it was not significant. Most seepages and all the valuable ones were near the south-western limits of Wiru settlement in the Iaro Valley or across that river in the territory of the Kewa. *To* was collected near Warababe, an oil of unknown name near Poreia, *ere* west of Karani, *napuai* and *miræmbe* near the Iaro River, and *Walo*[1] and *an* were imported from south of the Iaro. The Kewa were said to refer to mineral oil as *kunggu*.

The best oils, of which *walo* was said to be a good example, were traded to the north and east, occasionally reaching central Poru settlements in containers as large as a 1.5 m length of bamboo worth a small pig or pearl shell. Smaller quantities were more common and were sometimes exchanged for foodstuffs. These reached the end of their journey near the eastern Wiru settlements around Laue and Undiapu and the furthest distance travelled would not have exceeded 20 miles (32 km). They did not pass north or east out of the Wiru language area. The northernmost Wiru speakers said that although they had heard the names of the better types of mineral oil in pre-contact times they had not received any until partial pacification had increased the trade area of these products. In contrast to the trade in vegetable oil further west, mineral oil in the Puru region was not borne by traders through the territory of intermediate groups - containers of oil passed from group to group and journeys made to fetch it did not exceed the circle of relatives and contemporary allies.

In the Tua region an oil seep was described by Daribi informants. They too called it *pero* and said that it occurred in the bed of a small stream a day's travel from the Genabi settlement of Bumaru on the north-east side of the Tua River. It had been first located by its strong smell, it was said, and men from Noru had occasionally collected it during spells of dry weather by methods similar to those described by the Wiru. The stream covered it in wet weather. It was used cosmetically but did not figure in exchanges, and most men had not even heard of it.

Oil seeps have been reported in the Tebera region in the Irou Valley and near Gurimatu on the upper Purari River; the latter site was exposed only when the river was low (Johnston Kikori PR 6 1952-3:29). Pawaian speaking Piawa informants at Gurimatu said that although a few men had sometimes used the oil they did not store it and they regarded it as unimportant.

PIGMENTS

Coloured minerals, mainly clays, were used everywhere for decorating the body, clothing, weapons, sacred objects, houses and other artifacts of wood, fibre and stone. Some were marks of mourning, of festivals, personal status or of the sanctity of objects or people. Others were a matter of personal choice, though different regions showed preferences for certain colours in personal decoration and in ornamenting sacred objects. These preferences continued when factory-made paints became available. Brightly coloured pigments were frequently used as payments for food and services by early patrols and are used still away from areas with trade-stores. It was a common experience to find that only one colour was acceptable, even though the hue and saturation of the others must have been sensational: for example, only red was acceptable in the Southern Highlands District in the early 1950s (Wren Kutubu PR 8 1952-3). Although these strong colour preferences persist today, they may have changed more than once since whites first arrived. In the Poru region of the Southern Highlands District in 1968, blue was favoured for cloth. The prejudice extends to such minor ornaments as glass beads; Clarke (pers.comm. 1971) found that while a Jimi Valley Maring group would accept only blue beads, a Simbai Valley group insisted on red or white - he believed these were very changeable fashions. This was confirmed by R.N.H. Bulmer, who found that while red beads were demanded by the Kyaka from the start, the Karam of 1960 would not accept them and valued

[1] The similarity of some of these 'traditional' terms for oil (e.g. *welu* offered by some Wiru, *dolio* offered by Erave River Foraba) to the MP word for oil, *wel* and to English, suggests borrowing from the men of the oil exploration companies who have been prospecting the area for nearly two generations. It would be interesting to know if further south one receives cognates of the Hiri (Polis) Motu term, *girisi*.

white ones most. Within four years Karam demand for blue equalled white and green beads had also become popular, and by the late 1960s they would accept even red ones (pers.comm. 1971). The complexity of colour denotation and connotation among the Melpa has been examined by A. and M. Strathern (1971).

Pale grey, blue-grey, yellow, orange and reddish clays were ubiquitous. White clay was fairly common and was supplemented by grinding weathered limestone and by using ash and milky saps. Charcoal was the main source of black, the Karam, for example, making special cosmetic charcoal from the seeds of the cultivated castor-oil tree (R.N.H. Bulmer pers.comm. 1971). But the brighter and rarer colours were valuable and were widely traded. Red ochre was exchanged in most parts, and in the more isolated areas small nodules of it can still be found suspended in bundles from the rafters of houses or carried about in small string bags. In former times some red clays were heated to improve their colour, presumably by the oxidation of more of the original mineral. These, together with rare blue, green and specular pigments, were in great demand in the highlands and were traded in small bamboo containers and leaf packages. This trade did not extend to the hills, Ramu and Tebera regions nor to the southern part of the Tua. Pigments were usually stored in bamboo tubes stoppered with bark or leaves and pushed into house walls or hung in net bags. Just west of the study area coloured earths used in poison were obtained from the south in return for aluables but no toxic ingredients were found in them (Vicedom and Tischner 1943-8, Vol.1:135).

Even some years after store paints were readily available, good native pigments still held the status of valuables in some localities, as was shown by their inclusion in a bride-wealth distribution in the Dom language area of the Wahgi region as late as 1955 (Wolsey Chimbu PR 1 1955-6:10). In less favoured areas this is still true, but where there are trade-stores, traditional trade in all but one pigment, a lustrous one, has been supplanted by the purchase of commercial colours.[1]

Red Ochre

Red ochre has been used in the area for more than 6000 years, as archaeological excavations have shown. On the boundary of the Wahgi and Asaro regions just east of the Mai River, nearly 500 gm of ochre was found in the upper levels of Niobe (= Niombe, Nombe) rock-shelter (White 1967:356) for which no dates are available; red pigment and red-stained grindstones were found in levels 2 and 7 of nearby Kiowa rock-shelter (S.E. Bulmer 1966a:97, 98, 108a). Level 2 is probably more than 2000 years old (S.E. Bulmer pers.comm. 1968) though it is all younger than the C14 date of 2890 ± 140 BC, (Y-1371) and level 7 has been dated to older than 4150 ± 140 BC (Y-1370) (S.E. Bulmer 1966a:108b). Similar items have been recovered from Yuku rock-shelter north of Mt Hagen from level 3 (ibid:120, 122), for which there is a radiocarbon apatite date of 4760 ± 265 BC (GX-3111A) and a collagen I determination of 2630 ± 220 BC (GX-3111B) (S. Bulmer 1974:32).

During the remembered past, the red pigment with the largest trade area was collected and prepared by Chimbu men of the Gena Nogar tribe in the north-central part of the Wahgi region. Its source is a thin bed of friable red sandstone between two beds of limestone in the unit mapped by the Bureau of Mineral Resources as Chimbu Limestone (Bain *et al.* 1970). The site is called *giglengogl* (spirit/?/red), among limestone pinnacles and caves at an altitude of 2400 m overlooking Singga Nigl (*nigl* = water, here a creek). The pigment was gathered by the owners of the ground and their relatives, and with permission, their allies of the moment.

In the Wahgi region pigments are usually called 'earth' or 'clay' followed by a colour adjective. In Chimbu, for example, this gives *gamba gogl*, the common name for red pigments. But this particular pigment was distinguished as *gawagamba*. Analysis by X-ray diffraction[2] showed it to consist of quartz,

[1] In the upper Wahgi Valley west of the area, trade in red ochre continues, for it is still in demand for decorating pearl shell valuables used in the *Moka* ceremonial exchange system (A. Strathern 1971:238).

[2] Analysis of pigments was kindly carried out by Mr G.H. Berryman using a Philips PW 1051 X-ray Diffractometer at the Bureau of Mineral Resources, Department of National Development, Canberra. For details of the operating conditions and results see Appendix 1 (Laboratory Report No.53, 9 June 1969).

kaolinite and hematite. Kaolinite readily absorbs dyes, and it was brightly coloured by the red ocherous hematite, the universal ruddle dye shared by many cultures with technologies ranging from the simplest to the most complex. *Gawagamba* was heated on stones beside open fires in the men's house to improve its appearance, probably by further oxidising the small quantities of iron that commonly contaminate kaolinite itself, as well as further oxidising the main source of colour, hematite.[1] A test firing for 15 minutes at 250°C changed the colour of the raw material from 2.5 YR 5/8 to 10 R 4/8.[2]

Gawagamba was traded throughout central Chimbu and up the Koronigl and Chimbu Valleys. Relatives often received small quantities as gifts; others made return payments, typically of another pigment, or salt, or minor valuables such as small shells or animal fur.

Green Pigments

Green pigments are rare and only two sources were described by informants. Both were visited. The first was a pale green (drying to 2.5 GY 8/4) clay (*gamba denggigl*) exposed by a small stream tributary to the Koronigl and bisected by the main track into the upper Jimi Valley. Its colour was due to chlorite. Young people in the neighbourhood sometimes painted it on their skin but it was not otherwise used and was not traded, which may reflect the widespread unimportance of this hue in the scale of preference for dry pigments[3] or may simply be due to the low degree of colour saturation in this particular pigment.

The other green pigment, called *denggru* by the Gende of the Bismarck Fall who collected it, was a brighter hue and was traded. Although it reached the upper Jimi, Chimbu and Asaro Rivers only in minute quantities and was rarely seen in central Chimbu, men there knew of it and were vaguely aware of its source. Chimbu of the upper Chimbu Valley have strong marriage ties with the Gende around the settlement of Yandera, who control this trade, and this has helped to spread *denggru* and the knowledge of it further south than in any other direction, but people living near the Wahgi River heard of it only in modern times. Older men in the Chimbu Valley who had not visited Yandera knew nevertheless that the colour was hard to gather and some had heard that ladders had to be used. They associated it with stone and referred to it simply as *denggigl* ('blue/green spirit'), without attaching *gamba*, the term for earth. The most common payment given by the Chimbu was salt, the valued sodium salt *onogl*, an appropriate exchange since both rare pigment and salt were associated with special occasions.

Denggru is deposited by running water on the surfaces of rocks in a creek above Yandera; the creek is named for it. The colour under water is bright blue-green but it dries to a pale green, mostly 2.5 G 6/4 but with small patches of 7.5 G 3/4, 5 BG 7/4 and 5/4. It consists of magnesium chamosite and/or chlorite together with spangolite, a sulphate of aluminium and copper, the last probably contributing most to the colour. It is laboriously collected by scraping the rock surface and by gathering pieces of the rock itself. A small but thicker deposit occurs in Korikana Creek, a tributary of Denggru, and is itself distinguished by the term *korikana*. Like many of the sites, it was accessible only with ladders. Even here the pigment was only 0.5 mm thick and the mine was too small to yield export quantities.

The colour is transported in leaf bundles or in small sections of bamboo and is crushed and mixed with water before being applied.

[1] Cf. the Melpa process: the rusty-brown clay was wrapped in wild asparagus leaves and baked in a wooden trestle over a fire for about an hour, being turned from time to time with tongs. The ash was then blown away and the reddest parts selected for use (A. and M. Strathern 1971:26).

[2] Colours are described here by the Munsell system. Pigment samples were compared with standard colour chips (Munsell Colour Company 1929-60) in the laboratory under natural daylight without direct sunlight.

[3] Bright irridescent green beetles are popular in headbands in the Asaro, Wahgi and Jimi regions, but the other main source of bright colours, feathers, seem to show a general lack of interest in green, for the readily available green feathers of parrots and doves are not common in feather ornaments. The only locality visited where green was prominent in ornaments was in the Kaironk Valley where Karam speakers used it boldly in headdresses: this may be a recent phenomenon.

Blue Pigments

Larger trade areas were enjoyed by blue pigments, not the blue-grey clays used widely as a sign of mourning but pure light blue powders prepared in one place in the Wahgi region and at least two places in the Poru region. Blue was and is a preferred colour in both of these areas and was prominent on ritual objects, particularly in the Poru.

Like the red *gawagamba*, the Chimbu blue *gamba kun* was prepared by the Gena Nogar tribe. The raw material occurs as small encrustations (blue, pale blue and white) on rotting wood embedded in banded clays being dissected by Da Nigl, a headwater of the Singga Nigl. The location appears to have once been a small swamp which is now being drained by renewed down-cutting. The tiny specks and blobs of colour are carefully dug out of the clay matrix and dried in the sun and when quite dry, a hollow reed is used to blow away impurities. People say that the particles of pale blue and white occurring together with the desired blue can be turned blue in a week or so by immersion in a solution of rotting banana leaf and water. A sample of the prepared colour was obtained from the Gena living near the site and samples of the original material were collected from the bog. The colour of both was 5 PB 5/4.5. The substance is mainly vivianite (hydrous phosphate of iron) with some hematite. The colour was provided by vivianite, the deeper hues being more oxidised. This earthy form of vivianite has sometimes been called 'native prussian blue' in Europe (Dana and Ford 1932:721).

The Gena's blue pigment had a trade area larger than the 250 mi^2 (648 km^2) of their red one but the extension was mainly south into the Dom language area. Minute quantities occasionally came into the hands of influential men in the Maril Valley (Gumine dialect) in pre-European times. The same sorts of goods were given in exchange as for red pigment except that from the southern Wahgi payments tended more often to be forest products like fur and feathers.

Depending on the history of friendly relations in a given direction, men in former times who lived 10 miles (16 km) away from the source usually did not know where it was though some had heard that it was in Gena territory. Outside the trade area a few men claimed that they had equivalent deposits in their neighbourhood but others who knew both the Gena product and the more common blue-grey clay said that they were talking about the latter. Minor occurrences of vivianite may occur in other streams draining the Bismarck massif but if so they have not been found. In the Wahgi headwaters, recent commercial draining of a swamp revealed a good deposit of vivianite 1.5 m below ground surface. If deposits exist elsewhere in the highlands they have not been exploited for trade.

In the Poru region, however, there are two occurrences of a blue pigment in similar swampy sites, one near Noiya just south of the Poru River in the centre of the Wiru language area and the other near Warababe in the Iaro Valley. The sites were not visited. The pigment was called *tumbo*. As in the highlands, it was transported in small leaf wrappers and bamboo containers, immediate relatives obtaining it without formal obligation but others having to make substantial return. It was more valuable in the Poru than in the highlands, probably because of its importance for decorating the tall poles which formed the centre-piece of one of the two kinds of spirit-houses which were once the most visible feature of religious life from Mt Ialibu to Mt Murray. This was probably also the reason why the standard trade quantities were larger than in the highlands, cakes of colour of an indicated size 2 cm thick and 10 cm diameter being needed when an important festival was approaching. These cost as much as a large pig only 5 miles from the source of the pigment, suggesting that the colour was regarded as essential to the proper construction of the spirit-house. The flow was to the east and north, though one group in the extreme south of the region said that they had once been able to supplement their imports with a small local deposit, long since exhausted. In general, *tumbo* from Warababe supplied western and southern Poru and *tumbo* from Noiya supplied the east and north. It was known and used over an area of some 500 mi^2 (1295 km^2) and was also used in the Kewa language areas to the west and south. It has now been supplanted by the factory-made blue pigment sold by the trade-stores and could

not be obtained for analysis. Its mode of occurrence indicates that it was vivianite.

Metallic Pigments

The most remarkable pigments, one of which was the most widely traded in the highlands, were those having a metallic lustre. Three were significant, two shiny black ones and a shiny red one, all from two localities 12 miles (20 km) apart near the boundary between the Wahgi and Bismarck Fall regions east of Mt Wilhelm. Nearby minor deposits were used locally but were not important in trade.

The best known black pigment comes from a site called Singgenai near Bomkan in the upper Chimbu Valley. It occurs as pure lenses rarely more than 200 cm^3 in volume and usually less than 1 cm thick in friable deeply weathered granodiorite, the rock that forms the bulk of the central Bismarck range (Dow and Dekker 1964:23, 24). Careful collection is needed to avoid the surrounding coarse gravel; the colour is scraped with the fingers and a bamboo spatula onto a leaf and poured into a short length of bamboo. If immersed for about ten days in water containing vegetable peelings it is said to become even more lustrous. Throughout the Chimbu language area it is known as *gamba pine* and sometimes simply as *pine*. The Gende to the north call it *pine pogo*. The desired brilliance and black colour are due to specular hematite.

The trade area of this pigment was expanding before the first whites visited the Wahgi Valley and it has continued to expand since then. The Leahy brothers and Taylor saw it in use in the valley of the Mai River in 1933 (Taylor 1933:49),[1] though the people there say that at that time they had not been receiving it for long. By the 1940s it was known in the upper Jimi Valley, south of Mt Elimbari, throughout Sinasina and as far south as the Maril River, and by the 1950s small quantities had reached the Nomane dialect speakers near the Wahgi-Asaro junction, the Gumine speakers near Mt Au and the people of east Kambia across the Kubor Range. In 1968 it could occasionally be bought in village trade-stores in Chimbu, a bamboo tube containing about 30 cm^3 costing one dollar.

Wahgi language speakers on the south side of the Jimi Valley said that they had occasionally made use of a local earth that shone somewhat like the *pine* that they had got to know in modern times. None was seen, but the description suggested that it was a micaceous light brown earth. A similar substance was described in the middle Wahgi Valley but was used only rarely and locally.

Since enforced peace, *pine* has trebled its 1930 trade area of some 600 mi^2 (1554 km^2) in spite of competition from a wide range of introduced pigments. In former times, men who were fortunate enough to have it would invariably use it to blacken their faces for festivals and warfare in preference to the more common pig-fat and charcoal, and although it arrived south of the Maril River relatively recently it has there displaced for some purposes the previously favoured red oil of the cultivated pandanus fruit.

The Gende near Yandera who produce the green *denggru* also produce *gamba pine*'s chief competitors - the other shiny black pigment and the shiny red one. The first of these looks similar to the Chimbu product although the lustre of its specular hematite is supplemented by chlorite and a trace of muscovite. The red pigment is less lustrous because the hematite is more earthy. Its colour is 7.5 R 4/3. It, too, includes muscovite. Both occur in veins in the bedrock on the hillsides and in the watercourses above Yandera, and are easy to extract; there are enough natural exposures to avoid having to shift overburden. The black form is also mined from lenses in weathered granodiorite in the same way as near Bomkan; at both places small ephemeral watercourses and deeply incised walking tracks usually expose sufficient of the colour to make large-scale excavation unnecessary.

[1] They thought it was graphite, as did later observers like the missionary Vicedom (Vicedom and Tischner 1943-8, Vol.1:100). Taylor's companion in 1938 during the Hagen-Sepik patrol, J.R. Black, was probably also mistaken while in the Lae Valley when he noted that one of his Siane carriers had a 'glint of graphite on his brow', although he recognised specular iron ore when he saw it *in situ* in the Lagaip Valley (Diary 1938:24/3, 8/4). It would be interesting to know if the carrier had brought it with him from the Wahgi region or had recognised and obtained it during the journey west from Mt Hagen. Had he traded for it in this distant and hostile territory?

Both red and black types were used throughout Gende territory, reaching the furthest groups by trade, and small amounts were traded into the upper Asaro, upper Chimbu and upper Jimi Valleys. These pigments would have been much more widely traded into the densely populated highlands if their place had not been pre-empted by the Bomkan product. The Chimbu Dengla-Maguagu tribe who mined this had the advantage of being located astride the most important trade route into the central highlands in addition to sharing a common language and tradition of descent with the people who made up the large market to the south.

EDIBLE EARTH: A DIETARY SUPPLEMENT FOR PIGS

The fortunate Gende at Yandera are also the distributors of *mondono*, a whitish powder used as a tonic dietary supplement for pigs, fed to them with cooked sweet potato and said to make them grow fat. Gende-Chimbu trade in 'clods of a special earth' was first reported by Nilles (1944:14) writing about the Inaugl tribe of upper Chimbu (1943:106). He said that it was mixed with pig-fodder in the belief that it caused 'an immense increase of pigs' - wording which suggests an effect on fertility. Close kin get it free but more distant people, including those of the nearby upper Chimbu Valley, get it by trade just as they did before Europeans arrived.

The Daribi and Tundawe of the Tua region have what appears to be a similar substance called *sezemabidi di*,[1] or excrement of the *sezemabidi*, a benign forest spirit that lives on the tops of ridges and tall trees (Wagner 1967:59). It is said to be collected from the top of a rock outcrop 'somewhere above the river Nie, between Iuro [a northern outlier of Tundawe settlement] and the Pio [River]' and, like *mondono*, was 'fed to pigs in order to make them grow, and to dogs, so that they would find *kapul* [MP = tree dwelling marsupials] more easily'. Dr Wagner bought some for a few shillings, presumably in Daribi territory north-west of Iuro, suggesting that *sezemabidi di* was traded by the Tundawe. He describes it as a 'white, limey powder'.

East African farmers feed an edible earth to cattle which is said to make them fatter, breed better and resist disease. It has a high calcium content (Orr and Gilks 1931:25).

Mondono was first discovered many generations ago in a garden just below central Yandera. In those days it belonged to the Sundiga sub-clan but when visited in July 1968 it belonged to Bare, an old man of the Kumburumba sub-clan. The garden had recently been abandoned to fallow. Two small hillocks, remnants of a tiny spur, with a cordyline growing in the hollow between them, marked the spot where the substance originated.

The ground had opened up at this place during a nocturnal earth tremor such as are common in the Bundi fault zone. When the ground shook strange noises were heard, trees rustled though the air was still and sounds were made like the grunting of large pigs or a giant snake turning in its hole. Tremors here were still accompanied by mysterious noises in 1968 and although the people living on the next ridge did not hear them they were familiar to everyone in the immediate vicinity of Yandera. Indeed, there had been three since Christmas, it was said, which even the children heard; they had been plainly audible at the mining company camp nearby.

On such a night a hole formed at this spot and a large python with two tails appeared. Next morning a white powdery substance was found in and around the hole and it was believed to be the faeces of the snake. The pigs ate it and grew fat and ever since then it has been fed to pigs. After appearing a second time the snake abandoned the hole and has since lived elsewhere. A banana patch now occupies part of the hollow where the great events happened and there no longer seems to be anything dangerous or sacred about it; *mondono* is no longer found there, but on a neighbouring hillside.

For as long as tradition records, pigs have been sacrificed to the snake and blood poured into the hole. In traditional times all five sub-clans are said to have done this but about a generation ago the Sundiga said that they were no longer going to; since then only the Kumburumba have faithfully killed pigs on

[1] I am indebted to Dr Roy Wagner for information about *sezemabidi di* (pers.comm. 1969).

their own ground and poured the blood into a hollow.[1] They control the supply of *mondono*.

Living memory extends to the time of old Bare's father, Yonggauwo, who collected *mondono* in his garden on the hill. The secret is now held by a crone[2] called Anatuma, Bare's sister. In Yandera this magical relationship with the snake is regarded as the limit of her powers but further away she is regarded as a witch.[3] When young she married a man of the Inaugl tribe and went to live with him but later the whole family returned to live on Kumburumba land at Yandera, her husband being killed some years ago on the hillside on which she now lives. Her father instructed her in the secrets of *mondono* and since his death she has collected it from the leaves of plants in her taro garden. It is put there by the great snake during the nights when the ground shakes and when daylight comes she gathers it, dries it and sells it. Many Yandera men have small stores of *mondono* which they say they got from Anatuma and which they sell to visitors and carry to friends and trade partners. Five miles away at the Gende settlement of Bundikara a few old men have used it to fertilise slips planted out in food gardens, though this was the only example of such a practice. They said that in the old days it was so precious that only those who had links of kinship and marriage with Yandera could obtain it.[4]

The trade area of *mondono* has grown since enforced peace, spreading from its former limits among the Gende and their affines in the upper Chimbu Valley to the rest of the valley as well as to the headwaters of the Koronigl, Jimi and Asaro Rivers. A few men in central Chimbu who have recently established marriage links with the Gende have seen it but most there have not done so even today and some have not heard of it. Chimbu that know it call it *imemdem*.

Imem means an earth tremor, and Nilles (n.d.:81) gives *imem dem* as equivalent to *gamba imem dem* and translates it as 'dirt of the earthquake', though the meaning of *dem* is not clear. He adds that it also means lava, but the Chimbu have not seen volcanoes and would not recognise lava as ejectmenta; presumably he means that the term denotes stones and soil exposed or displaced by earthquakes. However, it also has the specific meaning of a tonic for pigs obtained from the Gende and called by them *mondono*.[5] Nilles goes on to say that the people of the upper Chimbu Valley believed that the Gende caused earthquakes by magic and from time to time they would placate them with gifts. He also implies that feeding sick pigs on tonics with sweet potato was a widespread Chimbu practice when he says that a grey clay called *gamba umbu* was used for this purpose (ibid:66). The Melpa of the upper Wahgi Valley say that white clay resembles the desirable white fat of pork and sometimes rub it on sick pigs (A. and M. Strathern 1971:164).

1 A two-tailed spirit snake also inhabits the swamps and water-holes of Daribi territory and the summit peaks of Mt Karimui: it punishes humans who trespass on its territory by stealing their soul-staff and must be placated by pig-sacrifice (Wagner 1967:59).

2 MP = *lapun meri nogut tru, sikin nogut*. Unfortunately she was absent at the time and could not be interviewed.

3 MP = *sanggwma meri*.

4 F. Panoff (n.d.:16-20) has noted that the Maenge of south-east New Britain receive a similar substance called *paerang* in trade but use it differently, though there, too, it is associated with taro and is produced by a snake. It is a grey earth said to be the faeces of an important underworld deity during his common manifestation as a male python. The name of the earth is apparently derived from the verb 'to clean' and it is used in medicine and in the gardening ritual for a taro variety called 'snake'. A red earth from the same source is said to be the faeces of the deity in the form of a female python. These earths were very costly, a *page*, one of the large circular shell valuables, fetching only two handfuls. Here, too, earthquakes are associated with the activity of this deity when he is displeased (F. Panoff 1970:70).

5 Aufenanger and Höltker (1940:57) give *mondono* as the Gende name of a tree and also the steam-oven 'cooking barrel' hollowed from a tree trunk and used by some Gende and by the people of the Wahgi region. They say, however, that the oven is not carved from the *mondono* tree and that they do not know why it should be called by the same name. They do not record the pig tonic. Aufenanger (1953:35) gives the same term for 'barrel' in the Wahgi language. It is the same term in Chimbu: Nilles (n.d.:164) spells it *monduno* and gives the names of 16 trees from which it can be carved, none of them similar to the word *monduno*. Since this cooking method common to the Wahgi region was shared by only those Gende living close to the upper Chimbu Valley it seems likely that the technique, artifact and term for it were borrowed from the Chimbu.

In former times the people of the upper Chimbu Valley gave salt, dog and possum teeth, small axe blades and small pigs in return for *mondono*. Nowadays they pay cash, strangers observed buying it at the source, Yandera, giving one dollar for a small bamboo tube containing about 50 cm^3. The attitude of young sophisticates from central Chimbu was tempered with some scepticism but they were very keen to try it on their pigs.

When analysed, *mondono*, or at least the substance now purveyed under that name, was found to contain less than 1.5 per cent organic matter and that mainly rootlets.[1] None of these were from annuals, which casts doubt on the story of its collection from a garden in current use. Analysis by X-ray diffraction showed it to be mainly quartz, with some gibbsite, chlorite, albite and muscovite in diminishing proportions. It is the natural weathering product of the local rock, granodiorite.

[1] Appendix 2, details of analysis for organic matter kindly carried out by Mr Keith Fitchett of the Department of Biogeography and Geomorphology, Research School of Pacific Studies, ANU.

VI MAJOR MINERAL PRODUCTS

POTTERY

Pottery is one of the durable artifacts most commonly found in archaeological sites and it is 'one of the most diagnostic of artifacts that archaeologists have to deal with in the Pacific' (S.E. Bulmer 1970:1). Despite the paucity of pottery so far in archaeological sites in the study area, potsherds remain one of the principal hopes for demonstrating continuities or changes in manufacturing or trading practices between the time of field-work observations, the historical accounts of the first literate observers, the period preserved in memory, and the prehistoric past.

In the densely populated upland valleys of the area no pottery was made during the remembered past, although there are reports of suitable clay (Tuckson 1966:9). Apart from the use of clay in fixed constructions, like fire hearths and salt evaporators, unfired clay artifacts of two types were known in former times and are still being made. The Chimbu and Sinasina speakers make small, sun-dried, two-note ocarinas in a variety of rounded shapes, sometimes in the form of a pig[1] and often with incised and painted designs. Their reported easterly limits when Europeans first came was on the Sinasina-Chuave boundary (Black Bena PR 16 1934-5:3) which coincides with their present distribution, but Salisbury (1956a:84) implies that they were formerly also made by the Siane. Like reed panpipes, they are and were playthings and were not traded. A group in the Asaro Valley makes dance masks of blue-grey clay applied over a wicker frame and sun-dried. These, too, are of only local use and in traditional practice did not outlast the ceremonies for which they were designed. Although the clay ocarinas could be expected to preserve their shape moderately well under favourable conditions, neither mask nor musical instrument fragments have been found in archaeological excavations in or near the study area (S. and R. Bulmer 1964:57; S.E. Bulmer 1966a; White 1967).

Potsherds, however, were found in a context younger than 2890 ± 140 BC at Kiowa rock-shelter on the border of the Wahgi and Asaro regions, where three were recovered from level 2 of Bulmer's excavation. Two were associated with firestones. All were undecorated and were between 5.7 and 7.6 mm thick. The largest was made by coil technique and formed part of the slightly everted rim of a vessel with a mouth diameter of 'about five inches' (12 to 13 cms) (S.E. Bulmer 1966a:98).

None were found at nearby Niobe (Nombe) rock-shelter nor at Omkombogo rock-shelter in central Chimbu (White 1967:33-8; 332-71) nor at the only other archaeological excavations within the study area, the open sites in the Melpa area of the upper Wahgi Valley (Golson pers.comm. 1971). However, goldminers found buried sherds in the upper Wahgi (Vicedom and Tischner 1943-8, Vol.1:222) and 'a number of broken pieces of pottery' together with a stone mortar were seen by the Leahy brothers arranged apparently as ritual objects on a small fenced mound in the centre of a ceremonial ground in the lower Nebilyer Valley in 1933 (Leahy and Crain 1937:201). No detailed description of these important pottery pieces from the Melpa area is known and M.J. Leahy does not recall any buried sherds (pers.comm. 1972).

For as long as people can remember, pots made in the Hills region have been traded south to the people of the Ramu and Bismarck Fall regions, some being passed on to the people of the Chimbu, upper Koronigl and upper Asaro Valleys. In the 1930s a few reached the headwaters of the Jimi River and central Chimbu north of the Wahgi River but today they rarely go further than the Bismarck Fall. However, the pots being made in the Hills in 1968 were identical with those still in use in the Ramu and Bismarck Fall regions and those lying unused in highlands villages. Old men say that the style has not changed in their lifetime. Some of the pots seen in the highlands had not been used since the second world war and one collected from the head of the Koronigl Valley had been there for at least a generation.

Everywhere they functioned as cooking-ware only; even in the pot-making areas water was collected and stored in lengths of bamboo. In the Hills and

[1] They are occasionally referred to in the literature as 'pig-whistles'.

Ramu regions and on the Bismarck Fall from the territory of the Gende east, pots were used regularly in ordinary cooking. In the Hills they were used daily but even among the Gende they were preferred for cooking some foods and provided variety for others. In those highland valleys which they had penetrated they were a luxury; most families did not use them regularly, preferring to steam food over heated stones in an earth oven or wooden *mondono*, or in a length of green bamboo, and morning meals and snacks were usually roasted or re-heated beside an open fire.

Nilles (1944:6) briefly mentions pots called *gala* at the head of the Chimbu Valley. Aufenanger and Höltker (1940:54, 56, 57) said that the Gende sometimes cooked in pots called *garia* which they got in return for stone axes, net bags and bows from the Ramu people. They described them as being about 50 cm high with a mouth about 10 cm wide, and illustrate one (ibid:plate 2E). Remarking the existence of a 'village' called Garia across the Ramu, they wondered if the pots originally came from there and thereby got their name. I have found no record of pots in the middle Ramu though pots from the upper Ramu in the eastern highlands have been described by Watson (1955). A poorly made pot of a style not unlike that of the modern Hills region is illustrated in Biro (1901:plate VII, 4) and was said to have come from the Oertzen-gebirge (ibid:92) and to have been made by the coil technique (Bodrogi 1959:92). A typical pot of the Hills region appears in Werner (1911:144, fig.74). The German's Oertzen-gebirge are the hills between Astrolabe Bay and the Ramu plain - the Hills region of this study. The provenance of the coiled-ware collected in German times will be discussed later in this chapter.

The following sections describe the pots, locate the potteries and outline the manufacturing techniques, the terminology following that of Shepard (1957). Finally, trade in pottery is discussed in the context of trade with groups outside the study area. The only previous attempt to survey the pottery of the central highlands has been that of Coutts (1967), who during 1966 in the upper Chimbu and Benabena Valleys collected pots of a tradition and province - to use S.E. Bulmer's terms (1970:4) - similar to the pots described here. A recent unpublished paper by Keil (1973) discusses the pottery traded into the Benabena.

The Usur Potteries

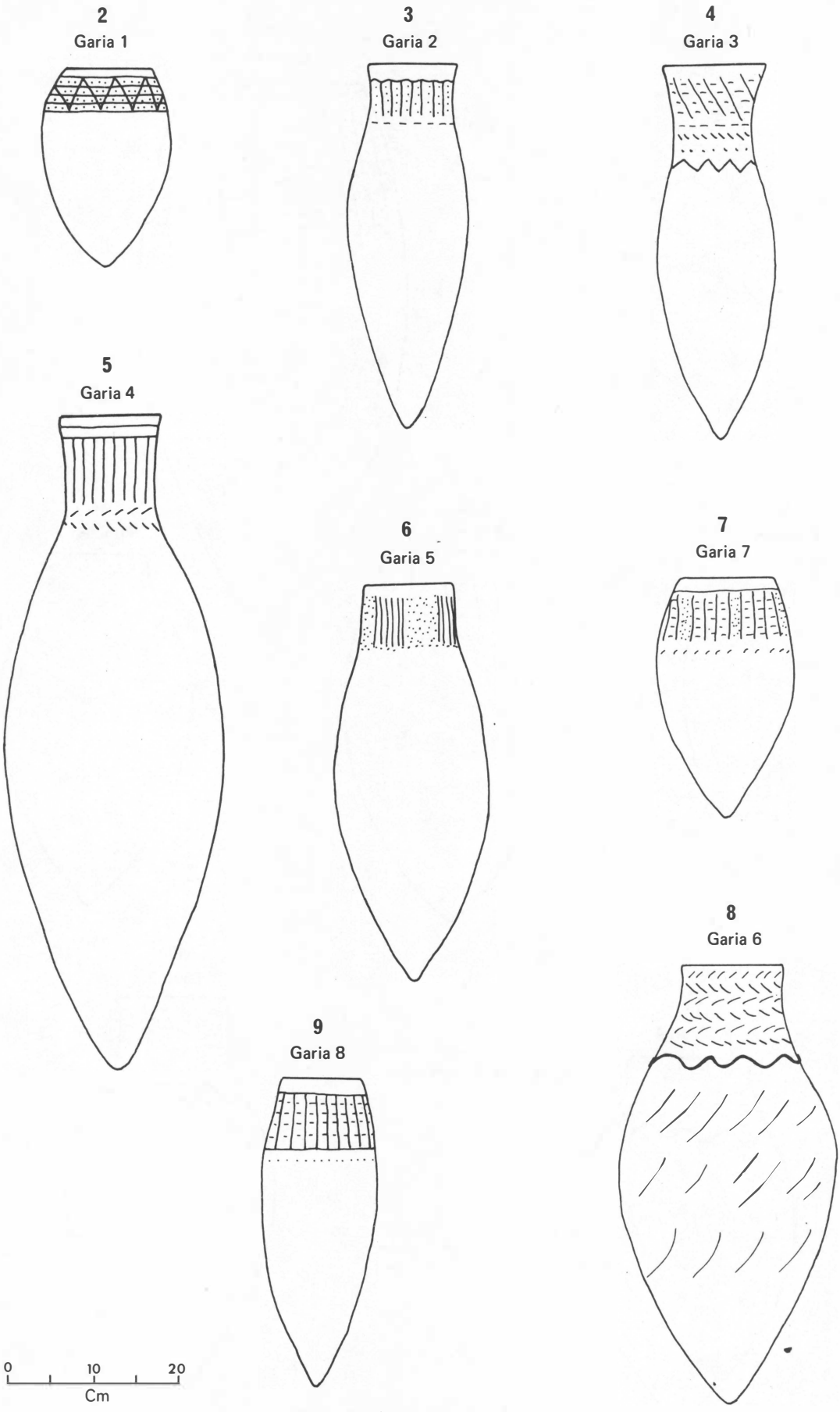
Because of the difficulties and costs of porterage it was not possible to collect pots, but they were photographed, measured, sketched and described in the field. One of medium size was bought in the upper Koronigl Valley.[1] Pots were seen in every settlement in which formal interviews were carried out in the Hills and Bismarck Fall regions, in one settlement in the Chimbu Valley, at one settlement in the Koronigl Valley and at one place in central Chimbu. This most southerly site had received its single pot only since the war. None were seen in the upper Jimi or Asaro Valleys.[2] Clarke (1971:97) records that one pot at least reached as far west as the lower Simbai Valley. In the year he was there he saw no others, and this one appeared not to be used. It resembled those described here and had been got many years earlier from Aindem, a small settlement of Maring and Narak speakers living on the Bismarck Fall in the headwaters of the Mambu River (Clarke pers.comm. 1971), which has connections with the Gende further east along the Fall. R.N.H. Bulmer said (pers.comm. 1971) that the Karam got pots from Aiome but very few indeed.

All the pots seen except one had been made by men in the Garia and Kopoka language areas of the Hills region (Map 2).[3] It was said earlier that these languages are regarded by Z'graggen as part of the small Usur Stock, and it is

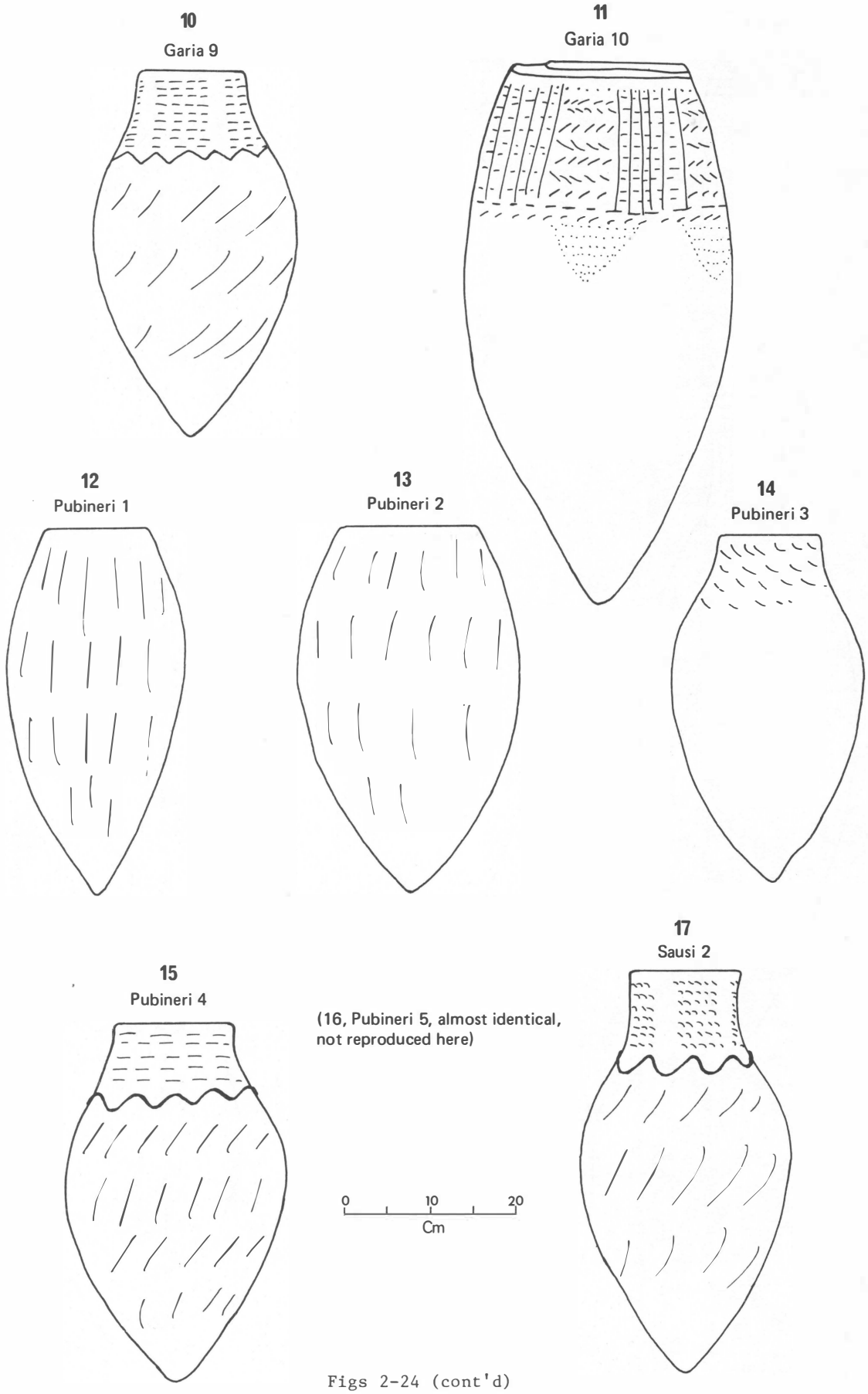
[1] Three pots thought to be from the same potteries were collected in the upper Chimbu Valley in 1966 by Coutts and are in the Australian Museum, Sydney. These are the ones that he described as UC/1, 2 and 3 (Coutts 1967:488).

[2] Rounded-based shallow pots thought to have been collected from the Benabena area were seen at what was then Mr I.F. Downes' plantation in the upper Asaro Valley.

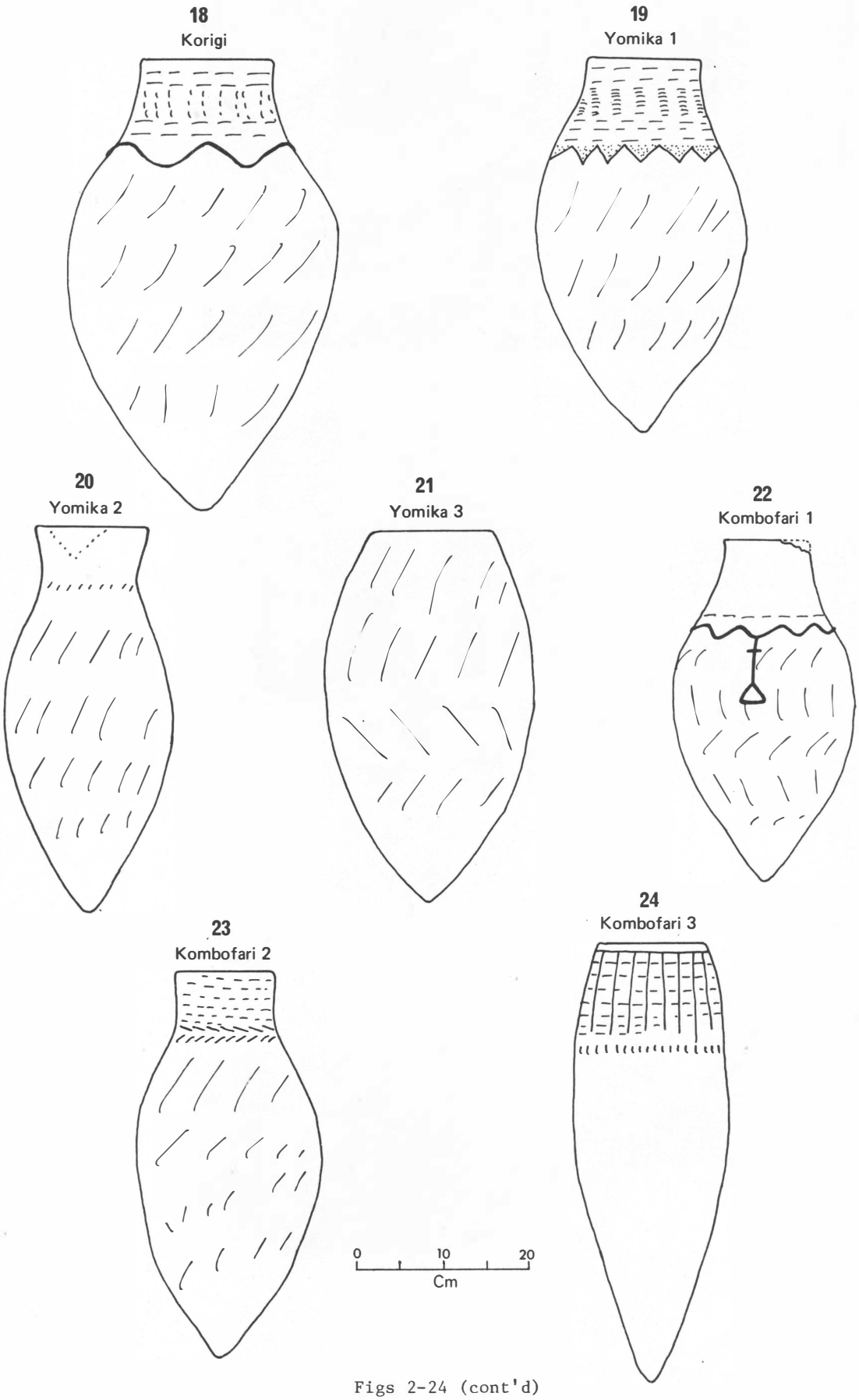
[3] Coutts saw 'a few Markham and Madang types' in the upper Chimbu Valley (1967:486) and J. and G. Hope collected a worn Madang-type pot there in 1969 (pers.comm. 1971). I did not see these. Returned plantation labourers familiar with Madang pottery said that they had not seen any in their own district but said that some men may have brought them back (by air). Gende informants were adamant that round-based pots had not reached their area in traditional times.



Figs 2-24 Usur pottery



Figs 2-24 (cont'd)



Figs 2-24 (cont'd)

Kesa 1,2,3

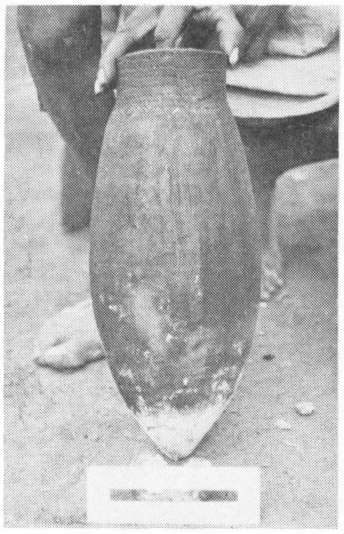
Kogoto dish

prepared clay

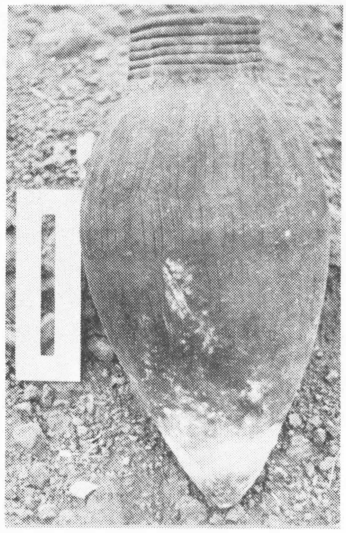
Mondisipi 1,2,3

Yandera 1,2,3

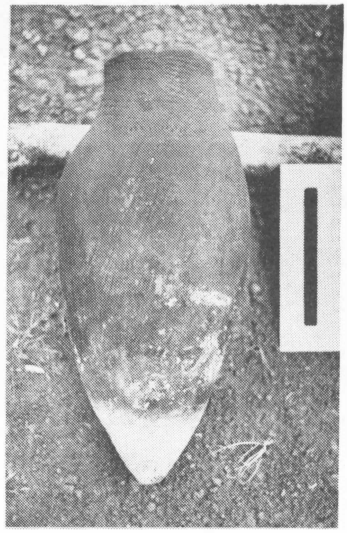
Plate 3 Usur pottery



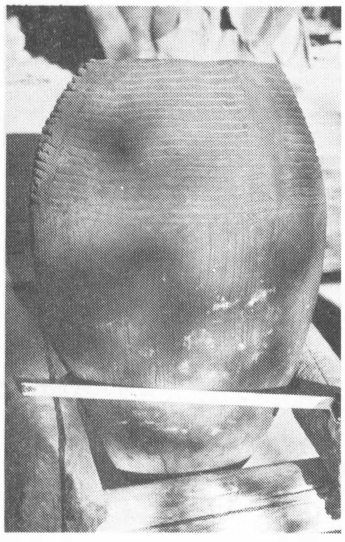
Kesa 4



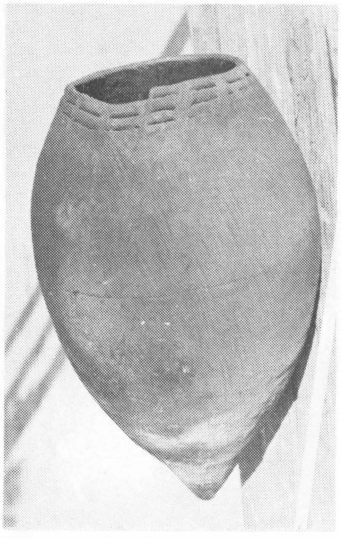
Kesa 5



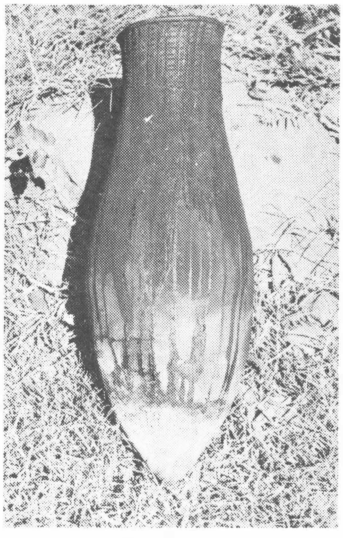
Kesa 6



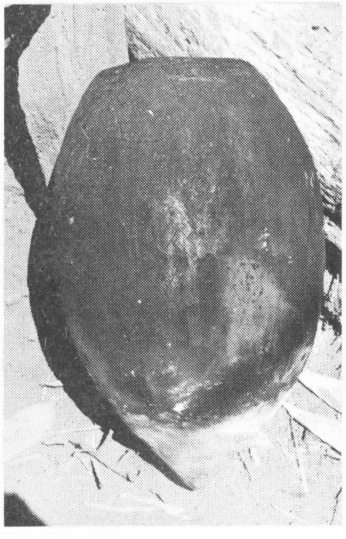
Sausi 1



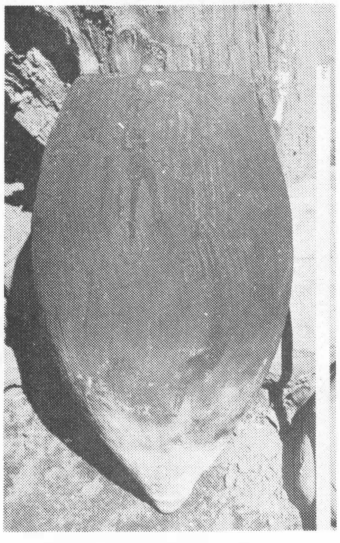
Sausi 3



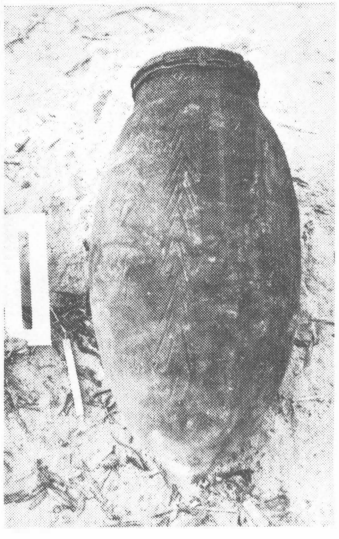
Tauya 1



Tauya 2

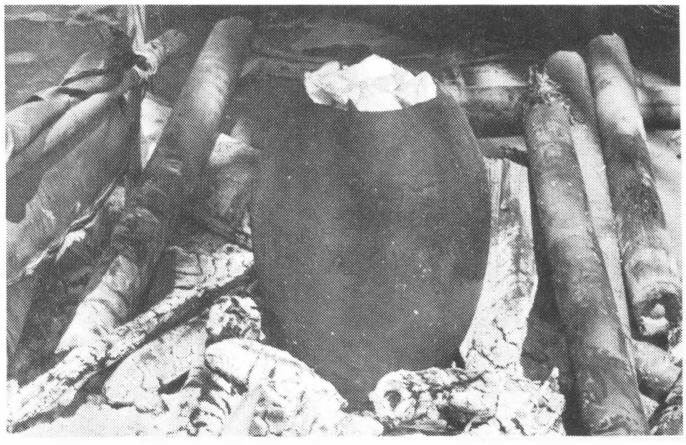


Tauya 3



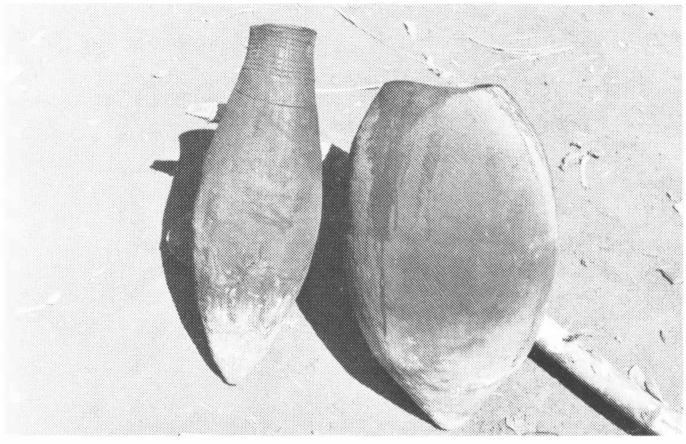
Bundikara

Plate 4 Usur pottery



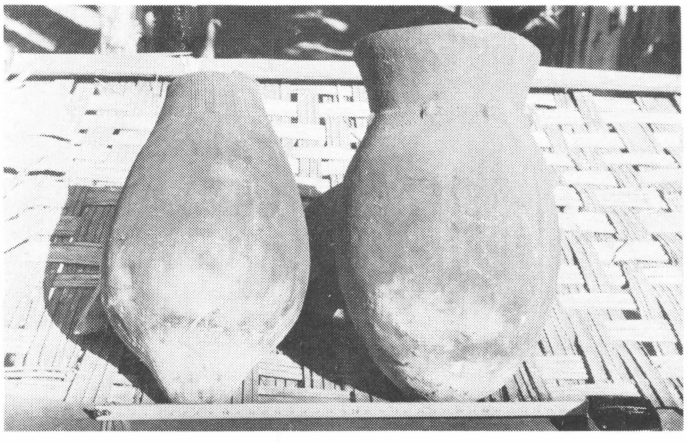
Tauya 4

Bogo



Tauya 5,6

Tauya 7



Sausi 4,5

Plate 5 Usur pottery

convenient to refer to Garia and Kopoka pottery collectively as Usur pottery. Some Garia and Kopoka speakers live in the flood plains of the upper Peka and Nopu Rivers and their tributaries but the main pottery-making communities are in the hills themselves. Garia pot-making is focused on the hamlets of Totopa and Yanipa, at an altitude of some 600 m MSL, under the western faces of Mts Karakatai and Sumau in the centre of Garia territory. (Their northern neighbours, Girawa speakers near Manipur and Bagasin, are said to make pots in a small way from their own clay deposits but these are not traded into the study area.) The principal Kopoka pot-making hamlets are Ongoru and Kesa, perched close together on a ridge top at 680 m MSL, and Sana, on a lower ridge to the west across the head of Yagumbu River. The men of Pieli and Matoroi on the upper reaches of the Bogu River (the main headwater of the Nopu) to the east, also make a few. For Kopoka exports to the Ramu, the first three places are important.

Clay Quarries

In both areas the raw material is a naturally lean clay-loam which includes sand and gravel and some organic material. No temper is added. A fragment of the pot collected at Bogo was analysed by Mr C.A. Key, then of the Department of Prehistory, ANU, and found to be untempered oxidised clay of limonite base with less than 5 per cent of inclusions. These were rounded fragments of very weathered basalt up to 0.5 mm diameter and very fine (0.01 mm) remnants of felspar laths and probably quartz. Fractures in other parts of the same pot exposed pebbles as large as 5 mm.

The clay is normally excavated by women who carry it back to the hamlets, knead it with water and pick out the larger pebbles and obvious organic matter. At this stage all or part may be set aside for some time. Two lumps, each weighing about 2 kg, which had been collected before May, were seen at Yanipa in August. In a palm spathe ready for use, they still bore the imprint of the breadfruit leaves (*Artocarpus* sp.) in which they had dried. The end of the wet season and beginning of the dry season is favoured for mining because it is easier after steady rain, particularly in the Kopoka area where new deposits are exposed by land slips and flooded streams. However, clay is also dug when needed or when opportune; the clay in Plate 3 had been collected by the potter, Anggia (F = Ubu) from a small terrace beside Yagumbo Creek while returning from a meeting at Usino Patrol Post two weeks earlier. It had been exposed where the bank collapsed, undercut by a small tributary. Blue-grey sedimentary secondary clay is said to be the only raw material used by the Kopoka. The Garia on the other hand use residual primary clay from a ridge above Yanipa. Several pockets have been excavated since the war, the top-soil having to be removed to get at the underlying gravelly clay, light brown drying to a yellow-brown. At a pair of quarries visited, some 600 m^3 (785 yd^3) of soil and clay had been excavated but how much of that was overburden was impossible to estimate. Other quarries over the ridge were ten times the size and were said to have been used by ancestors.

Individual potters saw that enough clay was collected to suit them, most men preferring to make from two to four pots at a time. A small pot could be made from one lump of about 2 kg, it was said, indicating the clay lumps already described, a medium sized pot needed five such lumps and a very large one like Garia 4 or 10 (Figs 5 and 11) needed up to ten. On these figures, if the 'average' potter made three at a time, one large, one medium and one small, he would need about 30 kg (66 lbs) of cleaned dry clay - perhaps 45 kg of freshly mined damp clay. However, unless there is much wastage, these figures are excessive, for the Bogo pot is a third of the way up the size range and weighs only 2.95 kg (6.5 lbs); it is probably about a third of the way up the weight range, suggesting raw material figures two-thirds of the above.

While most Garia and Kopoka men could make pots, not all did so. It is not known if this specialisation was due to the greater economic or social obligations of some men, which could be met by making pots, or to their possession of superior skill. Despite the insistence of informants wherever pots were used that food boiled in pots was better than food boiled in metal, production has declined with the growing use of metal containers. Many older men who formerly made pots have not done so since the war. Individual potters did not specialise in particular

shapes or sizes and some at least used a number of ornamental designs. Kesa pots 1, 2 and 3 (Plate 3), for example, were made by the same man.

Basic Styles and Manufacturing Methods

This description is based on 50 observations. The pots taken to be representative of the work of each pottery centre were those seen in the pot-making hamlets themselves or at nearby hamlets known to be within their immediate sphere of trade. Most of these were within 8 miles (13 km) of the centre and their inhabitants spoke the same language as the potters and had marriage ties with them. Added to these were the three Mondisipi examples and the one from Korigi. The owner at Mondisipi and his neighbours said that they had always received them only from the north-east and that they now knew that they had come from the Garia via Usino. The Korigi owner named Kopoka as the hamlet from which he had received his pot. This gave a total of 15 known Garia pots (Garia, Usino and Mondisipi) and 11 known Kopoka pots (Kesa, Sausi and Korigi). (The pot Sausi 5 was not Kopoka-made and no-one knew its place of origin.) Most Gende speakers thought that all of theirs came from the Garia but Gende living in the east of the region thought that some came from the Kopoka, though no-one was sure of it. All had received them from settlements less than 10 miles (16 km) away. Awareness of the existence of Kopoka potters was post-war. Some Gende said that before the war they had heard of a 'village' called Garia but that this had not been before the early 1930s. Elsewhere, people did not know who made their pots and could name only the settlement from which they had received them.

All pots were deep ('depth is markedly more than maximum diameter', S.E. Bulmer 1970:2), had ellipsoid or ovaloid bodies and an inverted cone at the base, requiring them to be supported on stones in the cooking fire. They were built up in coils arranged in a spiral from the bottom and smoothed by hand. All were restricted. Analysis of the forms shows that they were of two basic types, those of simple form lacking necks and those that were inflected. Impressionistically, the inflected type divided into three sub-types, those in which the neck itself was continually restricted, those in which it was cylindrical and those in which it was everted: however, these were part of a continuous range. One vessel, Sausi 5, was composite in shape, the everted neck in the form of an inverted truncated cone making a bold corner point with the body, an aberrant shape believed to have been imported from the east, since confirmed by Keil's recent investigation of the trans-Ramu trade east of the study area (1973).

The coils began tightly at the bottom and were built up clockwise or counter-clockwise, depending on the potter, and bonded with the fingers inside and out, a piece of wood, bamboo, or nowadays a knife blade being used to lift any excess clay up towards the top. Old pots tend to break at these points of weakness leaving the shape of the original coil visible. As an ornamental feature, about a third of Kopoka pots had a number of the upper coils exposed, being fully bonded on the inside only. This can be seen in Kesa 1 and 5, Sausi 1, 3 and 4. Partial exposure of coils can be seen on Yandera 2 and Tauya 1 and 5. When this device was used, partial outside bonding and additional decoration was obtained by running a finger or stick up across the coils at regular intervals. Sometimes the final coil only was left visible, as on Garia 10.

Once the lower portion was laid down and bonded, the pot was stood on a torus of dried leaves, called by the Garia a *nami*, typically about 25 cm in diameter and 12 cm in height (Plate 3). The Garia favoured pandanus leaves and the Kopoka banana leaves.[1] The base of the pot was closed and the point formed by adding a separate cone of clay, not all of it necessarily at the one time.[2]

[1] Similar supports of banana leaves, but lower and of larger diameter, were used to hold the shallow round-based pots made by paddle-bonded coiling by Azera men of the upper Markham Valley (Holzknecht 1957:101, 106).

[2] Although the Agarabi man using coil technique observed by Watson near Kainantu in the eastern highlands did not add a separate piece of clay, this separate plugging of the base was usual in her accounts of pottery making. It was also the method used in the pottery origin myth. Agarabi pots were either shallow vessels with considerable restriction and a round base, or deeper vessels with little restriction, a wide everted mouth and semi-rounded semi-pointed base. The average thickness was 16 mm (Watson 1955:122-5).

Plate 3 shows a newly made leather-hard pot; wrapped in a piece of green banana leaf inside it is a small piece of clay which the maker said would be added to the base as a point after two days 'to strengthen it'. In some cases hand-smoothing was supplemented on the outside with a piece of coconut shell but the surfaces in general were fairly rough.[1] The surface of the Bogo pot appears to have been closed over by finer particles, perhaps by wetting while smoothing. When firm, the bodies were usually lightly scored with the point of a stick in casual oblique strokes and the necks and lips decorated with a variety of incised and impressed designs; applied ornament was less common. The surface was left unpolished and no slip was used. The pots were then air-dried in the shade for three to six weeks, depending mainly on the thickness of the wall.

No glaze was used. Each potter fired his own creations in an open wood fire, the pots being laid on their sides and turned from time to time with a stick, a procedure believed to be unusual in New Guinea.[2] Accounts suggest that the fires had a relatively open structure producing low temperatures and generally oxidising conditions.[3] No pot was seen immediately after firing. Nearly all were blackened on body and neck, the only exceptions being Kesa 2 and 3 which had not been fired (Plate 3) and Mondisipi 1 and 3, showing part of what was thought to be their original brown colour (Plate 3); because of its large capacity, the last was rarely used by this single-family settlement. The basal cones of most pots were brownish-grey.

Detailed examination was possible only on the Bogo pot. It is thought to be representative of the firing methods used on all Usur pottery and of the Garia clay. On this pot, too, the base was brownish-grey, being 7.5 YR 4/1 on the surface and 7.5 YR 5/3 just under it. The rest is covered in superficial carbon but underneath this crust body and neck are contrasting colours. The scraped surface and freshly broken cross-section of the body is a dark purplish-grey (5 P 4/1) while the surface and cross-section of the neck is dull yellowish-brown (10 YR 5/3). There is no separately coloured core. Fragments of both were refired in an electric kiln at 500°C for 15 minutes, which changed the body sherd to greyish-yellow-brown (10 YR 5/2) and the neck sherd to dull-brown (7.5 YR 6/3). Refired again at 700°C for 30 minutes (the specimens reached dull red heat) both became dull reddish-brown (5 YR 5/4) on the natural surface and dull orange (5 YR 6/4) on the scraped surface and cross-section.

These changes suggest that the Bogo pot was not fully oxidised during firing, either through insufficient oxygen or too low a temperature, but a number of explanations are possible, as shown by Shepard's discussion of the problems of interpreting firing atmosphere from pot colour (1957:217-22). On the available evidence, the following explanation seems most likely. True reducing conditions are improbable; the variation in colour of the neck, body and base of the pot indicates that its porous paste absorbed carbon differentially when smudged by smoke during repeated cooking use. Observation of pots in use showed that the body received much more smoke than the restricted neck (see Plate 3, centre) and the base received very little. Especially towards the end of every cooking, the base was exposed to well-ventilated smoke-free hot coals permitting carbon to be removed in a good oxidising atmosphere. The final change in colour of both sherds to dull orange in the second refiring indicates that the original firing temperature was too low to fully oxidise all carbon compounds in the clay.[4]

After the pot cooled, it was tested and the inside sealed with vegetable matter by adding taro peelings and other food scraps together with water to an already warmed pot and bringing it to the boil. After three or four such treatments it was regarded as fit to cook food for humans and was either added to the household utensils or given to an exchange partner.

[1] Coutts (1967:488) described them as 'scraped', and this is how they appear.

[2] But not unique. Neuhauss shows a woman potter turning a pot during firing at Kelana, Huon Peninsula (1911, Vol.1:323).

[3] According to Watson, Agarabi coiled-ware was fired in a reducing atmosphere. She does not say how this was achieved.

[4] Lower than the coastal firings measured by Lauer in south-eastern Papua (1972).

Variations in Form

The basic shapes have already been described; here, description will be aided by the following abbreviations:

Basic style:	Simple	(no neck)	= Type 1 e.g. Kesa 3
	Inflected,	continuously restricted neck	= Type 2A e.g. Sausi 4
	"	straight neck	= Type 2B e.g. Kesa 5
	"	everted neck	= Type 2C e.g. Yandera 1

After Shepard (1957:230), a neck is defined as that portion above the point of inflection, that is, where the body curve inflects to another curve. (It tends to coincide with the position of the mouth on Type 1.) Yandera 1 shows it marked (exceptionally) with a raised seam. Decoration is normally carried down to this point and this is where applied ornament is usually placed. On pots of Type 2A the form of the neck is a truncated cone, on Type 2B it is a cylinder and on 2C a paraboloid. These are categories of convenience; it has been said that Type 2 shows a continuous range of shapes, including neck styles, and a further indication is that on some Type 2B (e.g. Kesa 5), while the point of inflection is in the usual position, the neck continues to restrict in a curve for a short distance before becoming a cylinder. On pots of Type 2C the paraboloid neck usually restricts further before curving out, both on wide ones (e.g. Yandera 1 and Mondisipi 3) and on narrow (e.g. Mondisipi 1 and Tauya 1).

Nearly all have, in Shepard's term (1957:245), a 'direct rim': very rarely is there any change of angle or thickening near the lip but it can be seen on Tauya 1 where the final coil has been featured. With Type 2 the lip is sometimes slightly thinner than the neck wall which in turn is often thinner than the body. These measurements on the Bogo pot are lip 5 mm, neck 6 mm and body 7 mm.[1] The basal point is 39 mm thick.

Ovaloid body form is common on pots of Type 1 but rare on Type 2. When it occurs on Types 1 and 2B, the point of maximum curvature and maximum diameter is in the top half and the ovaloid apex is down (e.g. Kesa 3 and 5). Ovaloid pots of Type 2A have the apex up (e.g. Yandera 2 and Sausi 4). No ovaloid Type 2C were seen. Narrow pots of Type 2 sometimes give an illusion of ovaloid form which is not sustained by measurement. The basal cone commonly makes a continuous curve with the body of narrow pots but on wide ones it is often marked by an inflection. The Bundikara example is unique in having the neck joined to the body by a small shoulder. About three-quarters of all pots are Type 2 and both areas make sub-types A, B and C, though sub-type A is rare.

Size, Proportions and Restriction

Heights range from 23 cm up to 76 cm and maximum diameters from 12.5 cm to 31 cm. Only the weight of the Bogo specimen is known but a crude index of comparative size is provided by height-plus-maximum diameter; this ranges from 37.6 to 101.4, a factor of 2.6. The inter-quartile range, however, is only from 58 to 69 with a strong clustering around the median of 63, and the distribution curve is approximately normal. Those that were traded all fell within the range 49 to 84. An index based on weight would probably show a range twice as great and would be more meaningful for trade but it is clear that mainly middle-sized pots were traded. The Garia make a wider range of sizes than do the Kopoka. In terms of weight, they made some which were about 60 per cent heavier than the largest ones traded and their smallest pots were about half the weight of the smallest ones traded.

Basic body proportions can be expressed as the ratio of maximum diameter to height. This shows a range of from .29 to .72 with a normal distribution about a median of .49. Garia pots encompass the entire range and are evenly distributed throughout it; Kopoka pots cover a smaller range. Although the most oblate Garia pot seen had travelled as far as the Ramu (Mondisipi 2), pots of extreme

[1] Cf. Agarabi 16 mm, 'Lihona' 'somewhat less' (Watson 1955:123, 124, 127), the latter possibly the thickness of Coutts Fig.1 D 2, *left*, from the Benabena and Gafutina Valleys, which it closely resembles (Coutts 1967:484). It appears to be about 10 mm.

proportions were not often traded.

The degree of restriction can be expressed as the ratio of the minimum diameter of mouth or neck to the maximum diameter of the pot. The percentage restriction ranged from 15 to 60 per cent with a near-normal distribution around a mean of 41 and median of 42 per cent. Again the Garia covered the whole range and the Kopoka little more than half and the most open and the most closed ones were not traded. (The imported composite pot, Sausi 5, is as open as any but other pots at this end of the range are of Type 1, lacking necks.) There is no correlation between basic proportions and degree of restriction in the pot population as a whole. Type 1 tends to be wider in proportion to height than Type 2 and to be less restricted, which is to be expected since in Type 2 part of the restriction is usually achieved with the neck. In contrast to Type 2, the wider Type 1 examples are more restricted than the narrower ones, perhaps to reduce spillage in the absence of a neck.

In attempting to distinguish between Garia and Kopoka pots in distant settlements, size, gross proportions and degree of restriction are of help only insofar as pots with extreme characteristics are more likely to be Garia-made.

Decoration: Elements and Motifs

No pots were seen entirely without markings; the scoring on the body of two-thirds of them may be decorative or it may be to aid gripping these unstable shapes. On a quarter of the specimens it forms crude chevrons, running horizontally on two and vertically on the others, and is clearly ornamental. It is more common on Type 1, half of which lack any other marks. Most Kopoka pots have it, compared with less than half of the Garia. Type 2 all had decoration on the neck or at the inflection point.

The ornamental device of exposed upper coils has already been described, together with the technique which S.E. Bulmer has called 'coil sloughing' (1970:4). This last was used only on Type 1 and only by the Kopoka. More than a third of their products showed at least two coils, usually more. Three Type 2 pots with exposed coils seen in the Bismarck Fall region had the coils partially bonded on the outside by long vertical incisions, either with a sharpened pointed stick or a flattened and squared stick, one of the decorative elements characteristic of modern Garia pottery.

Incised lines (zig-zag, vertical and horizontal, long and short) are the most common decoration, appearing on half the pots, more often on those made by Garia. Point impressions (punctations) occur on half of the Garia pots but on few Kopoka. Finger-nail imprints are uncommon and occur only on pots lacking incised designs.

S.E. Bulmer regards cord-impression as one of the dominant decoration forms within the pottery tradition she terms 'Upland Sepik 1 and Upland Madang' (1970:4) into which the Hills region pottery generally fits, but cord-impression, if used at all by the Garia and Kopoka, must be very rare. Only two pots bore patterns which could possibly have been produced by cord-impression but they were both heavily encrusted with carbon and it is more likely that the marks were carbon-filled short incisions in one case and nail impressions in the other.

Appliqué technique was used on less than a quarter of the total and never on Type 1. It consisted of thin (2-4 mm) coils of clay applied in a zig-zag around the bottom of the neck at the inflection point. On two examples only, additional motifs had been applied below this line, a loop in the case of Mondisipi 3 and a pendant triangle on Kombofari 1.

Apart from the foreign Sausi 5, there were two other examples of decoration extending below the normal limit, both on Type 1 pots. The first consisted of point-impressed infilled diamonds on Garia 10 and the second was an incised motif of star and triangles inside a circle on Tauya 2.

Taken separately, these design elements do not distinguish Garia from Kopoka pots. In combination and composed into design motifs they are more help. Linear arrangements appear on nearly every example. On half of them they are formed into rectangular patterns ranging in emphasis from rows of nail impressions interrupted by a blank band, as on Bogo 1 and Mondisipi 3, to the strong rectilinear effect of the Type 1 vessel Sausi 1 or the Type 2 vessel Tauya 1. Angular motifs (chevrons, diamonds and zig-zags) were much less common, the Kopoka using only the zig-zag.

The most elaborate combinations are on Garia 1 and 10, the latter also bearing a rectangular pattern, and on Tauya 2. In decorative design as in all other characteristics, the Garia make a much wider range. Identification is complicated by the possibility that designs common to a particular group may have changed during the lifetime of the present potters and the probability that individuals have imitated the inventions of others and borrowed motifs from other media. The motif on Tauya 2, for example, occurs on wooden bowls.

Provenance of the Traded Pots

Of the 22 pots recorded in detail outside the Hills region, only half can be identified with any degree of certainty by design characteristics, nine being probably Garia and three being probably Kopoka. Both potteries export to this part of the inland and vessels from both sources intermingle.[1] The Garia and Kopoka call pots *suma* and *sema*, respectively. In the lower Tauya Valley they are called *sema*, in the middle Tauya *suma* and in the upper Tauya *somo*, as in Benabena (Keil 1973). The Ramu people north of the Gende call them *singgi* and the Gende call them *garia*, an intriguing name change, since the Ramu people are the intermediaries. To the Chimbu they are *gala*.

The mingling of pots away from their source areas illustrates the pattern of pottery exchange and supports informants' statements about it. In former times, pots rarely figured in barter, that is, in exchanges which can be regarded simply as trade. Though made by men, once they were added to the household effects, they were women's things. In the Ramu and Bismarck Fall regions, while men sometimes cooked in pots on their own account, they were regularly used by women. The most common form of transfer was as a gift to a woman's affinal relatives, either while a marriage was being arranged, at marriage or as a replacement or addition after marriage. Most often, it was as part of a set of gifts accompanying the bride. No established form of equivalence for a return gift existed for pots received in this manner, and usually such a transfer merely established an obligation to be met later as part of a continuing round of exchanges between affines.

Some trade in pots did occur, but it was rare. (It was said to have grown in recent times under European influence.) Before the war, a common return gift was a small highlands axe of a size regarded in some places as suitable only for women. Other utilitarian products were given but not valuables. Only in the sense that pottery transfers formed part of a continuing exchange of goods and that, overall, specialist goods flowed in the one direction, is it possible to say, as did Aufenanger and Höltker (1940:54), that stone axes, net bags and bows went to the Ramu from the Bismarck Fall in exchange for pots. (The same qualification probably applies to Coutts' report of the Benabena trade (1967:485): 'pottery was traded for salt, dogs' teeth, male pigs and used for bride prices'.) These writers do not mention pots continuing to the highlands, but Nilles' (1944:6) pre-war observation of them among the Inaugl of the upper Chimbu Valley has been cited. The movement into the highland valleys was small, slow and intermittent, and except in the upper Chimbu Valley, was of little economic significance. In remembered pre-contact times, less than a fifth of the highlands within the study area received any pots at all - few households had them and those that did were confined to the upper Koronigl, the upper and middle Chimbu Valley and the upper Asaro Valley.

No pots were seen nor was their use remembered in the area of the Wahgi-Asaro regional boundary near Kiowa rock-shelter where pottery is known to have existed in antiquity. It will be recalled that the three excavated sherds were similar in thickness to modern Usur ware but that only one bore evidence of coil technique. (Whether the other two were made by other methods or were indeterminate is not known.) These, and the potsherds found by miners in the upper Wahgi Valley, may have been made in the highlands, though the ethnographic evidence makes it unlikely. If they were, the potters were probably not the ancestors of the present inhabitants, for it is highly unlikely that all pottery-making and food-boiling traditions could be lost. However, there is no archaeological evidence of a population change in this period, and it is more likely that the

[1] If clay samples were collected from both sources, provenance of sherds could likely be demonstrated with a high degree of accuracy. (See Shepard 1957:138-68; Key n.d. (1968?).

pottery was introduced by trade.[1] If so, the pottery trade into and through the central highlands was once much more extensive and its contraction or cessation and limited re-introduction need archaeological investigation. There may have been more than one interruption, and resumptions may have been accompanied by changes of source. Such a resumption within the last few hundred years could account in part for the lack of development of the contemporary pottery trade. In remembered times, pots moved slowly from group to group and the time taken for a vessel to travel the 50 miles (80 km) from the Hills to the Koronigl Valley was certainly a matter of years and may have been many years. However, although the earthenware is fragile and the terrain rough, 50 miles is unlikely to represent the limit that the overland pottery trade could have reached.

There is no evidence of unsatisfied demand in the Ramu and Bismarck Fall regions, and in any case, the potters could easily have increased their output. Trade in other items from the lowlands and the coast, such as shells, was much more vigorous and was unable to keep up with demand. On the evidence available, the only reasonable explanation of the small scale of the highlands pottery trade and its lack of integration into general bartering activity, was its exotic quality. In these parts, pots have the characteristics of relatively new goods expanding slowly into an area totally lacking in existing demand. Boiling was a cooking technique foreign to the area's culture. Some small growth in this century was aided by increasing pacification in the Hills and Ramu regions, and the introduction of metal containers there released some pots for trade. Most of these questions can be answered only by archaeological investigation in the study area but the archaeological and ethnographic information among neighbouring groups provides parallels, the data from the only other highlands region to have a pottery trade, the eastern highlands, being especially apposite.

Relationships with the Periphery of the Area

Interestingly enough, it was for the opposite reason that pottery outside the southern boundary of the study area failed to enter it. Pottery was in great demand among speakers of languages of the Kiwaian and Kikorian Families, of Koriki and Toaripi, and probably of Porome, living in the deltas and along the coast of the Papuan Gulf. They were the consumers at the end of the longest pottery trade route documented in New Guinea, 250 miles (400 km) by sea from the Motuan manufacturers.[2] Established trade routes ran inland from each of these groups, important ones linking the upper Vailala and middle Purari Rivers and the lower Kikori and middle Erave Rivers, but no pottery reached the hinterland, even failing to travel the busy routes around Mt Murray (PAR 1911:169; PAR 1922:150). Chalmers' observations make it plain that demand far exceeded supply and if the incentive existed to extend the pottery trade north, there were just not enough pots (n.d. [1887]:24, 56, 73, 74; 1895:112, 113).

No pottery was made west of the study area. To the north, however, similar pots were collected more than 70 years ago from the seaward slopes of the hills and to the east pottery like Usur ware was collected in 1966 in the Benabena Valley. The relationship between the deep, thin-walled Usur pots and the shallower, thicker-walled, pointed-based coil-ware used by neighbours cannot be understood without taking into account the only highlands potters, the Agarabi, who have a 'mixed' pottery industry with influences from 'Upland Madang' and 'Markham Valley' (Bulmer 1970:3). The eastern highlands pottery trade west of the Agarabi was almost as limited as in the study area.

The star, triangles and circle motif on Tauya 2 is of interest because the pot had come from further east than usual and the design was regarded at Tauya as quite new. It is copied from a motif common on circular wooden dishes called *kogotu* by the Kopoka and got by them from 'Laua', said to be a mountain village in the Finisterre Range,[3] but now known to refer to the Rawa language area in

[1] The introduction of pottery into the eastern highlands appears to have occurred only in the last 1000 years (White 1972:148).

[2] The western limit appears to have been Goaribari Island, none being reported further west (Jukes 1847:269-78; Grimshaw 1911:231; Murray 1912:181, 188; Austen 1934:20-7).

[3] The motif is related to the design on some of the round wooden shields collected around Astrolabe Bay at the end of the nineteenth century (e.g. Biro 1901:Plate XVI, 11, 12) and which were said to be made in the Oertzen Mountains (Haddon 1936:xix).

the Finisterre foothills to the east (Keil 1973). Those received since the war apparently originate north and east of the Rawa, who no longer make them (ibid:5).

The Type 2 pots collected by Coutts in the Benabena Valley have incised body ornament not seen in the study area. The two he illustrated have zig-zags well below the point of inflection (1967:482, Figs.2, 1 and 3). He suggested that these, together with the thicker-walled, squat, open-mouthed, pointed-based inflected or composite vessels called *parau*, seen in the Benabena and Gafutina Valleys, may have been made in the Ramu Valley (ibid:485, Fig.1, D2 left; Fig.2, 2). No potteries are known in the Ramu Valley but pottery similar to Coutts' *parau* was being made by Agarabi speakers in 1947 according to a patrol report, and one was illustrated (Grove Kainantu PR 1 1947-8:9, 10). It is inflected like Coutts' Fig.1, D2 left.[1] Grove had seen them used by the Kamano and had been told that Tairora and Gadsup villages had them; they were all said to be made in northern Agarabi villages from clay gathered near Kumieng on the banks of the lower Pumasi River on the Ramu Fall north of Kainantu.

Other wartime and early post-war patrol reports gave evidence of a relatively small eastern highlands pottery trading area. Among the Kamano, only those in the north used pottery and they got it from the Agarabi and from the Benabena side of the Ramu-Purari Divide; Kamano on the upper Onapinka River, for example, got theirs from Agarabi potters at Pumasi (Rae Bena PR 24 1944-5) but the trade did not reach further south to the Kamano of the Ramu headwaters-stream (Carruthers Bena ? PR ? 1945-6:App.D).[2] White found a recent sherd in the lower Dunantina Valley (1967:292) but Leahy saw none in 1930 (1936:232). Taylor saw none in the lower Benabena Valley in 1933 (1933:41).

The manufacturies listed in 1947 are the same as those given by Watson (1955) and are near the crest of the divide between the upper Ramu catchment and the main Ramu-Markham trough, some being on the north-eastern slopes. If the patrol officer's observation was accurate, these villages made a wider range of pot shapes than those seen by Watson in the southern Agarabi villages (cf. Watson 1955:123, 125, Fig.2,a,b) which were mainly very thick-walled (16 mm), very open large pots. Alternatively, intermingling of pots from different sources occurred in the northern Agarabi area, just as it did in southern Agarabi, Kamano, Benabena, and Chimbu. The profile, dimensions and proportions of Sausi 5 and of the *parau* pots described by Coutts and the patrol officer fall between those of Watson's Agarabi-ware and that of her 'Lihona' pot from the head of the Dunantina Valley in the Kamano language area.[3]

But the 'Lihona' pot is unlikely to have been made by True Kamano. The only representatives of the East New Guinea Highlands Stock who have been seen to make pottery are the Agarabi, speaking a language of the small Eastern Family. A small group of people speaking Abaga, a language of the Finisterre Stock, have been identified in the upper Dunantina Valley (Claassen and McElhanon 1970:61, 62; Wurm pers.comm. 1971). They are thought to have been displaced from the Ramu-Markham Valley by Austronesian speakers. They may be potters, or, with their location on an important trade route from the Ramu and their links with the Finisterres, they may import the *parau* style. Grove may have been similarly misled in regard to the one pot that he illustrated. Keil has now suggested that Watson's 'Lihona' pot came from across the Ramu (1973:6).

It was predicted (Hughes 1971:256) that other communities of potters, each with their own design traditions, where men made finger-bonded coiled-ware, would be found in the foothills of the Finisterre Range across the Ramu River north-east of Benabena and that they would be speakers of non-Austronesian languages of the Finisterre Phylum. It was said that Rawa speakers, a language of the Finisterre Stock (Claassen and McElhanon 1970:60, 72, map) probably made the style Coutts

1 Although this profile is between that of the pots labelled *parau* and *siliki* in his Fig.2, he apparently regarded it as a *parau*. It has the same profile as Watson's 'Lihona' pot (1955:124g) which Coutts identified with his *parau*.

2 Further east, Gadsup villages got Markham Valley pots (Stevenson Bena PR 8 1944-5:7, 8; Blyton Bena PR 32 1944-5).

3 Sausi 5 also had six small knobs applied at the corner-point of neck and body, a feature reminiscent of Azera pottery (cf. Holzknecht 1957:102, 105) suggesting that design motifs may be borrowed more widely now that travel is easier. Its maker labelled it '24 1955' in point impressions on the body, unfortunately without his name and village, but it was evidence that the pot had given 12 years' service; it was still in good condition.

called *parau* and that the Gurumbu to their west in the hills around the Uria River probably contributed his *siliki*. Gurumbu is in the Kabenau Family (ibid) and it was suggested that another member of this group, the Lemio of the upper Kabenau River, probably also made coiled-ware, for there was evidence that they had done so many years ago. Keil has now confirmed that the Rawa do indeed make the pots of the first type (though he says the Benabena term is *mu'iminose'i*) and his information indicates other potters to their east near the Uria River making the *siliki* type (1973:1, 4, 5). Because his Benabena informants' list of places believed to make pots included valley-floor locations like Kesawai and Beibi he believed the source to be the Ramu Valley itself, but at least some of these places are merely points on trade routes, indicating the familiar phenomenon of the limits of consumer knowledge. Kesawai, for example, gets its pots from the Kopoka. Benabena pots from as far west as Kesawai may be a post-pacification development and most *siliki* may come from the closer Finisterres rather than originating in Kopoka settlements.

The round-based vessels which reached their most westerly distribution in the Benabena Valley are unlikely to have come from the main Azera villages near Kaiapit 50 miles (80 km) to the east, not because of the distance but because the direction of flow does not coincide with the dominant trade routes cutting directly across the ecological zones. Round-based pottery in north-east New Guinea is usually associated with Austronesian speakers (S.E. Bulmer 1970:5, 6) of whom the Azera are the most inland representatives. One expects to find the manufacturers, therefore, near the Ramu-Markham Divide.

The apparently long hiatus between the archaeological pottery of the Wahgi region and twentieth century pottery may prove to be much smaller and more in keeping with the relatively recent interruption suggested by the ethnographic data. On this point, the archaeology and ethnography of the eastern highlands provides important comparative evidence which may have correlates in the central highlands; it shows considerable change in the pottery trade within the last 800 years.

In his excavation at the Tairora site of Aibura, the sherds found by White were all different in appearance from modern pottery in the region yet all were younger than 1180 ± 100 AD (GaK-622) (White 1972:57, 61-3; 1967:196, 216-21). Analysis of the pastes demonstrated at least two places of manufacture (Key 1972: 160-1) and stylistic differences suggest to me at least one additional source. Five sherds were of a paste similar to modern Agarabi ware. Bulmer interprets this as evidence of the antiquity of Agarabi pottery (1970:3). However, 3 of these sherds were thought to be from the same pot and were only 2.5 to 3.5 mm thick compared with modern Agarabi pots 16 mm thick (Watson 1955:123), the fourth was 6 mm thick and of a different appearance and the remaining sherd was different again and quite unlike Agarabi pots, having an incurved rim bearing an abrupt applied or folded band, the piece varying in thickness from 4.5 mm to 9 mm (White 1967:218). Key has limited the possible quarries to the area mapped by McMillan and Malone (1960) as the Bena Bena Formation, which includes the modern Agarabi potters (Key 1972:160). However, this huge unit extends 40 miles (64 km) from near Mt Otto east to Yonki Dome and 20 miles (32 km) from the Ramu Trough south to the Gafutina River, includes speakers of five languages, including the Tairora, and comes within 10 miles of White's site. One can conclude only that pottery of two or three styles has been made from untempered clays mined in the above area for less than 800 years and that in that time the early forms have been completely replaced by a new style. In this time, too, pots were imported from north of the Ramu-Markham trough, for one of White's sherds is likely to be from the southern Finisterres and another from Astrolabe Bay (White 1972:62, 63; Key 1972:160, 161).

Despite its proximity to the Usur potteries, the coiled-ware collected north-east of the Hills region in German times does not appear to have been Usur-made, with the exception of a pot illustrated by Werner (1911:144, Fig.74) with its provenance stated simply as 'inland'. This is a Type 2A or B style with ellipsoid body and short neck. The others were all collected within 10 miles (16 km) of the sea[1] and appear to form a distinct group of coiled-ware styles. Those shown by Werner (ibid:118, Fig.65) were collected on the Gogol-Nuru plain

[1] Bodrogi says within 15-20 miles (1959:44).

and resemble those shown by Biro (1901:Plate VII, 1-4).[1] One is like Biro's No.3, having a pointed base and an extremely oblate shape, a form still found on the upper Gogol. Biro's shows the top coils exposed. Two others have semi-pointed bases (one with two coils exposed) and the fourth has a rounded base (also with two coils exposed). Only the first and Biro's No.3 have a degree of restriction comparable to modern Usur pottery, and one has an unusual diagonal cross-hatch incised decoration. Biro's No.2 also has body proportions outside the Usur range. In general terms, the above pots are squatter and more open. Biro's No.1 is also more open, and although, like his No.4, its basic body proportions are like those of Usur pots, it has an unusual infilled diamond motif. Both 1 and 4 are crudely made. Biro's were collected at 'Balaj im Oertzen-Gebirge' an unmapped settlement, where they were called 'kadjaini' (ibid:92). Hagen collected coiled-ware at 'Ujja', also unmapped, but only a day's journey from Bogadjim. These pots all had thick uneven walls of black or grey easily crumbled material and usually were pointed (Bodrogi 1959:93). Zöller saw large pointed-based pots with incised lines and zig-zags at Tsiringo near the middle Kabenau River (1891:152, map), which is in the Lemio language area, mentioned above, 15 miles (24 km) east of the Kopoka potteries.

Coiled pots were already rare and valuable north-east of the study area when these collections were made 80 years ago (Bodrogi 1953:91, 92) and both Hagen and Biro regarded them as much older than the round-based pottery made by the coastal Austronesian speakers; they were the remains of an ancient craft, said Biro, and at Balaj at least, had already ceased to be made, imported Bilibili-type pots being used instead (Biro 1901:92).

These early historic pots form a distinct school within the 'Upland Sepik 1 and Upland Madang' tradition, just as Usur pots, possibly with those of the Gurumbu, form a school of their own. Their presence suggests an earlier occupation of the Astrolabe foothills and coastal plain by people speaking languages of the Rai Coast Stock. Some may still be made on the seaward slopes of the western Finisterres in the higher altitude hamlets and in any case the sherds should still exist. The tradition crosses the upper Gogol River and probably continues north-west with little interruption, passing inland of the Adelbert Range and may continue over the lower Ramu[2] and Keram Rivers (the Töpferfluss of the Germans) to join representatives of 'Upland Sepik 1'. The precise relationships in space and time between the different schools in this tradition urgently need defining. Only then will it be possible properly to relate 'Inland Madang' to the upper Ramu, lower Ramu and 'Upland Sepik 1' and to appreciate the full extent of the trade in coiled pottery made by the Usur people of the Hills region.

TRADE IN STONE

A great variety of stone objects have been used in the study area during the twentieth century, ranging from unworked stone through flaked tools to ground and polished tools; these included cooking stones, hammer and anvil stones, drill points, awls, scrapers, knives, bark-cloth beaters, axe blades, and the prehistoric mortars, pestles and naturally weathered curiously shaped stones used in magico-religious rituals. S. and R. Bulmer (1964:53-5) listed contemporary stone artifacts in the highlands and discussed the prehistoric ones in detail (ibid:59-72). The gamut of highlands contemporary and prehistoric stone implements was reviewed by S.E. Bulmer (1966a).

Most stone quarries of the central highlands have been described by Chappell (1966) and their petrographic differences defined. (Those of the eastern and western highlands have still to be located.) He also analysed six collections of stone tools from in and around the area of this present study and was able to trace nearly all of these more than 1200 artifacts to one or another of these quarries. The collections came from the Kaironk and Simbai Valleys, the Baiyer Valley, the Melpa part of the southern slopes of the Wahgi-Jimi Divide (just beyond our western boundary) and the upper Chimbu

[1] Chauvet's (1930:83) are prints from the same negatives.

[2] The inland groups of the Bosman tribe of the lower Ramu made and traded very good pots with pointed bases (Moyne 1936:123).

and middle Mai Valleys.[1]

The identifications were on petrographic characteristics alone, a fact important for our subsequent discussion of styles. When Chappell thought that his identifications were being influenced by 'certain regional variations of general typologies' of form that he discerned, he cut thin-sections for microscopic examination from these specimens as well as from the 10 per cent which he was unable to identify from hand specimens alone. For a few discriminations, X-ray identification tests and partial chemical analysis were needed (Chappell 1966:109-12).

For identifying the source of stone tools thought to have come from the central highlands, Chappell's expertise and his reference collection of type-specimen petrographic thin-sections at the University of Auckland are invaluable. Axes and adzes from these quarries were found to have been traded throughout the entire area of this study and beyond, and museum specimens and axes kindly shown to me by others, together with occasional references in the literature, show that their trade area may have been five times as large. Until further studies define the limits, the quarries of the central highlands should be considered as possible sources of any axes and adzes found between the South Sepik foothills and the Papuan Gulf, and between Mt Michael in the eastern highlands and Koroba in the western highlands.

Field Observations of Stone Tools

Within the area studied, it is unnecessary to differentiate between axes and adzes except when describing the angle of mounting the blade in the haft. Here I define an axe mount as one where the handle forms an angle with the transverse centre line of the blade of less than 45 degrees and an adze mount as one greater than 45 degrees.[2] Not far from the study area swivel sockets were used on the lower Ramu River (Moyne 1936:171, Plate 49; Moyne and Haddon 1936:272), at Lake Kutubu (Williams 1940:146) and in parts of the southern highlands (S. and R. Bulmer 1964:53). These last observers said that in the highlands they had seen blades set most commonly at angles between 10 and 45 degrees and had heard of a few hafted at 90 degrees but had found no difference between blades hafted either way (ibid). I found this to be true throughout the study area, so that the stone blades to be discussed here, like the 1200 classified by Chappell, are axe-adzes.[3] Adze mounting of the smaller stone blades was common in the highlands in former times, as Nilles noted (1942-5:211, 212), and in the highlands these were usually narrow, as M. Strathern saw among the northern Melpa (1965:185). There, the thicker blades were preferred for this purpose (1969:315) but in the study area this was not the case. For economy, the blades will be termed simply axes.

Apart from the ceremonial axes of the Jimi Valley (the so-called Mt Hagen axes), soft-stone versions of which are still being made for tourists,[4] about 50 hafted work-blades were seen, those set as adzes being between 80 and 90 degrees. The longitudinal centre-line of the blades of both axes and adzes formed angles with the handles of between 60 and 75 degrees, usually between 65 and 70.[5] (With ceremonial axes from the north side of the Wahgi this measurement often exceeded 90 degrees while on Dom ceremonial axes it was as low as 55 degrees.) Most of these hafted implements were being kept for sentimental reasons though men were usually keen enough to sell them. Only four were still in use, one in the Tebera region and three in the Bismarck Fall region. These were adzes, which

[1] Three of these collections were those discussed by S.E. Bulmer (1964a), S. and R. Bulmer (1964) and S.E. Bulmer (1966a).

[2] New Guinea hafting techniques have been discussed at length in Crosby 1973.

[3] Contrast von Koenigswald (1968:113) who sharply distinguishes between the blades of axes and adzes in New Guinea and Indonesia.

[4] In the upper Wahgi Valley these hafted axes are still displayed as personal ornaments at dances (A.J. Strathern 1971:106), a custom revived in 1973 by the Syaka Enga, who are now making fine copies of the best Jimi blades from softer local stone.

[5] Cf. ten Kukukuku adzes ranging from 50 degrees to 76 degrees with an average of 62.4 degrees (Blackwood 1950:25).

emphasises the limitations of the steel tomahawk. A Daribi canoe-maker at Bumaru on the lower Tua River refused to part with his adze of dark green stone from the Abiamp quarry in the middle Wahgi Valley, saying that for finishing the inside of a canoe there was no substitute. (The same preference had been shown by canoe-makers in the Mubi Valley south-west of the study area and at the Kikori River mouth 40 years ago [Hurley 1924:227; PAR 1926-7:36].) The others were in the Tauya Valley where there were quite a number still in use. One was in an isolated garden-house and another in the hamlet of Yomika, the second being accompanied by a small adze made from a rusty piece of broken bush-knife. Small stone adzes persisted here because in local opinion they were the best tool for carving wooden dishes and for removing the pith from the fruit of *Pandanus conoideus*. Hard, flat river pebbles were selected and ground on the edge only, and if scrap metal was available (plane-blades, broken knives or hoop-iron) it was hafted in the same way.

Cooking stones are still used throughout the highlands and in the Bismarck Fall and Tua regions, as are stone bark-cloth beaters in the eastern Wahgi region. Small flaked stone points are occasionally used for drilling and boring (though rarely in the highlands) and in the southern lowlands a man will still carry one about in his net bag. The continued use of unretouched flake tools in the Poru region has been described by M. Strathern (1969). Apart from the use of abrasive stone, often *in situ*, for sharpening steel tomahawks, the only other stone tools in regular use are the large pebble anvils seen in or near most houses in the lower parts of the Tua region and throughout the Tebera region, which are used for cracking and crushing various nuts and fruits. Hammer stones have been largely replaced by the back of a tomahawk. However, all of the above objects were made of local stone collected as required.

Obsidian sago pounders reported from the Kutubu area of the southern highlands (S. and R. Bulmer 1964:54; White 1967:77 and plates 3-1, 3-2) have proved to be of dark grey chert or flint (W.R. Ambrose pers.comm. 1975). A further specimen from Pimaga near Lake Kutubu collected by B. Probert and said to be quarried from under 'white' stone (letter 1974) is a dark grey flint. No doubt there are flint nodules somewhere in the abundant limestone of the area; flint pebbles are common in the nearby Nembi River (Bartlett 1964:670). However, minute obsidian flakes have been excavated in the Kuna Valley (a Wahgi headwater on the western boundary of the study area) and a larger piece was offered for sale there (O.A. Christensen pers.comm. 1973). In addition, a piece of unworked obsidian was recognised among objects in a 'magic bundle' recently collected at Mendi in the southern highlands. This, and the excavated flakes, originated at Talasea in New Britain (Ambrose in press, MS 16) and are evidence of the most distant trading connection into the study area, past or present. This link did not operate in remembered times, and the finds are further evidence of profound changes in trading patterns over the centuries. No evidence of recent trade in hard fine-grained siliceous stone with a conchoidal fracture, like chert, flint or obsidian, was found but in the Poru region M. Strathern has reported local barter of 'specially good' stone for flake tools (1969:316). Only stone axes and roughed-out axe blanks were traded inter-regionally, the latter in limited numbers over a very limited area.

Axes were discussed at each interview. Near the main roads of the Asaro and Wahgi regions where collectors had been active axes had become scarce. Everywhere many small ones were thrown away when steel became widespread and men realised that the supply of the new material was not going to dry up. In distant parts the number available for inspection or collection was not helped by the sparseness of the population and the relative scarcity of axe blades in traditional times. In general, stone axes were rarer, smaller in size and less highly polished away from the highlands factories, as other observers have also found (e.g. M. Strathern 1969:326). Nevertheless, enough remained to provide a fair sample of the raw material types and blade styles made or imported into most regions. At one stage informants suggested that the smaller and poorer-finished axes were under-represented, for these had been the first discarded, and an effort was made to collect more of them. This was particularly true in isolated parts where men more often improvised edge-ground axes from selected river stones.[1]

[1] This class may be under-represented in some collections for the additional reason that they tend not to be produced for inspection unless specifically asked for. Some collectors share the opinion of the inhabitants that these are 'rubbish' axes and not worth buying.

Although very large axes weighing between 1.5 and 4 kg are now rare, many work axes weigh more than 500 g and, as with pottery, the cost of porterage made it impossible to make a substantial collection let alone attempt a total one. A 'representative' set of 63 was bought (Plates 5 to 10, Fig.25) and nearly ten times that number were inspected. The collection is not a statistically representative sample since no systematic sampling rule was followed; ceremonial axes are under-represented and unusual axes are over-represented. However, axes were collected at widely separated sites in every region and every axe seen in the field and most axes seen in other collections from this area fall within the range of raw materials, sizes and shapes of this small group. Some conclusions reached from this group stand testing against the collections of others. A small group of axes of contrasting material and form was carried as an aid to discussion and used towards the end of each interview.

The Stone Quarries

Chappell's definitive study of central highlands quarries, petrography and terminology (1966) was not available in the field, with the advantage that inquiries were pursued without the prejudice of foreknowledge. Eventually, informants mentioned all but one of the quarries that he located within the study area, and clearly regarded as unimportant those which he termed minor. Map 2 retains Chappell's numbering and his site names, some of which were already established in the literature, with the addition of Mopa' (14) and Dabiri (15). The only sites not mentioned were the minor quarries Kumanigl (12) and Dabiri (15). The majority of axes collected and seen came from his major sources, Tsenga (2), Ganz River (3), Abiamp (8), Dom (10) and Kafetu (13). His other major source, Mbukl (5), lay outside the western border of the study area - one specimen, No.28, is possibly from there. All sites are in the highlands regions, Jimi, Wahgi and Asaro; no stone quarries were found in the lowlands.

Informants in the southern Asaro and eastern Wahgi regions said that they had received some pale coloured axes which they called *gaima* from a quarry near Yari River, draining the western slopes of Mt Michael into the lower Asaro River near the eastern edge of the study area. Its position is shown on the map as (14). Late in 1971 this quarry was visited and found to be on Mopa' Creek, a tributary of the Yari, near Beha hamlet. Rock was quarried where suitable faces were exposed in the stream bed but most raw material was from boulders. Locally, the quarry and its products were called *mopa'*. Axe and boulder specimens had a hardness of 6 on Mohs' scale, and were an even pale grey, and to the non-specialist resembled the ubiquitous *gaima*. The rock unit in which it occurs has been mapped by the Bureau of Mineral Resources as 'Movi Beds'. The Kafetu quarry appears to be in the same unit and hand-specimens of *mopa'* and the *kempame* type from that quarry could be confused, though they can be separated by thin-section examination (Bain pers.comm. 1971). Chappell has described the rock as 'volcanolithic metagreywacke fine sandstone, with quartz spherules, relic olivine, granular fine epidote' (pers.comm. 1973). *Mopa'* travelled about 10 miles (16 km) to reach my original informants and for the Yagaria and Gimi speakers to the east it was a significant source. It is the most easterly source of 'planilateral' blades in the highlands, to use the term of S. and R. Bulmer (1964:53, 54).

While excavating in the Kuna Valley, a tributary of the upper Wahgi River, in 1973, O.E. Christensen was told of a small quarry on the south-western slopes of the Kubor Range. Later that year it was visited by Christensen, J. Rhoads and the writer. The quarry is known as Dabiri and its position is shown on the map as (15). It is at about 1700 m MSL on the headwaters of Goi Murun Creek, an easterly tributary of Dabiri Creek, some 4 km NNE of the settlement of Kegu. The main stone source at the head of the stream was now covered by a landslip, it was said, but boulders of the same material were available in the stream bed, as they always had been. Production ceased some 25 years earlier. Specimens were collected from the stream bed and from waste flakes at a factory site on the bank. Their colour varies from medium to dark greenish grey (7.5GY 4/1) with bands of darker value, and they are not as hard as rock from the major axe quarries. The area has been mapped as Kondaku Tuff by BMR geologists and thin sections prepared from the specimens closely resemble samples collected by the BMR some

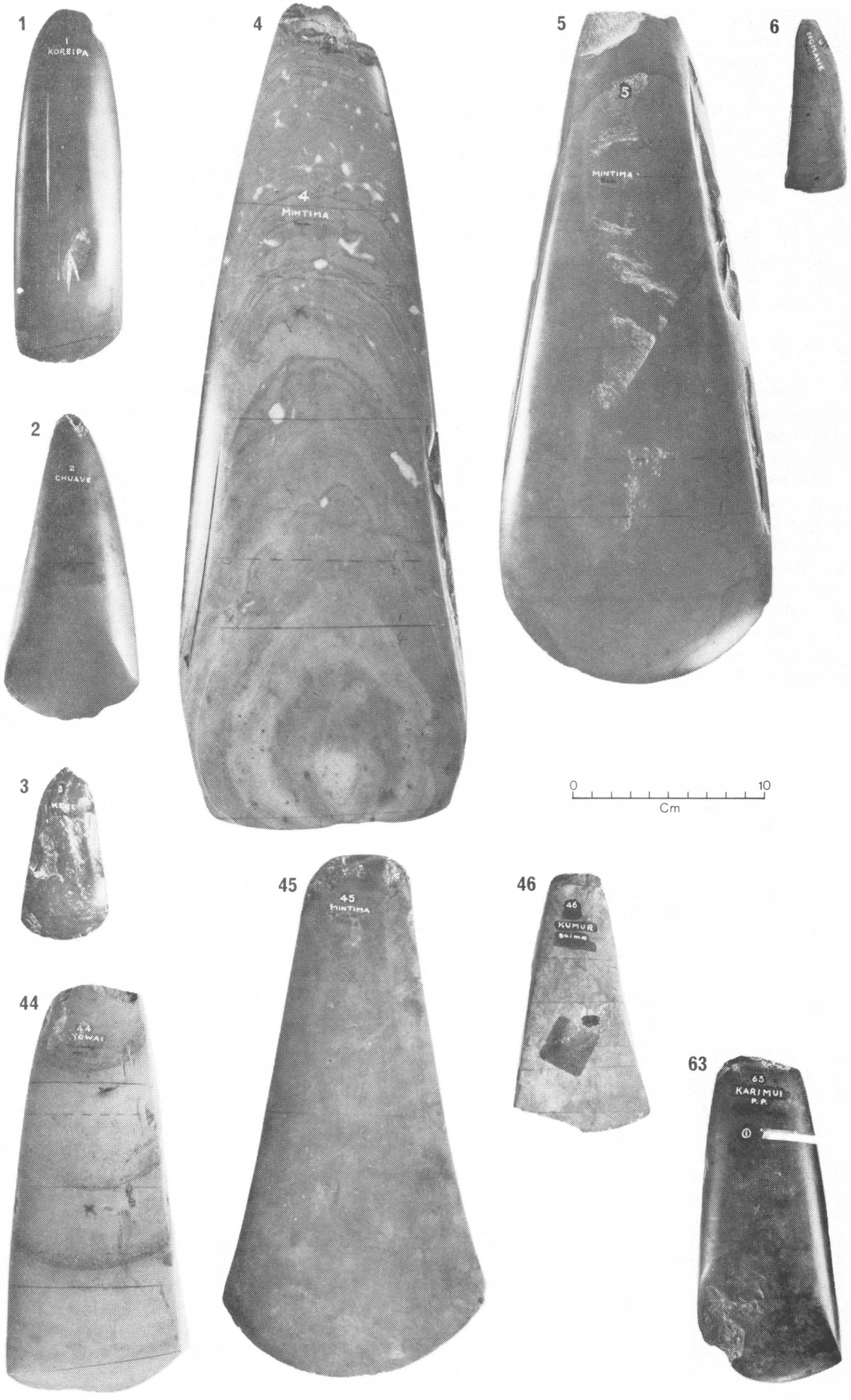


Plate 6 Axe-adzes in Table 9, from Kafetu, Dom, Kumanigl, Kerowagi and Maegmul

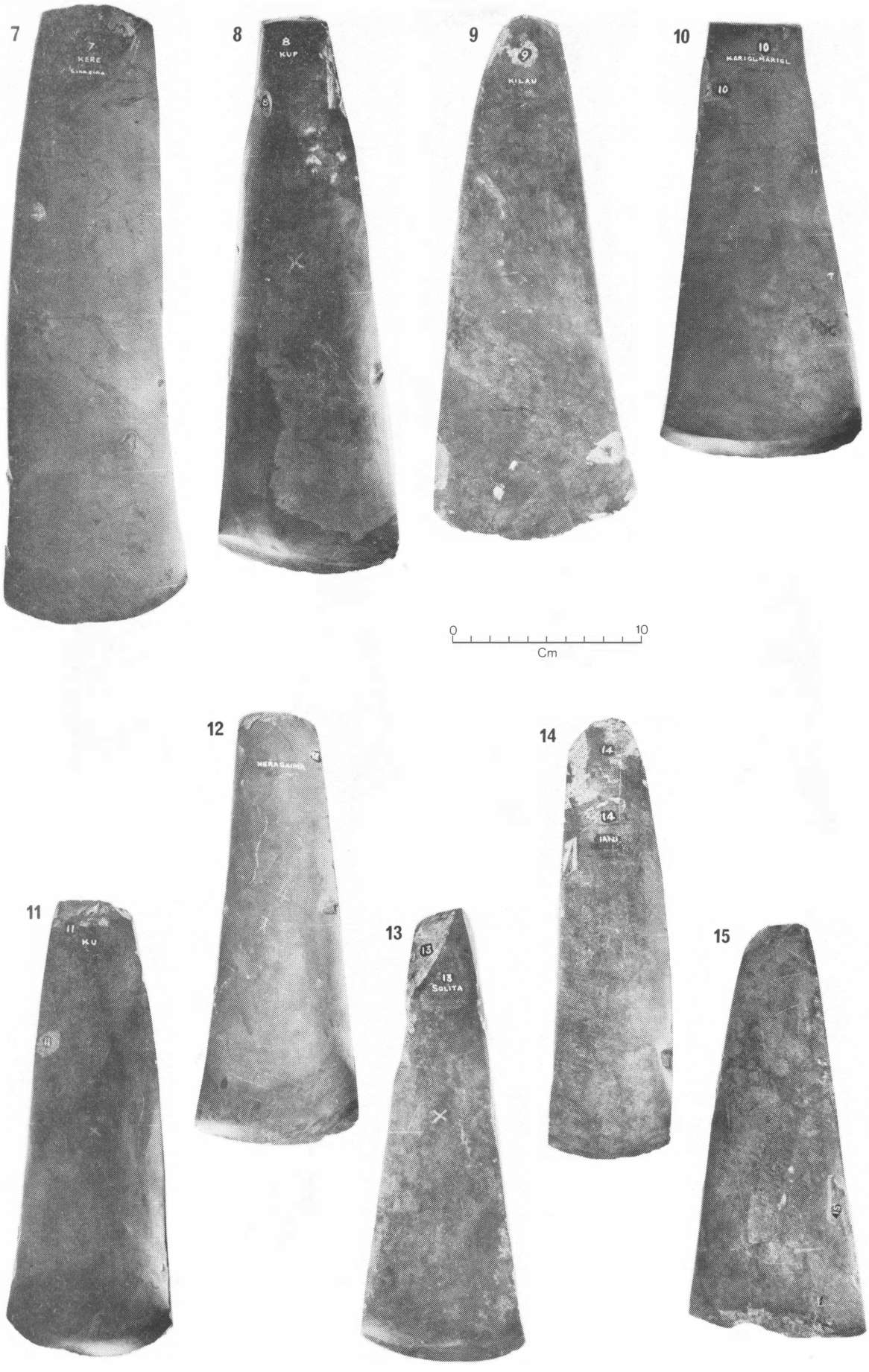


Plate 7 Axe-adzes in Table 10, from Abiamp

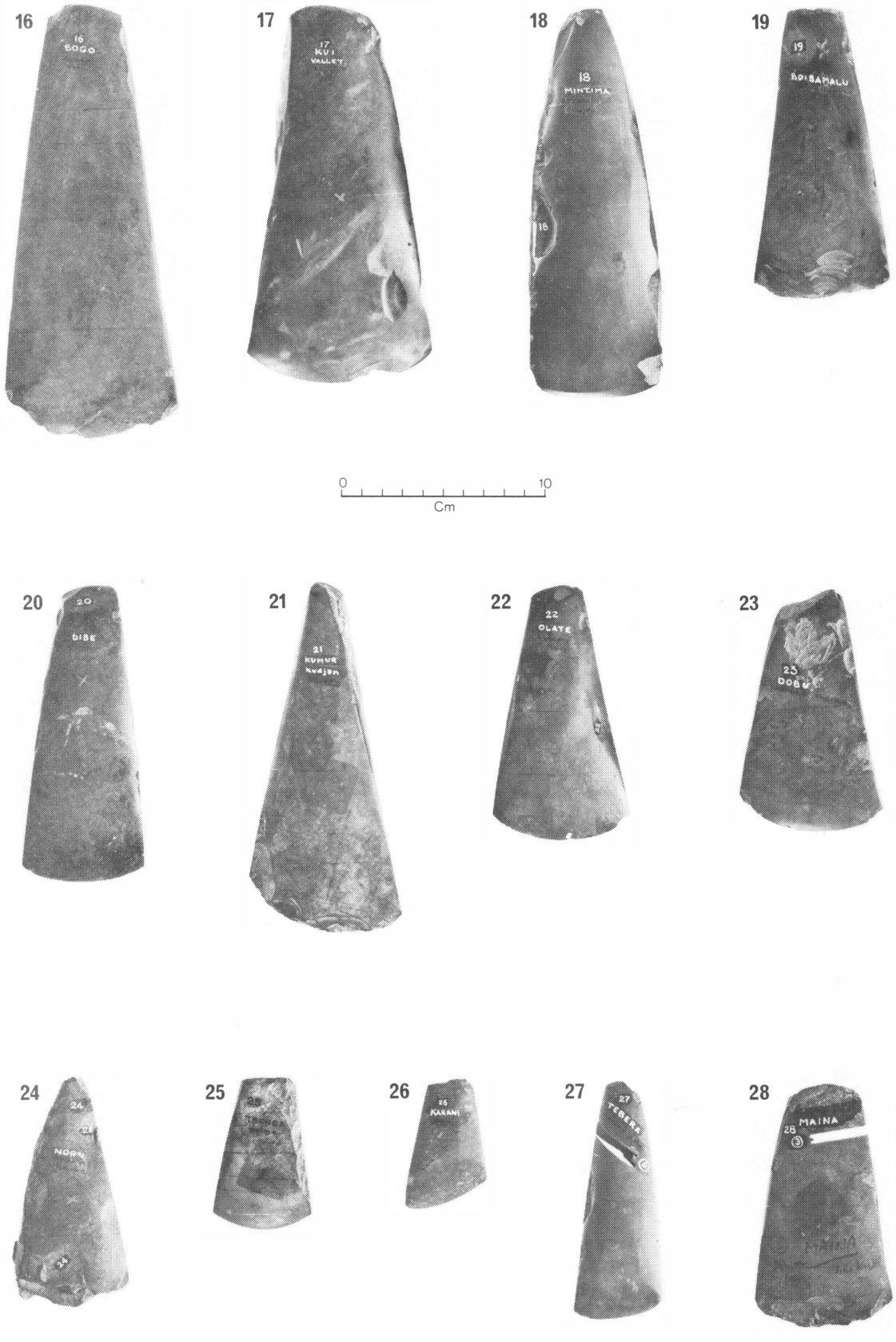


Plate 8 Axe-adzes in Table 10, from Abiamp

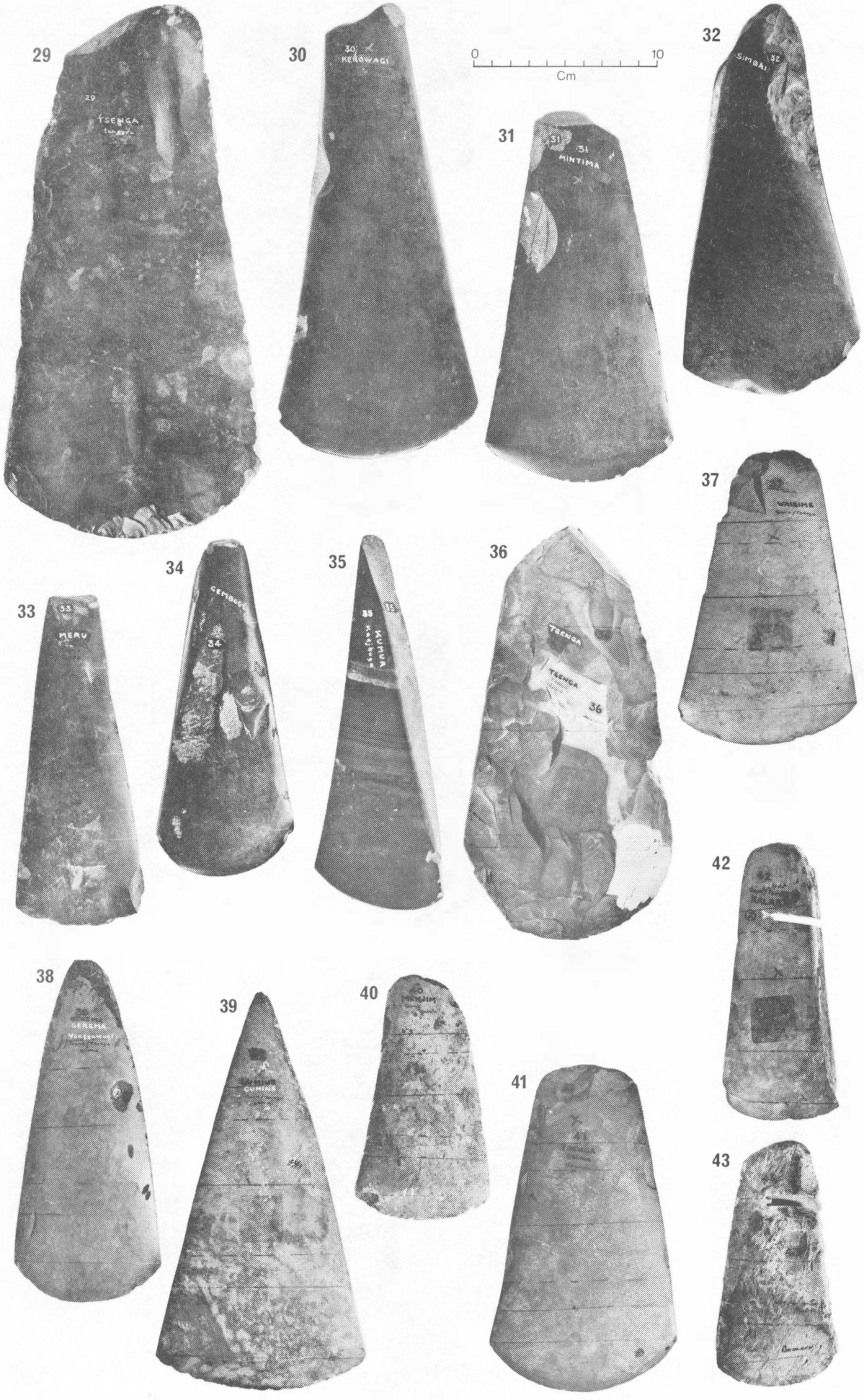


Plate 9 Axe-adzes in Table 11, from Ganz-Tsenga

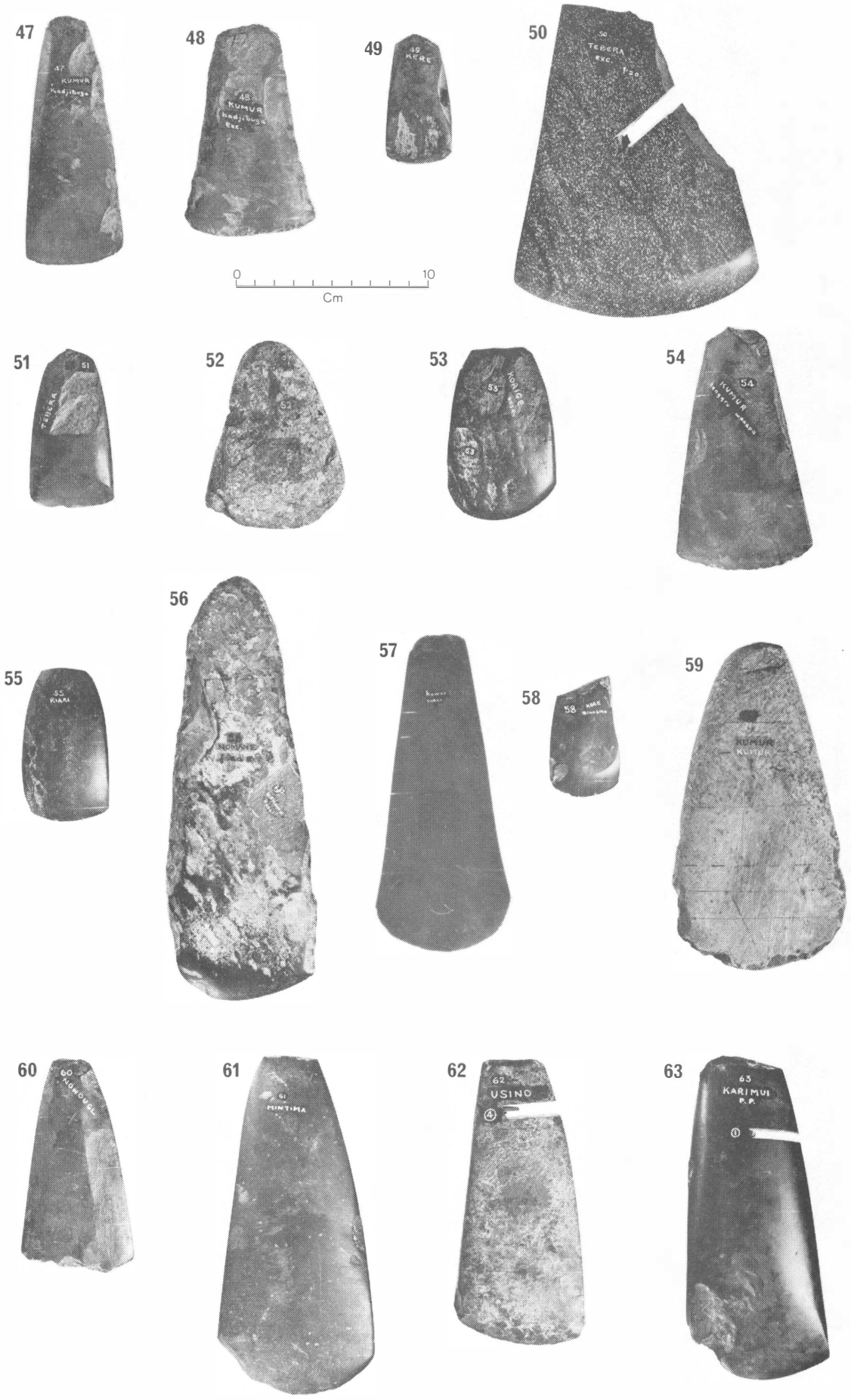


Plate 10 Axe-adzes in Table 12, from unknown quarries

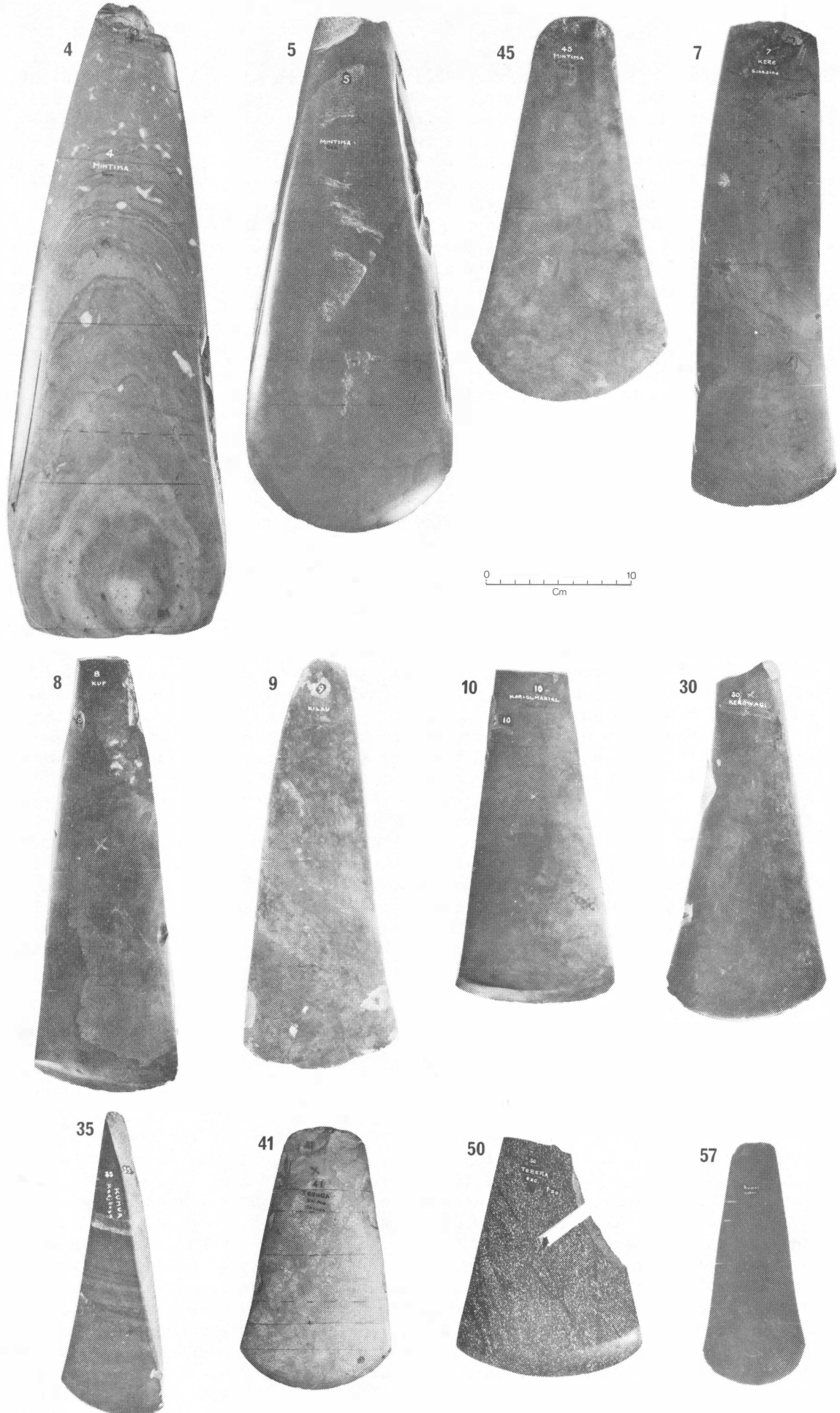


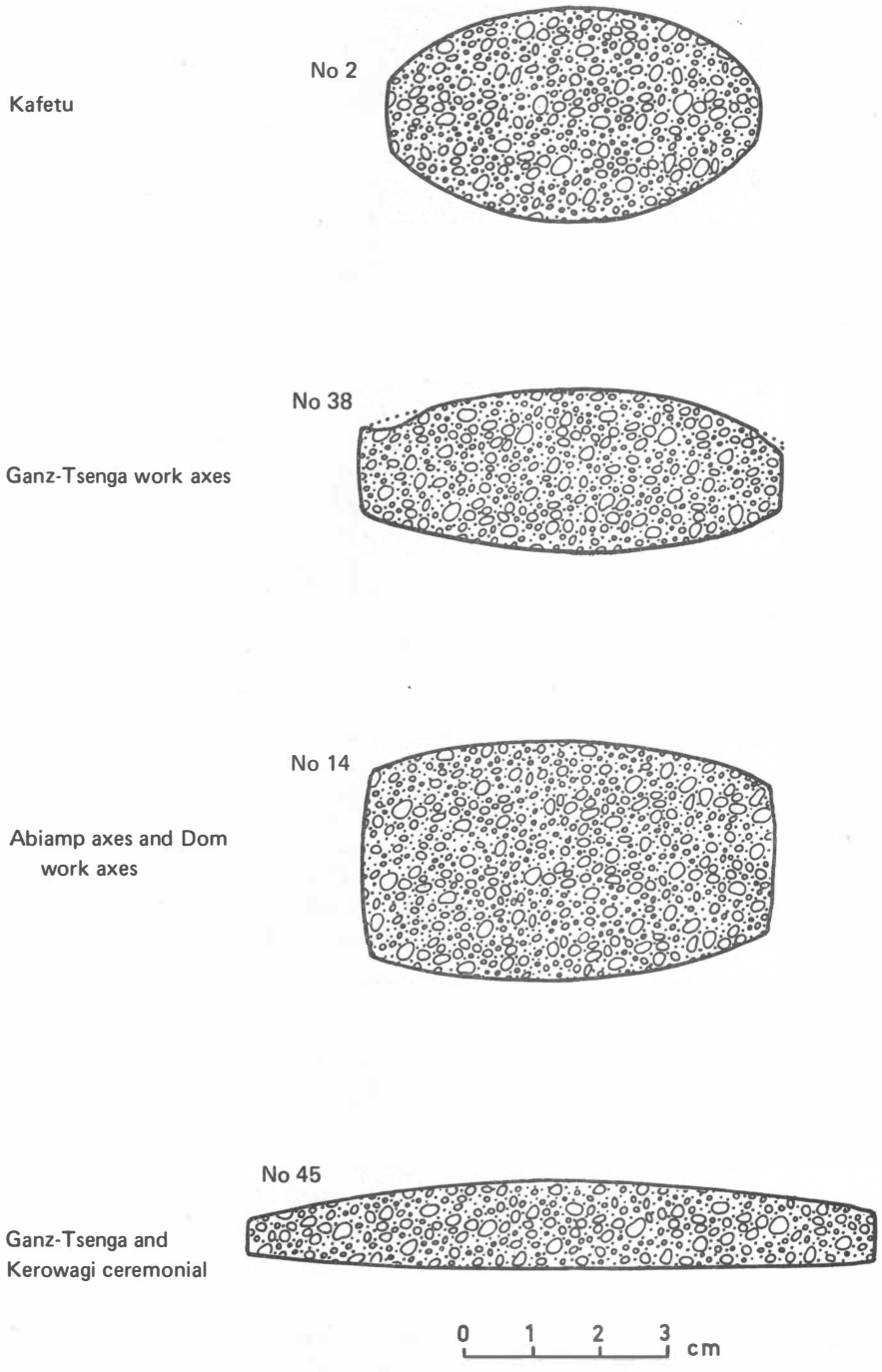
Plate 11 Ceremonial blades from Dom, Kerowagi, Abiamp, Ganz-Tsenga and an unknown quarry

20 km to the east (Bain pers.comm. 1974). Informants said that their product was inferior to the *kombamun* and *gaima* that they received from the east, which, with some of their own *dabiri*, were traded mainly west to Weka, though some crossed the Kaugel River south to the Poru Region.

The only major quarry not visited by Chappell was Dom (10), first recorded by Patrol Officer L.G. Vial and geologist L.C. Noakes in 1939 when it was still in full production. Noakes' official report makes only passing reference (1939:14) but a fuller comment on the rock type and mode of occurrence was quoted by Vial in the course of a description of the quarry, its manner of exploitation and its products (1940:160-2). When visited in 1968 all signs of the shafts had been removed by collapsing, slumping and stream erosion and the resulting shallow valley from which more than 50,000 m^3 of soil and rock had been removed was covered by tall grass and shrubs. It is at Tonemai at 2000 m MSL half an hour's walk above the hamlet of Kolma, now on a vehicle road. Informants said that all mining ceased shortly after the end of the war. It was still functioning when ADO Costelloe visited it in 1943 but was disused when he saw it early in 1947 (Chimbu PR 7 1946-7:4, 5). Vial's photographs show a large conical open cut through the deep soil, the sides held in place by woven matting, and in the centre, a rectangular shaft mouth about 6 m by 2 m, complete with a substantial timber set. It was about 10 m deep. He was unable to discover how a potential shaft site was selected. Noakes said that he attempted unsuccessfully to convince the miners that the need for sinking shafts could be avoided by digging an open cut from where the same rock was exposed by a stream slightly downslope, and that translation difficulties may have accounted for his failure (pers.comm. 1970). But in 1968, old men said that the stone had first been found and worked by their forefathers where the stream exposed it and that over the years they had been forced gradually to move up the hill to find usable stone, the continuing erosion gradually reducing the amount of overburden they had to dig through. Much waste material from the fine hard pale grey metamorphosed slate and greenish-grey hornfels still lay about, including pieces which had been used as hammer stones.

In 1943 some 25 m of overburden had been removed and mats of woven cane grass and bamboo were still used to hold back the soil. Fire, cold water and hammering with billets of wood were used to crack the bed-rock and wedges called *mabilapagae* made from *gul* hardwood were driven in and the blocks levered free. They were raised to the surface on vines and broken with hammer stones. All who had helped got a piece and took it home for shaping. There it was ground on white sandstone blocks called *dubil*, being continually wet with water, the work taking months, so Costelloe was told. According to the discovery myth related to him, the site had been found one night when two young girls were hunting frogs in Turingeniuri Creek by flares. They heard a sound from the ground like two stones being rubbed together and ran home to tell their fathers. At dawn the men began to dig and after much work came to a strange stone covered in wart-like bumps. This they struck with another rock and it fell apart, disclosing the first *di ngaima* (Costelloe ibid).

Vial was mistaken in thinking that in addition to axes called *gaima*, some called *kundun* were got from this quarry (1940:160). *Kundun*, or in Dom, *kurun*, was the general Chimbu term for the dark axes now known to have come from the Abiamp quarry, at that time known only to have come from the west. Although Tonemai was claimed by the Kaupabianggau clan of the tribe Vial gave as 'Gondigu', neighbouring clans mined the stone as well. The most notable and valuable products were the huge (up to 4 kg) blades used only as valuables (e.g. No.4, Plate 6). They were transferred only ceremonially, set in crude hafts so large that blade and counterweight often measured a metre long on a handle 70 cm long. They figured most often in bride-wealth payments, Vial recording as many as 60 in one transaction (ibid:162). Stone pieces too small for these were made into work tools, used locally and traded widely. Although Vial thought that most of the work axes used by Dom speakers came from the local quarry, he received the impression that its prime purpose was the production of valuables. Modern informants and the distribution of axes from rival quarries supported this impression. *Gaima* work axes were not as numerous as *kundun* work axes away from the Dom area, even in an easterly direction. *Kundun* work axes were well known in Dom territory in former times and in 1968 one was collected



(Dimensions at the centre: F/1 at the top)

Fig.25 Cross sections of basic axe styles characteristic of the main factories

within a mile of the Dom quarry. The trade area of the Abiamp quarry included the smaller trade area of the Dom quarry and quantitatively it was much more important, though occasional Dom ceremonial axes travelled a long way.

It was said in the previous chapter that the evidence about salt resources and their exploitation indicated that all saline springs were known to the local inhabitants. What of axe stone? Chappell believed that there must have been some stone outcrops in the study area which were suitable for axe-making but which were not exploited and that some of these must have been seen by the local inhabitants (pers.comm. 1969). Yet in most places away from the stone quarries, men from time to time made axes from selected river stones, implying that the demand for work axes exceeded the supply. Everywhere men regarded the imports as superior. In the lowlands, all informants stressed the shortage of good stone axes. If unexploited stone resources existed, it raises vital questions about the perception of suitable raw material and about the entrepreneurial initiation and development of manufacturing.

In a general sense, the rock types used for good quality stone axes are widely distributed in the central highlands. Chappell has described the raw material from the major quarries as hard contact metamorphosed hornfelses resulting from the intrusion of sediments by granodiorite. It was because of the 'repetition of the geologic environment' that rock types were duplicated from quarry to quarry and that discrimination required the consideration of detailed petrographic characteristics (1966:96, 97). The geologists of the Bureau of Mineral Resources engaged in mapping New Guinea have become interested in stone axe quarries, and have said that the hornfelsed thermally metamorphosed sediments which have been quarried occur in a variety of geological units. The Jimi Valley quarries of Ganz, Tsenga and Maegmul occur in the unit they have mapped as Balimbu Greywacke. The Koronigl quarry of Yendegle Mauglwa, the upper Chimbu Kumanigl quarry and the Dom quarry lie in the unit mapped as Maril Shale, and the Kerowagi quarry probably exploits transported boulders of this material. In the west, the quarries of Mbukl and Pukl also occur in this unit, and the small quarries at Mala Gap and Yambina may be located in small exposures of the same material. The Abiamp quarry has been visited by D.E. Mackenzie and found to be in the Omung Metamorphics. The Kafetu and Mopa' quarries exploit boulders of the Movi Beds (Formerly Omaura Formation) and the Dabiri material is probably metamorphosed Kondaku Tuff. All of these units are widely distributed and have been intruded in many places apart from near the quarry sites (Bain *et al.* 1970:Plate 1; Bain and Mackenzie 1974-5). Nevertheless

> All of the known accessible occurrences of suitably hornfelsed Maril Shale...within the central Highlands have been quarried, as has the only known occurrence of Omung Metamorphics... sufficiently hard...for axe manufacture. No other contact metamorphic rocks suitable for stone axe manufacture were located during our survey. It appears that the primitive stone miners were aided by efficient prospectors (Bain *et al.* 1970:79).

However, axe No.50 discussed below, suggests another earlier quarry in the Omung Metamorphics. Bain believes that it is highly probable that throughout the central highlands rock with the right combination of hardness, toughness, fine grain, and possibly fracturing characteristics, occurs only where it has been mined (pers.comm. 1971).

A notable development is the revival of axe manufacture which took place in 1973 among the Syaka Valley Enga to the west of our central area of interest. Two exposures of an attractive metamorphic rock of a hardness varying from 4 to 5 on Mohs' scale have been found (the first while excavating road paving, the second by systematic search; more prospecting is under way) north of the Wakima River on the ridge dividing the Syaka from the Lai Valley. The rock fits the description of aspects of the Lagaip Beds as given in Dow *et al.* (1968:51), being light grey to light blue, calcareous, with scattered pyrite and calcareous nodules, and the quarries are near the ends of a mapped exposure of diorite which probably produced the metamorphism. Langgamaili quarry is controlled by Palinan clan and lies just north of the settlement of Sapos: the smaller second quarry is Milikini, controlled by Waiminakun clan north of Pumakos R.C. Mission. Axe-making is for the first time an important industry in the valley, and

individuals and groups of men were seen filling flaked blanks into shape with flat steel files and smoothing them with emery cloth all along the Wakima road. Trade-store proprietors had groups of blanks, and these and axes could be bought at any stage of manufacture. On Saturday market day perhaps two out of three mature men were carrying these fine axes, very well hafted, and an export trade out of the valley had begun. Both colour and shape and the quality of finish replicate the valuable large ceremonial and fighting blades previously imported (via many intermediaries) from the Jimi Valley. This new industry is part of a cultural revival that is evident here and in central Enga territory, and they function as fine ornaments for ceremonial occasions, especially dances and *Te* exchanges. Secondly, they are good weapons for close fighting and unlike steel axes can be carried lawfully into town. Thirdly, their potential value in the tourist trade is understood, even exaggerated in terms of potential prices, though not yet exploited.

Axes of Doubtful Provenance

The details of these blades appear in Table 12. S. and R. Bulmer remarked on the stylistic differences between the axe blades of the eastern highlands and those of the central highlands (1964:53, 54). Regional variations of style within the central highlands became apparent in the course of field-work, as they did to Chappell (1966:110) and to S.E. Bulmer (1966a:45-53). These raise the difficult question of the determinants of style - the relationships between the potential of the raw material and its perceived capabilities, the limitations imposed by the extraction methods, the intended function of the blade, the manufacturers' evaluation of how this can best be achieved, fracturing characteristics and the role of an aesthetic tradition.

As the collection of axes and discussions about styles, origins and terminology proceeded and a correlation between stone types and axe shapes became apparent, it also became clear that while most men based their initial identification on stone type, principally by colour, when in doubt they appealed to shape. Small chips of stone, for example, were usually labelled with the same name as the axes of that colour before a whole axe was displayed. Men living between the Dom and Kafetu quarries shown stone pieces from each quarry selected for their minor differences, were unable to say which was which. The same men presented with a small Dom work axe and a Kafetu work axe of very similar colour invariably identified them correctly. Only old men living close to quarry sites discriminated between various axes from the same quarry on the basis of the internal markings of the stone. Elsewhere, no informant convincingly displayed a comprehensive knowledge of stone-working, and very few claimed it. Chappell's experience was similar (1966:115). Since pacification, knowledge of the stone sources has increased greatly. Men in Chimbu, for example, who have travelled now know not only that *di kundun* came from the west, but will say 'Abiamp'. This is modern knowledge. In the middle Wahgi, men will sometimes state the source a little more accurately as the 'River Tuman'. Even today Chimbu men cannot name the main Jimi Valley sources nor the Asaro Valley source. Outside the valley in which a quarry occurs men can still only state the direction from which an axe-type came and name the group from whom most were obtained. In former times, this was the situation everywhere and Chappell found precise knowledge of the Abiamp quarry only within 2 miles of it (1966:102).

The collection of 63 axes (including one half-finished, No.29, and one blank, No.36) was divided into 'factories' on the criteria of rock-type and style learned in the field. The group labelled 'unknown' held 20, many of them collected because of their unusual colour or shape, most of them not fully polished. Two of the remainder, Nos. 53 and 56, were edge-ground only and were known to have been made from local river boulders. The provenance of the blank was known because it was collected at a quarry, as was the half-finished axe. The latter, however, was also identifiable by colour and shape. Those allocated to 'factories' were 3 Dom, 3 Kafetu, 13 Ganz/Tsenga and 22 Abiamp.

Chappell then kindly identified each axe on the basis of petrography. Two of those allocated to Abiamp, Nos. 27 and 28, were regarded as doubtful so thin-sections were prepared. This was also done for four of the 'unknown' group, two weathered 'white' ones Nos. 42 and 43 thought to be possibly from the Yari

Mopa' quarry, axe No.62 from Usino in the Hills region[1] which is made generally in central highlands work axe style, and axe No.63 made in eastern highlands style from Karimui in the Tua region.[2] On the basis of the thin-sections, No.27 was confirmed as being from Abiamp and No.28 was described as being either from Abiamp or Mbukl. The remainder of the prior allocations were confirmed except for two, No.25, a small pale axe collected at Tsenga and thought to be from that quarry but in fact made of the Abiamp stone called *wui* (Chappell 1966:107), and No.33, collected in the Kambia region, a dark axe in Abiamp style and thought to be from there but which was made of stone from the Ganz quarry. The two 'white' axes were thought most likely to be from Ganz-Tsenga quarries and No.63 was thought to be possibly of Kafetu stone, though the ethnographic evidence makes this unlikely. No.62 was unlike any known source and was described as hornfels with much brown biotite (some eroded) in mosaic, some albite and minor epidote.

This left a total of 17 (including Nos. 62 and 63) of unknown origin, most of which Chappell thought were probably made in the areas in which they had been collected. This was already known to be the case with Nos. 53 and 56 and was thought to be the case with Nos. 49, 54, 55, 58 and 60. When axes were made away from the known quarries local stone outcrops were rarely used because superior material could usually be found in transported river boulders.[3] Axes in this category were usually not fully ground and were rarely polished. No.56, hafted when it was collected at Nomane in the eastern Wahgi region, is typical. However, the small axes Nos. 51 and 55 were exceptions. The former, collected at Lake Tebera, was made of very inferior brownish-green stone and had been fully ground on all surfaces including the poll before the surface had broken away in several places. No.55 from Kiari near the Wahgi-Asaro confluence was made of dark grey stone and had also been ground on all surfaces including the poll. Grinding on the poll is most unusual in the study area. Of the axes from recognised quarries, only the Kafetu axes Nos. 1 and 3 and the Kumanigl axe No.44 show evidence of it and on them it is incomplete.

The only other example is No.61 made from dark green stone from an unknown source. It is a good axe stone of a hardness of about 6 on Mohs' scale and appears to be tough. The poll has been squared and completely ground and the cutting edge has been worn and abraded in a way that can only have been produced by use as a hoe or as a tool for extracting the coarse raw material of an earth pigment like *gawagamba* (Plates 12,13). However, its width of 82 mm is too wide for the thin seam of *gawagamba* seen 5 miles away from where the blade was collected in central Chimbu. Wooden hoes were formerly used in this locality (West 1939:17; Nilles 1942-5:210-11) but the only reports of stone hoes (other than prehistoric flake tools) in or near the study area come from the Schrader Range (Gusinde 1958:559; S. and R. Bulmer 1964:55; S.E. Bulmer 1966a:38). At some time in the past one corner of the cutting edge has been broken and the remains of flake scars typical of a chipped axe-edge can be seen. No attempt has been made to grind them out. Abrasion from use has produced large striations coarser than those of the grinding used to first shape the blade. They are much deeper and wider than those on the edge of other blades and cover the working edge itself and about a quarter of the blade's length. They pass into the depth of the flake scars and out again, which does not happen on chipped axes in contact with wood (Plates 14,15). Most run longitudinally but without the regularity of those on axes, and some cross these at an acute angle mostly oriented towards one side. The working edge and all highpoints near it have become rounded and polished by contact with a softer material, as have the edges of most of the striations themselves. Running transversely across the blade are thin veins of harder pale material. Towards the working edge these form raised ridges left when the softer matrix has been eroded, providing further evidence of sustained hard use. The appearance resembles that of a hoe adapted from a damaged adze blade described by Semenov (1964:133): 'The blade appeared severely blunted from blows against the ground...all the hollows and facets on the tool's surface not removed by earlier grinding had been rubbed...

[1] Collected there and kindly donated by the Officer-in-Charge, Usino Patrol Post.

[2] Collected there and kindly donated by the Officer-in-Charge, Karimui Patrol Post.

[3] But not always; the geologist N.H. Fisher noticed sedimentary rocks *in situ* in the upper Wahgi Valley being used for poor quality stone axes (Fisher 1937).

Plate 12 Suspected hoe, no.61, edge view, Face 1 view

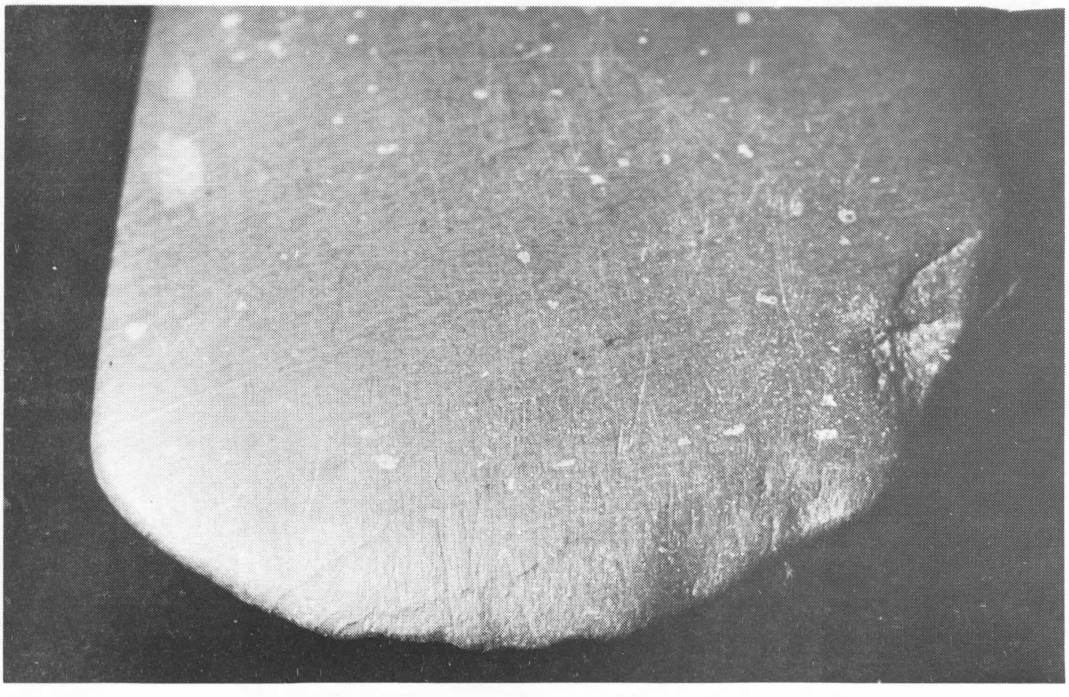


Plate 13 Suspected hoe, no.61, edge view, Face 2 view

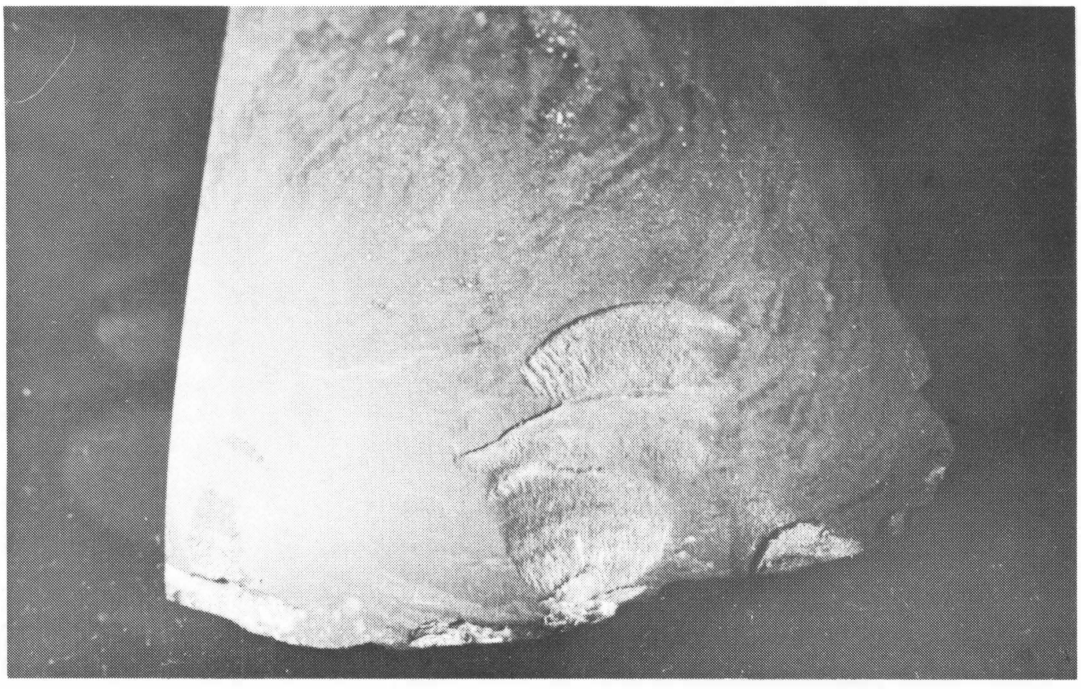


Plate 14 For comparison with Plate 12 and Plate 13 at same scale, axe no.19 of Abiamp stone, collected at Boisamalu Tua region; Face 1 view

Plate 15 For comparison with Plate 12 and Plate 13 at same scale, axe No.19 of Abiamp stone, collected at Boisamalu Tua region; Face 2 view

The striations did not run in one direction but intersected...'.[1]

If No.63 is not of Kafetu stone it may be from further east, for its general form and dimensions resemble Adam's Type II from the Berndt collection made north-east of Mt Michael (Adam 1953:414, 417) and two from that collection inspected at the museum of the Department of Anthropology and Sociology, Monash University, as well as others collected at Aiyura by Dr Paul Brennan.[2] No.57 is an example of the soft slaty ceremonial blades now being made at Tsenga for the tourist trade. The five remaining axes of unknown origin were excavated in the course of gardening. Three were quite unweathered. One of these of exceptional interest is No.50 which was collected at Lake Tebera. It is the main part of a thin ceremonial axe in the Ganz-Tsenga style and has a hardness of about 7 on Mohs' scale. The Foraba who found it called it *aiabe* and regarded it as unique. The informant, an old man of about 60 called Karo (F = Baisalu, FF = Haiai) who was born at the north-east end of the lake and whose father came from near the confluence of the Tua (there called Bure) and Pio Rivers, said that while he had not seen it himself, he had heard of such axes being carried as ornament in dance celebrations. The only site outside the Jimi Valley known to have produced axes of this shape is the small Kerowagi quarry, of which No.45 is a typical product. However, the Tebera axe does not come from any known quarry. BMR geologists said that it was probably from the Omung Metamorphics but of a facies different from that mined at Abiamp.[3] This geological unit is widespread in the Kubor Range but does not occur elsewhere: though not mapped, small outcrops may occur in the headwaters of the Tuman, Komun or Kuna Rivers. O.E. Christensen was given a small axe made from similar material while carrying out archaeological investigations in the Kuna Valley but no group near the Kubor Range remembers making axes of this style or from this material.

No.59 is a lenticular axe collected at Kumur near the Tsenga quarry but made of unknown dark greenish-grey rock weathered whitish-yellow to a depth of 1 mm. Local Melpa called it *gaima* because of its external colour but denied that axes of this shape had been made by them or their ancestors. Weathered axes are usually misnamed, as Chappell noted (1966:115), showing that surface colour is the most diagnostic feature. The excavated axes Nos.47 and 48 were also collected at Kumur and were given the name *kadjibuga*, probably the local equivalent of what Chappell heard at Ganz River as *katabogra* (1966:100). The men of Kumur are saying in effect 'this is not ours, we think it is from the Ganz River'. Both axes are of the same grey rock. No.47 has been ground but not polished on both faces and sides but one side and the edge have since been battered by repeated hammering. No.48 has been partially ground on both faces and battered on the edge and heavily battered on the sides, producing a slight flare on each. It looks like a part-ground blank, in which form a few axes were traded for short distances. (The Abiamp blank Reay-447 was collected in the 1950s north of the Wahgi River, having reached there as part of a marriage payment.)[4] However, several objects very similar to No.48, mostly excavated, are included in the collection of 194 axes bought by Mr R. Lampert in the upper Wahgi Valley between 1966 and 1968, and some of them have been battered on the sides *after* the faces have been ground,[5] which does not appear to be usual with blanks. They exist in sufficient numbers to form a distinct prehistoric type in the upper Wahgi Valley and adjacent areas and do not show the use wear characteristic of axes or hoes. They do not resemble the excavated 'waisted blades' illustrated by S. and R. Bulmer (1964:61, 63) but

[1] Cf. Nilles (1942-5:211); stone adzes were never used as hoes. No.61 is much bigger than the usual blade mounted as an adze in the highlands.

[2] In his collection at Wabag, 1973.

[3] R. Ryburn's description (pers.comm. 1971) is as follows: Hand specimen: Fine-grained dark grey 'spotted' slate. Thin Section: Definitely metamorphic. Fine grained meta-sediment with moderately well developed schistose texture. The 'spots' or porphyroblasts are mozaic aggregates of quartz with very small needles of ?actinolite and some fine-grained plates of biotite. The matrix is very fine grained and the minerals difficult to identify but there is much calcite (possibly sphene in addition), ?actinolite and opaque grains (probably magnetite). There is probably fine grained quartz and possibly some epidote and albite.

[4] Collected by Dr M. Reay and held in the Department of Anthropology, ANU.

[5] I am grateful to Mr Lampert for permission to make use of this collection and to refer to his unpublished data.

may resemble some of the 'earth axes' described from the Baiyer River and possibly Chuave surface collections (S.E. Bulmer 1966a:47, 50).

The remaining excavated blade is No.52 from Mamuane near the Iaro River in the southern Poru region. The Wiru speakers knew nothing of its origin, saying only that it was unlike the axes they used to use. It is made of a volcanic rock, now weathered, in a style unlike that of any other axe seen in the study area. Its profile and asymmetric lenticular cross-section are shown in Fig.26. Each surface has been ground, the poll smoothly rounded and the markedly asymmetrical cutting edge produced by sharpening from one side only. It is the only blade in the collection undoubtedly shaped for use as an adze, and was recently given added interest by the recognition in Christensen's 1972 Kuna Valley specimens of similar prehistoric 'plano-convex' adzes roughly sub-triangular in face-view and cross-section sufficient in number to form a distinct group. It is not known if the rock type or dimensions of any of the 'two (possibly four) apparently lenticular' blades collected in the Poru region by M. Strathern (1969:314) were of this type or whether they resembled the eastern highlands axes. (It will be recalled that an axe of the eastern highlands type was collected at Lake Tebera south-east of the Poru region.) Table 10 also lists axe No.F4, a hybrid style made of stone very like the Kafetu *gaima* collected in the Porgera Valley of the western highlands by de Ferranti of the BMR.

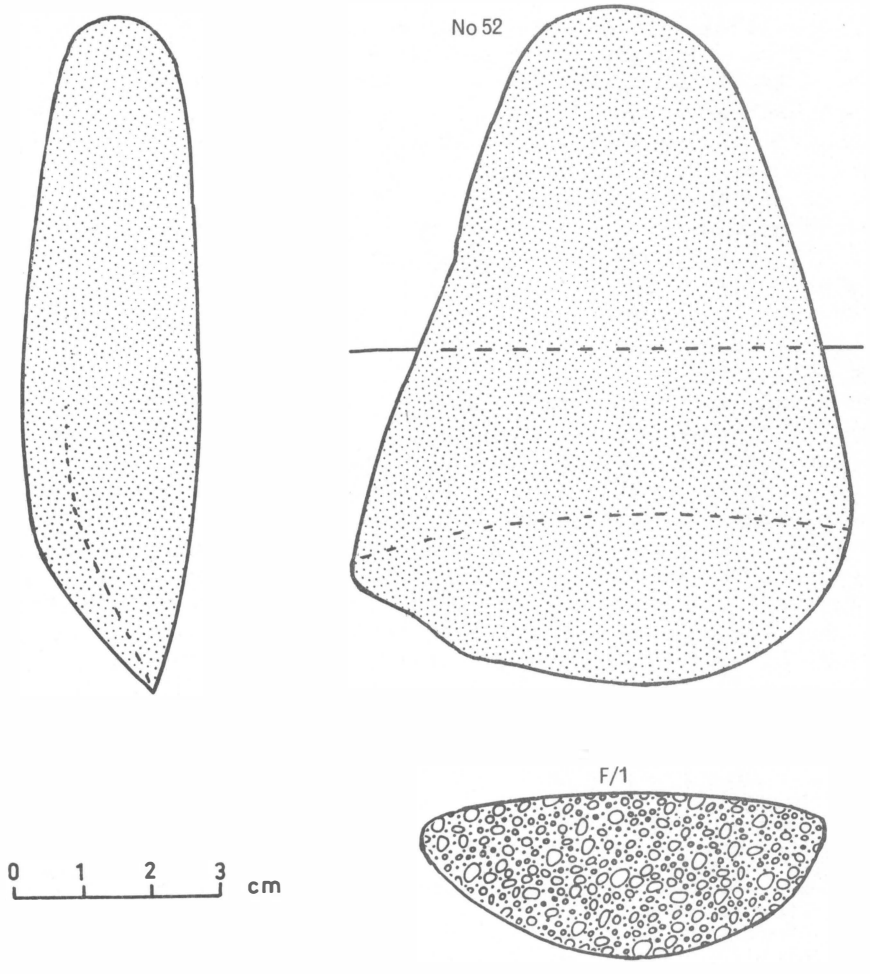


Fig.26 Prehistoric adze from Mamuane, Poru region

Axes of Known Provenance

Following S.E. Bulmer's morphological comparison of axes from a wide area of the highlands (1964), M. Strathern suggested that metrical analysis may provide criteria for more closely distinguishing manufacturing areas (1969:315). The apparent association between style and quarry area mentioned above suggests that at least within the central highlands it should be possible to demonstrate an association between axe styles and factories. There are two ways of testing such a hypothesis, one being to sort the axes into supposed manufacturing areas on the basis of style alone and then have a geologist identify the quarry that supplied each stone. As Chappell has said (1966:116) duplication of rock type from one quarry to another does occur and such axes can be separated only by an expert. However, most central highlands axes are not made of ambiguous material, and since the initial sorting of this small collection was influenced by the rock type its later almost complete confirmation by Chappell was not a test of the style hypothesis.

A second approach is to measure and describe each specimen and test the results for correlation with the rock types. Mr R. Lampert of the Department of Prehistory, ANU, has carried out such a project on nearly 200 blades from the upper Wahgi, Kaugel and Nebilyer Valleys and has had the results sorted by computer. Significant correlations between some of these parameters and quarries have been demonstrated (Lampert 1972). With the small collection made during the present field-work, elementary graph analysis has been used; even this biased sample showed similar correlations.

Detailed measurement and extended description is extremely time consuming but there are other important reasons for it. The first is to make the basic data of a particular collection more widely available, for inspection of the collections of others is even more costly and time consuming. Although for some purposes there is no substitute for personal inspection, for most purposes detailed measurements accompanied by illustrations will suffice. The second reason is to make the presentation of data unambiguous. In general discussion one must use terms like 'oval', 'elliptical', 'planilateral', 'plano-convex', but their precision is not high. In any case they need careful definition even when illustrated, especially when they are to be transferred for comparative purposes, as they usually are, between individual observers and discrete collections. The third reason is to permit one's own data, analysis and conclusions to be fairly judged.

In an attempt to meet these requirements the details of these 63 blades are set out in Tables 9 to 13. In order to discuss them unambiguously the following terms and abbreviations will be used (Figs.27 and 28):

length:	maximum length
centre:	the centre of the maximum length, the longitudinal centre
edge:	the working edge
faces:	the largest two surfaces
sides:	the surfaces joining the faces on their longest edges; on most of these axes the sides are the second largest pair of surfaces but on axes lacking any flattening of the sides, such as those of elliptical cross-section, the sides are merely the vertices of parabolic curves
poll:	the top of the butt
face profile:	the longitudinal profile; most consist of a single parabolic curve, some have two curves separated by a chin,[1] some have one curve and one flat (the transverse face profile of most of these axes is elliptical)

[1] After Duff (1970); this leaves the term 'shoulder' to describe a break in profile caused by a reduction of the butt to form a tang.

bevel: the angle or angles between the longitudinal profiles of the faces and the major longitudinal plane bisecting the edge; on axes with edge asymmetry, as most are, this is not the major longitudinal plane bisecting the blade

flat: a bevel straight in the longitudinal profile of the face and either straight or curved in the transverse profile; they occur only at the edge end; none have hollow-ground concave bevels

chamfer: minor bevels on the poll or sides

asymmetry: edge asymmetry; the maximum asymmetry of the working edge from the major longitudinal plane equally bisecting the blade; the point of balance of all blades occurred in the central third and edge asymmetry was measured by placing a side on graph paper so that the centre line equally bisected the central third of the blade and by reading off the maximum divergence from it of the silhouette of the edge; this factor is one of the determinants of the direction of cutting force at impact and is critical in the axe-versus-adze argument

F/1: the longest face; if the edge asymmetry is held to the right, the longest face is to the left

F/2: the shortest face

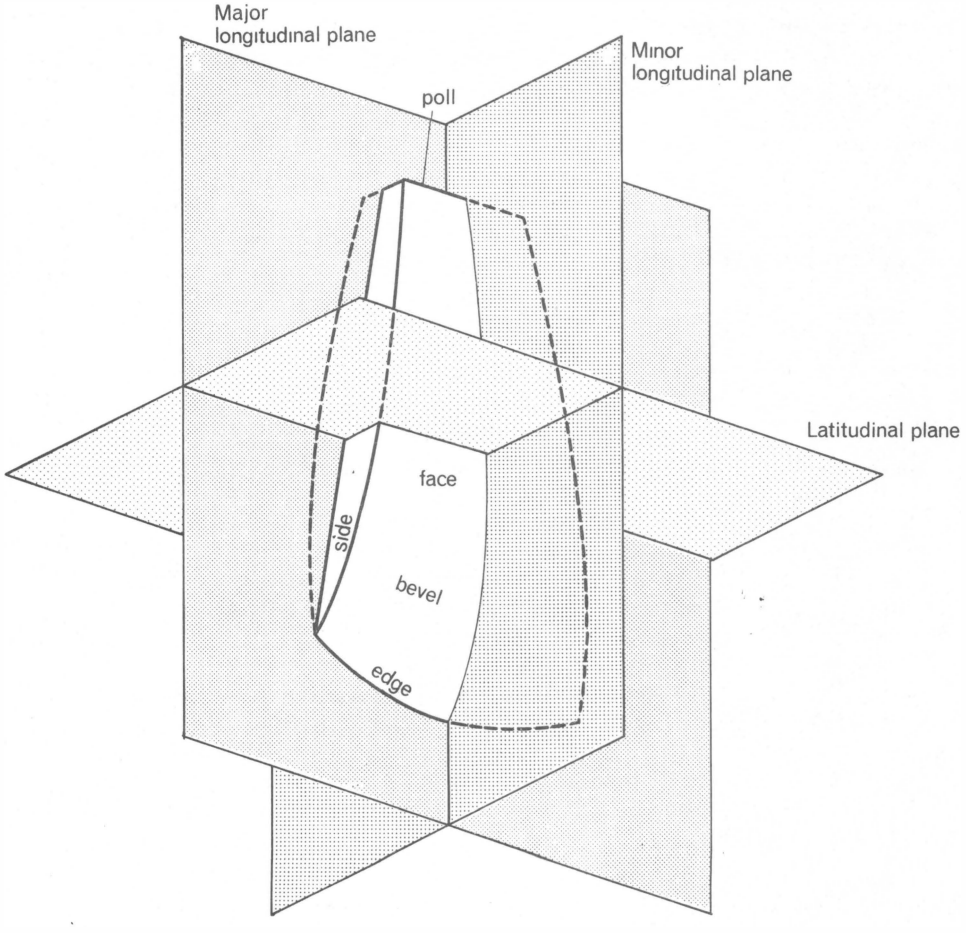


Fig.27 Trimetric projection of the main planes referred to in the text (In asymmetric axes, the major longitudinal plane does not pass through the edge; a fourth oblique plane equally bisects the bevels and passes through the edge: see Fig.28)

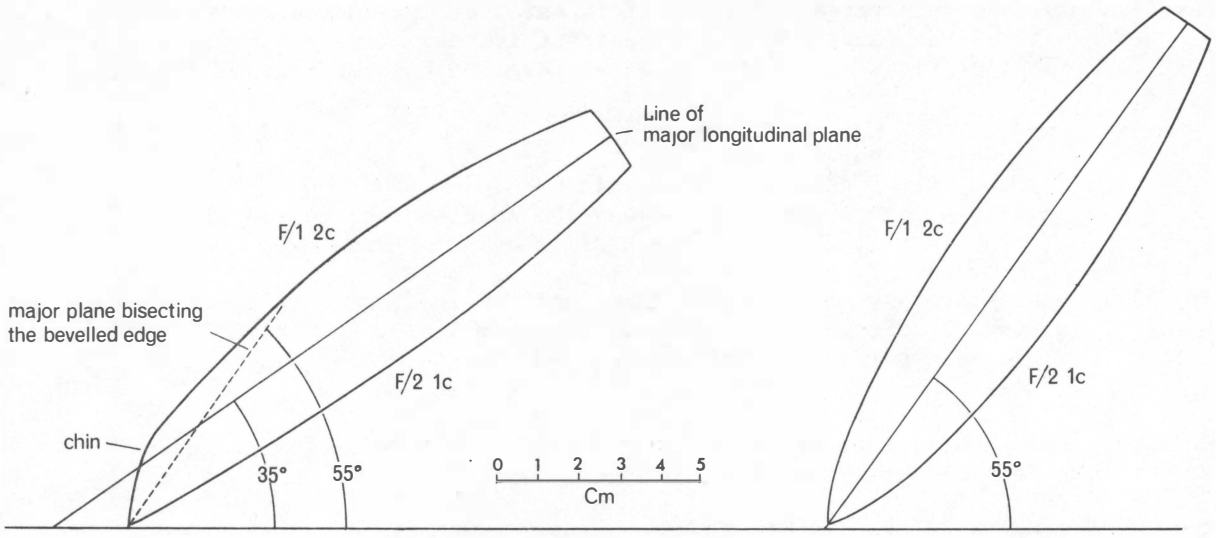


Fig.28 Minor longitudinal section of typical asymmetric and symmetric axes

The notes to Tables 9 to 13 further clarify the dimensions and the terminology.

Notes to Tables 9 to 13

Except for edge asymmetry, dimensions were measured by callibrated callipers.

Col.1 : reference number

Col.2 : the collection site

Col.3 : Munsell notation of main surface colour, usually ground and polished, sometimes weathered. Although these descriptions are approximate because of the low chroma and low value of most axe colours and because of the variation in hue, chroma and value over the surface of most axes, they are universal referents and are more accurate than terms like 'blue-grey' and 'green-black'

Col.10: index of the proximity of the point of maximum thickness to the poll; length of the blade = 100

Col.11: cross-section; the ratio of the thickness at the centre to the width at the centre; centre width divided by centre thickness

Col.12: angle of divergence of the sides from the parallel; half the angle of divergence of both sides; on axes with convex sides this was taken as the tangent at the centre and on axes with concave sides it was a straight line from the point of maximum width to the point of minimum width

Col.13: the average of the width of the two 'flat' sides measured in the centre of the blade; these surfaces are in fact slightly curved on axes from the Kafetu quarry and occasionally are very slightly curved on blades from other quarries

Col.14: the percentage of the total centre thickness of the blade occupied by the 'flat' sides as given in Col.13

Col.15: average transverse curvature of faces; width at centre divided by half of the remainder of the centre thickness after subtracting the flat sides; the flattest faces have the highest figures

Cols.16, 17:

1c; one continuous curve
2c; two curves separated by a chin
x; a flat bevel x mm wide across the longitudinal centre line of the face, the rest of the profile being a curve

Col.19: percentage asymmetry of the edge; half of the centre thickness divided by the measured asymmetry, multiplied by 100 (e.g. 100% would be a perfect chisel edge, as on some Asian and Polynesian adzes)

Col.20: edge angle; measured with the protractor arms tangential to each face immediately adjacent to edge

Col.21: transverse profile of edge; curvature; the chord divided by the maximum perpendicular from the chord to the arc of the segment; as with transverse face profile, the straightest have the highest figures

Col.22:

saw	:	saw marks visible
cere	:	ceremonial (prime function undoubtedly ceremonial, ornament and valuable)
exc	:	excavated
weath	:	weathered
nfg	:	not fully ground
ego	:	edge ground only
pg	:	poll ground
ham	:	hammered on side and/or edge
dull	:	unpolished
bl	:	blank

Systematic Differences

In searching for patterns of differentiation, all axes from known quarries have been used, including those in Table 13.

Cross-Section

The cross-section of stone blades has long been used as a distinguishing criterion when making comparisons over large areas, and even within the New Guinea highlands it has been used to advantage by the authorities cited above. The flat-sided axes of the central highlands are easily distinguished from those of lenticular section used to the east and to the west. Within each cross-sectional class, the characteristics which can be expected to vary least are the shape and dimensions of the central cross-section; the edges and polls of the axes seen throughout the study area received more varied shaping than did the central portion and the need to preserve the strength of the body of the blade may be the reason. Hafts were seen enclosing from one-third to two-thirds of the length of the blade, usually less in the case of large axes and more in the case of small ones. Although no large work axes were seen in use, Gilliard (1953:468) illustrates some in use for splitting logs in the middle Wahgi Valley. For this type of work a large amount of blade must be exposed. Gilliard remarked on how they effectively split casuarina logs more than a foot (305 mm) in diameter and that in spite of a very heavy blow the thickness of the blade prevented it jamming (ibid:480). Axes were subjected to both bending and torsion strains and for this type of strength the dimensions of the central third were critical. In spite of these incentives towards homogeneity there seemed to be an association

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
No.	Site	Colour	Weight	Length	Width		Thickness			Cross-sec	Sides			Faces			Edge				Add. info.
					Max	Cen	Max	Cen	Prox MT to poll	CW/CT	Diverg	Flat	% CT	Av Tran Prof	Lon F/1	Prof F/2	Asym	% CT	Angle	Tran Prof	
			g	mm	mm	mm	mm	mm	index	Ratio	deg	mm	%	Ratio			mm	%	deg	Ratio	
Kafetu																					
1	Koreipa	2.5BG5/2	545	183	60	58	32	32	51	1.81	2°00	7.5	23	4.7	1c	1c	3	19	73	4.9	s, p g
2	Chuave	5BG5/2	432	158	70	53	31	31	52	1.71	10°30	10	32	5.0	1c	1c	2	13	69	3.5	
3	Kere	5BG4/1	93	89	46	36	16	16	(c.50)	2.25	9°30	–	31	4.5	1c	1c	1	13	70	3.5	nfg, pg
Dom																					
4	Mintima	10G6/1	3868	433	153	127	39	38	37	3.35	7°00	15	40	11.0	1c	1c	5	26	90	15.7	cere
5	Mintima	7.5G4/2	1860	354	141	120	25	23	21	5.21	9°15	5.5	24	6.9	1c	2.5	2	17	65	3.0	cere
6	Nomane	10G5/1	93	89	32	30	19	19	49	1.58	6°45	15	79	15.0	1c	1c	0	0	70	8.9	
Kumanigl																					
44	Yowai	7.5G7/2	909	210	92	78	30	30	56	2.60	6°30	16	53	11.1	1c	1c	4	27	65	5.4	dull
Kerowagi																					
45	Mintima	7.5GY4/2	592	265	138	92	15	12	24	7.67	11°30	6	50	30.7	1mm	1c	2	33	41	2.2	cere, dull
Maegmul (prob)																					
46	Kumur	5B5/1	265	133	72	50	21	20	36	2.50	10°45	11	55	11.1	6mm	1c	3	30	58	6.5	dull

Table 9 Axe/adzes from Kafetu, Dom, Kumanigl and Kerowagi quarries

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
No.	Site	Colour	Weight	Length	Width		Thickness			Cross-sec	Sides				Faces			Edge			Add. info
					Max	Cen	Max	Cen	Prox MT to poll	CW/CT	Diverg	Flat	% CT	Av Tran Prof	Lon F/1	Prof F/2	Asym	% CT	Angle	Tran Prof	
			g	mm	mm	mm	mm	mm	index	Ratio	deg	mm	%	Ratio			mm	%	deg	Ratio	
7	Kere	2.5G3/2	2275	333	98	84	39	39	38	2.15	3°15	27.5	71	7.3	4	1c	10	51	65	6.5	cere
8	Kup	2.5G3/2	1952	304	97	75	42	42	45	1.78	6°30	29.5	70	6.0	12	1c	3	14	74	6.9	cere
9	Kilau	5G3/2	1340	280	107	77	33	33	51	2.33	7°30	22	67	14.0	14	1c	7	42	59	5.3	cere
10	Kari	5G2/2	1294	235	110	81	32	32	40	2.53	7°30	22	69	16.4	15	1c	12	75	50	7.9	cere
11	Ku	5G3/1	1087	244	90	72	32	32	52	2.25	6°00	17	53	9.6	13	1c	10	63	71	5.0	cere? use
12	Neregaima	5G3/2	1092	230	87	65	33	33	44	1.97	6°00	24.5	74	15.3	1c	1c	8	49	64	7.3	cere? less use
13	Solita	5G2/2	932	239	88	61	31	31	46	1.97	7°15	24	78	17.4	2c	1c	7	45	68	7.3	cere? V.little use
14	Iani	5G2/1	937	235	66	60	35	35	46	1.71	4°30	24	69	10.9	7	1c	9	52	68	7.3	cere? " "
15	Au	10G/3/2	976	221	95	70	32	32	46	2.18	7°45	18	57	10.0	1c	1c	7	44	68	11.9	dull
16	Bogo	2.5G4/2	968	211	86	66	35	35	60	1.88	7°00	26	74	14.6	1c	1c	4	23	73	4.8	dull
17	Kui	5G3/2	798	184	91	67	35	35	51	1.91	8°15	23	66	11.1	1c	1c	8	46	79	6.1	
18	Mintima	5G3/1	699	189	68	58	35	35	53	1.66	5°45	18	51	6.8	5	1c	3	17	61	5.5	
19	Boisamalu	5G3/2	416	140	66	49	29	29	44	1.69	8°30	21.5	74	13.0	1c	1c	6	41	71	7.0	
20	Dibe	7.5GY2/2	424	144	60	47	30	30	34	1.57	7°00	23	76	13.4	1c	1c	2	13	70	7.5	
21	Kumur	10G3/2	456	171	77	50	28	28	45	1.98	11°30	17	61	9.1	—	—	4	29	—	(4.5)	edge broken
22	Olate	5G3/2	261	123	66	48	25	25	45	1.92	10°45	10.5	42	6.7	9	1c	2	16	72	5.1	
23	Dobu	5G3/2	235	117	69	52	20	20	53	2.60	10°45	11.5	58	12.2	2c	1c	1	10	71	4.6	
24	Noru	5GY3/2	249	112	56	51	29	29	—	1.76	10°30	16.5	57	8.2	—	—	—	—	—	—	nfg, no edge
25	Tsenga	10Y7/4	84	75	48	38	16	16	(c.50)	2.38	9°45	9.5	58	(11.7)	6	1c	2	25	75	5.3	nfg
26	Karani	5G3/1	64	63	39	32	17	17	55	1.88	10°00	12.5	74	14.2	2c	1c	2	24	80	7.8	
27	Tebera	2.5G4/2	112	114	42	33	15	15	54	2.20	7°00	10.0	67	13.2	1c	1c	0	0	58	6.0	
Abiamp or Mbukl																					
28	Maina	10G4/1	332	119	68	55	27	27	60	2.04	9°00	18.5	69	12.9	1c	1c	4	30	—	(4.9)	dull

Table 10 Axe/adzes from Abiamp quarry

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
No.	Site	Colour	Weight	Length	Width		Thickness			Cross-sec	Sides				Faces				Edge		Add. info
					Max	Cen	Max	Cen	Prox MT to poll	CW/CT	Diverg	Flat	% CT	Av Tran Prof	Lon F/1	Prof F/2	Asym	% CT	Angle	Tran Prof	
			g	mm	mm	mm	mm	mm	index	Ratio	deg	mm	%	Ratio			mm	%	deg	Ratio	
29	Tsenga	N3	1237	289	137	112	27	16	(10)	7.50	8°15	–	–	–	–	–	–	–	–	(3.7)	bl, faces g, cere
30	Kerowagi	N2	534	244	109	73	20	15	10.5	4.86	9°30	5	33	14.7	1	1c	0	0	56	4.2	cere
31	Mintima	N2	619	200	103	76	21	20	20	3.80	9°30	9	45	13.8	2c	2c	4	40	55	4.5	dual?
32	Simbai	N2	667	207	97	69	29	23	15.5	3.00	9°15	8.5	38	9.5	1c	1c	2	17	70	3.9	
33	Meru	N2	522	178	71	52	29	29	42	1.79	8°15	17	58	8.7	2c	1c	1	7	70	5.1	Kambia
34	Gembogl	N2	366	181	75	53	22	18	19	2.94	9°30	8	44	10.7	1c	3	4	44	63	3.1	
35	Kumur	5GY4/1	192	204	72	45	12	11.5	(c.20)	3.91	9°00	6.5	57	18.0	1.5	1c	2	35	52	4.8	cere
36	Tsenga	N6	1188	222	112	96	38	30	–	3.20	8°15	–	–	–	–	–	–	–	–	(2.2)	bl
37	Waisime	10Y8/2	601	161	96	74	28	27	29	2.74	11°15	11	42	9.3	1c	1c	1	7	66	4.6	weath
38	Gerema	2.5GY7/2	468	180	78	61	25	23	26	2.65	10°00	11.5	50	11.6	4	1c	2	17	65	3.7	
39	Gumine	7.5Y8/4	508	212	113	71	21	18	22	3.94	14°45	9	51	15.8	17	7	4	44	50	5.9	weath, dull, dual
40	Menjim	10Y8/2	214	128	72	55	17	17	47	3.24	9°30	9	53	13.7	1c	1c	1	12	–	5.3	weath
41	Tsenga	10GY7/1	323	173	101	82	14.5	12	18	6.84	9°30	3.5	29	19.3	4	1c	2	33	40	3.7	cere
Probaby Ganz/Tsenga																					
42	Kalabai	2.5GY8/2	373	147	63	46	26	26	48	1.77	6°00	18	69	11.5	1c	1c	3	23	74	5.2	weath
43	Bumaru	7.5Y8/2	284	130	65	53	24	24	41	2.21	7°00	11	47	8.2	1c	1c	0	0	–	4.3	v. weath

Table 11 Axe/adzes from Ganz-Tsenga quarries

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
No.	Site	Colour	Weight	Length	Width		Thickness			Cross-sec	Sides				Faces				Edge		Add. info
					Max	Cen	Max	Cen	Prox MT to poll	CW/CT	Diverg	Flat	% CT	Av Tran Prof	Lon F/1	Prof F/2	Asym	% CT	Angle	Tran Prof	
			g	mm	mm	mm	mm	mm	index	Ratio	deg	mm	%	Ratio			mm	%	deg	Ratio	
47	Kumur	5BG4/1	201	128	50	41	22.5	22	35	1.91	6°30	8	36	5.9	–	–	(3)	27	–	–	exc, ham
48	Kumur	10BG4/1	147	109	68	47	15	14	–	3.36	10°30	–	–	–	–	–	(2)	(29)	–	(6.8)	exc, ham, bl?
49	Kere	10G4/1	47	66	34	32	13	13	(c.50)	2.46	5°15	8	62	(12.8)	2c	1	1	15	66	6.8	nfg
50	Tebera	N2	324	156	121	90	14	13.5	(20)	6.67	12°30	4	30	18.9	2c	1	1	15	61	5.8	cere, exc, no butt
51	Tebera	5G4/1	86	80	43	39	18	18	(c.50)	2.16	8°00	4.5	25	5.8	1c	1c	1	11	65	7.2	
52	Mamuane	5Y8/2	220	98	73	56	25	25	57	2.24	17°30	0	0	4.5	2c	1c	8	64	69	3.2	v.weath, adze
53	Korige	N3	118	89	57	55	14	14	55	3.39	7°15	0	0	(7.9)	1c	1c	4	57	76	3.4	nfg
54	Kumur	N3	219	134	71	53	17.5	17	26	3.12	10°00	7.5	44	9.0	5	1c	3	35	–	5.9	dull
55	Kiari	N2	109	77	44	43	20	20	57	2.15	6°00	8	40	7.2	2c	1c	2	20	76	5.7	pg
56	Nomane	N2	582	211	74	65	27	26	–	2.50	5°00	0	0	(5.0)	1c	1c	5	39	71	5.9	ego
57	Kumur	N4	167	185	79	58	10	9	27	6.45	8°30	3	31	19.3	3	1c	1	22	38	2.7	cere, dull, mod
58	Kere	N2	40	63	35	33	13	13	(c.65)	2.54	4°45	7.5	58	(12.0)	2c	2c	1	15	70	4.1	nfg
59	Kumur	10Y8/4	629	163	87	73	30	29	28	2.52	13°15	0	0	5.0	1c	1c	5	35	–	3.1	exc, v.weath
60	Nondugl	N3	119	115	59	48	12.5	12	–	4.00	9°45	5	44	(13.7)	–	–	–	–	–	–	nfg, dull
61	Mintima	5GY3/2	531	175	82	70	25	25	55	2.80	8°30	11.5	46	10.4	1c	1c	1	8	–	3.9	pg, dull
62	Usino	5BG4/1	406	143	67	55	25	25	43	2.20	7°15	18	72	15.7	1c	1c	2	16	81	5.8	weath
63	Karimui	7.5G4/2	596	167	75	66	31	31	49	2.13	6°00	7	29	5.5	1c	1c	0	0	77	5.0	poss. Kafetu

Table 12 Axe/adzes from unknown quarries

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
No.	Site	Colour	Weight	Length	Width		Thickness			Cross-sec.	Sides				Faces				Edge		Add.info
					Max	Cen	Max	Cen	Prox MT to poll	CW/CT	Diverg	Flat	% CT	Av Tran Prof	Lon F/1	Prof F/2	Asym	% CT	Angle	Tran Prof	
			g	mm	mm	mm	mm	mm	index	Ratio	deg	mm	%	Ratio			mm	5	deg	Ratio	
Bain and de Ferranti																					
B1	**Maramuni**	1.gr/gy	–	209	98	74	23	22	36	3.36	$10^{o}15$	9	41	11.4	1c	1c	1.5	14	–	4.1	Ganz/Tsenga
B2	**Wulama R.**	black	–	269	115	86	27.5	26	11	3.31	$8^{o}45$	11	42	11.5	1c	1c	4	31		4.4	Ganz/Tsenga
F1	**Keglsugl**	l. green	1327	297	119	95	25	25	c.50	3.80	$9^{o}00$	12	48	14.6	9	1c	2	16	–	4.4	Kumanigl? cere?
F2	**Porgera**	d.gr/b	305	112	55	52	26	26	c.50	2.00	$4^{o}30$	19	73	14.8	1c	1c	2	15	–	6.1	Abiamp
F4	**Porgera**	gr/gy	410	130	66	62	30	30	c.50	2.06	$6^{o}15$	17	57	9.5	1c	1c	3	20	–	8.3	Kafetu?
Monash																					
M1	**Wahgi**	gr	–	336	160	105	14	13	(25)	12.30	–	–	–	–	f1.	1c	–	–	–	–	Kerowagi, cere
M2	**Wahgi**	d.gy	–	227	120	80	13	12	(25)	10.00	–	–	–	–	f1.	1c	–	–	–	–	Ganz/Tsenga, cere
Lampert																					
D1	**Wahgi**	1.gy/gr	3302	423	137	120	32	30	13.5	4.00	$5^{o}00$	17	56	4.00	1c	1c	c.2	13	68	5.3	Dom, cere

Table 13 Axe/adzes from known quarries collected by others

between cross-section proportions and axe quarry so the basic measurements of centre width and centre thickness were plotted against each other (Fig.29).

All the Abiamp axes from the smallest weighing only 64 grams to the largest weighing more than 2 kg formed a clear and continuous curve on the side of greatest centre thickness and least centre width. They were joined by the only work axe from the Dom quarry, by the known and suspected Kafetu axes, and by all of the fully ground work axes from unknown sources which were collected south of the Abiamp and Dom quarries. (Here the term 'fully ground' excludes grinding of the poll.) In addition, they were joined by one known and two suspected Ganz-Tsenga axes collected south of the Abiamp and Dom quarries, Nos. 33, 42 and 43.

As was said on an earlier occasion (Hughes 1969:10), the axes of the central highlands taken as a whole form a continuum of form and function and fully ground work axes, if not too small, were valuable and were used in ceremonial exchange. M. Strathern has discussed this point in reference to the people of the upper Wahgi and of the Poru region (1969:320-3). Although that writer has said that ceremonial axes confirmed to the same design as work axes, merely emphasising quality or size, within the study area that is true only of axes of the middle range and is not true of Dom products. This lack of differentiation increases away from the main quarries and is more marked in the west. Most observers, including the highlanders themselves, recognised some axes as manifestly ceremonial only, limited by either great size or fragility to function as wealth objects, ornaments and weapons.[1] These axes formed a separate curve on the side of least centre thickness and greatest centre width and included the modern tourist axe, the Kerowagi axe and the mysterious one from Lake Tebera. The edges of most are unworn but three from the Ganz-Tsenga quarries show slight wear from light work. Both highlanders and European observers have recorded their use in warfare and for such tasks as cutting sugar-cane and trimming fibrous material, vines and split cane and for lopping finger joints in mourning. They are notable for their acute edge angles.

The remainder of the Ganz-Tsenga axes fell between these two curves, those lying closest to the 'ceremonial' curve being Nos. 31 and 39, said by informants to have been both ceremonial and work axes. The Kumanigl, Maegmul and remaining 'unknown' work axes occupied a similar position, mostly towards the Abiamp side. Although there were no very small ceremonial axes, trends converged towards the smaller sizes. Within each group, the average proportions were remarkably constant throughout the size range, suggesting that if small blades were sometimes made especially for hafting as adzes they did not differ in general proportions. Plotting centre thickness against maximum width produced the same distribution pattern for each group, merely enlarging the differences between the larger axes made at Jimi Valley factories.

Using the ratio of centre width to centre thickness as a constant, the pattern of distribution of other factors was tried.

Working Edge

In the case of edge asymmetry (Fig.30), 90 per cent of the axes were found to be fairly evenly distributed between 0 and 45 per cent on the scale, with no significant difference between the main quarries. A third of the axes were between 10 and 20 per cent asymmetrical, with a tail towards the 40 to 45 per cent class. Ordinary work axes, including those from Kafetu, tended towards the symmetrical end of the range. Only four blades exceeded 55 per cent, one a partially ground local axe from the Ramu, one the prehistoric adze from the Poru region and two ceremonial axes from Abiamp; one of these, No.10, with no use-wear whatever, was the most asymmetric of all at 75 per cent. While a blade ground with great asymmetry can be effectively used as a chopping tool and even as a splitting tool, a blade ground symmetrically is a great disadvantage when thin shavings are required, as in adzing.

[1] The ultimate stage of complete dimorphism is represented by the long, unhafted ceremonial 'adzes' of the Kukukuku (Blackwood 1950:20, 21) and the 'marriage stones' of the Dani (Verhofstad 1966:291, 293). In view of the symbolic function of these specialised developments it is premature to interpret as stone spear or dagger heads the long, flat, thin prehistoric stone objects occasionally found in the central highlands (cf. Bulmer and Clarke 1970:42-5), especially if the implication is one of practical use.

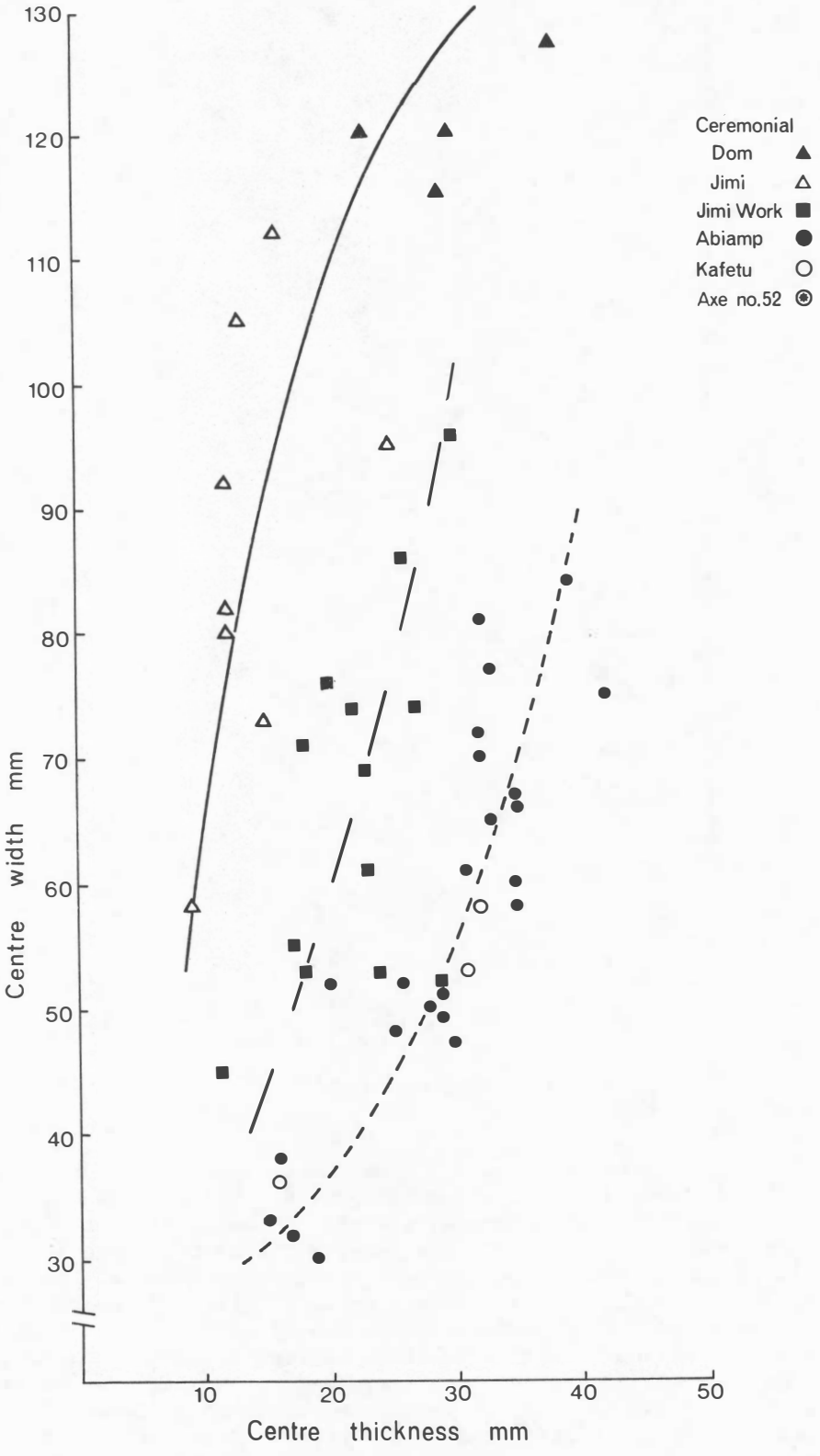


Fig.29 Centre width: thickness

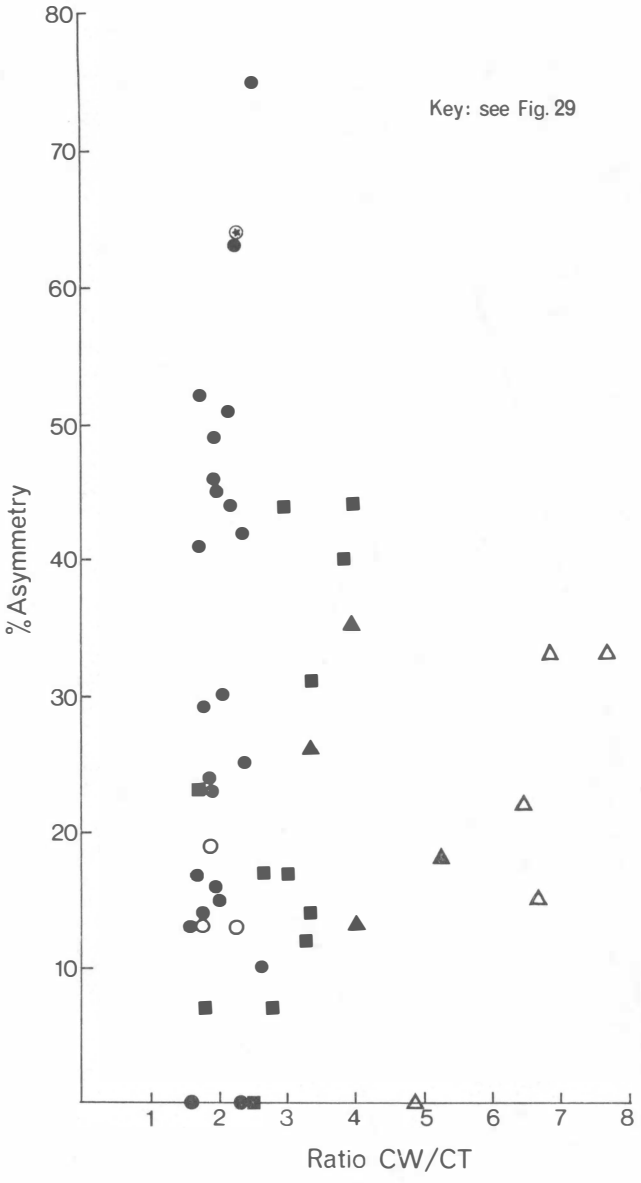


Fig.30 Edge asymmetry

Ninety per cent of the axes had a transverse edge profile (edge curvature) ratio (Fig.31) of between 3 and 8. Non-Abiamp ceremonial axes tended to be more curved than other axes and all Abiamp axes tended to be straighter edged than other axes. Exceptionally straight edges outside the normal range are one Abiamp axe and the largest Dom ceremonial axe, both affected by flaws in the rock.

Edge angles more acute than 58 degrees occurred only on non-Abiamp ceremonial axes and two dual-purpose Ganz-Tsenga blades, Nos. 31 and 39 (Fig.32). The most acute were the thin blades Tsenga No.41 at 40 degrees and the Tsenga tourist axe No.57 at 38 degrees. At 90 degrees, the large Dom ceremonial axe was exceptionally obtuse along the flaw in the rock. All other axes had edge angles of between 58 and 81 degrees, with a clustering around 70 degrees.[1] The determining factor in general purpose axes is the need for strength to resist shattering on impact while chopping and splitting. However, there is a suggestion that smaller axes tend to be more obtuse and that obtuseness increases with the distance away from the original manufactory. A much larger sample is needed to test these indications,

[1] 10 to 15 degrees higher than the neolithic chopping tools cited by Semenov (1964:205). Measurement precisely at the extreme edge is critical; one or two millimetres away the bevel is much more acute.

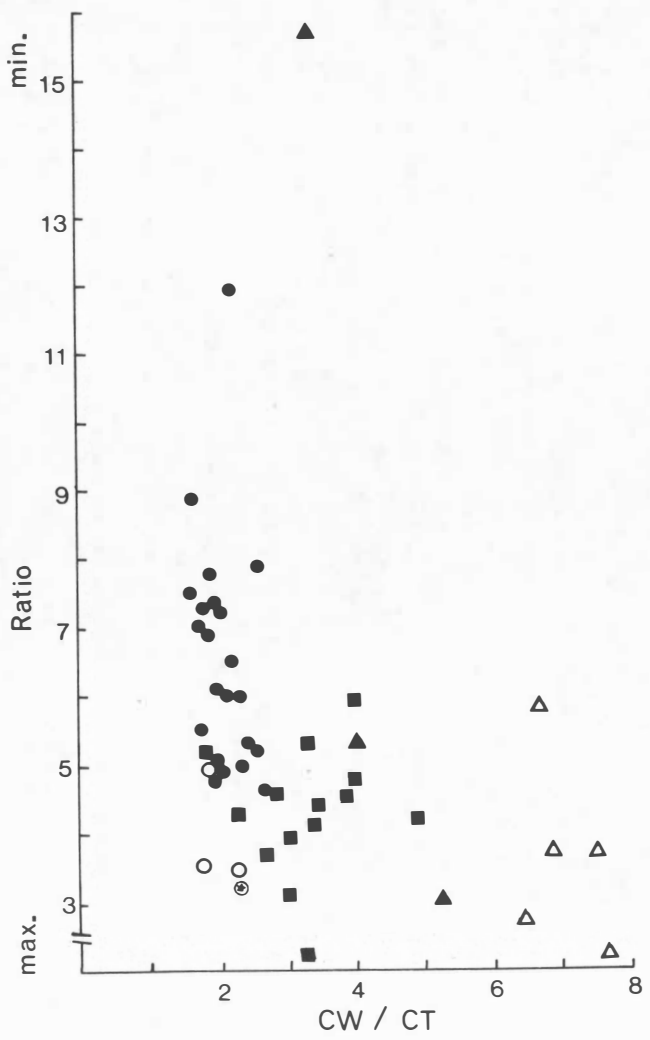


Fig.31 Edge curvature

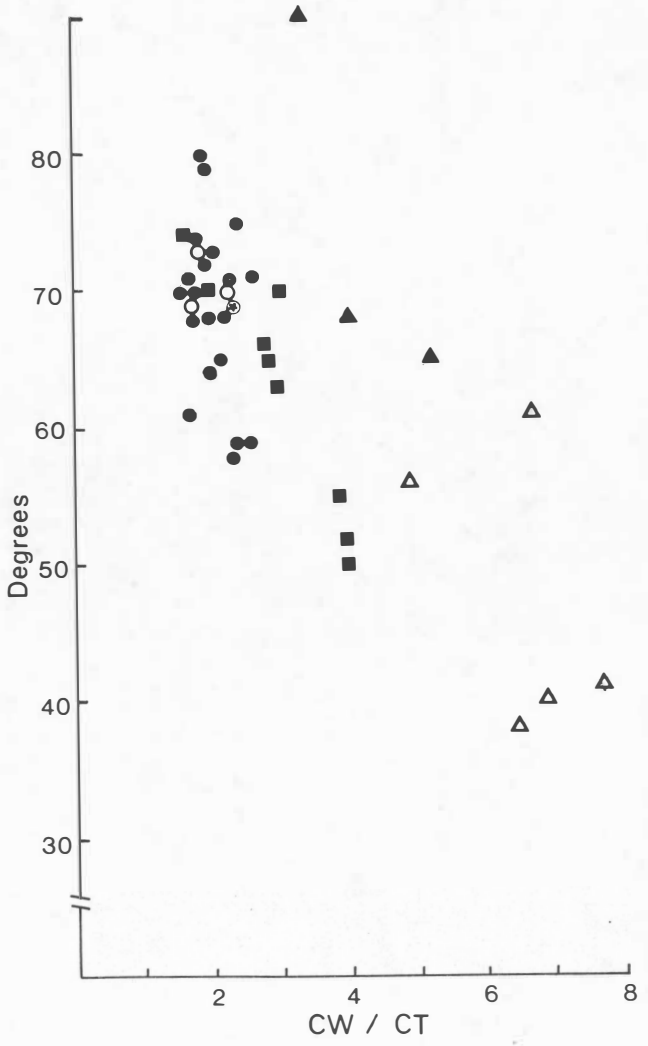


Fig.32 Edge angle

but they may be the natural result of resharpening by non-specialists and, in the case of locally made axes, it may reflect the inability of inferior material to hold a fine edge and resist shattering.

Maximum Thickness

Abiamp, Kafetu and locally made axes had their thickest part towards the centre of the axe; Ganz-Tsenga axes and Dom ceremonial axes had it closer to the poll (Fig.33).[1] Although only one Dom work axe was collected, these are expected to be consistently thickest in the centre. The only work axes from unknown quarries which were not thickest in the central 20 per cent of the blade were collected in the Ganz-Tsenga area. The only Abiamp axes which were not thickest in the central 20 per cent were a small one collected in the Tua region and two large ceremonial blades, and even on these the point of maximum thickness occurs in the central third. Three known and two suspected Ganz-Tsenga axes had their point of maximum thickness in the central third of the blade, though it was in the poll half. Three of these were those already shown to be aberrant in cross-section, No.33 collected in the Kambia region and Nos. 42 and 43 from the Tua region; the fourth, with a poll-proximity index of 36, was collected by Bain in the East Sepik District and the fifth came from Menjim itself. Although much larger samples are needed to allow for the opportunistic use of odd flakes resulting from the vagaries of stone fracture, the general contrast between Jimi Valley axes and the rest on the basis of this characteristic is clear. Though there is no evidence that this is its purpose, maximum thickness in the poll third of a blade has hafting advantages by assisting retention in the socket, particularly useful when the sides converge markedly towards the poll.

Sides and Faces

The sides of 80 per cent of the axes diverged from the parallel by between 4½ degrees and 11½ degrees, narrowing towards the poll. (Fig.34). Ganz-Tsenga axes fell into the top half of the range; the doubtful Ganz-Tsenga axes, Nos. 42 and 43, aberrant on the grounds discussed above, did not. Abiamp, Kafetu and unknown work axes were evenly distributed throughout. One Kafetu axe and the largest Abiamp ceremonial axe were exceptionally parallel, and three fully-ground excavated axes from unknown quarries and one dual-purpose Ganz-Tsenga axe were exceptionally divergent. The adze from the Poru region was right outside the range.

The proportion of the total thickness occupied by a flat side affects the curvature of the transverse profile of the face as expressed in column 15 of the tables (see also notes to these tables). Both these characteristics were compared on the basis of dimensions at the centre of the blade. Apart from flat bevels, the only flat surfaces or concavities on the faces were due to faults in the stone or to flake scars and all transverse face profiles were elliptical.[2] The degree of curvature did not separate Abiamp, Dom and Jimi Valley axes, but Kafetu axes, lacking substantial flat sides, were much more curved. It did help to identify the flat-faced ceremonial axes made north of the Wahgi Valley. The percentage of the centre thickness occupied by the flat side effectively separated Abiamp from Ganz-Tsenga and both from Kafetu. The small Dom sample covered the range. When both measures were combined, as in Fig.35, the division became very clear. Ganz-Tsenga work axes and those from unknown quarries came between the non-Abiamp ceremonial blades and the work axes from southern and eastern quarries. The only finished axes entirely lacking flattening of the sides (apart from two local axes with unground sides) were the Poru region adze and the 'unknown' blade perfectly elliptical in cross-section, No.59, which was excavated near Tsenga.

More than half the axes had a single parabolic curve on the F/1 profile and nearly 90 per cent had a similar single curve on F/2. Of the remainder, a third

[1] Vial noted this characteristic of Ganz ceremonial axes many years ago (1940:160).

[2] A weathered, *hollow-ground* adze, lenticular in cross-section, made from greenish-grey rock of hardness 4-5, was collected in 1972 in Chimbu by R.L. Hide. From thin-section examination Chappell has said that it is not from any of the known quarries and has described it as 'hornblende-quartz-albite, non-schistose metamorphic, with large relic calcic plagioclase crystals' (pers.comm. 1973).

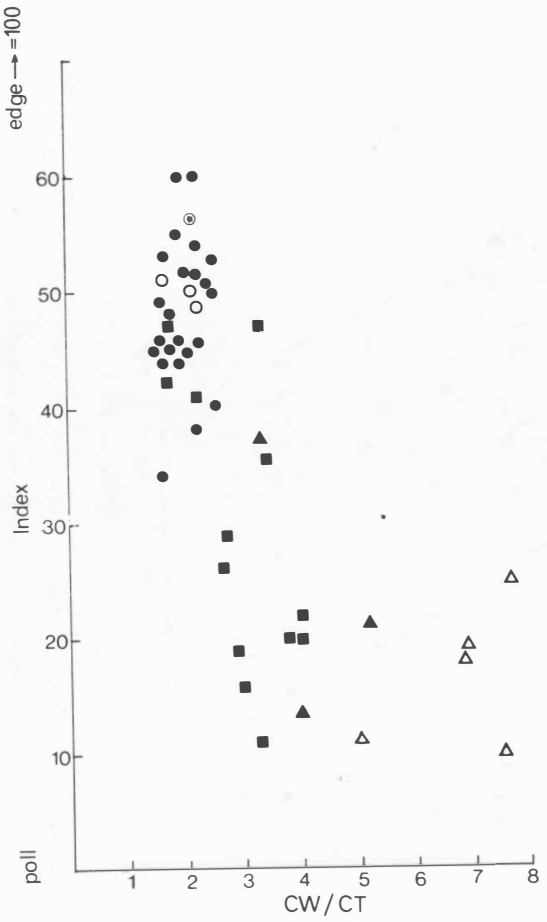


Fig.33 Proximity of maximum thickness to poll

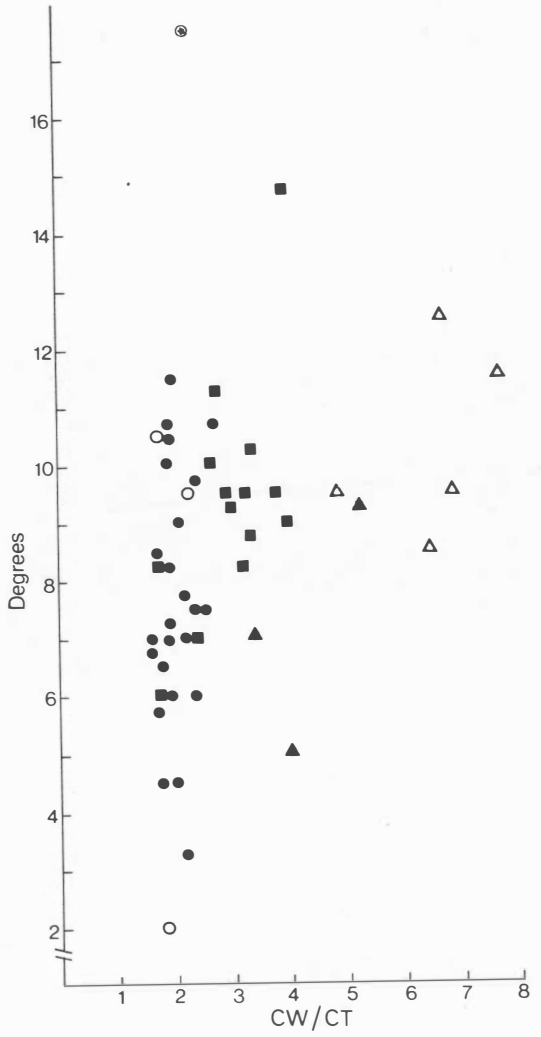


Fig.34 Angle of divergence of sides

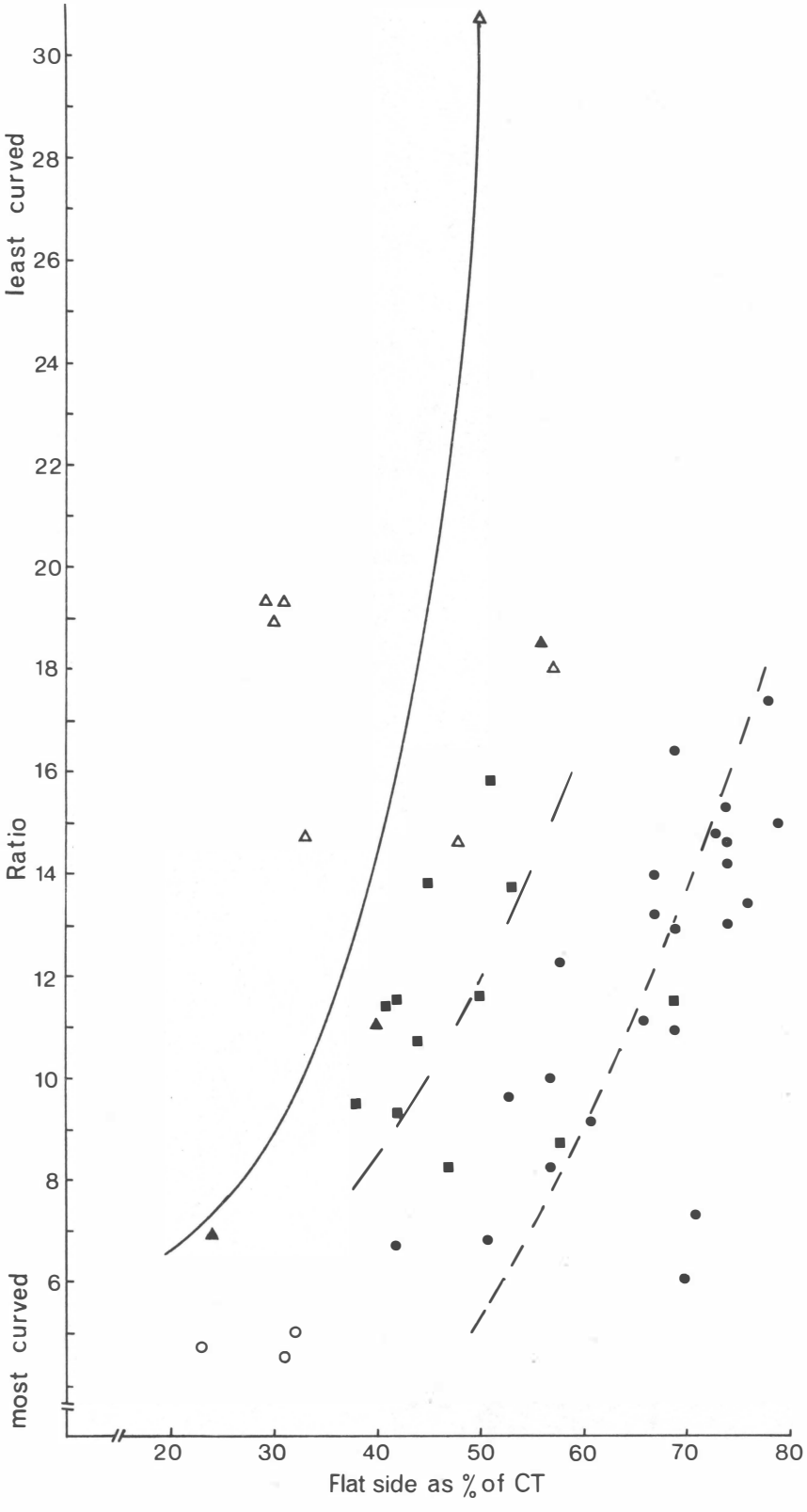


Fig.35 Transverse curvature of faces

had a curved secondary bevel and two-thirds had flat ones. More than half of those with flat bevels were ceremonial axes. There were no significant differences between the manufacturing areas.

Although they have a slight tendency towards greater edge asymmetry, Abiamp ceremonial axes, unlike those from other quarries, cannot be distinguished from Abiamp work axes by any of these measures except gross size (Fig.29). Of course, like Dom ceremonial axes, the edges show no wear other than the smooth polish given to the extreme edge by years of tender handling, greasing and careful wrapping in bark-cloth and leaves. Where the edge has sustained a small chip from contact with a hard object, such as another valuable axe while being displayed, the scar remains fresh. Small chips in the edge of work axes, on the other hand, acquire considerable striation and polish on the leading edge of the scar and on the high spots. No attempt is made to grind them out unless they are very large or until multiple flaking produces a stepped edge. The reason for the apparent neglect is that the leading edge of the flake scar is usually very sharp (in contrast to gaps in the edge of a steel tool) and continues to do a reasonable job; to some extent it is protected from further shattering by the proximity of the thicker ground edge.

To summarise, axes made as valuables south of the Wahgi concentrate on size while those made as valuables north of the Wahgi emphasise a flat, wide, thin cross-section and fine curved edges. Although Dom ceremonial axes are wide in relation to their thickness, this appears to be dictated by the tabular form of the original slabs. These Maril Shales seem to have a strong cleavage plane which was exploited to split the quarried rock and all bear saw-marks where the slabs have been carefully divided. Kafetu axes are distinguished by small side 'flats', transversely curved faces and edges more curved than other central highlands work axes. They sometimes show marks of sawing. (The evidence of my No.1 is supported by three in the Bulmers' Chuave collection; S.E. Bulmer, 1964: 249). Kerowagi and Dom ceremonial axes and all Jimi Valley axes are usually thickest in the butt third while all other axes are thickest in the middle third. Kerowagi and Jimi Valley axes tend to have diverging sides and Jimi Valley axes tend to have relatively small flats at the centre of the side, increasing towards the poll. Work axes in general have minimal edge asymmetry. Ceremonial axes generally have composite bevels, many of them with a flat bevel. While it is true as Chappell has said that 'blades of different sizes and shapes were made at the same quarry, determined to some extent by the unpredicted splinterings of the stone during the roughing out process, as well as by variations in hardness and ease of splitting' (1966:113) there appear to be basic shapes peculiar to each principal area. It is believed that the rare presence in one style area of an axe of local style but imported stone, such as Ganz-Tsenga No.33 in the Kambia region and the probable Ganz-Tsenga No.42 in the Tua region, is usually due to the imposition of a local style on the occasional imported blank or to changes occurring in the course of resharpening damaged imported axes.

A Test of the Generalisations: The Lampert Collection

Since these patterns were derived from a small biased sample, it was desired to test them. Mr R. Lampert kindly allowed his collection to be used for the purpose. This is a very different sample; it is from the far west of the area and from beyond the western boundary, it includes axes recovered from excavations and few obvious ceremonial axes. Most of them are small, so that it was not possible to test all of the conclusions reached about ceremonial blades. Many, too, are not fully ground. The axe-makers of the main quarries in the recent past did not regard an axe as finished until it was ground on all surfaces but the poll. Although a few blanks were traded for short distances they could not be expected to have acquired more than the crudest aspects of the manufacturer's characteristic style. Fortunately a total of 70 axes were fully ground and not seriously weathered and these were admitted to the test. Most of them were in fact polished, including some of the more than 15 per cent which had been excavated. If the provenance of items in this collection had been better known, I would have excluded any that may have been excavated.

They were sorted on the basis of form irrespective of rock type, the opposite of the method used by Chappell (1966:111). Since the collection

included specimens from west of the study area it was thought that the minor quarries of the north-west may be represented and these were grouped with Ganz-Tsenga into a category called 'Jimi Valley-Jimi Divide'. Twenty-one axes were allocated to this group, 47 to Abiamp and two were thought to be 'Strickland area' (Nos. Tibi/9 and Dow/103MTH) because of their resemblance to axes collected by L.B. Steadman[1] at Lake Kopiago in the far western highlands and others from Lake Kopiago seen in the Australian Museum, Sydney (various numbers from E62982 to 63081).

These groupings were then compared with Chappell's identifications of the rock types, which showed three of the first group to have come from Abiamp and four of the second group to have come from Mbukl, though one of the latter was 'probably Mbukl-possibly Abiamp'. He considered one of the 'Strickland area' axes to be from the Ganz-Tsenga quarries and the other to be 'local volcanic', but the foreign origin of this pair was eventually demonstrated. In view of the nature of the sample, the fact that the chief collecting areas were roughly equidistant from both Abiamp and the Mbukl-Ganz River quarries, that some blanks were traded and finished in localities where other styles were dominant and that a few broken axes were re-made, a 10 per cent error was considered very satisfactory.

As a further test the basic cross-section dimensions of the 68 central highlands axes of this group together with 27 others from Lampert's collection which were sufficiently undamaged for their central measurements to be taken, were graphed, centre width against centre thickness. The result is shown in Fig.36. Although they encompass only half the size range of my own collection and many of the Abiamp ones cluster closely around a mode of 21 by 40 mm, they nevertheless show the same general distribution, with the Ganz-Tsenga work axes lying between those from Abiamp and the few Ganz-Tsenga and Kerowagi ceremonial axes. If Figs. 29 and 36 are placed one over the other the Lampert collection fits the lower part of the distribution pattern of my collection, the large Abiamp group filling a gap and precisely matching the original curve.

Such an artless measure as the proportions of the centre cross-section will not necessarily be effective elsewhere nor will it produce the same pattern with axes from the same area which have been excavated and date from the distant past, but it is significant that it was diagnostic for axes in use during the twentieth century in the central highlands. (The same measure used on the Kopiago group produced a distinctive curve which crossed that of the Abiamp axes, leaving ambiguity at the intercept.) But other diagnostic features were also demonstrated and the clear implication is that by using combinations of such systematic variants it should be possible to construct type models of the products of each area which, because they are based on careful quantification from large samples, may be more dependable than those intuitively perceived.

The Imported Axes

Discussions with Bureau of Mineral Resources geologists about the Kopiago collection had already suggested that many of them may have been made from glaucophanitic rocks quarried on the north side of the Schatteberg Mountains in the West Sepik District some 30 air miles (48 km) north-west of where they were collected.[2] In view of the known extent of the stone axe trade elsewhere in New Guinea, this was very reasonable; but if an axe of this type had reached the upper Wahgi Valley 160 miles (258 km) south-east along the line of the central cordillera, it was remarkable. Three of the weathered specimens also resembled the Kopiago axes in shape. Mr R.J. Ryburn of the Bureau of Mineral Resources kindly had petrographic thin-sections cut from one of these, Tibi/4, from Tibi/9 and Dow/103MTH and from six of the Kopiago specimens. His report appears as Appendix 3. He found that five of the tools were very likely to have come from the area in question and that two others were likely to have come from there. Another could have come from the same area or from elsewhere in the mountains

[1] Department of Anthropology, Arizona State University, Tempe, Arizona, U.S.A. I am grateful to him for allowing me to record his valuable collection of 16 hafted adzes and to have petrographic thin-sections cut from 6 of the blades.

[2] Their final conclusions about these sixteen blades were: certainly glaucophane schist, 4; very probably, 7; probably, 2; greenschist probably from the same area, 1; greenschist from the south Sepik mountains, 1; indeterminant metasediment, 1 (R.J. Ryburn and J.H.C. Bain pers.comm. 1970).

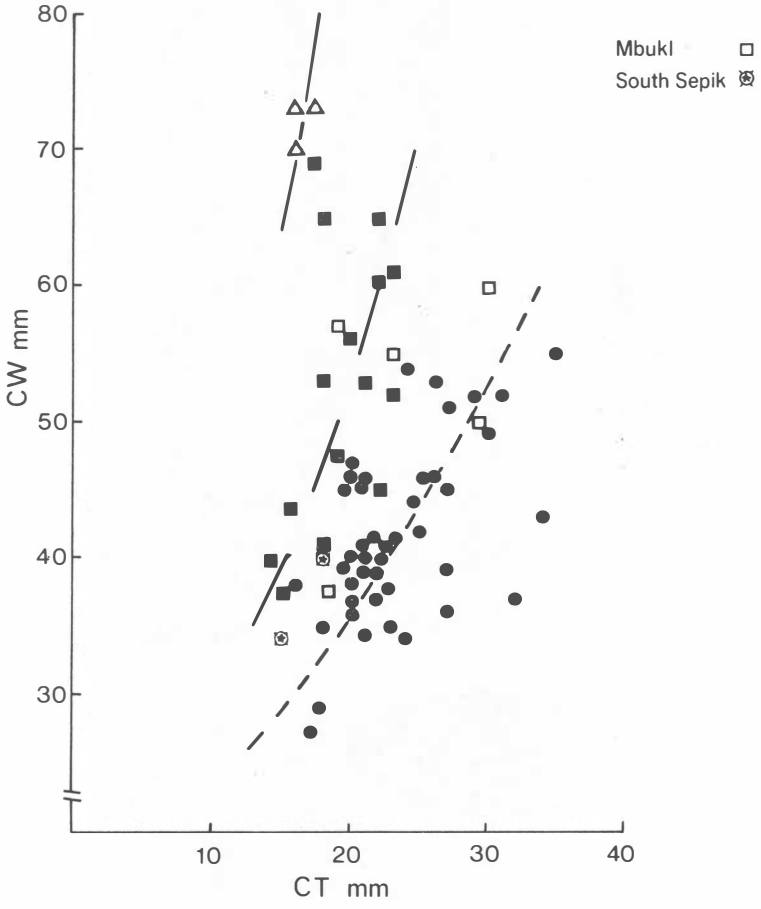


Fig.36 Lampert collection. Centre width: thickness

between the highland valleys and the Sepik River. Two of the 'highly probable' specimens were from Lampert's upper Wahgi collection, Tibi/9 and Dow/103MTH (Fig.37).

Most of Lampert's axes labelled 'Dow' were purchased from a single source at Mt Hagen and those with the suffix 'MTH' were obtained in the upper Wahgi Valley, many of them found while digging drains. If Dow/103MTH was one of those excavated, its association with the western border area of the Wahgi region should be reliable. The axes labelled 'Tibi' were purchased from the Tibi plantation in the upper Wahgi and the vendor said that most of them were excavated while digging drains. If Tibi/9 was one of those excavated its 'stratigraphy' should be good but there is a risk that it was brought in by one of the 'Tari' labourers now common in the area.

The nearest probable source of these axes is the headwaters of the Leonhard Schultze River. The rock has been named Gufug Gneiss and described as 'a spectacular suite of glaucophane bearing schist and gneiss with associated ecologite cropping out as fault wedges within the metamorphic phase of the Salumei Formation' (Dow *et al.* 1968:57).[1] No quarries have been found but the people of the Om-Strickland confluence refer to their axe suppliers as the Hapi (Hatanaka pers.comm. 1972) which is the most easterly headwater. Small outcrops also occur further east on the upper Frieda and April Rivers (see Appendix III, 3), also accessible to the intermediaries who supply axes of this type south across

[1] The most valuable axes of the Dani of the Baliem Valley, West Irian, are of similar shape and are made of similar rock obtained by trade from the north (Harrer 1964:114, 124, 140-56, Plates 18, 20, 25, 29; Verhofstad 1966), and axes from that area made from glaucophanitic rock were described earlier by de Sitter-Koomans (in Roux 1950:914-20).

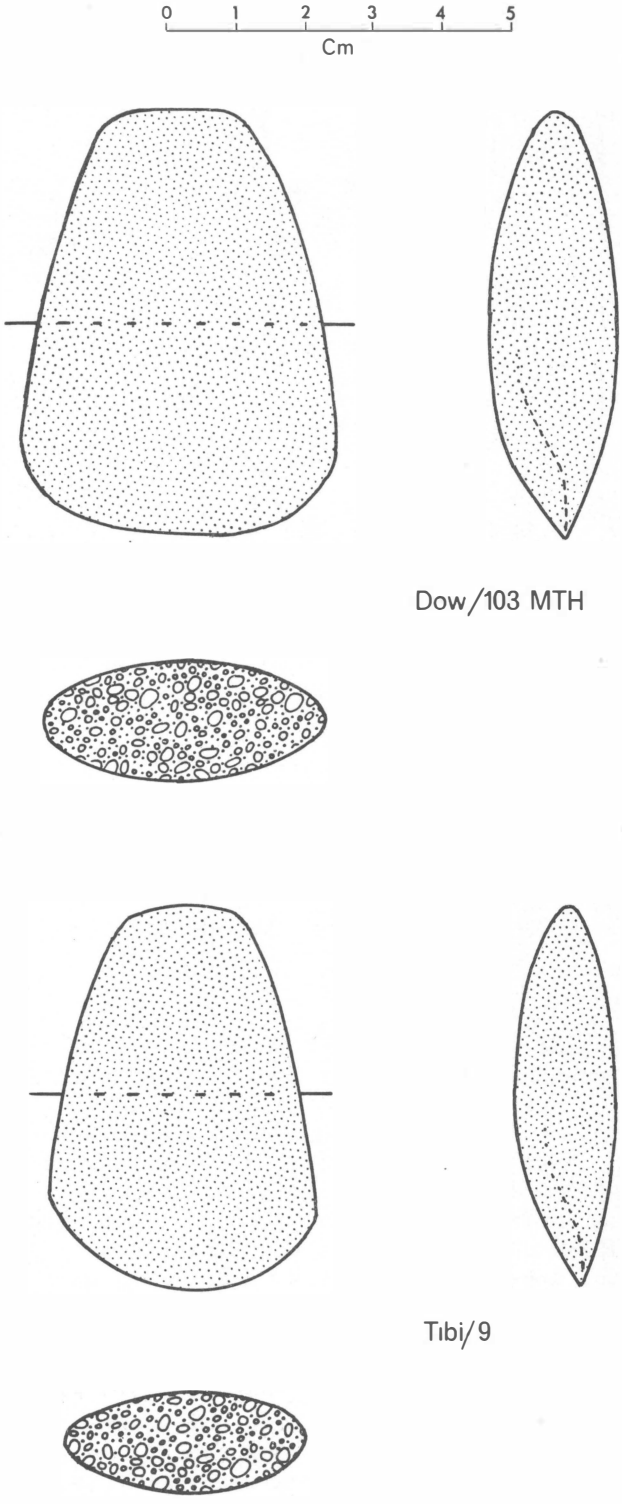


Fig.37 South Sepik axes

the Lagaip River to the Hewa (Steadman 1971:16), east across the Strickland River to the Duna (Sinclair 1966:162) and south-west to Telefomin (Australian Museum, Sydney, several, e.g. E61373). A very minor occurrence of similar material has been noted at Woropa Creek, a headwater of the Wogupmeri River (Ryburn and Bain pers.comm. 1970) and the possibility that this has been mined receives some support from lenticular axes very similar to those of the Kopiago collection collected by J.L. Taylor in the Maramuni River area in 1938 (A.M. E49100, 49101).[1] One contains prominent garnet and pyrite and possibly chalcopyrite, and looks very like the Gufug Gneiss.[2] Nevertheless central highlands axes appear to have been in the same area in 1929 (Shepherd 1971a:44; 1971b:38, 39) and a Jimi Valley axe (B1 in Table 13) was collected there recently, so it may have been at the overlapping ends of two long axe trade routes.

It seems that in the past stone axes were traded or carried by migrants to the upper Wahgi Valley from the south Sepik area at least 100 miles (160 km) away - comparable with the distance central highlands axes travelled to reach the hinterland of the north coast near Bogia and the Duna people south-east of Lake Kopiago. The pattern of probable past imports and twentieth century exports of stone tools both illustrate the larger east-west orientation of this important component of western highlands trade when compared with the central and eastern highlands.

Form and Function

In presenting his findings Chappell suggested that the data now existed for petrographic character to be correlated with formal typology (1966:117). How much of this demonstrated regularity is due to the limitations imposed by the raw material, how much to the general intended purpose of the blade, how much to distinctive local views on the optimum shape for the purpose, and how much to local aesthetic tradition? This fundamental, perennial and complex question is impossible to answer with finality from the data so far available and it deserves a major study of its own, but there is some evidence bearing on the matter.

Raw Material

The effect of the tabular form of the original raw material on Dom ceremonial axes has already been mentioned. The natural cleavage and the high value imposed by scarcity of material and arduous extraction methods combined to encourage the economising of material by laborious sawing rather than the use of much quicker hammering and flaking. The slabs were sawn with the edge of a piece of hardwood using angular sand as a cutting agent and water as a lubricant. The material may determine or contribute to both the flat faces and the divergence of the sides.

However, this shape was sometimes imposed on other stone, as shown by an axe collected from the Naregu of central Chimbu by J.P. White (A.M. E63853), which appears to be of Kerowagi stone. Kafetu axes were also sometimes sawn and they have the roundest faces of any in the central highlands. The raw material from which these were made did not look as if it had strong cleavage planes which would produce flat slabs when the boulders were broken - in 1968 there was no shortage of good boulders and Chappell earlier observed that they were 'widely distributed in the stream-bed and boulder-banks' (1966:104).

Sawing has not been reported from the other quarries and there are no saw marks on any of the axes from them, although they far outnumber the relatively small collections from Dom and Kafetu. (There are saw marks on one Kaironk axe (S. Bulmer 1964a:249) but its provenance is not known.) There are no published eyewitness descriptions of extraction and fabrication methods for the Abiamp quarry, the most important single quarry in the central highlands. It was the

[1] Reference numbers prefixed by A.M. are in the Australian Museum, Sydney.

[2] The style is identical with that illustrated and described by W.H. Townsend (1969:200) from the Wogamus River in the middle Sepik. Although he calls the material 'greenish-black diorite' the general description, illustrations and location strongly suggest that it is from the upper Leonhard Schultze River.

largest seen by Chappell (1966:102) and its quantitative importance is reflected in the dominance of Abiamp blades in the highlands and lowlands of the study area in every direction except north. Chappell was fortunate in meeting a man who still worked this hard material and who was the only impressively knowledgeable stone-worker met during his entire survey. Subquadrangular roughouts were made 'comparatively readily by knocking the edges off a rough lens rapidly and rather lightly with a blunt hammer, and sawing does not appear to have been used'. These were then ground into final shape. The methods were similar to those employed at the Jimi quarries (ibid 103). Reay-447 and Tsenga 29 (Plate 9) show that the sides were gently hammered so that the final proportions before grinding closely approached those of the finished axe.

Chappell's is also the only published description of the Tsenga site. The rock was shattered with fire and prized out with wooden levers;[1] it did not break naturally into slabs but had 'a rather unpredictable conchoidal fracture - a characteristic which may influence the final shape of the tool'. No sawing was used and rough blanks were wet ground (ibid:98). I do not understand what aspect of the final shape Chappell thought may be influenced by the 'rather unpredictable conchoidal fracture' since both thin, flat-faced, flared-sided ceremonial blades and thicker, curved-faced, straight-sided work axes were made of the same material, and elsewhere similar axes were made of different material. One flaked blank and one blank which had been rough-ground on both faces were collected near this site in 1968 (Nos. 36 and 29, Plate 9) and show that the faces were shaped by flaking and the sides and edges by hammering. The material of the first was called *gaima* though Chappell said that to some extent it resembled the *pöglabe* which he saw at the Mala Gap quarry (pers.comm. 1969). I found it beside a little-used track five minutes walk from the main Tsenga quarry and was assured it was quarried there. It has a dark grey edge and appears to have come from material adjacent to what Chappell calls 'a black, flinty phase, *Epaldi*' from which No.29 is made. I was told, however, that this dark grey rock was called *tenggru*.

Men were observed grinding the softer ceremonial blades now made for the tourist industry. There were two kinds, a relatively soft (about 3 on Mohs' scale) medium textured uniformly grey stone called *koban* (No.57) mined where it was exposed in a small creek nearby, and a slightly harder (about 4 on Mohs' scale) and stronger grey-green stone called *ilipol* mined from a small creek close to the old main quarry. Both were roughed out by flaking and hammering. The *ilipol* was said to be a little harder to shape than the *koban* and both blanks and finished axes of the former material were slightly thicker than those of the latter rock. (The same price was put on them, however.)

Chappell was told that the Maegmul site not far away was used only for ceremonial axes because the stone was not hard enough (ibid:98) but he identified a work axe in my collection (No.46, Plate 6) as being made from Maegmul stone. In shape it resembles work axes from Tsenga and the Ganz River, although unlike the rock from those quarries, the Maegmul boulders used are 'irregular to tabloid and break predictably in all directions, with a rough conchoidal fracture'. He watched three blanks being flaked to a rough lens shape with a hammer and was told that the convex faces and flat sides were produced by wet-grinding. It would be surprising if the sides were not first partially flattened by hammering.

The Ganz River quarry was first visited by white men in 1933 when the Leahy brothers and Taylor explored the Jimi Valley. Taylor noted numerous grindstones beside pools of water and small shelters where the inhabitants 'were busy making stone axes'; the visitors were thought to be in quest of good axe stone and had examples of it pointed out to them (Taylor 1933:152). Leahy saw many men 'sitting by waterholes and patiently grinding away...with sandstones, stopping every few moments to dip the stones in water and to sight with a craftsman's eye along the tapering blades' (Leahy and Crain 1937:183). Vial visited the main quarry in 1938 and 1939 and published the first detailed description of the materials and methods (1940:159, 160). Loose rocks 'up to a cubic foot in size' were pulled out of a rock face and split lengthwise on the ground with large hammer stones, the best pieces being flaked and hammered into shape in the hand with a pebble. The blanks were ground at the residential hamlets

[1] The same methods were used by the north Dani in West Irian (Harrer 1964:141-5, Plates 25, 26).

beside streams or pools of rain water. (Races were sometimes built from a creek to provide water for grinding and for sluicing top-soil at the quarry.) Each man made his own axes though some were more skilful than others. At times six or eight men worked side by side. The blade was held in both hands and rubbed back and forth on a sandstone block, being occasionally dipped in water. Smaller sandstone pieces lying nearby were thought to be used for the finishing touches.

Ceremonial axes were still being made here in the late 1950s and Attenborough has published a useful description of the methods together with excellent photographs (1960:72-5). Boulders from a stream were being used, and he describes a lengthy discussion between a group of men about the best way to break one. In the event, when an old man hurled down a heavy stone with all his strength the boulder broke in the opposite way to that predicted, to the amusement of the others. The larger portion was then flaked into a dozen pieces from which he selected the biggest and left the rest to the other men. The shape was roughed out in the hand with a pebble hammer (ibid: plate facing page 72),[1] from time to time the blade being suspended between finger and thumb and tapped with the pebble so that it rang. Attenborough thought that the pitch of the sound indicated whether it was still uncracked. They took the blanks to the main river and joined a larger group who were grinding and polishing axes on river boulders of coarse sandstone. There was no uniform method, some men filing with a small whetstone while the blade rested on the ground, others rubbing the blade on fixed boulders.[2] He thought that the fine, flared cutting edge of these axes would break if hit against a tree, and rightly predicted that in the future, now that steel had come, even softer stone would be used if the demand for ceremonial axes continued.

Chappell described two main types of stone from Ganz, a light coloured *gaima* and a more common black stone *katabögra*, neither of which would cleave readily into slabs. Both had a shallow conchoidal fracture, the former being less predictable and more inclined to splinter because it was harder and more brittle. Stone sawing was unknown (ibid:100).

The Tsenga people had told me that a rock type at Ganz called *kadjibuga* was like their dark grey *tenggru* and that one called *gaima* was the same as their own *gaima* (which appears to be what Chappell recorded as *tingri*, ibid:98). However, they added that the Ganz people had another dark stone called *tenggirip*. Near the Ganz quarry, the Menjim people said that their pale coloured stone was *gaima* and that *tengegribe* was also pale in colour. *Kadjibuga* and *ting* were said to be dark. They listed others for which I could obtain no satisfactory description but which they said had been made in small numbers by men of their area. These were *nöbili*, *wadjibe*, *konoba*, *ng'gëng* and *koro*, all dark in colour, and *mamena* which was pale, as well as a new type not made in former times called *wendama*. The first four seem to be the *ngaema*, *tinggrina*, *katepukla* and *ting* listed by M. Strathern (1965:188 as coming from near Menjim, and *nöbili* is presumably the axe listed as *nøpilye=øpin* (ibid:189). Chappell groups this with types from the Yambina quarry at the head of one of the eastern tributaries of the Muklpin (Mogulpin) River (1966:101). If so, it probably comes from the upper Øpin (Abin) River, together with the inferior *mendamo* which he says the same people have begun to exploit for tourist axes (1966:101). However, the Menjim people may themselves get it from boulders in the lower Abin River which joins the Ganz River near one of their important low altitude garden areas at Simpump (650 m MSL). (The surrounding country is one of their main hunting grounds.) They certainly have one source of stone for tourist axes up the valley of the Abin River but the informant at Simpump who mentioned it said that axes were called *djama*. This is probably the same as the *wendama* recorded at Menjim and Chappell's *mendamo*, said to be from the same river (ibid). *Mamena* seems to be named after the main tributary creek joining the Ganz River opposite Menjim. The same methods were said to be used to shape axes from all of these sources.

[1] Blackwood (1950:plates I and II) shows the same technique being used by the Kukukuku, and a similar grinding technique.

[2] Gilliard (1953:486) shows the second method being used in the middle Wahgi Valley on an Abiamp axe.

In overview, similar extraction methods were used at the main quarries, some being aided by heat. No significant differences are evident in the ease or difficulty of working stone from the Kafetu, Abiamp, Tsenga or Ganz River quarries. No differences have been noted in the techniques used to prepare blanks for work axes or ceremonial axes at the Jimi Valley quarries, nor at the Abiamp quarry, nor for most of the products of the Kafetu quarry, nor for the Dom work axes. Similar grinding and polishing methods were used at all places. We must conclude that apart from the Dom ceremonial axes, the raw material did not significantly influence the differences in final shapes peculiar to each area. Blackwood reached a similar conclusion in regard to variation in Kukukuku stone blades (1950:14-6).

General Purpose

Both the general purpose of work axe/adzes and local views of their optimum shapes are part of the very large question of their design and efficiency which cannot be discussed at length here, but enough can be said to show that the form of central highlands work axes as a group and the variations of form within it cannot be explained in terms of variation of practical function.

Two shape characteristics are dysfunctional for normal axe tasks. The planilateral sides are a disadvantage. Weight for weight, a very curved transverse face profile is best, for an axe of elliptical cross-section is stronger than a rectangular axe of the same cross-sectional area. The treatment of the butt is also disadvantageous. While grinding and polishing the edge half greatly improves performance, the same treatment of the butt hinders its retention in the haft. A few Ganz-Tsenga axes were thickened sufficiently towards the poll for the split-socket in which they were set to benefit from a dove-tail effect, but of all other axes, those that were most firm in their sockets were edge-ground only (e.g. No.56). No attempt was made to fashion aids to gripping, such as shouldered tangs, waists, face grooves or notches in the corners of the flat sides. Retention was by friction alone. Because of the corners, wooden sockets were needed to prevent the cane binding from being cut when green and cracking when dry. Small blades set as adzes were usually placed between the foot of the handle and a piece of wood or bark (Nilles 1942-5:212) and in parts of the lowlands they were wrapped in bark-cloth (Moyne and Haddon 1936:287).

Many observers, including trained ethnographers, have described the variety of uses to which highlands axes were put. There are no significant regional differences and all show axes to have been versatile multiple purpose tools. Blackwood said of the Kukukuku, 'most men possess only one adze and use it for everything' (1950:23) and S. and R. Bulmer said of the central highlands 'the axe-adze was the all-purpose tool' (1964:54). M. Strathern has contrasted the use of axes in a locality that had many with a locality that had few and suggested that the differences may have been due to relative affluence in axe blades (1969).

Within the highlands it was impossible to get a meaningful estimate of the average number of axes possessed by individual men. Early reports support the statements of the axe-makers that blanks tended to be made two or three at a time and Vial said that near the Ganz quarry men often had several in their possession (1940:159). This is also the case with modern stone axe makers. The observed distribution of axes in post-contact times showed that axes of all types decreased in number, size and quality away from quarries. Informants knew well that their better placed neighbours owned more and superior axes and that those in the opposite direction were usually worse off. Within each group, some men had more than others. Near factories, most men had more than one work axe in their possession nearly all the time. Even ceremonial blades must have existed in reasonable numbers there, for figures of from 20 to 60 Dom ceremonial axes in bride-wealth distributions cited by Vial (1940:162) suggest that most men obliged to contribute to these exchanges were able to obtain a ceremonial axe even if they did not own one. Old men were able to state the number of axe blades transferred in prestations in which they had been directly involved but I found it impossible in the time available to identify

ownership reliably. But for stone axes to be mentioned as frequently as they were in accounts of barter exchanges, they cannot have been in short supply in the main highland valleys.

There was general agreement that most men did not have more than one work blade hafted and that the few who did usually had a small one as an adze. Any other work axe blades were wrapped and stored carefully as valuable possessions. Outside the highland valleys most men said that they had only one work axe and important men said that when they were able to acquire a second it was invested in important transactions fairly soon. W.C. Clarke has pointed out that the same pattern continues with steel axes among the Maring (pers. comm. 1971) and I believe this to be so throughout the study area.

Everywhere the picture that emerged is of the day-to-day use of only one complete axe, supplemented in the highlands by the occasional use of a small adze, often borrowed. In spite of the fact that away from the factory areas the blades were costly imports and everywhere were highly valued, this does not seem to be the sole explanation, for the same pattern of ownership and use existed among the Kukukuku where every man made his own axe from local river boulders (Blackwood 1950). What little eyewitness documentation exists for stone axe use in the highlands, combined with the accounts given by informants, indicates that the subsistence use of axes was essentially the same everywhere, differing only in degree in localities where they were in short supply; practical function cannot be the explanation of the different styles.

Only the specialised non-subsistence functions of ornament, display, ceremonial giving and wealth storage led to the development of special expressive shapes. M. Strathern has suggested that this in turn may have enhanced the value of the total category 'axe' and improved or maintained the quality of finish given to work axes (1969:323). This may well be so, but it was only scarce objects that were elevated to the status of true valuables and it was the constant demand in every region for high quality stone work axes that provided a basis of production technology and continual manufacture that allowed the development of ceremonial axes in areas where work axes were plentiful.

Optimum Shapes and Aesthetics

Analytically these two factors can be separated but in practice they are closely related. In the case of ceremonial axes it is a relatively simple matter. The Jimi and Kerowagi type were used as personal ornaments (Vial 1940:162; Vicedom and Tischner 1943-8:122; M. Strathern 1969:322; A. Strathern 1971:106), and with those of the Dom quarry they also adorned group displays of wealth at prestations. The shapes that they were given reflected shared views of what was aesthetically pleasing for that purpose (how those shapes and views evolved is quite another matter). Men contemplating and discussing them described some as finer than others and pointed to the characteristics that made them so, stone quality, size, and finish being important everywhere and shape being noticeably important with the Jimi and Kerowagi ones. The use of these to strike an enemy or to cut a soft substance appears to have been the opportune use of a sharp object carried primarily for display. Their lethal effect was testified to by Leahy (Leahy and Crain 1937:183) but any stone axe would have performed that task, some, because of superior balance, much better.[1] The greater fragility of one type and the huge size of the others were not serious handicaps for their function as stored valuables. Attenborough's comment that if they continue to be made they may become even more ornamental (1960:75) draws attention to the one characteristic that mattered - a distinctive appearance that identified and advertised their symbolic role. Clearly, there was no possibility of conflict between form and prime function.

In the case of work axes, the position is not so straightforward. The disadvantages of flat sides and polished butt have already been discussed. Different forms of stone blade (as with steel ones) are in fact better suited to certain tasks. Heavy work is helped by a large blade and delicate work by a small one. Blades which are heavy, thick and have markedly curved

[1] None of them would kill as well as a stone club. The shape of these hafted axes indicates that they were not designed primarily as killing instruments.

faces in longitudinal profile are best for splitting logs (recall Gilliard's observation cited in the discussion on cross-sections) and symmetry is a help. For hollowing canoes weight is needed together with narrowness for shaping inside curves. For reducing the walls of canoes, dishes and drums and shaping shields a thin blade (in absolute, not relative, terms) is an advantage, together with considerable edge asymmetry towards one flat side. A strong edge of obtuse angle is ideal for splitting large timber but an acute angle is best for adzing. Chopping is easiest with a medium weight tool with slightly curved longitudinal and transverse face profiles, approximate edge symmetry and an edge that is a compromise between impact-resistant strength and acute sharpening angle. Axes can be (and elsewhere sometimes are) very specialised, but in the study area they were not. My own inquiries support the other observers cited; within the axe-making areas of the central highlands axe use was essentially the same and there was almost no selection of blade type for specific work.

Although the evidence is sparse and much, through a process of elimination, is negative, what information there is allows only the following conclusions: firstly, the main reason for the attributes of central highlands axes which were dysfunctional for work was to increase their value in exchange, perhaps, as M. Strathern suggested (1969:323), by giving them some of the characteristics of ceremonial axes (I would look for the antecedents of specialised ceremonial axes in fully polished and gradually elaborated work axes but the process was probably not unilinear and the feed-back was probably mutual); secondly, the main reason for the systematic variations in style between the factories of the central highlands was that each developed and maintained its own aesthetic tradition - 'this is the way we do it; this is the way our grandfathers did it'.[1] On the basis of this, one must predict that an axe factory of significant size will be found in the far western highlands, for collections of blades from such places as Tari and Porgera include a considerable number that are not from the quarries described here, yet exhibit a strong stylistic homogeneity which extends to ground and polished polls.

Only an ethnologist very familiar with a particular people and their way of life and fluent in their language could pursue the question of aesthetics and form usefully and even then would need a most careful technique to screen out rationalisations and speculations; within New Guinea the possibility exists of clarifying this vital aspect of the evolution of a neolithic culture but it must be done soon.

Trade Areas

The distribution of axes from central highlands quarries throughout the main highlands valleys themselves has been shown by Chappell (1966:110-13). This was based on the study of large collections, and while Lampert (1972:fig.4) provides better data for the upper Wahgi Valley, Chappell's data cannot be improved upon for the northern part of the Wahgi region, the Jimi Valley, and the north-western end of the Bismarck Fall. Each quarry was dominant in its own area but the trade areas of the smaller quarries lay within the trade areas of the larger ones and even within their own localities their share of the market was relatively low. Ganz-Tsenga axes had a near monopoly of the trade north-west to the Schrader Mountains and had nearly three-quarters of the market at the western end of the Bismarck Fall. Half the axes immediately outside the western boundary of the study area came from these Jimi Valley quarries. A few reached the Chimbu Valley but they rarely got as far east as the Mai Valley. Few Abiamp axes reached the eastern Schrader Range though they were better represented at the north-western end of the western Bismarck Fall. They made up half of the axes in the middle Chimbu Valley but few got to the Mai Valley. There, Kafetu axes made up half the number, most of the rest being of poorer local stone. The minor quarries of the Wahgi-Jimi Divide supplied half the local market but their trade area was small. The smaller quarries of the Chimbu area supplied only a quarter of their local needs.

[1] MP = *Em i pasin bilong mipela tasol, na pasin bilong tumbuna bilong mipela.*

My delineation of trade area is based on style as well as stone type and shows the above pattern to be extended throughout the study area, with each major trade area being arranged in sectors around the highlands, with the proviso that the sectors express dominance, not exclusiveness; overlapping occurred everywhere. Map 4 shows the pattern.

South of the area considered by Chappell, Abiamp axes predominated. The Poru region was supplied mainly from the sparsely populated west Kambia region across the middle Kaugel Valley, which in turn received some axes from around the western end of the Kubor Range but more from east Kambia. These were mainly of Abiamp make, though the western Kubors received some axes from north of the Wahgi Valley and the eastern Kubors received some from the Dom quarry. The Dom axes entered the Monogo Valley via the pass at its head and from the head of the Pima River but few reached west Kambia. The people near Kegu in west Kambia also manufactured some axes themselves.

The northern settlements of Moro, Aria and Moria dominated the axe imports to the Poru, and informants here revealed a shift in the direction of stone axe supply, a phenomenon not met with anywhere else. To the north and east of the Poru is uninhabited hunting territory as far as the Kaugel River. This stream is a formidable barrier and is not bridged below its middle reaches; the only other place where it is crossed is near its confluence with the Tua, in Daribi territory, where rafts are used. Informants of the Leri clan at Aria said that all their axes came from the north across the middle Kaugel, but that they were made near Mt Suaru (Mt Au), called Tuaro by the Wiru, a prominent volcanic cone 30 miles (48 km) to the east. A black axe and a poor quality grey one both had Kambia names, *ambamonggo* and *dabiri*, the first in the Wus Valley being pronounced only slightly differently as *ambamënggo*. The Aria men named a third axe as *kaima*, a term common to both Kambia and the area around the Dom quarry, and added, rightly, that near Mt Suaru it was called *aniano*. The people there made *ambamonggo* and *kaima*, it was said, and were thought to trade them to Kambia, from whence they came to Aria. *Dabiri*, which were not common, came from near the upper Kaugel and were small and not worthy of inclusion in such settlements as bride-wealth payments. It was true, they said, that nowadays adventurous young men going hunting had travelled as far as Mt Suaru,[1] and that once, long ago, before they moved their settlement north to its present position, one of their own women, Pomba,[2] was said to have married a Suaru man, but their stone axes did not come that way. At nearby Moria, an old man (Tomio, F = Toroma) gave the same axe names and said that when he was a young boy (about 50 years before, that is about 1920) two men from Moria had travelled as far as Suaru. In those days there were one or two families who spoke another language living at bush gardens on the near side of the Kaugel River, and although they only half understood each other, the Wiru men stayed with them. They returned with stone axes and the bush people continued to trade them. Since then the bush people had died, and all axes had come from Kegu (west Kambia).

Evidence from the Suaru side showed that the Wiru contacts had not been with the people north-west of the mountain, but with the Daribi speakers to the south of it. Here, however, I could not find a man old enough to check the tale of the earlier contact, although the post-war trade was clear enough, a few European goods, including steel, having gone to the visiting Wiru largely in return for the only huge baler shells seen outside the Poru region.

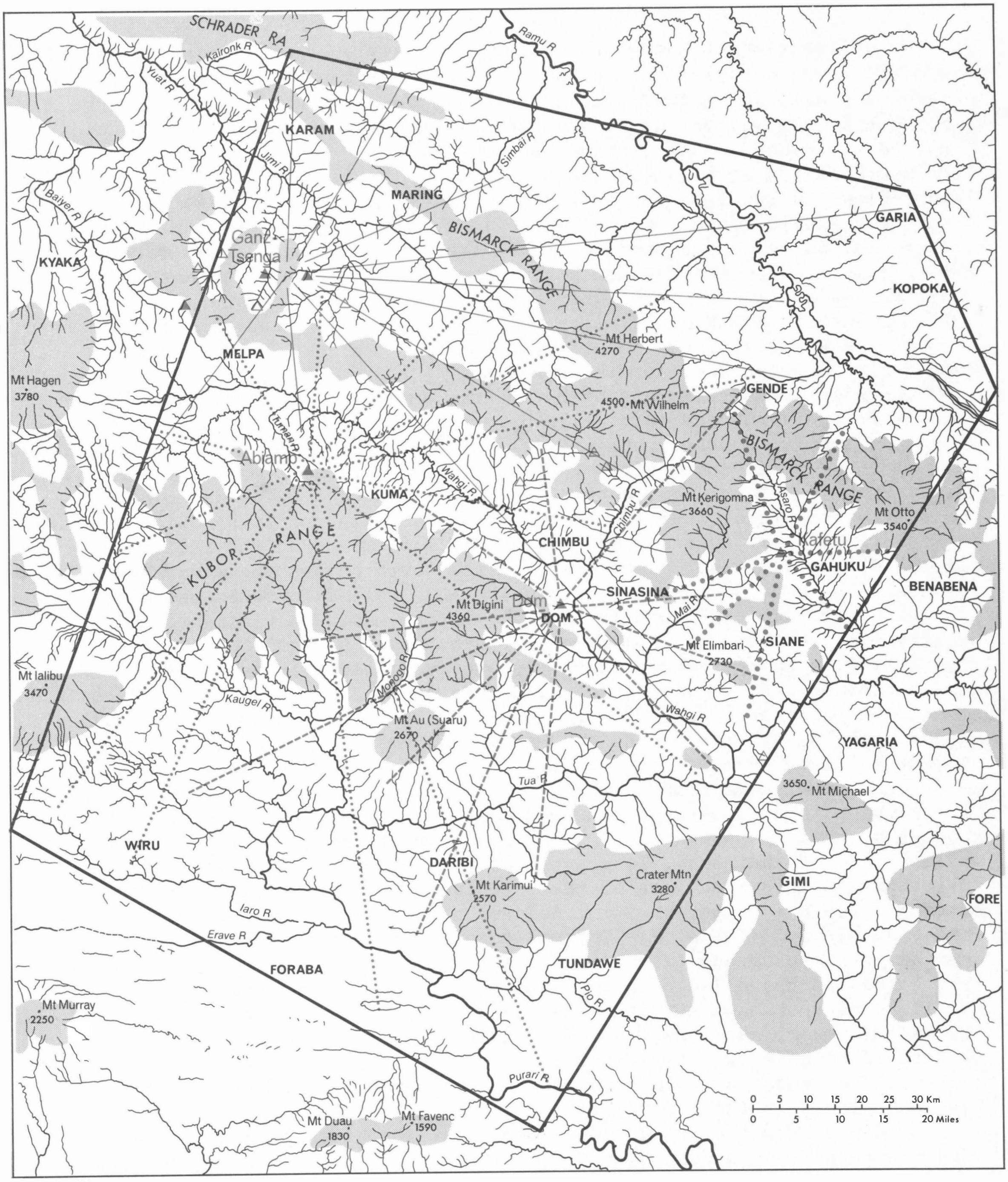
My travelling companions told me that when they walked to Suaru they had not met anyone until they reached the Kaugel River. They had been very hungry and were not keen to repeat the journey.

In 1968 some northern Daribi had bush gardens or sago stands close to the Kaugel-Tua junction[3] and an old garden clearing was seen on the north side 5 miles further down-stream, presumably also Daribi. The only other marks of human occupation were worked sago patches and cut trees along the tributary streams, indicators only of seasonal sago making and hunting. When Champion

[1] One of my companions at the time was a young Wiru man whom I had first met near Mt Suaru.

[2] Said to be the name of a Wiru tribe west of the Poru River near Mt Ialibu (I. Champion 1936:PR 99).

[3] Inferred from footprints of the archetypal New Guinea domestic unit of man, wife, child, dog and pig, seen on the northern bank of the Tua River near the Kaugel confluence.



Main quarries; known distribution within the study area

Map 4 The axe trade.

and Adamson travelled from the northern Poru area to near Mt Suaru 30 years earlier, they saw several small bush gardens belonging to Wiru speakers east of their present limits of settlement and several large Daribi gardens west of the lower Kaugel, but no permanent houses (I. Champion 1936:PR 105, 106). Evidence from ecological, genetic, and epidemiological sources as well as oral tradition and historical documents - to be discussed elsewhere - strongly suggests that the Wiru-Lower Kaugel contact was first made at about the time the Daribi moved north over the Tua, perhaps as recently as 100 years ago (Hughes 1970:275), and that the Wiru tradition of an earlier eastern trade route for axes is itself recent in prehistoric terms and an example of the shallow time-depth of many superficially ancient traditions in and around the central highlands. Post-war re-establishment of this link was aided by a reduction in warfare under European influence, for in the Suaru area pacification preceded regular government patrolling (Pegg Chuave PR 2 1954-5:21), and was inspired by the new supplies of European introduced tools and ornaments reaching the northern Tua region from the Wahgi Valley.

In the central part of the Bismarck Fall, the Gende appear to have received about equal quantities of Jimi Valley and Abiamp axes but few from the small quarries in the southern slopes of the central Bismarck Range. Jimi and Abiamp axes were traded north-east down to the Ramu and on to the Hills region. Only two axes were seen in that region, one a black Jimi axe at a Garia settlement and the unknown highlands style axe No.62 from Usino, but all said that their axe supplies had come from across the Ramu River. About 24 hafted planilateral axes, mostly of a rock type like that of the Jimi Valley quarries, were collected in the Ramu Valley and Madang hinterland between 1930 and 1932 by a missionary, A.H. Voyce, and are now in the Auckland museum (E.V.B. Crosby pers. comm. 1970). Some are of medium rectangular cross-section, others flat and thin and one or two of thicker cross-section are of mottled dark green Abiamp-type stone. Most are black or pale green and there is little doubt that they came from the Jimi Valley. The collection sites included the Ramu village of Faita and the north Madang village of Nobanob.

We know that central highlands axes went further north than that, for axe No.B2 (Table 10) was collected by Bain in the western Schrader Range and others have been collected on the lower Ramu River and towards Bogia on the coast. Moyne and K. Haddon obtained some in 1935 from mountain people of the western Schrader Range visiting the Ramu and although they were thought to be mere copies of 'Hagen' axes (Moyne and K. Haddon 1936:270-3, plate XVIII, XX; Moyne 1936:170, 171, plate 49; A.C. Haddon 1936:xxii), probably because the basis of comparison was the finest type of 'Hagen' ceremonial axe, Chappell believed that the published petrographic description showed them to be Jimi blades (1966:112). Wauchope, who helped rescue Lord Moyne's expedition, collected a number of axes of particular interest from Ramu villages below the Sogeram junction, six of which are in the Australian Museum, Sydney. Three of these are planilateral central highlands axes, E46285 being of Ganz-Tsenga stone, E46284 appearing to be either Mbukl or Abiamp stone and E46283 being probably Mbukl. At some time after they were fully polished, probably after they reached the Ramu, the first two were hammered on the sides and the corners reduced to provide a grip for the binding. The three others, E46278, 46279, and 46282, are lenticular, and their presence raises the question of whether, in this direction, the trade area of the central highlands quarries was limited by exhaustion or by competition. Were they made of river boulders because insufficient axes from the Jimi reached here or do they mark the perimeter of the trade area of an unknown quarry? The exhaustion hypothesis is not invalidated by the finding of a black Jimi-style work axe (A.M. E44721) and a black Jimi ceremonial axe (A.M. E47218) further north on the Adelbert Divide just south of Bogia, for the collection site lies on an overland route from Aiome and Atemble, and within the study area overland routes have been much more important than those open to river canoes.[1]

[1] In the middle Sepik, where canoe-borne trade appears to have been important in traditional times, it was probably oriented in the main across the Sepik Valley itself, routes tending to follow the lower reaches of tributary streams and small sections of the main river. Elsewhere in New Guinea, river canoe trade has been significant only near the sea and only for short distances.

At the south-eastern end of the Bismarck Fall the best axes were from Kafetu but most were of local river stones. Kafetu axes dominated the upper Asaro but some Abiamp and an occasional Jimi axe came over the shoulders of Mt Kerigomna from the upper Chimbu, especially over the northern shoulder where strong ties link the Inaugl tribe to their relatives in the upper Asaro.

Few Dom ceremonial axes reached the eastern limits of the Wahgi region and Abiamp axes were more important numerically than Dom axes. A few Kafetu axes were said to have crossed south of the Wahgi River here, but none were seen. Similarly, some Yari (Mopa') quarry axes were said to have been received in two settlements, but none were produced. Two pale Ganz-Tsenga blades were collected from Nomane speakers and Chappell believed that the two weathered ones from the Daribi in the southern Tua region were also from the Jimi Valley.

It is probable that planilateral axes from central highlands quarries reached their eastern limits on the western slopes of Mt Michael but the provenance of the planilateral blades in the Berndt collection described by Adam (1953) is unknown. The stated collection area is as large as 1500 mi^2 (3880 km^2) and the axes could have come from anywhere within it. Others in the same collection appear to have been coloured like Kafetu axes but the Yari (Mopa') quarry produced blades of a similar hue. It is also notable that Yari axes had a degree of flattening on the sides larger than on the Kafetu axes, as was predicted (Hughes 1971:309), for in the locality of the lower Asaro-Tua River junction the language and material culture of the central highlands reaches its most easterly distribution, and a group living in the Nomane language area in the bend of the Tua River trace their origin to near Mt Elimbari in the north via a location near the Yari River east of the Asaro River.

In all of the Tua region Abiamp axes were the most common, with Dom axes represented only north of the river and increasing in number towards the Dom language area. One Abiamp axe was collected in the heart of the Tebera region and both Foraba and Pawaian speakers said their axes came from the Daribi. In 1894 Sir William MacGregor collected a small axe at Biroe, near the site of modern Uraru in the southern corner of the study area. This is now in the Queensland Museum and is planilateral in cross-section and pale grey in colour (E.V.B. Crosby pers. comm. 1971). The south-eastern limit of the known distribution was the lower Purari River below the Subu (Aure) River junction, where a dark green planilateral Abiamp-style axe was collected in 1915 (ibid).

There are no available data on the territory to the east of this but it lies in what was probably an area of overlap of planilateral central highlands blades and lenticular eastern highlands ones. Lenticular work axes have been collected from the Toaripi of the eastern Gulf and are in the Australian museum, as well as a fine Massim ceremonial axe of Woodlark Island stone obtained by MacGregor (E7125), suggesting that the territory east of the main Purari River mouth was outside the range of central highlands axes. In the delta, however, this was not the case and although the Annual Report for 1908 said that Motu canoes brought stone axes to this area (PAR 12) the only axes from the delta seen in collections were planilateral examples from Goaribari Island at the Kikori-Omati mouth and blades of Abiamp stone collected near Kikori by S. Bowdler. Those from Goaribari were collected by Hurley and McCulloch in 1923, and are in the Australian Museum; E27734 and E27737 are good examples of medium sized Abiamp axes. The latter is astonishingly blunted and polished from use apparently as a sago pounder, though lacking the high degree of gloss that distinguishes old sago pounders.[1] The use of broken axe blades for this purpose was common in many parts (e.g. A.M. E62367) but to use a good unbroken axe is remarkable enough to cast doubt on the evidence of the working edge. A small hafted adze, E27738, from the same site (with unground sides) bears similar use marks. Jukes' observation in the Turama River estuary 80 years earlier of axes like those of the South Sea Islanders and made of 'jade' and 'flinty slate', was mentioned on p.30

Although some of these axes may have been transmitted by the small groups

[1] It may have been used for breaking the tough bark of the sago palm, a task for which specialised stone tools are used in some places (e.g. Lake Kutubu, Williams 1940:146; Townsend 1969:199, 200) although those were usually spindle-shaped, and at Lake Kutubu imported axes were too precious to risk on the hard sago bark.

inhabiting the delta hinterland, most probably arrived via the main north-south trade route of the area which links the lower Kikori River to the Samberigi Valley north of Mt Murray via an important bartering point 3 miles below the Iehi Creek-Kikori River junction. This had the characteristics of an annual proto-market many years ago and was still flourishing at the end of the second world war (Mott 1947:5). As noted earlier, 'Splendid greenstone axes' were seen near Mt Murray when Europeans first visited the area and to the east in the Kerabi Valley there were 'fine stone axes' which their owners would not sell. One from the Samberigi Valley now in the Australian Museum (E57790) is of Abiamp stone and style.

These axes came from the Kewa speakers north of the Erave just south of the Poru region but most do not appear to have been received from the Poru, for the Wiru speakers say that they had few and could not afford to trade many southwards. Most were probably channelled via the Kewa west of Mt Ialibu who may have got them from both the Kaugel and Mendi Valleys. Champion and Adamson noticed that the quality of stone axes improved as they travelled north-east across the Mendi Valley in 1936, and that north of Mt Ialibu they were very good indeed. Mendi connections seem to have supplied central highlands axes to Lake Kutubu (Williams 1940:132, 145, 146) for there have been many observations of them in the western part of the southern highlands (e.g. Waga Valley, Hides 1936:88, 104, 114; Augu Valley, I. Champion 1936:PR 69, 75; Upper Waga and Lai Valleys, Black 1938:plate 1/5; Meggitt 1956:102, 126, 131). Axes of Abiamp style and stone collected at Tari are in the Australian Museum (E59963, 59964).

They appear to reach their western limits among the Duna living near Lake Kopiago, for some small planilateral axes were among those collected there in 1967 by J.P. White (E.V.B. Crosby pers. comm. 1971). In the Western Highlands District they were the usual axe; even ceremonial axes from Kerowagi reached Wabag, one being collected by Meggitt in 1957 (A.M. E59394). More noteworthy, a lenticular axe collected by Meggitt (A.M. E58926), testified to occasional imports from west or north. A poor example of a Dom ceremonial axe appears in Brennan's collection at Wabag, labelled *Pawasa 54 9/4/69*. Pawasa is in the middle Lai Valley.

The most north-westerly examples known are Abiamp axes collected in the Paiela Valley by Brennan, and the Ganz-Tsenga axe listed here as B1 (Table 10) collected in the Maramuni Valley.

Within the study area and probably throughout the trade area of central highlands axes, small axes could be exchanged for any specialised products but large ones could be obtained only in return for other valuables - shells, live cassowaries and marsupials, the best plumes and skins, bulk supplies of salt, and for pigs. Within the highlands, the most significant single transfers of axes both quantitatively and qualitatively took place in the context of ceremonial prestation.

Does axe terminology reflect trade? How widely is an axe type known by the name given it by the maker and does the name distribution mark out a trade territory or trade routes in the way a 'registered brand' name would?
M. Strathern examined axe terminology among a group of northern Melpa who had a quarry of their own and lived close to a number of others. Their degree of knowledge was sophisticated. She found that within the dichotomy of 'black' (*pombora*) and 'white' (*kund*) axes, distinctions continued to be based on characteristics of the raw material and that these were associated with known and supposed quarries (1965). Chappell recorded the principal names used at each factory and, by grouping names of similar rock types, used them for the petrographic groups that he, as a geologist, distinguished (1966:tables 1, 3 and 4). When he compared these with informants' identifications he found more than 60 per cent correspondence both close to and far from the factories. He thought the discrepancies were due to geographical ignorance, lack of specialist knowledge (including the failure to allow for weathered surfaces), loss of knowledge since the advent of steel, and the use of shape or size as criteria (ibid:113-6). In the present study there was no time to examine the basis of indigenous taxonomy, even to the degree permitted by translation, but names for recognised axe types were collected. Those for which there was general agreement are given in summary form in Table 14; they permit a number of conclusions.

Source	Colour	Type	Chappell	Jimi Melpa	S. Wahgi Melpa	N. Jimi Karam	N. Jimi Maring	N. Jimi Narak	Up. Jimi Kandawo	Wahgi Wahgi
Kerowagi	gy-br-gr	ceremon.	kruo	–	–	–	–	–	–	–
Ganz-Tsenga	black	ceremon. work	(epaldi (katabögra	(tenggru (kadjibuga	)mitra-)gara?	)porumb)dangund	)dangunt)da nunt	porumbo	porumbo	pogumb
Abiamp	dark grey	work	wui (A)		)		nyambi		abn	
Kaf.+ Var.	grey	"	besya (K)		)abinz					
Abiamp	light grey	"	wui (A)		)					
Abiamp	green-black	"	kujn	)	kundun	)	)	)		(kudjën
"	green	"	umbamn	)kundjën)	yedime?	)kundjën)	)këndn)kundjan	)kunzën)kundjin	kunjën kundun	(kundun ambamun
Dom	light gy-gr	ceremon.	)			–	–	–	–	–
"	" "	work	)gaima	(nbs.)	(nbs.)	–	(nbs.) tengge-	–	(rare)	(nbs.)
				gaima	gaima		ringgi		gaima	gaime
Ganz-Tsenga	v. l. gr	ceremon.	(tingri	)	tenggren	)	tenggeringgi	)	porumb gëru	tenggren kru
" "	"	work	(gaima	)gaima	gaima	)marau?	gaima	)gaima	gaima	kenggeringge
Kafetu	l. bl-gy	work	gaima	–	–	–	–	–	–	–
	l.mve-gy	"	luwafo							

Source	Colour	Type	Sinasina Sinasina	S. Asaro Siane	Asaro Gafuku	Ramu Kopoka	Bismarck Gende	Chimbu Chimbu	S. Wahgi Dom
Kerowagi	gy-br-gr	ceremon.	abën telege	de gerage	–	–	pogumbo	pogumbo	pogumbo
Ganz-Tsenga	black	ceremon. work	abën bril abën	kembane kabo	? mbesi	– bese	porumbu besa	pogumbo kundun kama	pogumbo haben
Abiamp	dark grey	work	)						
Kaf.+ Var.	grey	"	)gebame	karnbe lelenggo	mbesi	bese	besa	kundun kama	kurun
Abiamp	light "	"	)			bese	besa		
Abiamp	green-black	"	) kundun						)kurun
	green		) gebame	kembame	kunduno	–	kundunu	kundun	)gebame
"		"	) kurun	kaima					gebaban
Dom	light-gy-gr	ceremon.	gaima daua	kaima daua	–	–	?	)	
"	" "	work	gaima	kaima	(nbs?) gaimi	–	gaima	)gaima	gaima
Ganz-Tsenga	v. l. gr.	ceremon.	?	–	–	–	?	pogumbo kruo	?
" "	"	work	nba	aruba	gaimi	–	kanggoi?	gaimi	gaimi?
Kafetu	l. bl-gy	work	gaima kau	kaima daua	gaimi	gaimi	gaima	(nbs)? gaima	(nbs) gaima gumba
	l. mve-gy	"	–	kaima fandena	nami ?	?	?	mainde?	–

Source	Colour	Type	E. Kambia Kambia	Poru Wiru	Tebera Foraba	Teb. Tua Tundawe	Tua Daribi	Chappell	Low. Wahgi Nomane	Low. Wahgi Elimbari
Kerowagi	gy-br-gr	ceremon.	–	–	–	–	–	kruo	bagege	abiri
Ganz-Tsenga	black	ceremon.	pogumbo	)	aiabe[1]	–	–	(epaldi)	aberi	abiri
	"	work	ambamënggo	)ambamonggo				(katabögra)		abën
Abiamp	dark grey	work	abënz	)	)	obweni	abidi	wui (A)	)abarun	)
Kaf.+Var.	grey	"		)dabiri	)apindi			besya (K)	) fasa	) kabarema
Abiamp	light grey	"		)dabindi	)			wui (A)	)	)
Abiamp	green-black	"	ambamënggo	)	)			kujn	)	)
				)ambamonggo	)keba	obuduri	keba		)gebame	)gebame
"	green	"	nambamun	)	)				)	)
Dom	light gy-gr	ceremon.	–	–	–	–	–	)	)	)
"		work	gaime	kaima	–	poiene	(aniano	)gaima	)gaima	)gaima
							(hanoiano			
Ganz-Tsenga	v. l. gr	ceremon..	pogumbru	?	–	(nbs?)	–	tingri	–	–
" "	"	work	gabënts	kaima	haniano	poiene?	(aniano	gaima	gaima	gaima aruba
							(hanoiano			
Kafetu	l. bl-gy	work	–	–	–	–	–	gaima	gaima	gaima kaua
	l. mve-gy	"						luwafo	–	?

1 This was the prehistoric axe No. 50 found at Lake Tebera. Without it, this name would not have been put forward.
(nbs.): Not before seen. Name elicited by the sight of a specimen produced by me.

Table 14 Terms for axe/adze blades

The number of names offered decreased noticeably away from the factories. Rock types were gradually grouped together without discrimination and the association of type with supposed quarry was replaced by an association with direction of supply. Nevertheless, most men thought the factories were closer than they were. When finer discrimination was wanted, adjectives were used instead of specific names. In the central and south-eastern Wahgi region one term was based on style instead of rock type, the same term being applied to ceremonial axes from both the Jimi and Kerowagi quarries, a fact significant for my own conclusions about the importance and perception of style.

For example, the makers' terms for black axes from Ganz and Tsenga did not survive in any form outside the territory of the northern Melpa but were replaced by cognates of the general term for black axes, *pombora*, and sometimes by local specific terms. To the north of these quarries I got both *porumb* and *dangund* from Karam speakers but only *da nunt* from Simbai Valley Maring and *dangunt* from Jimi Valley Maring. East of them, Narak speakers offered *porumb* and *porumbo* which became *porumbu* among the Gende of the Bismarck Fall. Here the term crossed the boundary of a Family and followed the route by which the Gende got most of their black axes. They received few of these from the Chimbu, for whom the term had become *pogumbo* and was reserved for black ceremonial axes from the Jimi and green-brown ones from Kerowagi. Again the Gende reflected the direction from which they were supplied by distinguishing Kerowagi ceremonial axes as *pogumbo*. A man at Kurumul in the middle Wahgi Valley to whom I showed a Kerowagi ceremonial axe said he had not seen one before but immediately applied the term he used for black ceremonial axes from the Jimi, *pogumbe*. Unfortunately, not until the last weeks of the field season did I acquire a Jimi ceremonial axe of pale stone, for it would have been useful to see if this was placed in the same primary taxon by the Wahgi region people or named for its stone type.

In Chimbu all dark coloured work axes were called *kundun*, after Abiamp products, black ones being distinguished if necessary by the adjective *kama*, whereas the middle Wahgi people had *abëns* as a special name for the dark grey work axes from the direction of Abiamp. Black ceremonial axes were also called *pogumbo* near the Dom quarry and black work axes were called *habën*. Two separate Sinasina groups lumped all black axes under the name *abën kama*, adding *bril* and *keruab* for the best thin ceremonial ones. East of the Mai River *abën kama* became simply *aben*, then *aberi*. In the Tua region to the south black axes were *abidi*. Siane offered *kembane*, a cognate of a term applied in the south to dark green Abiamp axes. The Gahuku term *mbesi* was not offered here but forms of it, *embese* and *bese*, were the norm in the valleys of the eastern Bismarck Fall where they included edge-ground axes of local river boulders. The Gende too, used *besa* for all dark grey and black work axes. In the Poru region, as already discussed, black axes were called *ambamonggo*, derived from the *ambamënggo* of central Kambia.

In contrast to the generic terms for 'stone axe' which changed with language boundaries, patterns similar to that outlined above were shared by the main terms for axe types from all the major highlands quarries, reflecting trade routes rather than common antecedents of language.

The overall view of the study area and of the whole trade area of central highlands axes does show, however, two correlations with linguistic boundaries. All the known planilateral axes of inland New Guinea, possibly all the planilateral axes of New Guinea of the 'ethnographic present', were made at these central highland factories by people speaking languages of the Central Family as defined by Wurm (1964). With their small flat sides, Kafetu axes are intermediate in form between the lenticular axes of the eastern highlands and the markedly flat-sided planilateral axes from the other quarries. Planilateral axes penetrated very little the area of Kafetu dominance in the Asaro Valley. The east-west limits of the trade in planilateral axes coincides remarkably well with the limits of settlement of people speaking languages of the Central and West Central Families.

The north-south limits of the central highlands axe trade, however, bear no relationship to language boundaries, cultural peculiarities or physical barriers and provide further evidence that, whatever the obstacles, the most vigorous trade developed between regions with the greatest differences in resources.

VII SEA SHELLS

INTRODUCTION

Shells were the trade goods which most frequently performed some of the functions of money, even though scales of value varied in place and time and shells highly valued in some parts were almost worthless in others. Shells shared their role as valuable ornaments with brightly coloured feathers, especially bird of paradise skins and plumes, and they shared their role as durable valuables with axe blades. The importance of large shells in ceremonial display and exchange is a commonplace of anthropological and popular writing but in addition the circulation of a variety of shells of different size and value facilitated the barter of other objects. The smaller common shells and small pieces of the rarer shells were widely used as divisible small denominations of currency.

The importance of shells in helping to trace the history of New Guinea societies was mentioned in Chapter I. The shells of fresh water and land molluscs as well as the shells of marine animals have been found in inland archaeological sites (S.E. Bulmer 1966a; White 1967; M-J. Mountain pers.comm. 1973) and outlying highland peoples, like the Karam, continued to obtain fresh water mussel shells for use as vegetable scrapers from the lower riverlands after the war (R.N.H. Bulmer pers.comm. 1971). However, marine shells for ornaments, not implements, dominated the twentieth century shell trade.

Of the great variety of shells available on the coast, only a few were used, and the selection process would be a study in itself. Table 15 lists those shells in regular use within the study area in the period just before white contact and before Europeans themselves began to use shells in payment for goods and services. Only seven types, based on seven genera, were common, the rest being either of very restricted distribution or very rare. Taking the area as a whole, the most numerous shells were the money and ring cowries and dog whelks; the most valuable were the large pearl oyster, large volutes (the baler shell), the large white egg cowrie and, in the north-west corner of the study area only, the giant green turban shell (the commercial green snail). The terms in use for these at the time of field-work are set out in Table 16. While there are some 17 or 18 different terms for the small cowries and for the dog whelks, there are only nine for pearl shell and eight for baler shell. Only part of the difference is explained by the more limited distribution of the pearl and baler shells - the rest is due to the length of time that a shell type has been present in a particular area, for new arrivals tend to be called by the term used in the locality from which they have been received while established shells acquire their own names.

The patterns of distribution and directions of flow of various shell types in the period immediately before white contact and before Europeans began to use shells for payments are shown in Maps 5, 6 and 7. Some types were relatively constant over space and time and others showed marked changes - a very ancient characteristic of the inland shell trade, to judge by the little archaeological evidence available, reviewed briefly below.

When the observations about shell ornaments recorded by the pioneer travellers came to be read (most of which are given in Chapter III), they were found to support informants' statements very well and the collected information about types of shell ornaments, quantities, relative values and directions of movements for the period around 1930 is highly dependable. The rapid changes occurring after 1933 when whites began to use shells are well known and most of them are not discussed here. Statements about the situation some 25 years earlier when the informants were children and their fathers were mature men are believed to be reliable in regard to shell types and shell quality and in regard to quantities in a general and relative sense. Descriptions of the situation a generation earlier, around 1880, just before the beginning of colonial administration on the coast, are vague, particularly in regard to time, not because the hearsay statements of the experience of fathers and grandfathers were untrue but because they were generalised and, as with memories of migrations and great events, the time scale for that period tended

	Zoological name	Commercial or popular name	M. Pidgin	P. Motu	Where commonly worn	Fabrication	Distribution
1	*Cypraea moneta* L. *C. annulus* L.	money cowrie ring cowrie (gold ringer)	girigiri	keukeu?	necklace, bandeau, baldric, belt, apron, bracelet, ears	Dorsum removed by heat and pressure with stick, ventral or lateral surface featured, sewn to bark or string	All regions
2	*Nassa* sp. or spp.	dog whelk	tambu	?	as above, also chest orn. rosette on nasal alae short string over nose	Dorsum removed as above, ventral surface featured, sewn to bark or string	All regions
3	*Pinctada maxima* Jameson	goldlip pearl oyster	kina				
(a)	large crescent (two types)	(mother-of-pearl shell)	kina golip hap kina	mairi	breast, neck, back, forehead septum, chin	sawn, ground polished and drilled	Not in Hills, Ramu Bismarck Fall, Asaro
(b)	thin crescent						
(c)	pieces			lara?	as for 1 and 2, common on apron in highlands		
4	*Melo aethiopicus* L. *Melo amphora* Lightfoot	baler	gam	koko			Only in Poru, Tebera. west Wahgi
(a)	whole, outer whorl				breast	as above, possibly broken then filed	
(b)	large sub-triangular piece				breast		
(c)	oval, round, sub-rectangular piece				forehead, breast		
(d)	small sub-tri. pce				pendant		
5	*Turbo marmoratus* L.	green snail	talibum	kuararigi?			Tebera, rare in Tua Kambia
(a)	outer whorl		talbun		breast	as above, sometimes broken then filed	
(b)	large curved pce.		(coastal: spun)		breast, temple, pendant		
(c)	small amorphous pces.				as for 3 (c)		
6	*Conus leopardus* Rőd.	leopard cone	?	bou?			Not in Poru, rare in Tebera, Tua, Kambia
	C. litteratus L. *C. betulinus* L.	lettered cone betulinus cone					
(a)	outer whorl		?	toea	bracelet	as above, also broken and filed	
(b)	spire, disc				forehead, pendant		
	" slotted				septum, ear		
	" annulus				forehead, necklace, ear		
7	*Ovula ovum* L.	egg cowrie	(eastern h'lands)	dunala?			Only in Bismarck Fall, Asaro
(a)	whole	white cowrie	gam, guma				
(b)	labia	(not a true cowrie)			necklace, pendant, ear	drilled, sawn, bound with black fibre, bound to bamboo	
(c)	small pieces				nose tip, alae	sawn, drilled	
8	*Oliva* sp. or spp.	olive shells			bandeau, necklace	drilled or filed	as above and s-e Wahgi
9	*Cypraea tigris* L.	tiger cowrie			necklace, pendant, ear	drilled or filed	as above, w. Wahgi. rare
10	Rare Items						
10	*Cypraea caputserpentis* L.						Not in Tua, Poru, Tebera
11	*Cypraea arabica* L. Other *Cypraeacea*						

Table 15 Shell ornaments in the study area, c.1930

Area: Lang./Dial.:	Jimi Melpa	South Wahgi Melpa	North Jimi Karam	North Jimi Maring	North Jimi Narak	Upper Jimi Kandawo	South Jimi Wahgi	Central Kambia Kambia	East Kambia Kambia
C. moneta *C. annulus*	kogolmong	kogomong	fare	mengge and mechenuai	tun	uru, milma	tun	kogoa	tun, kirir
Headband	kogolmong gabam	?	?	?	?	milma mambarene	?	kogoa wagup	tun wagup
Nassa	nun	non	kinong (large) kumbung (small)	ambabo	non	non	non	maiga, nun	non
Headband	?	non garam	?	nggon wak	?	?	non wagip?	nun wagup	non wagup
P. maxima	kin	kine	anggon	anggane	kina	kina	kin	kin, tumol	kine
Melo spp.	duma, dumu	dumo (for head) raim (for breast)	mendimai, kolumchenk	mendima	maindima	maindime	maindimu	duma (head) tame (breast)	maindimu
T. marmoratus	kedye	kedye	kumbab, kumbaf	dedya	gela	gela	gele	kaita, gele	gale
Conus spp. bracelet	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown
" disc	poge	pogi	urur	urur	pagai	(wiseru, (kor pogai	pagai	pogia	uru, wisiru
" annulus	?	dindonggo	?	kemeng?	dindongg	dindonggo	dindonggo	dingdongg	dindongg
O. ovum	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown
" " *labia*	"	"	"	"	"	"	"	"	"
Oliva spp.	"	"	"	"	"	"	"	"	"
C. tigris	manzimam	manzimam	?	?	?	unknown	manzima	manzimam	unknown

Area: Lang./Dial.:	Asaro Gafuku	Bismarck Fall Biyom?	Ramu Kopoka?	Hills Garia	Ramu Usino	Bismarck Fall Gende	Wahgi Chimbu	Wahgi Dom
C. moneta) *C. annulus*)	kere	sanggi	sanggi	podidi	bodidi	aranggaisa	urumonggo	mari
Headband	?	?	?	?	bodidi dala	kogo pugande?	uru mamburo	?
Nassa	itiri	miruhu	mafua'i	sanamuli	muribu	kogisa	nin	nin
Headband	?	?	?	?	muribu kutakuta	kogo pugande	nin mamburo " diŋglbi	nin kamane
P. maxima	urugise	kunu	feregaria	kina	pleregarai	ongga	onggan, ogan	on
Melo spp.	unknown	not known	unknown	kuapioko	oga	maindimbu	maindime	maindibe
T. marmoratus	aten	som	asa	suli	gasa	gara	dendine	dedĕna, dela
Conus bracelet	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown
" disc	mele mele	mele mele	?	pau	pau	komru	pogai	pogai, wipa
" annulus	?	so	?	memele	pau	dendenggu	dindonggo	?
O. Ovum	nombaiye	kunbo	unupo	ogumo	gwate	bogu	bom	bom (new)
" " labia	?	?	?	mese	kobu kale	bogu gunggunaua	unknown	unknown
Oliva spp.	itehe	itiki	?	amagus?	amagus	?	unknown	unknown
C. tigris	?	?	?	?	?	mandimam	mandimam	unknown

Area: Lang./Dial.:	Poru Wiru	Tebera Foraba	Tebera-Tua Tundawe	Tua Dariba	Lower Wahgi Nomane	Lower Wahgi Elimbari	Sinasina Sinasina	South Asaro Siane
C. moneta) *C. annulus*)	tonggo	birigi	whę	kuizigi	wamelu, wimar, uno	wiwamil, uri, uwamul	mari	keraru, kedaru
Headband	tanggeli	birigi hariga	?	kuizigi torai	?	?	?	?
Nassa	ponopo	laro	se'ni	wiyani	nin	nin	nin	nombeiya foro, fobaiya
Headband	ponopo yurok	unknown	?	?	?	?	?	?
P. maxima	maiyo[1]	ke	whi	ge	ane, on	ogan	ogan	okani
Melo spp.	dume (round)	kunama (round)	unknown (round)	same (round) (new)	maindibe (new)	maindumun (new)	maidibe (new)	maindebu (new)
	tam (large)	same (narrow)	kami (narrow)	same (narrow)	maindima			
T. marmoratus	paga, faga (new)	faipage (new)	pagai (new)	pagai	dirala, dera	dene, derena	dena	katan
Conus bracelet	unknown	sigere	neme' ha'	kagame	unknown	unknown	unknown	unknown
" disc	kipoi (new)	?	tabara (new)?	tariba, po (new)	wipa, morma	wipa	wipa	wiva
" annulus	unknown	kau	tani	dani	?	?	?	?
O. ovum	unknown	unknown	unknown	unknown	bom, bomerum	bom	bom (new)	kurana, bom
" " labia	"	robu (new)	mom rai (new)	guniparigubi (new)	unknown	tegere, segere	unknown	unknown
Oliva spp.	"	unknown	unknown	unknown	"	"	"	?
C. tigris	"	"	"	"	"	sugu?	sugame?	?

1 A. Strathern gives *mande* (1969), Note 6).

Table 16 Terms for shells and shell ornaments

to be telescoped together. However, general statements about the dearth of shell and the importance of ornaments of other material during the last few years of the nineteenth century received strong support from men who themselves remembered the diminishing importance of other valuables and the growing importance of shell valuables during the course of their own childhood and young adulthood in the early part of the present century. Rappaport has gone so far as to say that during the period 1890 to 1920 shells were introduced to the north-west corner of the study area for the first time (1967[1968]:56).

All shells entering the study area in the period being considered here came in a finished state, shaped and mounted on fibre rope or bark, and when unworked shell was introduced by Europeans, men had to be shown how to cut, clean and polish it. For as long as men can remember, individual shell types entered the study area consistently from the same directions - whatever minor changes may have occurred on the coast, no change in the source of supply occurred around the periphery of the study area for the past 75 years or so. No shells appear to have come from the Huon Gulf in the east although some shells from the north and south coasts are thought to have travelled much further; in general, the supply routes from Astrolabe Bay and the Gulf of Papua were the shortest.

The Situation c. 1930: Ubiquitous Shells

The only shell types common to every region at this time were the small, very similar, money cowries and ring cowries, *Cypraea moneta* L. and *C. annulus* L., and the dog whelk, *Nassarius* sp. or spp.[1] One authority, D.F. McMichael, has said that the most widely used of these two cowrie species at the time of European contact was the money cowrie (cited by White 1967:213). The ring cowrie seems to have been well represented in necklaces and headbands in the north-eastern half of the study area, which was supplied from the north coast; whether they were also present in the south-western half is not known.

As Map 5 shows, these shells entered the north-east of the study area from the general direction of Astrolabe Bay. The Hills and Ramu regions tended to receive more cowries from the eastern or Rai Coast side of Astrolabe Bay and more of the dog whelks from north of Madang, a pattern of supply which fits the distribution of the known habitats of these animals, the former living in a sandy reef environment and the latter living in brackish lagoons.

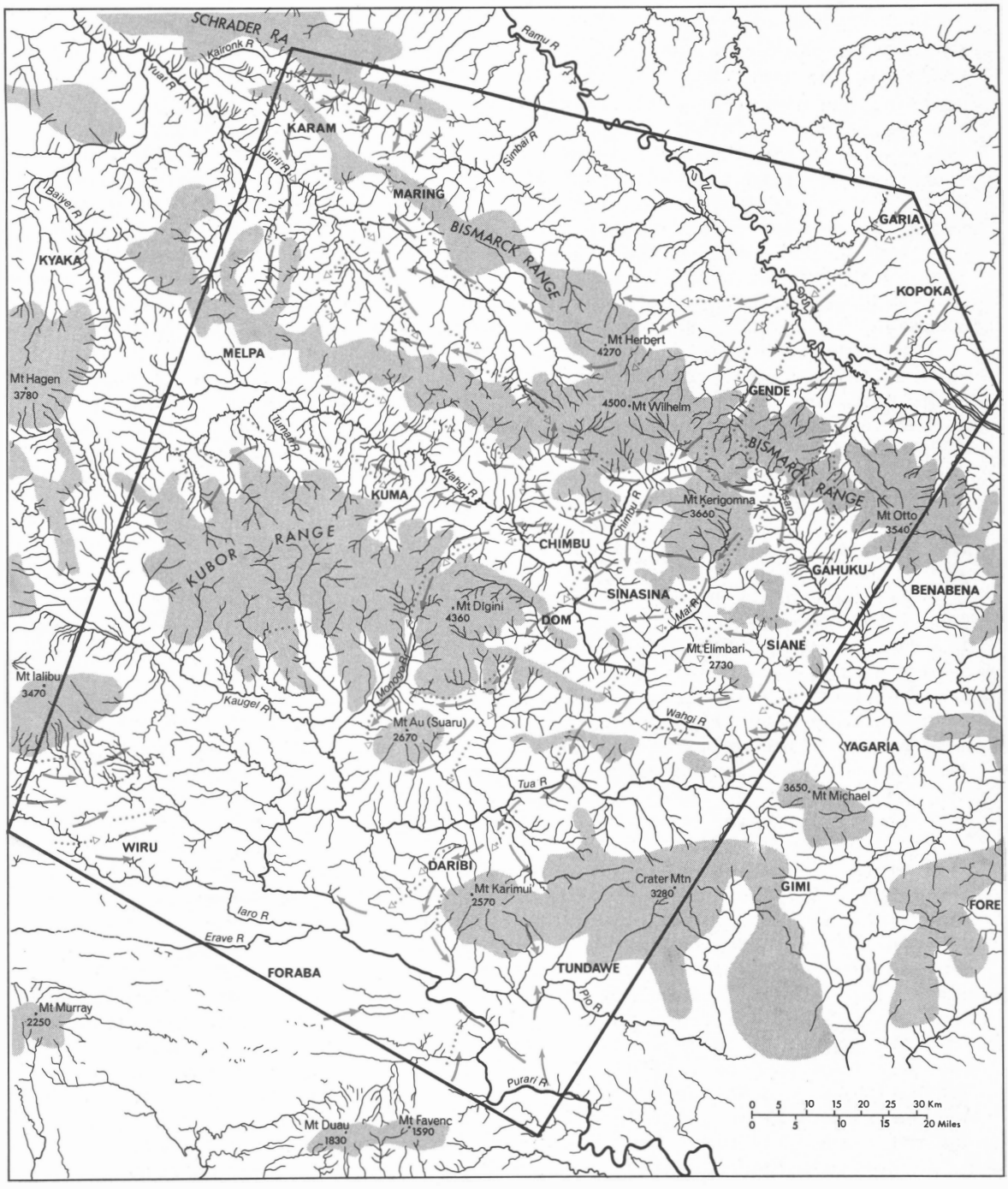
In the north-west corner of the study area people said that they had got cowries from the direction of the Ramu (they are thought to have come there across the north-western continuation of the Hills region) and that although some dog whelks came from the same direction,[2] most came from the north-west, from the people of the Schrader Range and Yuat Valley, they presumably having received them from the hills and lowlands south of the lower Sepik River.[3] The Murik Lakes near the Sepik mouth are thought to have been a rich source of dog whelks and it is possible that some of those entering the study area from the north-east may first have been traded from the direction of the Ramu and Sepik deltas. The estuarine parts of the long lagoon from Madang Harbour to Sek Harbour may also have been an important source.

The eastern orientation of the main cowrie supply is supported further by the pattern of overlap of the competing trade spheres where they met in the Jimi, Wahgi and Kambia regions. Dog whelks coming from the north-east did not travel as far as did cowries, the latter continuing west and north-west to overlap the supplies of dog whelks coming from that direction. Cowries from there did not penetrate far at all. Both sorts of shell from the north-east continued into the Tua region after the first contact between the southward moving highlanders and the northward moving Daribi some four generations ago, and in the southern Tua they supplanted small supplies of these shells which had formerly come from the south. The people of the Tebera region said that

1 Salisbury (1970:24) gives the east New Britain form, used by the Tolai, as *Nassa callosa*.

2 Cowries and dog whelks were used by the R.C. Mission at Atemble after 1934 (Br David, Kondiu, pers.comm. 1968).

3 Rappaport received the impression that all shells, apparently always, came to the middle Simbai Valley from the south (1967[1968]:105).



Cypraea moneta and C. annulus ——→

Nassarius sp. or spp. ·····▷

Map 5 The shell trade: cowries and dog-whelks

the flow from the south ceased before the war. After European occupation of the highlands, supplies from the Wahgi and Asaro regions increased enormously, reaching a peak in the decade after the war, some shells moving as far as the Tebera region.

By 1930, cowries and dog whelks had reached only the eastern valley of the Kambia region. The sparsely settled central valleys were very poorly supplied with shells, and although a few dog whelks were reaching them from relatives and trade friends to the west, there is some doubt as to whether cowries got there ahead of the Leahy brothers and Taylor in 1934. Informants in most Poru settlements said that they had got a few cowries and occasional dog whelks from the Kewa speakers to their west and south-west before they heard of the first white men passing near Mt Ialibu but those living in the northern part of the region said that dog whelks had come later. In contrast to the valuable pearl shell, which in this region and in the Tebera and southern Tua regions was said to have been of great antiquity, all Wiru speakers said positively that cowries and dog whelks had first arrived during the lifetime of men alive today. It suggests that in spite of the traffic over the southern trade routes, notably in pearl shell, the dog whelks coming to this region, together with many of the cowries, may have reached the Kewa from the north and north-west.

Informants in the southern tributary valleys of the upper Wahgi said that dog whelks had come from the north-west and north but for cowries they had depended on the Wahgi Valley people to the east. However, at the head of the Kaip Valley there was a recollection of a few cowries that came at an earlier time over the pass from the Nebilyer Valley, and Vicedom and Tischner (1943-8:104) believed that cowries first reached the upper Wahgi from the direction of the Sepik towards the end of the nineteenth century. Dog whelks were said to have entered the Jimi Valley before cowries but everywhere else in the highlands cowries were described as antedating every other shell.

The valuable shell headbands worn in the Wahgi, Jimi and Poru region in 1933 were much poorer affairs than those appearing in post-war photographs (e.g. Plate 16). In the Chimbu area they bore from one to three rows of cowrie shells and in the western Wahgi region they rarely carried more than three or four rows of small dog whelks. (Since contact, the dog whelk bandeau fashion has spread throughout the highlands regions and to the Bismarck Fall and Tua, following trade in the ornaments themselves; even small modern ones measuring less than 10 cm by 50 cm have about 1000 shells and the largest 'breastplate' type, which became popular in the north-west of the area, has 2000 or more.) Everywhere informants said that formerly the pale grey seeds of *Coix lachryma-jobi* were used in headbands (and of course for necklaces and baldrics) and within the study area the substitution appears to have been introduced in the western Wahgi region beginning there no more than 25 years before contact. The custom may have antecedents many miles to the north-west, for similar ornaments have been collected in the Sepik area (e.g. Australian Museum E55433 and others).

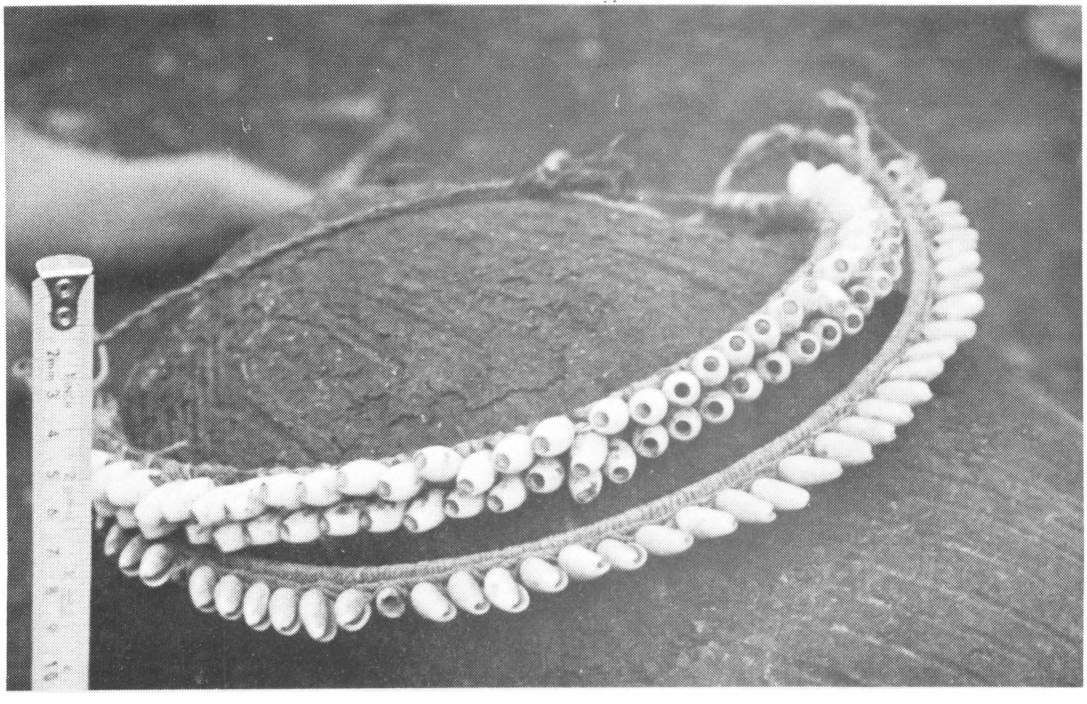
Supplies of both of these common shell types from the north coast greatly exceeded those from the south and in the case of cowries, this in part reflects the natural distribution of the species, the nearest southern reefs being at the entrance to Torres Strait and at Yule Island with minor reefs near Cape Possession and the mouth of the Lakekamu River. In the south-west small cowries were usually mounted so that the lateral surface was displayed whereas the people of the north-east usually featured the ventral surface. Tracing the origin of the shells that entered the area from the south requires a more extensive study, made doubly interesting by the probability that two very distant sources were responsible, one in the south-east dependent on long distance canoe trade and one in the south-west dependent on a series of short canoe links (Landtman 1927:214) and possible overland routes across the middle reaches of the Turama, Bamu and Aramia Rivers.

Exchange rates quoted for 'ropes' of small cowries and dog whelks were typical of the general increase in shell value that accrued with distance from the coast. In 1930, a pig given to the Gende of the Bismarck Fall by the people of the upper Chimbu Valley fetched a length of shell-covered rope as long as the pig itself but near the Wahgi River such a pig would be exchanged for a handspan of rope bearing perhaps no more than six cowrie shells. Near the Dom axe quarry

Plate 16

A *ponopo yurok* headband of *Nassa* shells and a *tam* breast plate of *Melo aethiopicus*; a small piece of pearl shell, *Pinctada maxima*, is half concealed and a small piece of green snail, *Turbo marmoratus*, hangs by the right temple. Poru region

Plate 17 *Hiki* headbands ancient and modern; *Oliva ?carneola* and '?' plastic. Tanya Valley, south-east Bismarck Fall region



good axe blades would change hands at this time for as little as three or four shells while 5 miles away the length of the shell rope would have to match the length of the axe blade. These gradations of value were typical of the pattern throughout the entire area, depending in a very straightforward fashion on relative supply and demand.

Valuable Shells of Limited Distribution

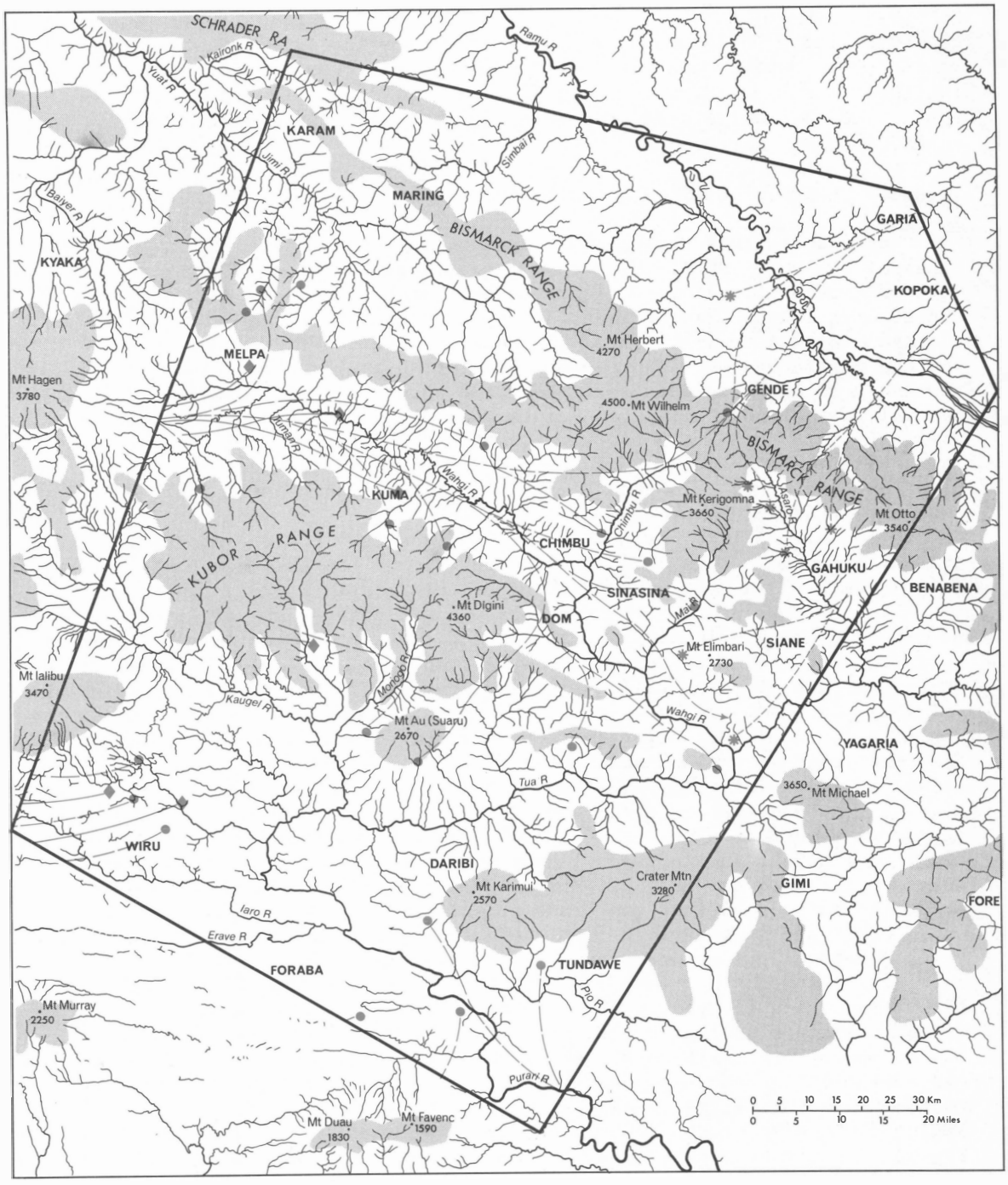
Map 6 shows that the valuable shells, the pearl oyster (*Pinctada maxima* Jameson) the baler shell (*Melo* spp.) and the large white egg cowrie (*Ovula ovum* L.) were of a much more limited distribution than the small shells discussed above. The observations of Taylor and Leahy concerning the change from egg cowrie in the Asaro region to pearl shell in the Wahgi region were cited earlier. Although the egg cowrie was used in personal decoration by the Kiwai (Landtman 1933:41, 87) and was well known in eastern Papua, none appear to have been traded into the central part of Australian New Guinea from the south coast until after the war. Similarly, although small septum ornaments carved from pearl shell[1] and ovals of baler shell were used along the north-east coast, none were traded from there into the study area. In general, it was only common coastal shell ornaments that were traded inland, and the most frequently traded were the least valuable to the vendor. All groups had neighbours whom they could comfortably regard as unsophisticated in regard to some valuables, and the attitude that 'hillbillies knew no better' was explicitly stated by informants in every region.

The egg cowries from the north-east coast formed part of important ornaments there and in many parts of the Finisterre Range (see, e.g. Finsch 1893: Taf.XVII) but they were common and were traded inland in considerable numbers. On the eastern Bismarck Fall and in the Asaro region they were the chief shell valuable and were used to a smaller extent at the extreme eastern end of the Wahgi region near the Asaro River. The routes by which these shells travelled from the Gende show that their absence from the lower Chimbu Valley, central Chimbu and Sinasina was a matter of choice rather than availability and that such selection decisions continued to be made over a period of time. Some egg cowries went from the Gende to the people of the upper Chimbu, especially the Inaugl tribe, and instead of continuing south (where a strong demand for other shells existed) they were traded south-east over the northern shoulder of Mt Kerigomna to relatives and trade friends in the upper Asaro. Similarly, while other shells travelled from there south-west into the head of the Mai Valley, most of the egg cowries that reached the middle Mai Valley and north side of the lower Wahgi came via the middle Asaro and the Siane people.

In addition to wearing these shells whole, the Gende used the labia as septum ornaments and set broken pieces on the tip of the nose, fashions which do not appear to have been shared by the Gafuku and Siane. After the war the egg cowrie labia became popular in the southern and eastern part of the Tua region around Mt Karimui, reaching there, it is believed, from the Gimi people living south-west of Mt Michael, a trade link begun after white contact. To the east, the most southerly Gimi speakers between Mt Michael and the lower Lamari River had these ornaments in 1944 (Rich Kikori PR 4 1944-5:6) and it was probably the same ornaments that were mistaken for carved pig tusks among the Daribi in 1951 (Hicks Kikori PR 8 1950-51:16). By 1964 at the latest, they had reached the Tebera region (R. Wagner letter 1973).

As reported, crescents of pearl shell were very few and poor in quality when white men first entered the Wahgi region, and men living there now said how in those days only the most influential leaders had them. Often broken and carefully repaired, they were painstakingly concealed against theft whenever they were not being used for display. Here, only all-white shells were known; the more valuable ones with the golden edge were rare even in the upper Wahgi Valley. The first pearl shell crescents reached the central Bismarck Fall, the upper Jimi Valley, the lower Wahgi region and the Monogo Valley of east Kambia around 1930. In the middle Jimi region only the axe-makers of Tsenga and the Ganz River had them then, and they had few. At that time pearl shells owned by the people living around Mt Karimui in the Tua region had come from the

[1] It is likely that some of these were cut from the black-lip species, *Pinctada margaritifera* L.



Pinctada maxima ——— ●

Melo spp. ——— ♦

Ovula ovum - - - - - - - ✱

Map 6 The shell trade: pearl shell, baler shell and egg cowries

south-west and south but in the 1930s pearl shells began to arrive there from the Wahgi region to the north in a flow which reached a peak in the 1950s.[1] Old men of the middle Wahgi said that pearl shells had been unknown when they were children during the second decade of the century; further west, informants believed that pearl shell had been unknown to their grandfathers.

Pieces of baler shell began to circulate in the study area more recently still, and by the time white contact began the quantities arriving were still much below those of pearl shell. In the highlands baler shell was known only in the upper and middle Wahgi Valley where it was at least as valuable as pearl shell and much rarer. It was not more valuable because pearl shell had been in use long enough to achieve a special place in ritual and social life, notably in the *Moka* ceremonial exchange cycle of the upper Wahgi Valley but also in the ceremonial exchanges of the Poru region. In most parts, in the years just before 1930, individual shells of these valuable types were commonly worth a large pig, regional variations being reflected, speaking generally, not by multiples of shells or by adding shells of another type, but by the varying quality of the individual shell being exchanged and the size of the pig being matched against it.

The baler shell ornaments appearing in photographs taken in 1933 in the upper Wahgi were often broken and repaired with stitches and gum. They were shaped like broad sub-triangular shields, like those worn as pubic coverings from the Fly River to the Gulf. (They were traded to the head of the Gulf from Torres Strait.) In contrast, the baler shells which began to circulate in the Poru region during the decade before 1930, and which were traded at about the same time into the Tebera and southern Tua regions, were very narrow shield shapes like the chest ornaments of the western Gulf. (Illustrations of these contrasting shapes appear in Hurley 1924:182-202 and descriptions of them in Landtman 1933:33, 41.) For the study area of 1930, these two shapes represented two sources of supply, one from the west and the other from the south-west and south. Whether this was because their coastal sources were different or because the flows were channelled along routes where certain shapes were preferred, is not known. Very large baler shells, like that in Plate 16, have been introduced by Europeans.

Pearl shell crescents of contrasting shapes have also been described south-west of the study area (e.g. Williams 1940:134, but also in a number of patrol reports) - broad half-moon shapes like those popular in western Papua and thin recurved crescents capable of encircling the neck like those of south-eastern Papua (see, e.g. Hurley 1924:facing page 256), in addition to many of intermediate form. That the flow pattern was not a simple one can be seen from statements by Williams and Austen. Williams was told that Kutubuans constantly received pearl shells from the south coast but got better 'broad' ones from the 'grasslanders' north-east of them (1939:47, 48; 1940:131-5). He was there in 1939, six years after Europeans had begun to distribute pearl shells in quantity in the Wahgi Valley and after exploratory journeys north and north-east of Lake Kutubu by the Leahys (several in 1934), Fox brothers (in 1934), Champion and Adamson (in 1936) and Taylor and Black (in 1938), all of whom used pearl shells. After 1937 a few patrols from Lake Kutubu had also distributed pearl shells in the nearer valleys. This north-east to south-west movement was probably part of the reversal of shell flow already noted around the Wahgi Valley, made all the more possible here by the likelihood that, unknown to the Kutubuans, the people of the Waga, Nembi, Ka, Mendi and Iaro Valleys had for years received most of their shells direct from the Mubi and Samberigi Valleys; it is likely that their favourable trading position had allowed the 'grasslanders' to supply a few good shells to the small population at Lake Kutubu for many years. Only a small supplement from the highlands to the north-east would be needed to stimulate this trade. Nevertheless, the differences in quality and shape raise intriguing questions about the origin and development of preferences and of comparative trading advantages.

Austen's earlier observation (1934:22) is more cryptic. The bush people living between the middle reaches of the Kikori and Turama Rivers were said

1 Supplementary shells from the north may have helped to account for the difference in the number of shells in this area observed by Leahy and Dwyer in 1930 and by Champion and Adamson in 1936 (quoted in Chapter III).

to have previously traded pearl shells south to the people of the Turama, shells which were said to be superior to those presently being traded along the coast from east and west. Austen wrote in terms of a 'cache' of shells now exhuasted, and Williams, who had read Austen's article, wrote of a 'vast reservoir' of shells in the inland, both, I suspect, reflecting local views. Turama men produced examples for Austen to see; there seemed to be some differences, he said, the old shells being much harder than contemporary ones and of a different colour. Here, the cessation of flow may have been due to European effects on the traditional trading patterns of the delta, especially during the preceding two decades, but it could also have been due to a growing demand for shell in the north. Shell availability in source areas may have been affected by the pearling trade in Torres Strait, especially during the later years when shallow water beds had been fished out.

Investigation of the changing pattern of routes travelled by these ornaments of contrasting styles made from the one shell species would reveal much about the long southern trade links, the relationships between overland and canoe-borne traffic and the causes and effects of changes in direction of circulation. It would also very likely throw light on the way in which stylistic preferences evolved and were expressed and show whether any information feedback influenced the suppliers.

Other Shells of Limited Distribution

Only two other shells circulated within the study area in 1930 in any numbers and their relative positions in scales of popularity and value varied from place to place. These were pieces of green snail (*Turbo marmoratus* L.) and the spire of the leopard cone shell (*Conus leopardus* Röd., which now includes *C. millepunctatus* Lam.).[1] Other large cone shells such as *C. litteratus* L. and *C. betulinus* L. were also probably used from time to time, especially for the smaller pieces, but those seen during field-work all appeared to have been cut from *C. leopardus*.

The ornaments of green snail were in the form of curved pieces mostly irregular in shape, but a few valuable sub-rectangular sections up to 10 cm long and 4 cm wide circulated in the eastern Wahgi region by 1933. By then, sufficient of these existed in the south-eastern part of the Bismarck Fall region for them to be sometimes worn as necklaces, each piece suspended from one of the short edges so that they resembled the fan-shaped necklaces of rectangular fragments of cone shell worn by the Kukukuku of the eastern highlands (Aufenanger and Höltker 1940:Taf.III, Abb.19; Simpson 1953:facing pages 16, 17, 32, 33). The large segments of green snail illustrated by Aufenanger and Höltker (ibid:Taf.IV, Abb.21; Taf.XVII, Abb.64) arrived after the Europeans.

In the Bismarck Fall region, including the upper Simbai, and in the Kaironk Valley, old men recalled seeing a few small pieces of green snail all their lives. In the north-west, however, they remained rare, for only fragments reached the axe-makers of the Jimi before 1933 and few passed into the upper Wahgi until later. These intermittent supplies probably came from the scattered settlements of the Yuat River and south Sepik area, for, by the early 1930s, green snail was an important shell in the middle Sepik, originating at Walis Island and coming from the north coast over trade routes crossing the Prince Alexander Range (Mead 1938:162). Karam informants said that there had been a slight increase in the supply before the war and that at this time the flow from the north-west had been supplemented by new arrivals from the Asai Valley to the north-east. Those coming to the Gende from the Hills region increased in number during the early years of the twentieth century, and at this time these shells began to circulate in the upper Chimbu Valley and gradually spread south, reaching the lower Wahgi in minute quantities just before 1930. During the 1930s sections of green snail cut mostly from shells introduced by the Europeans were traded in increasing numbers into the Tua, Kambia and Poru regions and for a very short time after the war a few even reached the Foraba and Tundawe speakers of the Tebera region.

[1] Some malacologists disagree, viz. Sarramegna 1965:20, Plate V, Fig.10, '*Lithoconus millepunctatus* Lam.'.

No green snail entered the area from the south. This mollusc seems to be more common in northern waters, particularly around offshore islands and in the straits, and appears to favour depths greater than 10 m, though this may be partly the result of commercial fishing; it does not live in the Gulf of Papua and is not mentioned as being in Torres Strait waters by Yonge (1930; Meyer 1910:413; A. Hinton pers.comm. 1968). The shell was probably rare in native ornament before commercial fishing for green snail began late in the nineteenth century, and it seems that the twentieth century boom in the indigenous inland trade in green snail was a by-product of European industry. The implications for the pearl shell trade would bear investigation. *Trochus*, however, which began to be fished commercially at the same time,[1] was not in demand inland, and when J.L. Taylor attempted to introduce it in the Wahgi Valley, it was refused (Daniel Leahy pers.comm. 1968).[2] But *Trochus* had always been available on the coast whereas green snail was a deep water species. In view of this, it is possible that all regular inland trade in green snail post-dated the commencement of commercial fishing. In contrast, pearl shell grew in shallow water until fished out by commercial fishermen.

The ornaments of cone shell were of two main shapes, both cut from the spire at the posterior end, one in the form of a disc ground flat on the inside to remove the whorls completely and the other in the form of an annulus, usually with the marks of the whorls still showing. (It was the second form which was imitated in porcelain and glass and later plastic by Europeans, see, e.g. Aufenanger and Höltker 1940:Taf.II, Abb.16; Simpson 1954: facing pages 14, 190.)[3] A very few of the annulus form reached the Tebera region from the Papuan coast during the first 30 years of this century. They were worn as earrings, as they often were on the coast, a slot being cut through the annulus to slip over the lobe and closed with gum. The central hole tended to be smaller than on the examples from the north coast. The sources of these shell pieces can have been no closer than Torres Strait and Yule Island, where, although they were minor ornaments in their own right, many were off-cuts from the production of precious armshells, broad bracelets of cone shell valued from Torres Strait to the Louisiades as well as on the north-east New Guinea coast.

However, most of the annuli entered the area from the north-east, only the smaller specimens being traded inland; coastal ornaments incorporating these shells had much larger ones than were ever seen in the study area (see for example A. Baessler 1895:Taf.VI) and in 1933 those retained by the Gende of the Bismarck Fall were generally larger than those traded on to the Chimbu. By 1930, some had reached the upper Jimi Valley, the middle Wahgi and northern Dom language area, rapidly extending south to the Wahgi-Asaro junction and into the Tua region in the late 1930s. They were worn as necklaces, bandeaux and pendants.

In the Wahgi and Jimi regions this form overlapped with discs coming from the north-west. These often had a small central hole, and occasional small holes drilled at opposite edges showed that some had once formed part of a necklace or headband, but their chief characteristic was a slot cut from the central hole to the edge (in this resembling the Papuan earrings) so that they could be worn in the septum. The gap was reduced at the periphery with gum. These came from the west, and their origin is uncertain. They were prominent on important men in the upper Wahgi when the Leahys and Taylor arrived and a few men had them as far east as the middle Wahgi Valley. Even after Europeans had been distributing cone shells for a few years,

1 Like pearl shell and green snail shell, *Trochus* was used for costume jewellery, buckles and buttons.

2 Aufenanger and Höltker (1940:15, 54), refer to *Trochus* rings among the Gende but I believe that these were *Conus*. These authors also refer to 'mother-of-pearl snails (Nautilus pompilius)' which I think were green snail, though occasional nautilus shells were used along the north coast: they are comparatively fragile.

3 Bracelets patterned on traditional bangles of *Conus*, *Trochus* and *Tridacna* were also made, in addition to counterfeit *Ovula ovum*, dog's teeth and boar's tusks, the latter said to have failed because they were all left-handed. Were these rings or bracelets the 'frames of small round mirrors' seen near the Koronigl Valley by Taylor in 1933, mentioned in Chapter III.

their value in the upper Wahgi Valley was still half a grown pig and only a minority of men had them (Vicedom and Tischner 1943-8:106). Like baler shells, they had reached the southern Jimi Valley axe-makers during the decade before contact but did not pass across that valley or to its head until the late 1930s. Very few indeed reached central Kambia before 1933 and everywhere else they are post-European.

Discs like these were used as necklaces on the coast of western Papua (Landtman 1933:41) but typical necklace holes are absent from most examples in the western highlands. *Conus* spires were common on Sepik River masks but they were usually smaller and with much of the whorl still attached, and various parts of cone shells were used as personal ornaments there and in the hills to the south. I have not searched published information on the western highlands or southern parts of the Sepik region for statements about the shell trade but some clues are known: Meggitt was told that the Ipili Enga of the Porgera Valley received cone shell discs from the west up the Lagaip Valley (1957:40) and a number of patrols from the Porgera and Laiagam patrol posts have remarked on trade links towards the north (Hicks Porgera PR 1 1964-5:21; Treutlin Laiagam PR 2 1964-5:3; Henderson Porgera PR 1 1966-7). On present information, trade routes from the west and north-west, ultimately trans-Sepik, were the source of the *Conus* discs which entered the study area from the west.

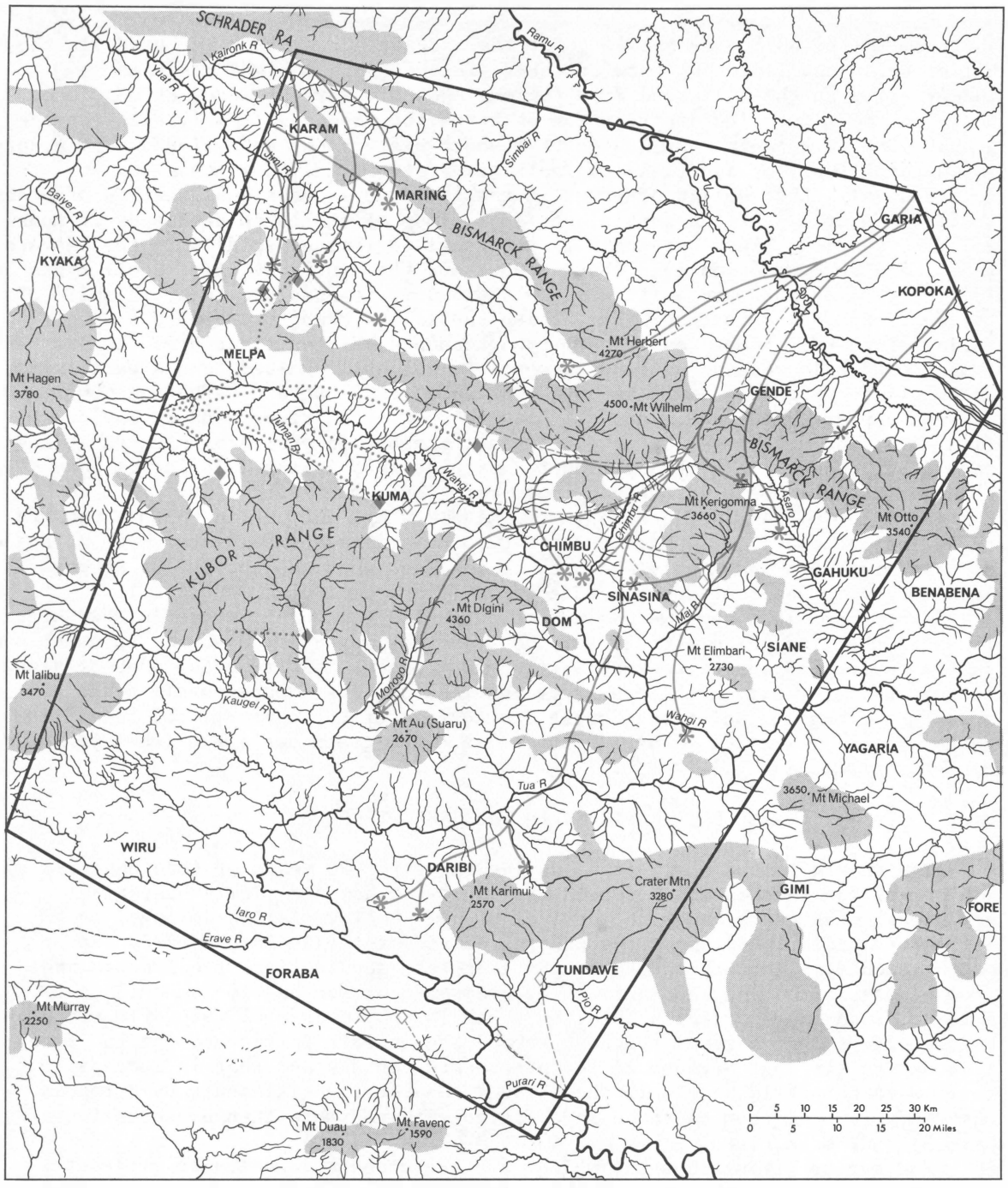
Pieces of broken cone shell armbands entered from the south-east, drilled and sewn together as bracelets or sewn to lengths of rope. They were known only in the eastern part of the Tebera region and the southern part of the Tua region and were worn mainly as bracelets. Before the war they were few in number but like all other shell ornaments, increased during the 1950s. Most seen even today appear to be very old, for the original broken edges are smoothly polished over old break-scars from years of handling and wear. Recently some unbroken armbands have arrived, poor examples of those valued on the coast. They come from the people of the middle Purari, some possibly via the upper Pio River, and to date are the only clear link with the Vailala River and the Toaripi speakers of the eastern Gulf coast. In former times, when old armshells became broken, they seem to have been made up into composite ornaments and traded inland. A fine example of a gauntlet for the lower arm featuring the equivalent of four upper-arm bracelets was collected in 1920 from the Vailala area and is now in the Australian Museum, Sydney (E26331). This part of the coast was probably the source of many of the similar cone shell pieces traded to the Kukukuku and referred to earlier. Map 7 shows the trade in green snail and cone shell.

Minor shell ornaments were olive shells (*Oliva* sp. or spp.), tiger cowries (*Cypraea tigris* L.) and rare examples of other cowries common in the inter-tidal zone.

A headband of olive shells together with what appeared to be an imitation of it in oval beads (Plate 17) was seen in the Tauya Valley at the south-eastern end of the Bismarck Fall. The owner was content to sell the olive shell band, which appeared to be very old, but refused to part with the other. All the shells seemed to be of the same species, *Oliva ?carneola* Gmelin. There had once been more, he said, but they had been replaced since the war by these new things, also thought to have come from the sea.[1] Both were known by the same name, *itiki*, and came from across the Ramu River. The only other regions in which olive shells were recognised (though none could be produced) were in the Hills, Ramu and Asaro; they had never been very common, it was said. (There are more of them in the eastern highlands.)

Tiger cowries were rare in the Wahgi, Kambia and Bismarck Fall regions; they did not appear to be known elsewhere in the highlands or in the southern lowlands. Where they were known, some people said that they had been seen from time to time for as long as men could remember, others said that they had not been seen until after the white men came. The shells were rare enough for both statements to be true, not only for individual informants but for whole localities. The few specimens seen in 1968 were very old, whitened to varying degrees by abrasion and oxidation (unintentional) of the formerly brilliant

[1] That any of them came from the sea was modern knowledge throughout the study area, except in the Hills region.



Map 7 The shell trade: cone and green snail shells

surface. Distribution of knowledge of them suggests that they had come via the Hills region but I did not know of their presence in the highlands when interviewing in the Hills and Ramu regions and none were produced or mentioned there at the time. The distribution of terms for the type (nearly all language groups sharing the one name) suggests a short history but undeveloped terminology may alternatively or additionally indicate rarity or unimportance.

The only other shells observed in the field were occasional cowries of other species, sometimes as the central shell or group of shells in necklaces of money and ring cowries. They were only in the Wahgi region, especially in the western Wahgi, and were uncommon even there. However, the distribution of shell types in 1968 was not the same as it was in 1930 and it is possible that, in spite of the wear apparent on some of them, these shells had been traded up the Wahgi Valley since that time. As a shell type became devalued in one area, it was traded out in increasing numbers to where it was still valued, and a westward movement of *Cypraeidae* seems to have continued after contact. The odd cowries did not appear to be modern and the Arabian cowrie was recognised by Taylor (1933:66); some of these larger cowries are visible in photographs taken at and soon after contact (e.g. Leahy 1936:facing page 244; Spinks 1934:facing page 416). When shells were being discussed, these were never mentioned - they were an insignificant element. Two seen in the middle Wahgi and one in Chimbu appeared to be Arabian cowries (*Cypraea arabica* L.) and a necklace collected near Mt Hagen by A.J. Strathern and kindly shown to me included what was thought to be one Arabian cowrie and four snake-head cowries (*Cypraea caputserpentis* L.).

Conspicuously absent were a number of shells valued elsewhere in New Guinea, rings of the giant clam (*Tridacna gigas* L.), very valuable on the north coast and in the Sepik, bangles of commercial trochus (*Trochus niloticus* L.) popular along the north-east coast, necklaces of cylindrical and disc-shaped shell beads prominent along the north-east coast at the turn of the century, the black-lip pearl oyster, (*Pinctada margaritifera* L.) and the green cat's eye (the operculum of *Turbo petholatus* L.).

PAST PATTERNS IN THE SHELL TRADE

The growth in the shell trade during the first 30 years of this century was one of the factors which forced this study to adopt a firmly historical approach. Statements about the arrival of new shell varieties during informants' lifetimes, about the general dearth of shells in the early years of the twentieth century and about the long-term supplanting of ornaments made from plants, birds and land animals by ornaments of sea shells are well evidenced and are unexceptionable; but what is one to make of categoric statements to the effect that some of the most common shells were introduced for the first time during the last decades of the nineteenth century and that in some parts there were no shells at all in about 1900? Supporting statements by European observers, one of them based on information gathered more than a generation ago, have already been cited.

For groups living in areas which, for the present inhabitants at least, are newly settled, for example, the isolated, sparsely populated and heavily forested Kambia and Tua regions, it is plausible that all shells could have been absent in the time of the grandfathers of men alive today, especially if the new settlement had occurred during that or the preceding generation. Whatever the reason for the migration but especially if it was due to warfare, the immigrants would have had a new environment to exploit and adapt to, new social and economic links to establish, new trade routes to develop. It is feasible that the severing of past links could last a generation and that new links could take a generation to forge. We have seen elsewhere in New Guinea, documented in the case of knowledge of iron, that a lapse of three generations, say 75-90 years, was quite sufficient for memories of earlier conditions to be lost. For these people, shells could conceivably have been a wholly new phenomenon, even during the time of men alive today, and I believe this to be the explanation of, for example, the late arrival of cowries in the valleys of central Kambia.

But what of those areas where intensive agricultural settlement is of proven antiquity, such as the Wahgi (Golson *et al.* 1967; Golson in press a; in press b)? We know that sea shells have been used as ornaments in the

general area for at least 6000 years and probably longer, for a broken ground and polished juvenile black-lip pearl oyster, *Pinctada margaritifera* L., was recovered from a level of greater age in Kiowa rockshelter near the Mai Valley just on the Asaro side of the Asaro-Wahgi boundary (S. Bulmer 1966a:105; pers.comm. 1968). Less than 10 miles east of the study area, in Kafiavana rockshelter in the lower Dunantina Valley, White found four money cowries some 9000 years old, three with their backs removed just as they are today, and one possibly marine gastropod even older (1967:279, 280, 297; 1972:93). It is possible that they were brought by early settlers but trade with the coast is the most likely explanation. The existence of coastal trade links two or three thousand years after the earliest proven occupation of the central highlands (S. Bulmer 1966a:15; White 1967:436; 1972:147) should occasion no surprise; it is unlikely that the oldest occupation sites so far found represent the campsites of the first pioneer settlers, and the present study has shown that trade, including trade in sea shells, took place across parts of inland New Guinea which were 'virtually uninhabited'.

Bulmer and White have also shown that sea shell ornaments (and some fresh water shell implements and possibly ornaments) continued to be used in and near the study area from time to time during subsequent millennia. Level 2 of Kiowa rockshelter (younger than 5000 years but probably older than 2000 years) yielded a curved piece of *Trochus niloticus* and a cockle shell (*Arca granosa*) with an indentation at the hinge end, both resembling septum ornaments of today though fashioned from different shell species. Yuku rockshelter, less than 20 miles (32 km) west of the Wahgi region, yielded fragments of what was probably black-lip pearl oyster and two worked money or ring cowries (S. Bulmer 1966a:92, 98, 119, 120; pers.comm. 1968). White's excavations provided similar data. Niobe (Nombe) rockshelter (like Bulmer's Kiowa, near the Mai Valley and the Asaro-Wahgi boundary) contained in its disturbed upper horizon of uncertain age, two fragments of *Oliva carneola* and one probably of ring cowrie (1972:131). In central Chimbu, Omkombogo shelter contained shell fragments throughout, with an estimated maximum age of anywhere from 400 to several thousand years (White 1967:35, 37, 38). This 3 m deep deposit was further excavated in 1971 by Mary-Jane Mountain, who believes it to be all post-Pleistocene (pers.comm. 1973). It appears to represent an accumulation of at least several hundred years. The upper levels contain drilled shells of probably fresh water mussel, and two other shell ornaments were recovered from the upper half, an *Oliva ?carneola* drilled through the spire and a 1 cm diameter ring cut and ground from a probably marine gastropod. Three *Cypraea ?annulus* specimens came from a depth of 2 m together with a small *Nassarius* sp., all with the dorsum removed in the modern style. Near the bottom of the deposit was a 5 x 2½ cm piece of the anterior end of *Conus leopardus* whorl, ground along one 5 cm edge like a modern cone bangle but with the other 5 cm edge broken roughly from the spire. At Kafiavana a dog whelk was found in level III, a money cowrie in level II and an olive shell together with another possibly marine shell in level I. Pieces of an estuarine bivalve (*Geloina* spp.) were also present, one in level IV, two each in levels III and II, and three in level I. There is a radiocarbon date of 2740 ± 170 BC (ANU-42) for the base of level II, after which the site was probably used much less for 2000 years or more (White 1967:279-81, 330; 1972:109). Either none of these shells had been worked or the fragments were too small to show it.

Fifty miles (80 km) to the east of the study area and closer to the Huon Gulf, White's Aibura and Batari excavations showed more shells and a greater variety, most, however, of recent date. At Aibura they were all younger than 1180 ± 100 AD (like the pottery) but showed some species differentiation between the four upper levels in which they occurred, though the most common shell, commercial trochus, was in all of them and ring cowrie was in 1, 2 and 3. Level 4 had two olive shells, part of a Triton's trumpet shell and a plicated dog whelk, one of which also occurred in level 3. Level 2 had a *Murex* or *Cymatium* shell and level 1 had an egg cowrie (1972:60). Batari cave contained an estuarine bivalve (*Geloina* sp.) a sand snail (*Polinices* sp.) and two olive shells, all older than 1100 ± 53 AD (ANU-39), and from unstratified contexts one specimen of *Trochus*, three *Geloina*, two dog whelks, two olive shells, an ark shell, tusk shell and nerite were

recovered. Only the nerite was obviously worked but in addition four shell ornaments were found, three beads (two discoid and one cylindrical) and a drilled sliver of thin shell, the last dating from before 1100 AD and the others from disturbed deposit (ibid:15, 18-19, 22).

The low incidence of worked shell found archaeologically suggests a major change in fabrication and trading practices, for unworked sea shells did not reach the central highlands in twentieth century stone-age trade, not even under the influence of European commercial shell fishing. But the difference may be more apparent than real - it may be based on negative evidence. While one of White's very early cowrie shells at Kafiavana appears to have been a whole shell and unworked, I find it impossible to tell from most of the published data whether the other specimens lacked evidence of working simply because they were fragments which would not normally bear signs of it.

Some of the spatial pattern found in twentieth century stone-age trade is reflected in the sparse archaeological record, in that money and/or ring cowries were found in both east and west, egg cowrie and olive shells were found only in the east and pearl shells were found only in the west; however the pearl shells were of a different species and were thousands of years old. The only common elements in the temporal patterns are the occurrence of money and/or ring cowries in both ancient and modern times in east and west, the ancient and modern occurrence of dog whelks in the east and the recency of egg cowries where they occur. In general, olive shells are also recent, except for two older than 850 years at Batari in the east.

The archaeological samples are very small; despite the large east-west distance, proximity to the east coast and an enormous time scale, only 14 species are represented, compared with 12 in use during the twentieth century. Only five species are common in both groups; within the study area, only two. In this area the additional shells in the archaeological record are all old, the *Trochus* and the cockle shell probably more than 2000 years and the black-lip pearl shell more than 6000 years; the shells common to both oral and archaeological evidence, olive shells and ring and/or money cowries, occur in recent levels.

During the course of the present inquiry some shells of low incidence and value may have been overlooked but if so they will be few and of very limited distribution. Moreover, if found later, it will be hard to be certain that they date from pre-contact times, for white men tried a number of new varieties which failed to win acceptance.

How representative is the archaeological data? Ethnography suggests that minor shell ornaments were not discarded until badly broken, major shell ornaments if broken were repaired or re-used in other forms, and that the most valuable were worn only on special ceremonial occasions; at least during a period of 6000 years when settled agricultural communities can reasonably be postulated (Golson in press b, MS 13) rockshelters are unlikely to have been used for ceremonial gatherings. The excavated shelters in and near the study area do not appear to have been normal habitation sites at least during the latter part of this period and perhaps for much longer, so that shells found there may be unrepresentative of the full range of species owned.

Does the archaeological record overlap the time scale of oral tradition or is there a lacuna of several hundred years? The site within the study area where stratified overlap is possible is Niobe (Nombe) in the Asaro region; at Kiowa and Omkombogo presumably the surface only can be assumed to be of relevant age. What little evidence there is tends to support the statements of informants, for the two species present at Niobe, *Cypraea annulus* and *Oliva carneola*, were both said to have been present in the Asaro region before 1900. The archaeological picture of shell distribution throughout the central and eastern highlands is one of areal diversity and is analogous to conditions described for the periods around 1900 and 1930, with two species common to most parts, and some areas with species peculiar to themselves; it also shows temporal constancy in some species and change in others.

The 30 years since 1900 saw the use of at least 12 species of marine shell in the central highlands; seven of them were archaeologically absent from both the central and eastern highlands in earlier times, though it is

uncertain how much weight can be put on that. The archaeological sample is drawn from a much larger highlands area yet more than 10000 years of occupation has left a record of only 14 marine species, five of them also being used in the twentieth century. It is a comparison between the record of little more than one generation of New Guinean traders and the record left by more than 400 generations. Whatever the archaeological sampling error in terms of total numbers, in terms of species it is unlikely to involve a factor remotely approaching 400; under-representation can explain only a small part of the comparative paucity of shell species in the long archaeological record. Shells may well have been less numerous trade items in the past. The presence of nine species not used during the 'ethnographic present' suggests that the constantly changing trade patterns evidenced by the ethnographic data extended far into antiquity.

The sum of the evidence strongly suggests that for most of the study area old men who said that there were no shells when they were children or when their immediate ancestors were alive were mistaking extreme poverty for total absence or at least exaggerating it, but it also shows that they were right in saying that during the course of their lifetime the individual value and quantitative importance of most other ornaments was largely destroyed by a great increase in the numbers and varieties of shells traded into the study area ahead of the Europeans.

Some of the causes of the areal and temporal variations in shell species and in ornament styles in the inland in the distant past and in the late nineteenth and early twentieth century were probably the same. Some changes were no doubt engendered by changes in shell selection on the coast, for reasons which it is not possible to examine from inland data (though the selection criteria and processes for feather ornaments may be analagous). Although informants said that specific types of shell were asked for from time to time and that some feed-back of information took place in this way, it is doubtful if it can have been effective over great distances except in the most general and long-term sense. In any case, requests were made on the basis of known acceptable types; while demand helps to account for the maintenance of supplies and increases in quantities supplied, it cannot explain the introduction of new types. Suppliers tended to trade their least valued shells; inland, perhaps any shell was to some degree acceptable for minor ornament and the introduction of new types was largely due to the nature of the 'low cost' species available on a particular coast. But for a shell type to become valuable and in wide demand it probably had to meet specific local aesthetic criteria of the moment, to be suited to a particular ornamental niche regarded there and then as desirable to fill, and to be available in certain minimum quantities. For widespread acceptance there may have been a quantitative threshold, and once this was crossed the demand for and value of a species continued to rise faster than the supply. From the evidence available, it is unlikely that supplies were ever sufficient to produce a loss of value and market collapse like that which followed European spending of shells in the twentieth century.

For species to be elevated to the role of principal ornaments and supreme valuables, they probably had to be remarkable in size or beauty and to remain in relatively short supply. Some items which would otherwise have remained minor because of their small size or large numbers gained added value by being made up into large composite ornaments, like the headbands and breastplates displaying massed numbers of dog whelks and cowries. Also, as happened with other manufactures like certain forms of salt and ceremonial axes, once a shell type achieved a special role in the ritual of social relations, its value was further enhanced and protected.

What could cause a particular species to go out of use? J.P. White suggested (pers.comm. 1968) that a decrease in the quantities supplied would have led to a loss of value. This is conceivable only in the case of minor ornaments and then only if they were subject to changes of fashion. Fashion affected the choice of pigments for personal adornment, and changes in fashion in the use of minor ornaments have been noted since contact, but in conditions of over supply. In former times small dog whelks took the place of the seeds of *Coix lachryma-jobi* on necklaces, bracelets, baldrics and bandeaux in a

number of regions, but not because of a decrease in supply. As supplies became available, sea shells and sea shell pieces replaced fragments of cassowary egg shell. The short-supply hypothesis merely shifts the question to the supply side, and the evidence is that before 1900 shell supplies were never large enough to permit any type to be discarded. On the demand side, there are no examples of established ornaments losing their place because of shortages; on the contrary there are examples from the north coast of New Guinea (and in Borneo and Micronesia) of introduced glass beads and bracelets increasing in value as they became scarcer and continuing to do so after all further supplies ceased, ultimately achieving the role of supreme valuables.

The quantities of shells shipped inland in traditional times can have little effect on their total availability on the coast, and decrease or cessation cannot have occurred through natural shortages. However, changes may have occurred in the relative value of different shells on the coast and this would have influenced the selection of species sent inland.

In spite of White's emphasis on the continuities of cultural history in inland New Guinea (1972:148), he and others have provided and discussed evidence for some major discontinuities (see esp. S. and R. Bulmer 1964; S.E. Bulmer 1966a), interruptions and changes which appear to be reflected in aspects of stone tool kits, in the introduction and abandonment of stone pestles, mortars and figurines, the introduction and abandonment within the study area of stone clubs, innovations in subsistence practices including the beginnings of agriculture and the introduction of new crops, and changes in the manufacture and trading of pottery. The supplies of goods dependent on trade were more susceptible to disruption than supplies dependent on home production, and those arriving by long-distance trade were the most vulnerable. It is highly probable that trade in sea shells was always subject to long-term interruptions and re-orientations.

Long- and short-term variations in species and quantities, including total interruptions to supplies from particular sources, were caused by changes in the orientation of trade routes and the activation of new trade links brought about by many different things, population growth and migration into unsettled areas and into areas previously occupied by others, fluctuating fortunes of war, changes in the patterns of enmity and alliance and in the organisation of marriage ties, the discovery and development of new inland resources and new skills, and the emergence of different groups at different times as dominant in localities favourably situated for middle-man trading.

VIII CONCLUSION

INTRODUCTION

The overall patterns of trade within the study area were outlined in Chapter IV and details of trade in key goods both within and beyond the area's boundaries were given in Chapters V, VI and VII, general points about cultural adaptation to resources, skills and favourable locations and changes over time being made where they could best be aptly illustrated. Important aspects discussed at length included the technology of production for both subsistence and exchange, changes in the pattern resulting from the reorientation of locational advantages, and the antecedents of early twentieth century trade as indicated by oral tradition, early documented observations and archaeological findings. Here, additional details and generalisations are presented about the traders, the trade routes, and the economic and social context in which trading took place.

THE TRADERS

Within the study area, men dominated the production of trade goods, their transfer between individuals and between groups, and their consumption. Women were not involved in the production of important goods like stone axes, nor in the collection of the best pigments or oils, bird plumes and animal skins, cassowaries and wild animals, nor, within the study area, shell ornaments. The luxury crops like pandanus nuts and fruit which in some parts figured in exchanges, usually ceremonial, were men's crops. But women quarried and prepared clay for the potters, helped to collect grasses for salt-making, produced most of the string and fibre products made from garden and semi-cultivated plants and some of those made from wild plants, made net bags and some clothing, and were the main labour force in the production of pigs. On the consumption side, the only items of which they were the principal users were pots, net bags and some clothing, but on special occasions they were important users of pigments, oils and ornaments. They commonly wore minor shell ornaments and for special occasions, such as betrothal and marriage ceremonies, or the killing of the pigs near the end of a Wahgi region pig festival, they wore major shell ornaments. When goods were being transferred in ceremonial exchange, women were often involved in prominent but subordinate roles which varied from place to place; they were the public mourners of the pigs they had reared, the wearers of ornaments received in bride-wealth payments or of dowry shells being given by the bride's group, and the formal receivers of 'women's things' (net bags, bark-cloth and women's clothing) being presented to the women of the groom's group at weddings. Barter was the province of men: women's roles in producing trade goods were recognised mainly in the case of transactions involving pigs, where it was not unusual for part of the goods received to be demonstratively presented to the woman to ease her sorrow at the animal's loss. However, in the case of valuables, including, usually, the pigs she reared, she was only the custodian.

Every man took part in ceremonial gift exchange and bartered on his own account when opportunity offered; there were no professional traders, no merchants, no itinerant pedlars. The trade delegations that travel so widely since pacification are a new phenomenon in this area; formerly, armed parties rarely moved more than 8 to 10 miles in closely settled parts and even among the scattered hamlets of the southern lowlands, travel rarely exceeded 12 to 15 miles. The longest described individual trade links were those between northern Poru settlements and the west Kambia people around Kegu and between the north-eastern Poru and the Daribi of the lower Kaugel area. Even here, the distance between the realm of close kinsmen and the furthest trade friends was little more than 15 miles (24 km) and was covered in the course of dual purpose trading and hunting expeditions. In general, the closer the density of settlement, the more restricted was individual movement, showing that the presence of enemies, not physical distance, was the principal obstacle. Only one case was cited where a particular group of men were privileged to travel further than usual among potential enemies - that of Gende speakers from the Bismarck Fall visiting trade

friends in the middle Chimbu Valley. Gende living in the upper valleys of the central Bismarck Fall region had marriage ties with the people of the upper Chimbu Valley but in former times these did not extend to the middle valley.[1] Nevertheless, from time to time they moved beyond the normal limits of affinal connections to establish trade friends further away. This was still only a total of about 15 miles (24 km) but in this populous region that was a very long way. (Formal trade friendships were more important in the maritime trade, for, unlike inland people, especially those in populous areas, canoe traders regularly travelled beyond the territory of relatives.) Kokia and his brother Kondiagl of Dognbun near Duglpagl recounted a tradition illustrating that the chief protection for the people from the Bismarck Fall was their reputation as sorcerers. Once, long ago, a Gende man had been killed just south of Duglpagl and that very same night a great landslip and limestone rock-fall blocked the Chimbu River near its junction with the Kwinigl and a number of men were drowned in the resulting flood. Ever since then Chimbu men have invited Gende visitors to their homes and taken care to establish trade friends among them.[2] Of course, the people of the Chimbu Valley were dependent upon the Gende for shell valuables and lowlands products.

Fear of sorcery by the Daribi helped to protect them in their contacts with Gumine and Nomane dialect speakers in the south-eastern Wahgi region, though the risk may have been less than that of the Gende since the highlands population here was low. They had no shell valuables to offer, only feathers and skins and other forest products, but they safely visited the southern fringes of highland settlement. Overall, there was a marked tendency for men involved in trade to move uphill, that is to say, the men of lowland communities tended to travel up to the settlements of those living at intermediate altitudes more often and further than men from the intermediate levels travelled down to them, and the same was true of trading relations between men of intermediate altitudes and the highlanders. This was brought about by two things, an extension of the patterns of movement of daily life, and comparative fear.

Since they lacked the trappings of primitive affluence that so impressed the first white visitors to the highlands, one tends to assume that the people of the highlands fringe and lowlands had a greater economic need than did the highlanders and that for this reason they could be expected to take the initiative in trade. This was not so. The large highland population had needs which, though they could have been met from local products, could better and more easily be met with fibres and woods from the lowlands. In addition, those living on the outer limits of highlands settlement wanted the luxury of lowlands fruits, in particular oil pandanus, and some wanted tree oil. More importantly, they had unsatisfied and growing wants for ornaments and valuables, feathers and skins of lowland birds, the live creatures themselves, and in particular, sea shells. Their trading initiatives, even in *per capita* terms, were at least equal to and probably greater than those of the people around them. This gains considerable support from the remarkable expansion of trading, and in particular *travel* for trade, which developed in the highlands immediately some safety was assured. It began with carriers accompanying the very first patrols and has extended ever since. Expeditions to the lowlands did not begin until the 1950s but within 10 years Chimbu traders, especially plume buyers, had been reported as visiting the far western highlands, the far eastern highlands, the interior of the Finisterre Ranges and the Rai Coast. Differences in trading initiative, then, were not reasons for the predominance of inland and upward movements in trade journeys.

Extensions of the patterns of movement used in subsistence was a contributing factor. In the normal course of getting a living the men of the sparsely settled lowlands moved much further than did the highlanders, partly because of their pattern of gardening, partly because of their pattern of forest use, and partly because of the wider movement required to maintain social relationships. Unlike the intensive economic and social domain of the highlanders, that of the fringe population was extensive and that of the lowlanders was more extensive still.

However, the main reason was the highlanders' fear of the lowlanders' powers

[1] Nowadays they extend to the Wahgi Valley.

[2] How this was done has been described by Aufenanger (1966).

of sorcery. It is true that sorcery by strangers and enemies was always to be feared and that in some places such fears marginally increased when former enemies were prevented by the Administration from expressing aggression by physical violence, but the phenomenon being stressed here was different to and separate from the sorcery accusations made about fellow tribesmen or others seen as belonging to the same general cultural tradition, and it is a phenomenon that men said had always existed. It was independent of the highlanders' association of malignant spirits with low-lying swampy places, though the re-inforcing mechanism of disease was the same. When most highlanders travelled beyond the limits of their own security circle, to borrow Lawrence's term (1964:24), they feared mainly spears and arrows, but those living on the highland limits were inhibited in their movement away from co-linguists by fear of sorcery. Because it was impalpable it was much more to be feared. There was a regional gradient of fear of sorcery by strangers, running from high country to low country and probably quite independent of local differences in sorcery practice and belief. It was expressed first by helpers and carriers recruited in each region and later affirmed in strong terms by older informants in every group visited, always in reference to the people of the region below them, never about their upland neighbours. The Chimbu feared the Gende and the Gende feared the Ramu people; the southern Dom dialect speakers feared the Daribi of the Tua region and the Daribi feared the Tundawe and Foraba of the Lake Tebera region.[1] With the sorcery charges went accusations of cannibalism, unintentionally ironic from the Daribi. As pacification was extended and highland traders began to visit the lowlands their fears were greatly reinforced, for many became ill and some died. The extension of medical services, especially the malaria eradication program, has diminished the incidence of infection but so far has not diminished the fear of lowland sorcerers.[2] While now travelling widely, no highlander travelling south of the Wahgi region at low altitudes will casually discard worn out personal belongings, deposit exuviae without care, sleep with unfastened doors or windows or go outside at night without a companion if he can help it.[3] In former times, the strictures imposed by their *orientation* of fear restricted the options of highlanders and extended some initiatives available to the fringe people; they more often had the choice of trade partners and this strengthened their position as the suppliers of valuables.

Risk to life and limb was the one meaningful transport cost - no price was put on time. Nowadays men will talk of the arduousness of past travel and the obstacles of some routes but the goods which travelled over the most hazardous course were exchanged at the same rates as good which travelled easy routes and short distances.

I have used the term 'middlemen', but in most cases it is appropriate only in the general sense that trade goods everywhere travelled in a series of chain-like steps, and except for the producers and consumers, the other traders were acting as middlemen at various stages along the trade route. In fact durable goods were used by the intermediaries while they had them; they continued to circulate. This was the case with implements, ornaments and pots; most of the goods which travelled rapidly through intermediate hands were relatively perishable consumer goods and only in the case of these are the concepts of true 'middlemen' and 'end-users' applicable. Examples of goods handled in the manner of true middlemen (the nearest approach to a short-haul carrying trade) were salt, pigments, bows and fibre products, live cassowary chicks, parrots, cockatoos and lowland animals traded to the highlands. Except for cassowaries, which grew into dangerous adults, live birds and animals would sometimes remain in

[1] I know nothing of these people's claims of proficiency as sorcerers. If there is a gradient close to the coast which overrides varied parochial reputations, it may be the reverse of the inland one as far as the sub-coastal hills (cf. Harding 1967:63; Lawrence and Meggitt 1965:16, 19).

[2] Cf. Taylor's observation that malaria had placed a cordon around the highlands. Having lost their tolerance to malaria, the highlanders' fear of lowlands sorcerers was an effective measure of preventive medicine. It was fortunate that, like trade goods, *Plasmodium* spp. had to travel slowly from group to group over routes inhibited by natural and man-made barriers.

[3] On more than one occasion I have been saved from the consequences of my own ignorance by the attentive care of companions: my colour and culture was inadequate protection. For others, my presence was a safeguard and it was implied 'if anything should happen to you how would we fare?'

intermediate hands for some time before being passed on. Traffic in pigs and dogs occasionally followed this pattern but this was rare. The longest clear-cut examples of middleman through-trade were from the Ramu region to the highland valleys via the Bismarck Fall. Salt travelled almost as far within the study area but, like pigments, it tended to be stored in the houses of intermediaries for varying periods, large quantities being divided and some being used before the rest was passed on. Goods which travelled as transit traffic through the highlands fringe did not normally continue to do so in the highlands, they either stopped or began to circulate.

TRADE ROUTES AND FLOWS OF GOODS

Maps 3 to 7 show the flows of the principal goods as linear but except where these movements were channelled into single paths by the constraints of physiography or lack of population, these flows are simply the sum effect of myriad transfers of goods taking place in many different directions. In regions of light and moderate population the total pattern of routes on the ground is in no way remarkable, consisting of the expected network of varying density stretching from coast to coast. All the physiographic constraints result from high or steep relief or from rivers, sometimes in combination, and portions of the communication net near these barriers have the usual dendritic patterns focusing on nodes on each side of the obstacle. Where the channelling of flow is due to low population, the web retains a cell-like structure. Notably, within the study area, neither these nodes nor any other intersections had developed market characteristics before contact; barter transactions occurred everywhere. Nevertheless the people living near those nodes were better placed for developing trading activity and flows tended to funnel into their hands before again spreading out. The largest quantities of goods per mile of route, the heaviest unit loads and the most frequent traffic occurred where path density was restricted by natural barriers. In most parts of the highlands regions the web is so dense and structurally so simple that in spite of physical obstacles and the fact that it has not evolved in response to marketing principles, it represents as close an approach in nature to the simplest communication landscape models of Christaller and Lösch as can be found in any region of the world. Settlement hierarchy is undeveloped, consisting, in the main, of two levels in the west, garden-houses and hamlets, and three levels in the east, garden-houses, hamlets and villages, the last being in effect agglomerations of hamlets with a minimal development of central place functions. It is true, of course, that where more men were gathered together more transactions occurred but in general in this area it was a one-to-one relationship, not generative of another order of exchange transactions. Where a particularly important manufacturing activity was carried on, such as near a stone quarry or salt spring, the increased nodal importance of the surrounding hamlets was shown by the more frequent movement of persons, more rapid flow of goods and increased quantities of goods being transported and exchanged, not by an increase in the density of the network of paths. Within the areas of close settlement and minimum natural barriers, not all paths were of equal importance, but most linkages had a multiplicity of alternative routes and in general there was no development of trunk routes. Where a path gained minor importance it was usually because it was oriented towards a physical feature, bridge site, ridge saddle or gentle spur, or away from a cliff or swamp.

The economic decision-making that went on in men's club houses and on the plazas beside them affected trade, and there, too, transfers of goods by both ceremonial exchange and barter sometimes took place. The only other nucleation that concentrated the incidence of economic transactions and increased the quantities changing hands was the periodic use of clan ceremonial grounds for prestations. Whether this was for functions associated with the preparation and carrying out of the large pig-killing ceremonies held every few years or for lesser events, dyadic barter transactions between individuals often preceded or followed the main business. It would be overstating the importance of trade on these occasions to see them as proto-markets, for the continual trading activity being carried on in hamlets and elsewhere appears to have had much more quantitative importance. Nilles has described a genuine proto-market held near

the R.C. Mission in the upper Chimbu Valley in the late 1930s (1944:12) but by that time the pattern of trade had already been changed by pacification, as he himself noted (ibid:11; 1943:105) and informants' statements suggest that by then the peace of the market place had begun to follow the peace of the government and mission.

The discovery of new resources and changed avenues of access to old ones brought about considerable long-term changes in the importance of alternative trade routes, new links growing usually at the expense of old ones. Examples from traditional times have already been given - that of the Poru-Tua and Poru-Kambia links and the complete reorientation of Tua regional trade from a southward facing system to a northward facing one. The incidence of this type of change since contact suggests that it may have been more frequent in the past than the limited number of examples described during the course of field-work would suggest. The isolated people of central Kambia provided a precise example of post-contact route loss and new route establishment which bears on this point. Formerly, they had a difficult but direct connection with the people at the head of the Tuman River not far from the Abiamp axe quarry. In those days their connections with the people of the Minj River over the 3200 m MSL Kinkainku Pass were unimportant. The Tuman headwaters link continued to be maintained during the 1930s but as soon as steel had replaced stone it was allowed to lapse into disuse and by the 1950s was overgrown. In contrast, the track to the Minj headwaters had become what for Kambia was a major highway leading to the steel tools and shells being distributed by European establishments in the middle Wahgi Valley.

Temporary route alterations were brought about by a number of things. Some choices were made on the basis of seasonal hunting needs, sometimes whole sections of routes were closed by agreement to aid the trapping and hunting of pigs for an approaching festival. Mountain passes were used in all weathers but the choice of lowland routes was affected by the seasons, spells of wet weather and short-term floods, nocturnal rains and flash-floods and the state of repair of bridges. Some were changed by politics. All were affected by current states of enmity and alliance and in many cases the signals of hostility were clearly shown on the tracks, bridges being cut down and warning signs posted. This happened in every region but the patterns of response that it was possible to adopt varied, largely because of contrasting settlement patterns.

In former times, in both densely populated highlands and sparsely populated lowlands, marriage ties rarely extended beyond immediate neighbours. One's consanguinal kin, relatives by marriage, and enemies, habitual and temporary, were all neighbours. In isolated settlements, once enmity broke contact with a neighbouring group all trade in that direction ceased until peace was made. In closely settled parts alternative strategies were possible, for enemy territory could be avoided and contact with more distant groups made through the land of allies or through uninhabited mountains, all without much interruption to the dominant directional flows of goods. Of course the demand for particular goods and ease of access to them was a powerful incentive to re-establish peace - salt-makers and axe-makers enjoyed more peaceable relations than most - but alternative paths were frequently used because of hostility.

Journeys around the main block of the Bismarck Range exemplify the phenomenon. Established popular routes over the lowest cols joined the surrounding valleys, the Jimi headwaters to the Mambu and Marum tributaries of the Ramu, other Ramu tributaries in Gende territory to the Chimbu, the Chimbu to the Koronigl and the Koronigl to the Jimi headwaters. When fighting made the use of a regular low altitude route hazardous, secondary and tertiary paths were used. Typical of these are the multiplicity of routes over the Iwam pass between the head of the Chimbu Valley and the Bismarck Fall, and the routes from the middle Chimbu Valley via the Singganigl and Mainigl Valleys to the Koronigl. Higher still, hunting paths criss-crossed the alpine grasslands and scrub: in former times these were not through routes but men sometimes met trade friends from other valleys in the hunting shelters. The mountain tops themselves, here generally above 3750 m MSL, were carefully avoided for they were the haunt of spirits.[1] Since pacification these tracks have occasionally been used for through traffic. As informants in highlands regions said, it was not just that

[1] In marked contrast to Melpa and Enga traffic near the summit of Mt Hagen.

safety was achieved by avoiding settled areas but that the danger came from neighbours, not distant friends, and that by using circuitous routes in times of danger it was possible to pass behind one's neighbours to meet people with whom one had never come into conflict and among whom men of enterprise had trade friends. The flexibility of strategies open to highlanders probably helps to explain part of their evident success in promoting transactions of all types, ceremonial exchanges and trade.

Something should be said of the ways in which, indeed, the ingenuity with which, physical obstacles were overcome; New Guinea terrain has a notorious reputation among people dependent upon the wheel. Mountain passes which carried significant traffic varied in altitude from 1900 m MSL in the western Bismarck Range to 3500 m MSL in the Kubor Range. Most were easy to use, the paths climbing gradually by spurs and ridges to the saddles, the only difficulties being long, relatively level tracts inside the high mountain forest which in the wet season became quagmires of tangled roots, and the occasional necessity to use a steep water course as an avenue of access to a summit ridge. Most passes could be crossed in a day though one in the Bismarck Range and both of the principal Kubor Range routes required nights on the track. In the Kubors these had to be spent at altitudes in excess of 2750 m MSL, always cold, usually windy and wet,[1] and the people did not wear clothes. Yet not only men travelling for trade used these routes; as everywhere else, nearly all roads were used by families, including heavily laden women and small children. The longest routes had regular named shelter sites, where low huts of pandanus leaves were built and maintained by passing travellers. In the middle altitudes rockshelters were used, and in the lowlands rockshelters and lean-tos of sago fronds.

In all regions the precise location of a route was often dictated by the position of cliffs and river gorges. Large rivers forced paths to converge on canoe and raft crossings and bridge sites, the latter dictated by engineering problems and the former by the need for level stretches of quiet water. New Guinea paths may have more bridges per mile than anywhere else in the world; they vary from the flimsiest branches over garden drains to logs half a metre in diameter over deep gorges. Rivers in level terrain may have arch-bridges supported on posts fanned out from each bank, where high banks and tall trees are lacking, or suspension bridges ingeniously set on pylons, or combinations of both. Where large timber is scarce, bundles of laths are lashed together to form a beam. The main paths over the plateaus of the Tua region often ran for long distances along fallen logs, through garden and forest alike. There, many gullies were bridged simply for convenience, to avoid a short steep descent and ascent, for timber was in prolific supply. Where cliffs, giant boulders or tall trees provided suitable sites, suspension bridges were constructed of every size, some spanning distances of 100 metres, the lowest point sometimes 20 metres above the surface of the water.

THE CONTEXT OF EXCHANGE

This study has been concerned with the overall flow of trade goods and its underlying economic rationale, irrespective of the context of exchange itself. A detailed discussion of the relationship between transfers of goods which were manifestly prestations and those which were manifestly barter will be made elsewhere, but some aspects must be mentioned. Most of the goods which appeared in one form of transaction also appeared in the other, though, in the case of minor raw material trade items like forest fibres, they were transformed into finished goods for prestation. However, the context of exchange of some items differed according to whether it took place in exporting regions or importing regions. In the whole of the study area, only one product mentioned in trade failed to be mentioned as being used in some prestation, and that was the bark of a large lowland forest tree (*?Cinnamomum* sp.) used as a medicine and aromatic. Doubtless there are others, but they are minor forest products. Only one type of product ceremonially exchanged failed to be mentioned anywhere in trade, and that was staple root crops and common green vegetables.

[1] Everywhere in the central highlands silence is enjoined while passing through alpine forest; if men have to talk they should do so in low tones. A variety of calamities can result from loud violation of the realm of mountain spirits, the most frequent being rainstorms.

The staple food prestation of the Wahgi and Asaro regions has elements of the potlatch and is a fiercely competitive redistributive transaction with a long delay before the gift is reciprocated.[1] It has elements in common with the longer-cycle competitive pig slaughter and pork distribution and the two forms resemble the other examples of competitive feasting of rival groups and aggressive food distributions with which the anthropological literature abounds. However, in terms of the total traffic in goods within the study area the transactions involving staples were unique: other goods used in prestations, including pigs, pork and luxury vegetable foods, were also traded - staples were not. In general, goods which brought the highest economic reward usually brought the greatest socio-political reward, and valuables as a class tended to appear more often in prestations, utilitarian goods tended to appear more often in trade. Transactions elsewhere in tribal societies are sometimes described in terms of a model based on separate spheres of exchange derived from the restricted convertibility of categories of goods. This model will not fit any region in the study area. Although values had to be matched in both trade and prestations, and ornaments, axes, salt and animals or cassowaries of certain minimum value were needed for important ceremonial exchanges, different items were favoured in different regions and were often accompanied by items of lesser value, including such mundane things as cooked food. Pigs were the means of converting cheap carbohydrate into expensive protein and were the principal means of changing the most ubiquitous garden products into valuables. Varying quality and size in the most valuable items together with the divisibility of cooked pork, minor shell, tooth and feather ornaments, salt, pigments, oil and luxury crops, and at lower altitudes, tobacco, meant that somewhere in the process of production and manufacture and the network of distribution, complete interchangeability could be achieved.

Trading was aided by the institutionalising of certain aspects - the commercial use of kinsmen, the establishment and maintenance of trade friends, ritualised propitiation and peace-making, the ritualising of behaviour appropriate to trade, the recognised opportune use of public occasions for private trade, the extending of credit (not always by choice) by agreeing to delayed payments, the acceptance of minor shell valuables as media of exchange, regional measures of quantity especially in linear measure, the appropriate use of pigs and pork in certain exchange contexts, and in some parts, the use of special stone axes as stores of negotiable wealth.

Because this study has been concerned with total traffic in goods I have been able to use the word 'trade' loosely, in places using it to refer to all movements of a particular product, elsewhere using it only for simple inter-personal transfers of goods unaccompanied by ceremony. The data show that 'pure trade' and 'pure ceremonial exchange'[2] are idealisations, the poles at the ends of a continuum of occasions when goods change hands.

In contrasting what he called 'market', 'trade partnership' and 'affinal exchange' transactions in the Admiralty Islands, Schwartz found that the following terms described important differentiating criteria: ceremonial/non-ceremonial, among kin/among non-kin, intra-ecological/cross-ecological, immediate/delayed, symmetrical/asymmetrical (as to persons and goods) (1963:78). On an earlier occasion (1969) I listed the characteristics of the polar extremes as they appeared on the evidence of the present study, omitting the well known entrepreneurial role of the 'big man' in ceremonial exchange as initiator, assembler and redistributor. Meggitt (1971:196) drew attention to it and to the use of supporting magic. Table 17 is an amended list.

The barter end of the continuum is well exemplified by planned journeys to get stone axes or salt, specific goods for payment being prepared in advance, perhaps plumes, shells or a pig, and an armed party setting off to the limits of the security circle of the most important man. The prestation end is best

[1] A check of the recorded occasions of pig festivals and staple food distributions throughout the Chimbu area over a period of 20 years suggested that while clansmen could not give staples when their own pig festival was approaching, they did not receive staples at only these times. The two prestations did not appear to be an example of what Schwartz called 'the co-ordination of different ecological and ceremonial calendars' (1963:79).

[2] 'Pure gift' seems to have little utility even as an idealisation, as Mauss (1966) suggested more than 40 years ago when criticising Malinowski's use of the term and as M. Panoff recently reminded us (1970).

Trade	Prestations
Goods always differ	Goods often the same
Goods always the product of specialized resources and/or labour	Goods sometimes not the product of specialized resources and/or labour; usually not the specialized product of givers or receivers.
Return 'gift' usually immediate	Return give usually delayed
Transaction often between non-relatives	Transaction nearly always between relatives
Transaction usually between individuals independent of any group exchange	Transaction usually between individuals but usually as part of a group exchange, usually initiated by a leader and sometimes channelled through him
Transfer itself rarely involves prestige or status	Transfer itself always involves prestige and status
Transfer usually private and unceremonial	Transfer nearly always public and ceremonial
Magic in support of a successful transaction rarely used	Magic to ensure a successful outcome and a return of wealth often used
Traders usually stress material benefit more than socio-political benefit	Giver often stresses socio-political benefit more than material benefit

Table 17 Characteristics distinguishing trade from prestations

shown by a transaction involving no material return, such as the payment of blood-money without which neither trade nor peaceful social relations can resume.

THE OVERALL TRADE SYSTEM

This study drew an arbitrary boundary around a large section of the central highlands and adjacent lowlands of eastern New Guinea to enclose an area of contrasting resources, habitats and cultures. It was found to be covered by a network of trade routes which the presence of marine shells showed extended from coast to coast. The network itself was created by and built up of the interlocking and overlapping personal trading networks of individual men. For the purpose of this study they formed the smallest components. An analysis of the way in which the activity of individuals created their personal trade nets might usefully break them down on the basis of a number of separate criteria - linkages established primarily for subsistence ends, for luxuries or to acquire valuables and to participate in wider political relationships, or it could examine the portions of the net which were dependent upon consanguinity, affinity or friendship, and the basic dyadic connections that comprise them.

Each personal network and every larger unit of which it was a part was found to be an open system. Although the individual links of personal trading nets were not strictly coterminous with those of personal communication nets, when the trading connections were combined with connections for prestation they covered the entire personal communication net. A study of the total flow of goods therefore could ignore the differences between these webs of interaction and treat each man's personal communication network as the basic unit. Each was nested in a hierarchy of open systems in which trade took place. If the relationship of prestations to barter was to be further analysed note would have to be taken that they belonged to two different but overlapping hierarchies. The most notable manifestation of this was that the great ceremonial exchange cycles utilised like goods and tended to take place within regions of similar resources whereas trade utilised unlike goods and was most vigorous between regions of great contrast. Orders of magnitude in both of these hierarchies increased with the size of the social or areal units examined: family, men's house group, clan, relatives, trade friends, or hamlet, village, clan territory,

tribal territory and region. With each step the order of complexity of the growing web was multiplied by an unknown large factor.

Aspects of the totality of trade other than the network were also nested in rank order, and this characteristic explains some aspects of the pattern of flow of goods. For example, the main determinant on the supply side, access to resources, on which in an area lacking merchants all trading ultimately depended, can be abstracted in this way. It then appears as a hierarchy of production and supply systems, one inside the other, each order of magnitude being a resource access region of increasing ubiquity. Thus, access regions for minor mineral products were nested inside those for major mineral products which in turn were set inside large ecological zones determining plant and animal resources, each producing characteristic flow patterns. Comparative advantages in supply and regional and local differences in demand resulted in a pattern of trade areas for individual goods which were nested in another way, those for minor products, irrespective of the type, being encircled by those for valuable items like stone axes and shells.

The study has shown that the linkages that made up the basic network as well as the flows of goods which passed through them not only extended across physiographic, ecological and cultural divisions [1] but were most vigorous there, for that was where the potential for trade was greatest. The origins and destinations of the flows of goods traced by observation and interview supported the initial hypothesis that in inland New Guinea as elsewhere, resource differences made it possible for trade to develop; only areally specialised products were traded.

It is false to describe a segment of the wider trading network as 'a trading system' if it is distinguished by area alone; a trading system must have unique systemic characteristics. Where specialised merchants exist, such as coastal canoe traders, it is meaningful to describe their set of delimited movements as a system within a system, as Harding (1967) has done with the Siassi of the Vitiaz Strait. If a portion of the inland trade was exceptionally highly developed and active, as the early references suggest the Kikori-Samberigi-Kewa-Kakoli section was, it might usefully be studied and described as a system. However, within the area examined here, no such dominant system exists. Within the overall pattern of flow of goods, however, there were identifiable product trade areas, individual regional and inter-regional product-distribution systems for localised mineral resources (pottery, salt, pigments and stone axes), and well-defined regional ceremonial exchange systems. There were no tribal, regional or central highlands trade systems as separate entities. Individual goods travelled far beyond the horizons of individual traders, and the network itself far exceeded the trade area of the most widely distributed good. Whether the scale of trade is measured by distance travelled by particular goods or by quantities or by the number of traders participating, that which took place in and around the central highlands was very great, and it was not as restricted by the seasons as was the canoe trade. However, trade within the study area was one large segment of a web of trade that covered every part of the mainland of New Guinea, extended to the Bismarck Archipelago as Harding has shown, to all the offshore islands, to Australia and to Asia.

As a result of his analysis of the trade of the Vitiaz Strait Harding was of the opinion that special mechanisms of regional integration had developed in Melanesia which were not seen elsewhere, and he suggested that this may have been 'related to' [the cause of?, caused by?] the greater scale of trading, especially the existence of a long-distance canoe trade (1967:241, 242). He was referring to the *Kula*-type valuable exchange system to which he likened the Vitiaz Strait trade in pig's tusks and dogs on the one hand and pigs and dog's teeth on the other (ibid:244). Schwartz likened the *Kula* to the *Te* and *Moka* chains of the highlands and characterised them as integrative systems based on a 'horizontally structured network' in opposition to the 'dispersed network' typical of the Admiralty Islands (1963:89), which appears to be the most common form in New Guinea.

The existence of this form of integrative system in the highlands shows that as systems they were not dependent on long-distance specialised traders.[2]

[1] Whether these are regarded as boundaries or as gradients depends on the degree of abstraction.

[2] In contrast to inland trade, it is likely that much hazardous canoe trade resulted from necessity, commenced for subsistence and continued for wealth and social success; for many islanders it was the best economic option; a few probably had no option.

Nor was the system the result of a greater scale of trading, though more goods obtained by trade permitted more to be invested in prestation and the scale of the ceremonial cycle to grow. The ceremonial system in turn stimulated trade by raising the demand for valuables to even higher levels. The Wahgi region cyclic pig festival was not a parallel system intended to keep trade connections and obligations open, nor were the *Te* and *Moka*, though where they occurred this was a result. We have already noted their restriction to regions sharing what were essentially like resources, very clearly so in the case of the Wahgi pig feast. Although within this region shell valuables, stone axes, pigs and pork circulated and moved to and fro along the strike of the central cordillera, the dominant trade flows were between regions of contrasting resources, the highlands, the lowlands and the coast.

Meggitt has said that the *Te* 'facilitates' the flow of important commodities (1974:200), and in the sense of stimulating demand and providing opportunities for exchange, this is so. He also sees the *Te* as part of an 'equilibrium system' keeping the Mae Enga 'adjusted to their limited resources' (ibid:201). However, the data from within the study area clearly indicate that every increase in competitive production and exchange, including trade, increases the pressure on resources. Furthermore, unlike trade for utilitarian goods, these prestigious ceremonial exchange systems increased wealth differentials. No 'equilibrium system' has been demonstrated for subsistence farmers but those lacking elaborate competitive ceremonial systems like the *Te* reduce their total available resources at a much slower rate, as has been shown for biological resources by Clark (1971) and Rappaport (1971).

The phenomenon of delayed exchange has been seen by some as a purposive Melanesian mechanism sustaining social relations and trade (Harding 1967:243). Statements by informants in the present study showed that prolonged obligation and credit certainly facilitated all traffic in goods, just as it does in Western society, but that in the context of barter it was largely making a virtue of necessity. Alternating feasting and redistribution was a desired end in the large cyclic prestations, and although delay was due to the need to accumulate wealth, grow food and raise pigs before commencing the exchange transaction, the cyclic nature was co-ordinated and each group's festivals planned not to coincide with another's. In trade, however, delay resulted mainly from the inability to co-ordinate planning between regions and was due to lack of telecommunications.

On an earlier occasion (1969:14) I said that I believed Rappaport (1967[1968]:105-9) to be correct in his suggestion that among the Maring and their neighbours the unlimited demand for valuables allowed unmatched demands for utilitarian goods to be met.[1] (Utilitarian goods and valuables could be exchanged for each other, they were not in separate 'spheres of exchange'.) Rappaport noted that the Tsembaga Maring of the Simbai Valley produced salt which they traded through a chain of intermediaries to the Tsenga and Ganz River axe-makers of the southern Jimi Valley in return for work axes. Each was dependent on the other, he said, but these were utilitarian goods and the demand for utilitarian goods was limited - should either suffer an oversupply of the imported good they would cease production of their own speciality. Moral pressure to continue to supply without reward would be ineffective because of the distance and other groups intervening.[2] Because shell and plume ornaments and 'bridal axes' were always in demand, especially for bride-price, and could be exchanged for utilitarian goods, they 'provided a mechanism for articulating the production' (ibid:108) of the two specialised utilitarian items.

The fact that there was no firm division between work axes and 'bridal axes' and that elsewhere salt was used as a true valuable does not invalidate Rappaport's hypothesis. But the general statements of informants suggest that transmitted requests for goods were rarely effective when more than one mutual trade partner was the medium. Rappaport suggested that requests might be

[1] He also suggested (ibid) that valuables enabled population distribution and rates of population growth to be equalised by causing women to flow to the group which was slowest growing and hence had the smallest demand for utilitarian goods (cf. Salisbury 1956), but it should be pointed out that the ramifications in the directional flow of both valuables and utilitarian goods revealed in the course of the present study suggest that the asymmetry of marriages will show a pattern even more complex, because of the role of marriages in access to land and in political alliance.

[2] Within the area of this study no-one supplied goods without reward.

effective when trader or group was the centre of a trading *web* rather than part of a trading *chain*. However, in the Simbai and Jimi Valleys and throughout the study area the webs were constructed of chains; the path of a product through the web was a series of links in a chain of exchange forming part of the web. Utilities tended to take shorter paths than valuables but goods of both categories moved in the same basic steps, sometimes across one link, sometimes another, but trending in a general direction.

To derive his hypothesis Rappaport regarded the set of transactions as a closed system, which it patently was not, and pigs played a vital part in the total traffic, as he himself has shown. The Maring could have made less effective but adequate work axes from river boulders as others did when good imported axes were scarce; however, they were well off for axes and they had some choice; while most came to them from the Tsenga factory some came via different intermediaries from the Ganz River factory. Maring demand for work axes was not limited by the number they could work with, for some were traded north; similarly some salt was passed on by the axe-makers. They, in turn, were not dependent on the Maring for salt for they also got it from the Karam of the Kaironk Valley and they received Enga salt from the west; the people of Tsenga and Ganz River actually exchanged Maring and Enga salt. They also made potassium salts. A cessation of Maring demand for axes would not have stopped axe production, for they were exported in many directions, and conversely, not only the axe-makers ate Maring salt and in most places the demand for salt exceeded the supply.

Another serious objection is that the model underrates the importance of the intermediate links in the chain. In former times, neither manufacturer knew of the existence of the other. Simbai Valley Maring knew only that axes could be got from their Jimi Valley Maring neighbours to the south and that vaguely they came from across the Jimi River. The axe-makers knew only that salt came to them from over the river to the north. For each, their political and commercial worlds were circumscribed by the demands expressed by their neighbours and the goods which they had to offer. Each node in the many-stranded web that stretched between the Simbai and Tsenga-Ganz River areas had a different set of demands and a different set of goods to offer, all affected by their location in reference to east-west as well as north-south flows of goods, and by past, present and planned trading and ceremonial activity. Money cowries, for instance, came down the valley from the east, and dog whelks and green snail shell came up from the west. A host of minor ornaments and utilitarian goods were exchanged in a multiplicity of directions, mediating between transfers of larger items and often masking for a time the dominant directions of flow.

Rappaport's limiting assumption may have helped him to derive his hypothesis but his main argument is sustained even when the assumption is relaxed. The evidence presented here shows that valuables were not the only media of exchange and that the transfer of utilitarian goods would have proceeded without the circulation of special axes and shells and plumes, that subsistence needs would have been met and luxuries like better work axes and more and better salt would have been exchanged. Nevertheless, valuables stimulated the production of utilitarian goods, increased the quantities and rates of flow through the network and assisted their transfer by acting as supplementary and better media of exchange, better because their relative values changed less spatially and temporally than those of specialised utilitarian goods. In addition, shell valuables were almost as durable as stone axes and the small shells could be combined or divided almost as freely as the small denominations of other currencies. They gave flexibility to trade and added a new quality to the practice of politicking with gifts. This usefulness added value to beautiful ornaments and axes, and it is reasonable to suppose that it played a part in the evolution of valuables as a class of goods.

Traffic in goods reached its greatest elaboration in the highlands regions, well founded on a basis of mineral resources, benign agricultural environment, intensive and highly productive agriculture, intensive pig husbandry and a salubrious climate. In the context of New Guinea these regions had developed a series of high-consumption affluent societies. But whether the region was rich or poor, subsistence needs, luxury wants and the desire for wealth and

socio-political success all caused men to initiate and continue trade.

We see neolithic New Guinea trade as part of the process of human adaptation to a number of contrasting environments, see the resulting pattern of intersecting paths as a structure connecting regions of great ecological and cultural diversity, and see the long flows of goods as integrating the products of discrete localities into the economies of others, the paths and the flows transcending physical barriers and the dangerous boundaries of conflicting political hegemonies. To this extent we can regard the trading network as an 'integrating system', but this is an abstract construct. To the participants it would be quite unreal; for them, integration was tenuous in the extreme and for most of them it extended no further than the horizon.

APPENDIX I

Laboratory Report No.53 9th June, 1969

IDENTIFICATION OF MINTERALS IN PIGMENTS FROM TERRITORY OF PAPUA-NEW GUINEA

by

G.H. Berryman

Eight samples from various localities in the T.P.N.G. were submitted by Mr Ian Hughes, Department of Human Geography, A.N.U., for mineral identification by X-Ray Diffraction. Descriptions of the samples are given in Appendix I and are based on information supplied by Mr Hughes.

The analyses were carried out using a Philips P.W. 1051 X-Ray Diffractometer, with the operating conditions as follows:

kV 40	mA 24	Geiger Tube Cukaalpha
R.M. 2 & 4	Mult 1	T.C. 4
Chartspeed 1° 2Ø / min.		Disc. Ch. 12
Slits ¼° and 1° div.	¼° and 1° rec-filter Ni	
Chart range 5° - 80°		

The determinations were made by comparing the unknown patterns with standard A:S.T.M. index patterns and standard mineral patterns.

The order of relative intensities of the minerals identified follows:

Sample No.	1	2	3	4	5
Pigment A	Quartz	Gibbsite	Chlorite	Albite	Muscovite
Pigment B	Vivianite	Hematite	Quartz		
Pigment C	Quartz	Oligoclase	Mg Chamosite*	Spangolite	
Pigment D	Albite	Chlorite	Quartz		
Pigment E	Quartz	Hematite	Chlorite	Muscovite	
Pigment F	Hematite	Muscovite	Quartz		
Pigment G	Albite	Hematite	Quartz		
Pigment H	Quartz	Kaolinite	Hematite		

* Magnesium Chamosite and/or chlorite

PIGMENT A

Location: Yandera, Bundi sub-district, Madang District

Colour: White

Use: Medicine for pigs. It is mixed with cooked sweet potato and fed to the pigs to make them grow large and fat

Mode of occurrence: Not known

Remarks: This material is available from only one source, an old woman called Anatuma. It is believed that she collects it from the leaves of her taro plants on which it appears magically during nocturnal earth tremors which are accompanied by strange noises like pigs grunting in the forest. Legend has it that the substance first occurred some generations ago as a white deposit in and around a hole in the ground. This hole had appeared suddenly during one of the periods of nocturnal earth tremors.

A python with two tails was found in the hole and the substance was referred to as snake's faeces. The site of the hole is well known though the hole no longer exists.

PIGMENT B

Location: Near Nogar, Gena area, Kerowagi sub-district, Chimbu District. Stream called Danigl

Colour: Blue

Use: Pigment

Mode of occurrence: The material occurs as blue, pale blue, and white encrustations on swamp 'wood' found in banded clays. The pigment may also occur in the clays without any swamp 'wood' associated with it.

Remarks: The small deposits of the pale blue and the white pigments associated with the highly prized blue pigment are said to turn blue if tied in a piece of banana leaf and left in water for a week or so.

PIGMENT C

Location: Denggru Creek, Yandera, Bundi sub-district, Madang District

Colour: Pale green

Use: Pigment

Mode of occurrence: The substance occurs as a deposit on the surface of rock walls and boulders in Denggru Creek. It is bright green when wet but dries to a pale green. It appears to have been deposited by water flowing over the rock surfaces.

PIGMENT D

Location: Anaganggoi, Koronigl Valley, Kerowagi sub-district, Chimbu District

Colour: Pale green

Use: Pigment

Mode of occurrence: This material occurs as layers in clay and weathered shales

PIGMENT E

Location: Near Yandera, Bundi sub-district, Madang District

Colour: Shiny black

Use: Pigment

Mode of occurrence: This material is found in joints in rocks

PIGMENT F

Location: Yandera. Bundi sub-district, Madang District

Colour: Shiny red

Use: Pigment

Mode of occurrence: As for 'E'

Remarks: This pigment lacks the lustre of 'E'

PIGMENT G

Location: Upper Chimbu Valley, near Bomkan, Chimbu District

Colour: Shiny black

Use: Pigment

Mode of occurrence: This material occurs as small lenses in weathered rock, thought to be granodiorite.

Remarks: It is said to increase in lustre if immersed in water for ten days with vegetable peelings.

PIGMENT H

Location: Near Nogar, Kerowagi sub-district, Chimbu District

Colour: Red

Use: Pigment

Mode of occurrence: The sample was collected from a bed of sandstone occurring between two outcrops of Chim Limestone.

Remarks: It is said the colour is improved when the material is heated in an open fire.

MONDONO (YANDERA)

Sample No:

Ref. No: 0169

PIGMENT DIETARY SUPPLEMENT FOR PIGS (MARESIN, P.A.)

Collected By: I.M. HUGHES

Collector's Field Ref: YANDERA

Colour Wet/Dry		pH		ϕ	Wt.	% Wt.	Cum. % Wt.	REMARKS - Binocular Examination
170·20 154·04 16·16 169·97 0·23	Dry wts for H_2O_2 treatment	Before	16·16	- 4				GRAVEL
		After	15.93	- 3½				
		Wt Loss	0·23	- 3				
		% Soluble		- 2½				
	Dry wts for dilute HCl treatment	Before		- 2				
		After		- 1½				
		Wt Loss		- 1				
		% Soluble		- ½				SAND
	Wt. for Particle Size			0				
	Sand wt.	%wt.		½				
	Silt			1				
	Clay			1½				
	Silt + Clay			2				
	Organic	·23/16·16	1.42%	2½				
	Acid Soluble			3				
				3½				
	Hydrom Blk	After Subtr	Calculate	4				
	62 μ			5				SILT
	32 μ			6				
	16 μ			7				
	8 μ			8				
	4 μ			9				
	2 μ							CLAY

K Tuttle 23-6-1969

APPENDIX III

THE PETROGRAPHY AND PROVENANCE OF NINE STONE IMPLEMENTS FROM THE NEW GUINEA HIGHLANDS

by

R.J. Ryburn

From a collection of stone axe-adzes submitted by Ian Hughes of the Human Geography Department, Australian National University, nine were selected for thin sectioning and microscopic examination. Of these, three were collected in the Mount Hagen area and six in the Lake Kopiago area.

A brief petrographic description of each specimen is followed by a discussion of their possible sources.

MT HAGEN AREA

20 NG. 2710

Hand specimen: A dark grey metavolcanic retaining primary porphyritic texture

Thin section: The primary volcanic minerals have been reconstituted to *glaucophane*, pale green *clinopyroxene*, *lawsonite*, *garnet* *chlorite* and *sphene* in decreasing order of abundance.

20 NG. 2711

Hand specimen: A fine grained dark green metavolcanic rock

Thin section: *Lawsonite*, *glaucophane-crossite*, green *clinopyroxene*, *epidote*, *albite* and accessory *carbonate* (possibly *aragonite*)

20 NG. 2712

Hand specimen: A fine grained, hard dark rock

Thin section: A pelitic hornfels consisting of *quartz*, *cordierite*; *biotite*. *Muscovite* and *andalusite* in decreasing order. A thermally metamorphosed fine grained siltstone - non schistose.

LAKE KOPIAGO AREA

12 NG. 2550

Hand specimen: A greenish metavolcanic rock with visible garnet porphyroblasts

Thin section: *Glaucophane - crossite*; *epidote*, *garnet*, *chlorite*, *albite*, *zoisite*; *quartz sphene* and *iron ore*: The garnet is retrogressively altering to chlorite.

12 NG. 2551

Hand specimen: A dark grey metavolcanic rock with phenocrystic phase

Thin section: Pale green *clinopyroxene*, pale blue-green *amphibole* (*?hornblende*), *chlorite epidote*, *garnet*, *sphene*, *?lawsonite*

12 NG. 2552

Hand specimen: A fine grained green metamorphosed: sandstone

Thin section: *Actinolite*; *augite*, (relict) *quartz*, (relict detrital), *albite*, *chlorite epidote*, and *sphene*. A metamorphosed

sediment with detrital or tuffaceous volcanic component - green schist facies.

12 NG. 2553

Hand specimen: A fine grained greenish metavolcanic rock

Thin section: Yellow-green *clinopyroxene*, *chlorite*, *muscovite*, *sphene*, *epidote* and (?) *zoisite*

12 NG. 2554

Hand specimen: A dark green metavolcanic rock with blebs of pyrite

Thin section: *Glaucophane*, green *clinopyroxene*, *chlorite*, *epidote*, *garnet* and *zoisite*

12 NG. 2555

Hand specimen: A schistose crystalline metavolcanic rock with needles of glaucophane (?)

Thin section: *crossite*; *epidote*, *muscovite*, *chlorite*, *garnet*, *quartz*, *albite*, *sphene*, *apatite* and *pyrite*

Provenance

Of the nine specimens examined five are glaucophane schists closely resembling rocks outcropping in the Leonhard Schultze River at about 4°50' latitude and 142°15' longitude.

In New Guinea, glaucophanitic rocks are known from the Leonhard Schultze river area, scattered localities in Eastern Papua, and from West Irian where Verhofstad (1966) has described similar glaucophanitic stone implements that are thought to have been quarried at localities on the northern fall of the Central Range. The West Irian examples are more coarsely crystalline and strongly schistose than the specimens described above.

It is highly probable that at least five of these implements have been traded from the Leonhard Schultze River. Specimens 20 NG. 2710, 2711 and 12 NG. 2550, 2554, 2555 contain glaucophane or its iron-rich equivalent crossite, while lawsonite, which is particularly characteristic of the glaucophane schist facies, is present in 20 NG. 2710, 2711 and possible 12 NG. 2551. Of the associated minerals, garnet, zoisite and pale green clinopyroxene (probably sodic) are significant as they are also common associates in the Leonhard Schultze rocks.

20 NG. 2712 is (definitely) a misfit as it is a pelitic hornfels that could have been derived from the Omung metamorphics in the Kubor Range to the south of the Wahgi Valley.

12 NG. 2551 in which lawsonite has been tentatively identified has mineralogical characteristics similar to the glaucophanitic specimens and is probably derived from the Leonhard Schultze area.

12 NG. 2552 is a greenschist, examples of which are found in the Leonhard Schultze but are also common elsewhere in the mountains south of the Sepik Rivers.

12 NG. 2553 is also a greenschist but the presence of pale green clinopyroxene and zoisite indicate derivation from the Leonhard Schultze region.

The possibility of other occurrences of claucophane schist between the Leonhard Schultze River and the August River cannot be ruled out as systematic geological mapping has not been undertaken here. However, no glaucophanitic rocks have been reported by mining companies working in this area. Glaucophane schists are not entirely restricted to the headwaters of the Leonhard Schultze River as they have also been found in the eastern branch of the Frieda River and some western branches of the April River, notably the Bamali River. For further information on the distribution of glaucophane schists in the South Sepik Region refer to the map and text in Dow *et al.* (1968).

REFERENCES

DOW, D.B., J.A.J. SMIT, J.H.C. BAIN and R.J. RYBURN 1968 The Geology of the South Sepik Region, New Guinea. *Bur. Miner. Resour. Aust. Rec.* 1968/80

VERHOFSTAD, J. 1965 Glaucophanitic Stone Implements from West New Guinea (West Irian). Geol Mijub., 45. pp.291-30

BIBLIOGRAPHY

Adam, L. 1953 The discovery of the Vierkantbeil or quadrangular adze head in the Eastern Central Highlands of New Guinea. *Mankind* 4(10):411-23

Ambrose, W.R. in press Obsidian and its prehistoric distribution in Melanesia. *In* Barnard, N. (ed) *Scientific Methods of Research in the Study of Ancient Chinese and Southeast Asian Metal Artefacts: a symposium*

Anell, B. 1960 *Hunting and trapping methods in Australia and Oceania.* Uppsala: Almqvist & Wiksell, Studia Ethnographica Upsaliensia, XVIII

Anon. 1803 *Wreck and loss of the ship 'Fanny'...* . London: Tegg

1835 *Voyage pittoresque autour du monde,...* (published under the direction of M. Dumont D'Urville), vol.2. Paris: Tenre

1879 Geographical notes. *Nature* 19:491

(ed) 1934 Undiscovered New Guinea. *Walkabout* 1.11.1934:17-29

1968 *An ethnographic bibliography of New Guinea.* 3 vols. Canberra: The Australian National University, Department of Anthropology and Sociology

1968-1970 *Man in New Guinea.* Port Moresby: University of Papua New Guinea, Department of Anthropology and Sociology

1972 Salt makers and their origins in the Mt Hagen area. *Hagen News* vol.1(39)

Attenborough, D. 1960 *Quest in Paradise.* London: Lutterworth

Aufenanger, H. 1952 Vokabular und Grammatik der Gende-Sprache in Zentral-Neuguinea. *Micro-Bibliotheca Anthropos* vol.1

1953 Vokabular und Grammatik der Nondugl-Sprache in Zentral-Neuguinea. *Micro-Bibliotheca Anthropos* vol.5

1966 Friendship in the Highlands of New Guinea. *Anthropos* vol.61:305,306

and G. Höltker 1940 *Die Gende in Zentral-neuguinea.* Wein-Mödling: Missiondruckerei

Austen, L. 1934 The Delta Division of Papua. *Australian Geographer* vol.2, no.4:20-7

Australian Water Resources Council, Advisory Panel on Desalination 1966 *A survey of water desalination methods and their relevance to Australia.* Canberra: Department of National Development, Hydrological Series 1

Bass-Becking, L.G.M. 1931 Historical notes on salt and salt-manufacture. *Scientific Monthly* vol.32:434-46

Baessler, A. 1895 *Südsee-Bilder.* Berlin: Reimer

Bain, J.H.C., D.E. Mackenzie and R.J. Ryburn 1970 *Geology of the Kubor Anticline...* Canberra: Bureau of Mineral Resources, Record no.1970/79. (Also now published, 1975, as *Bulletin* 155)

and D.E. Mackenzie 1974 *Karimui, Papua New Guinea.* Canberra: Bureau of Mineral Resources, Sheet SB/55-9 of the 1:250,000 Geological Series-Explanatory Notes

and D.E. Mackenzie 1975 *Ramu, Papua New Guinea.* Canberra: Bureau of Mineral Resources, Sheet SB/55-5 of the 1:250,000 Geological Series-Explanatory Notes

Bampton, W. Capt. [1793] *Journal of the ship Shaw Hormuzear, towards Batavia, May to September, 1793, in company with the Chesterfield, whaler.* Canberra: The Australian National University, Department of Pacific & Southeast Asian History, microfilm

Barnard, N. (ed) 1972 *Early Chinese art and its possible influence in the Pacific Basin.* 3 vols. New York: Intercultural Arts Press

Barnes, F. 1970 The biology of Pre-Neolithic Man. *In* Boyden, S.V. (ed) *The impact of civilisation on the biology of man.* Canberra: Australian National University Press

Barrau, J. 1955 *Subsistence agriculture in Melanesia* (processed). Noumea: South Pacific Commission. (Since printed, 1958, Bishop Museum *Bulletin 219* Honolulu)

1959 The sago palms and other food plants of marsh dwellers in the South Pacific Islands. *Economic Botany* vol.13(2):151-62

Bartlett, H.K. 1964 Note on flint implements found near Nipa, central Papuan highlands. *Records of the South Australian Museum* vol.14(4):669-73

Barton, F.R. 1910 The annual trading expedition to the Papuan Gulf. *In* Seligman, C.G. *The Melanesians of British New Guinea* pp 96-120. Cambridge: Cambridge University Press

Bassett, M. 1966 *Behind the picture.* Melbourne: Oxford University Press

Beaglehole, J.C. (ed) 1962 *The Endeavour journal of Joseph Banks, 1768-1771.* vol.II. Sydney: Public Library of New South Wales with Angus and Robertson

Beauclair, I. De 1961 'Ken-pai', a glass bracelet from Yap. *Asian Perspectives* vol.5(1):113-15

1963 Addenda to 'Ken-pai', a glass bracelet from Yap. *Asian Perspectives* vol.6(1-2):232-35

Becke, L. and W. Jeffery 1896 *A First Fleet family.* London: Fisher Unwin

Behrmann, W. 1914 Geographical results of the Kaiserin Augusta River Expedition. *Berlin Geographical Society Journal* no.4 (translated by H.A. Thomson). Canberra: Australian National University, Institute of Advanced Studies Library, microfilm

1924 *Das Westliche Kaiser-Wilhelmsland in Neu-Guinea.* Berlin: Gesellschaft für Erdkunde

Belcher, E. 1843 *Narrative of a voyage round the world, ...* vol.2. London: Colburn

Bergman, S. 1957 *Through primitive New Guinea.* London: Hale

Bergmann, W. n.d. [1970] *Die Kamanuku.* (Die Kultur der Chimbu Staemme) 4 vols. privately processed. Queensland: Harrisville (English language version issued in 1971)

Berndt, R.M. 1962 *Excess and restraint.* Chicago: University of Chicago Press

Bevan, T.F. 1890 *British New Guinea from the protectorate to the sovereignty, 1884-1888: toil, travel and discovery in British New Guinea.* London: Kegan Paul, Trench, Trübner and Co. Ltd.

Biro, L. 1901 (W. Semayer ed) *Beschriebender Catalog der Ethnographischen Sammlung aus Deutsch-Neu-Guinea (Astrolabe-Bai)*. Budapest: Hornyanszky

Biskup, P. 1968 Hermann Detzner: New Guinea's first Coast Watcher. *Journal of the Papua & New Guinea Society* vol.2(1):5-21

1970 Foreign coloured labour in German New Guinea. *Journal of Pacific History* vol.5:85-107

B.A. Jinks and H. Nelson 1968 *A short history of New Guinea*. Sydney: Angus and Robertson

Black, J. 1938 *Diary* (in Mr Black's possession)

Blackwood, B. 1939 Life on the upper Watut, New Guinea. *Geographical Journal* vol.94(1):11-28

1940 Use of plants among the Kukukuku of southeast-central New Guinea. *Proceedings: 6th Pacific Science Congress, 1939* vol.IV:111-19. Berkeley: University of California Press

1950 *The technology of a modern stone age people in New Guinea*. Occasional Papers in Technology, 3. Oxford: Pitt-Rivers Museum

Blair-West, J.R., J.P. Coghlan, D.A. Denton, J.F. Nelson, E. Orchard, B.A. Scoggins and R.D. Wright 1968 Physiological, morphological and behavioural adaptation to a sodium deficient environment by wild native Australian and introduced species of animals. *Nature* vol.127(5132):922-28

Bligh, W. 1792 *A voyage to the South Sea,...* London: Nicolson

Bodrogi, T. 1953 Some notes on the ethnography of New Guinea. *Acta Ethnologica* Tomus III, Fasciculi 1-4, 91-184, Plates I-VI

1959 New Guinea style provinces: the style province "Astrolabe Bay". Pp 39-99 *in* T. Bodrogi and L. Boglar (eds) *Opuscula ethnologica memoriae Ludovici Biro sacro*. Budapest: Magyar Nemzeti Muzeum

1961 *Art in north-east New Guinea*. Budapest: Hungarian Academy of Sciences

Booth, D.R. 1929 *Mountains gold and cannibals*. Sydney: Cornstalk

Bougainville, L. de 1967 [1772] *A voyage round the world*. (translated by Forster, J.R.) *(Bibliotheca Australiana No.12)* Amsterdam: Israel and New York: Da Capo

Boyden, S. 1970 Cultural Adaptation to Biological Maladjustment. *In* Boyden, S.V. (ed) *The impact of civilisation on the biology of man*. Canberra: Australian National University Press

Bradbury, R.E. 1964 The historical uses of comparative ethnography. *In* Vansina, J. *et al.* (eds) *The historian in tropical Africa*. London: Oxford University Press

Braun, F. n.d. *A brief history of the Lutheran Mission, Madang, New Guinea Territory*. Leaflet (no publisher stated)

British New Guinea Annual Reports, 1886-1906. Brisbane and Melbourne: Government Printer

Brookfield, H.C. 1964 The ecology of Highland settlement: some suggestions. *American Anthropologist* Special Publication vol.66(4), Pt 2:20-38

and P. Brown 1963 *Struggle for land*. Melbourne: Oxford University Press

and D. Hart 1966 *Rainfall in the tropical southwest Pacific.* Canberra: Australian National University, Research School of Pacific Studies, Department of Geography Publication G/3

with D. Hart 1971 *Melanesia, a geographical interpretation of an island world.* London: Methuen

Brown, H.A. 1968 *A dictionary of Toaripi with English-Toaripi Index.* Sydney: University of Sydney Oceania Linguistic Monographs No.11

Brown, P. 1972 *The Chimbu.* Cambridge, Mass: Schenkman

and H.C. Brookfield 1959 Chimbu land and society. *Oceania* vol.30(1):1-75

and H.C. Brookfield 1967 Chimbu settlement and residence: a study of patterns, trends and idiosyncracy. *Pacific Viewpoint* vol.8(2):119-51

Bruyn, J.V. de 1959 New archaeological finds at Lake Sentani. *Nieuw-Guinea Studiën* vol.3:1-8; pl.1-3

1962 New bronze finds at Kwadeware, Lake Sentani. *Nieuw-Guinea Studiën* vol.6:61-62

Bulmer, R.N.H. 1961 Men and birds in New Guinea... Canberra: revised version of talk to New Guinea Society 14.5.1961 roneo

1969 Field methods in ethno-zoology, with special reference to the New Guinea Highlands. Port Moresby: University of Papua New Guinea, roneo

1971 The role of ethnography in reconstructing the prehistory of Melanesia. *In* Green, R.C. and M. Kelly (eds) *Studies in Oceanic culture history* vol.2. Honolulu: B.P. Bishop Museum

Bulmer, S.E. 1964a Prehistoric stone implements from the New Guinea Highlands. *Oceania* vol.34(4):246-68

1964b Radiocarbon dates from New Guinea. *Journal of the Polynesian Society* vol.73:327-8

1966a *The prehistory of the Australian New Guinea Highlands.* Auckland: University of Auckland, MA thesis (unpublished)

1966b Pig bone from two archaeological sites in the New Guinea Highlands. *Journal of the Polynesian Society* vol.75:504-5

1970 The historic and prehistoric pottery of New Guinea,... Port Moresby: paper read to ANZAAS Congress

1974 Settlement and economy in prehistoric Papua New Guinea. Auckland: University of Auckland, Department of Anthropology *Working Papers in Archaeology* no.30

Bulmer, S. and R. 1964 The prehistory of the Australian New Guinea Highlands. *American Anthropologist* Special Publication vol.66 (4): Pt.2:39-76

Bulmer, S.E. and W.C. Clarke 1970 Two stone spear or dagger heads from the Bismarck Mountains, New Guinea. *Records of the Papua and New Guinea Museum* vol.1(1):42-5

and W. Tomasetti 1970 A stone replica of a bronze socketed axe from the Chimbu District of Australian New Guinea. *Records of the Papua and New Guinea Museum* vol.1(1): 38-41

Burkill, I.H. 1935 [1966 ed] *A dictionary of the economic products of the Malay Peninsula.* Kuala Lumpur: Ministry of Agriculture

Butcher, B.T. 1963 *We lived with headhunters.* London: Hodder & Stoughton

Carman, W.Y. 1955 *A history of firearms.* London: Routledge & Kegan Paul

Catley, A. 1963 Notes on insects as foods for native peoples in Papua and New Guinea. *Transactions of the Papua and New Guinea Scientific Society* vol.4:10-12

Cernohorsky, W.O. 1967 *Marine shells of the Pacific.* Sydney: Pacific Publications

1972 *Marine shells of the Pacific* vol.II. Sydney: Pacific Publications

Chalmers, J. n.d. [1887] *Pioneering in New Guinea.* London: Religious Tract Society

1895 *Pioneer life and work in New Guinea 1877-1894.* London: Religious Tract Society

Champion, I. 1940 The Bamu-Purari Patrol, 1936. *Geographical Journal* vol.96(3):190-206; (4):243-57, map

Chappell, J. 1966 Stone axe factories in the Highlands of East New Guinea. *Proceedings of the Prehistoric Society* vol.32 96-121

Chauvet, S. 1930 *Les Arts Indigènes en Nouvelle-Guinée.* Paris: Société d'Editions Géographiques

Cheesman, E. n.d. [1934?] *The land of the red bird.* London: Joseph

1949 *Six-legged snakes in New Guinea.* London: Harrap

Cheng, Te-K'un 1969 *Archaeology in Sarawak.* Toronto: University of Toronto Press; Cambridge: Heffer

Chinnery, E.W.P. 1934 The Central Ranges of the Mandated Territory of New Guinea from Mount Chapman to Mount Hagen. *Geographical Journal* vol.84(5):398-412

Churchill, W. 1916 *Sissano movement and migration within and through Melanesia.* Washington: Carnegie Institution

Cipolla, C.M. 1965 *Guns and sails in the early phase of European expansion 1400-1700.* London: Collins

Claassen, O.R. and K.A. McElhanon 1970 Languages of the Finisterre Range - New Guinea. Canberra: Australian National University, *Papers in New Guinea Linguistics No.11,* Pacific Linguistics Series A, no.23

Clark, C.M.H. 1962 *A history of Australia* vol.1. Melbourne: Melbourne University Press

Clark, G. 1962 *World prehistory: an outline.* Cambridge: Cambridge University Press

1965 Traffic in stone axe and adze blades. *Economic History Review* 2nd Series, vol.18(1):1-28

Clarke, W.C. 1966 From extensive to intensive cultivation: a succession from New Guinea. *Ethnology* vol.5(4):347-59

1968 *The Ndwimba Basin, Bismarck Mountains, New Guinea: place and people.* Berkeley: University of California, Department of Geography PhD thesis (unpublished)

1969 The Bomagai-Angoiang of New Guinea: the world's most efficient farmers? Canberra: The Australian National University, Department of Geography seminar background paper

1971 *Place and people: an ecology of a New Guinea community.* Berkeley: University of California Press

and I. Hughes 1974 Salt making among the Baruya. *Australian Natural History* vol.19(1):22-24

Clements, F.W. 1970 Some effects of different diets. *In* Boyden, S.V. (ed) *The impact of civilisation on the biology of man.* Canberra: Australian National University Press

Clune, F. 1942 *Last of the Australian explorers.* Sydney: Angus & Robertson

1943 *Prowling through Papua.* Sydney: Angus & Robertson

Collingridge, G. 1895 *The discovery of Australia.* Sydney: Hayes Bros.

Cook, E.A. 1966 Narak: language or dialect. *Journal of the Polynesian Society* 75(4):437-44

1967 *Manga social organisation.* New Haven: Yale University PhD thesis

Corris, P. 1968 'Blackbirding' in New Guinea waters. *Journal of Pacific History* vol.3:85-105

Coutts, P.J.F. 1967 Pottery of Eastern New Guinea and Papua. *Mankind* vol.6(10):482-88

Criper, C. 1967 *The Politics of exchange - a study of ceremonial exchange among the Chimbu.* Canberra: Australian National University PhD thesis

Crosby, E. 1973 *A comparative study of Melanesian hafted edge-tools and other percussive cutting implements.* Canberra: The Australian National University, Research School of Pacific Studies, Department of Prehistory, PhD thesis (unpublished)

CSIRO (Commonwealth Scientific and Industrial Research Organisation) 1968 *Arid Zone Newsletter* Canberra

LRRS (Division of Land Research & Regional Survey)

1957 *Lands of the Gogol-Upper Ramu Area, New Guinea* Canberra: Divisional Report no.57/2

1959 *Lands of the Lower Ramu-Atitau Area, New Guinea.* Canberra: Divisional Report no.59/1

1968 *Lands of the Wewak-Lower Sepik Area, TPNG.* Melbourne: Land Research Series no.22

1969 *Lands of the Kerema-Vailala Area, Papua-New Guinea.* Melbourne: Land Research Series no.23

1970 *Lands of the Goroka-Mt Hagen Area, Papua-New Guinea.* Melbourne: Land Research Series no.27

Currey, C.H. 1963 *The transportation, escape and pardoning of Mary Bryant (née Broad).* Sydney: Angus & Robertson

Dahl, L.K. 1958 Salt intake and salt need. *New England Journal of Medicine* vol.258(23):1152-7

D'Albertis, L.M. 1880 *New Guinea: what I did and what I saw.* 2 vols. London: Low, Marston, Searle & Rivington

Dampier, W. 1729 [1939 ed] *A voyage to New Holland.* London: Argonaut

Dana, E.S. and W.E. Ford 1932 *A textbook of mineralogy.* 4th ed. New York: Wiley

Denton, D.A. 1965 Evolutionary aspects of the emergence of aldosterone secretion and salt appetite. *Physiological Reviews* vol.45:245-95

1967 Salt appetite. *In* Code, C.F. (ed) *Handbook of Physiology*, Section 6: Alimentary Canal, vol.2:433-59. Washington: American Physiological Society

1970 Salt and high blood pressure. *Insight no.270, radio script.* Sydney: Australian Broadcasting Commission

J.F. Nelson, E. Orchard and S. Weller 1969 The role of adrenocortical hormone secretion in salt appetite. *In* Pfaffman, C. (ed) *Olfaction and Taste.* New York: Rockefeller University Press

Detzner, H. 1921 *Vier Jahre unter Kannibalen.* Berlin: Scherl

Diamond, J.M. 1971 Birds of the Karimui Basin, New Guinea. *National Geographic Society Research Reports, 1965 Projects:* 69-74

1972 *Avifauna of the eastern highlands of New Guinea.* Cambridge, Mass: Publications of the Nuttall Ornithological Club:12

Dickie, J. and D.S. Malcolm 1940 Note on a salt substitute used by one of the inland tribes of New Guinea. *Journal of the Polynesian Society* vol.49(193):144-7

D'Orbigny, E. and J.A. 1859 *Histoire Générale des Voyage par Dumont D'Urville* vol.II. Paris: Furne

Douglas, J. 1900 *Past and present on Thursday Island and Torres Strait.* Brisbane: Outridge

Dow, D.B. and F.E. Dekker 1964 *The geology of the Bismarck Mountains, New Guinea.* Canberra: Department of National Development, Bureau of Mineral Resources, Report no.76

J.A.J. Smit, J.H.C. Bain and R.J. Ryburn 1968 *The geology of the South Sepik Region, New Guinea.* Canberra: Department of National Development, Bureau of Mineral Resources, Record no.168/80. (Also now published, 1972, as *Bulletin* 133)

Duff, R. 1970 *Stone adzes of Southeast Asia.* Christchurch: Canterbury Museum, Bulletin 3

Dunmore, J. 1965 *French explorers of the Pacific.* Vol.1. London: Oxford University Press

Dumont D'Urville, J. 1834 *Voyage Pittoresque Autour du Monde.* Vol.2. Paris: Dupuy

Earl, G.W. 1853 *The native races of the Indian Archipelago: Papuans.* London: Hippolyte Baillière

Edwards, E. 1791 *Journal of the ship Pandora, and the ship's boat, after shipwreck.* Canberra: National Library of Australia, microfilm

Etheridge, R. Jr 1894 On an aboriginal implement, believed to be undescribed, and supposed to be a hoe. *Proceedings of the Linnean Society of New South Wales* vol.19:109-12

Fernandez, J.G. and A.O. Rogel 1968 Digging in the past. *Esso Silangan* vol.13(3):6-13

Finsch, O. 1893 *Ethnologische Erfahrungen und Belegstücke aus der Südsee.* Wien: Hölder

Fischer, D. 1955 *Unter Südsee-Insulanern; das Leben des Forschers Miklouchо-Maclay.* Leipzig: Koehler and Amelang

Fisher, N.H. 1937 Geological report, Benembi Plateau, Mt Hagen Area. *Rabaul Times* 17.2.1937

Flierl, J. 1932 *Christ in New Guinea.* Tanunda: Flierl

Flinders, M. 1814 *A voyage to Terra Australis...* , (2 vols) London: Nicol

Ford, E. 1963 Nicolai Nicolaevitch de Miklouko-Maclay 1846-1888. *Annual Report* and *Proceedings of the Papua and New Guinea Scientific Society* vol.15:8-20

Forrest, T. 1779 *A voyage to New Guinea ...* . London: Scott

Fox, R.B. 1959 *The Philippines in the Prehistoric Times.* Manila: UNESCO National Commission of the Philippines

1967a The archaeological record of Chinese influences in the Philippines. *Philippine Studies* vol.15(1):41-60

1967b Excavations in the Tabon Caves... *In* Zamora, M.D. (ed) *Studies in Philippine Anthropology.* Quezon City: Alemar, Phoenix Publications

Franklin, K.J. 1968a *The dialects of Kewa.* Canberra: Australian National University, Pacific Linguistics Series B - Monographs no.10

1968b Languages of the Gulf District: a preview. *In* Voorhoeve, C.L. *et al. Papers in New Guinea Linguistics no.8.* Canberra: The Australian National University, Pacific Linguistics Series A - Occasional Papers no.16

Freund, A.P.H., E.E. Henty and M.A. Lynch 1965 Salt-making in inland New Guinea. *Transactions of the Papua and New Guinea Scientific Society* vol.6:16-19

Fry, H.T. 1969 Alexander Dalrymple and New Guinea. *Journal of Pacific History* vol.4:83-104

Furnass, S.B. 1970 Changes in non-infectious diseases associated with the processes of civilisation. *In* Boyden, S.V. (ed) *The impact of civilisation on the biology of man.* Canberra: Australian National University Press

Gaisseau, P.D. 1957 *Visa to the prehistoric world.* London: Muller

Gardner, R. and K.G. Heider 1969 *Gardens of war: life and death in the New Guinea Stone Age.* London: Deutsch

German New Guinea Annual Reports 1900-1913 (German Colonial Office Gazette, translated by H.A. Thomson). Canberra: Australian National University Library, microfilm

Gilliard, E.T. 1953 New Guinea's rare birds and Stone Age men. *National Geographic Magazine* vol.103(4):421-88

1955 New Guinea's rare birds and Stone Age men, II. *National Geographic Magazine* vol.108(4):440-685

Glasse, R.M. and M.J. Meggitt (eds) 1969 *Pigs, pearlshells and women.* Englewood Cliffs: Prentice Hall

Glover, I. 1969a Radiocarbon dates from Portuguese Timor. *Archaeology and Physical Anthropology in Oceania* vol.4(2):107-12

1969b *Prehistoric research in Timor.* Canberra: Australian National University, Research School of Pacific Studies, Department of Prehistory, seminar paper

Godelier, M. 1969 La 'Monnaie de Sel' des Baruya de Nouvelle-Guinée. *L'Homme* vol.9(2):5-37

1971 'Salt currency' and the circulation of commodities among the Baruya of New Guinea. *In* Dalton, G. (ed) *Studies in economic anthropology.* Washington: American Anthropological Association

Goldstein, K.S. 1964 *A guide for field workers in folklore.* Peru, Hatboro: Folklore Associates

Golson, J. 1968 Archaeological prospects for Melanesia. Pp 3-14 *in* Yawata, I. and Y.H. Sinoto (eds) *Prehistoric culture in Oceania.* Honolulu: Bishop Museum Press

1971 The remarkable history of Indo-Pacific man. 5th David Rivett Memorial Lecture. Published, 1972 in *Search* vol.3(1-2):13-21 and *The Journal of Pacific History* vol.7: 5-25

1972a Both sides of the Wallace Line: New Guinea, Australia, Island Melanesia and Asian Prehistory. Pp 533-595 *in* Barnard, N. (ed) *Early Chinese art and its possible influence in the Pacific Basin*, vol.3. New York: Intercultural Arts Press

1972b The Pacific islands and their prehistoric inhabitants. Pp 5-33 *in* Ward, R.G. (ed) *Man in the Pacific Islands.* Oxford: Clarendon Press

in press (a) Archaeology and agricultural history in the New Guinea highlands. Pp 201-20 *in* Sieveking, G. de G., I.H. Longworth and K.E. Wilson (eds) *Problems in economic and social archaeology.* London: Duckworth

in press (b) Simple tools and complex technology: agriculture and agricultural implements in the New Guinea Highlands. *In* Wright, R.V.S. (ed) *Stone tools as cultural markers: change, evolution and complexity.* Canberra: Australian Institute of Aboriginal Studies

R.J. Lampert, J.M. Wheeler and W.R. Ambrose 1967 A note on carbon dates for horticulture in the New Guinea Highlands. *Journal of the Polynesian Society* vol.76:369-71

Gordon, D.C. 1951 *The Australian frontier in New Guinea.* New York: Columbia University Press

Grabowsky, F. 1895 Der Bezirk von Hatzfeldhafen und Seines Bewohner. *Petermanns Mitteilungen* vol.41:186-9

Green, R.C. and M. Kelly (eds) *Studies in Oceanic culture history* vol.2. Honolulu: Bishop Museum, Department of Anthropology, Pacific Anthropological Records no.12

Greenop, F.S. 1944 *Who travels alone.* Sydney: Murray

Griffin, H.L. n.d. [*c.*1925] *An official in British New Guinea.* London: Palmer

Grimshaw, B. 1911 *The new New Guinea.* London: Hutchinson

Gusinde, M. 1958 Die Ayom - Pygmäen auf Neu-Guinea. *Anthropos* vol.53:497-574; 817-63

Haantjens, H.A. (ed) 1968 *Lands of the Wewak-Lower Sepik Area, T.P.N.G.* Melbourne: Commonwealth Scientific and Industrial Research Organisation, Land Research Series, no.22

1970 *Lands of the Goroka-Mt Hagen Area, T.P.N.G.* Melbourne: Commonwealth Scientific and Industrial Research Organisation, Land Research Series, no.27

Haddon, A.C. 1901 *Headhunters black, white & brown.* London: Methuen

(ed) 1935 *Reports of the Cambridge Anthropological Expedition to Torres Straits* vol.1. Cambridge: Cambridge University Press

1936 Introduction. Pp xiv-xxii *in* Lord Moyne, *Walkabout.* London: Heinemann

Hannemann, E.F. 1969 *Grass roots art of New Guinea.* Sydney: Pacific Publications

Harding, T.G. 1967 *Voyagers of the Vitiaz Strait.* Seattle and London: University of Washington Press

Harrer, H. 1964 *I come from the Stone Age.* London: Hart-Davis

Harrisson, T. 1963 Translucent glass rings from Borneo. *Asian Perspectives* vol.6(1-2):236-38

Hatanaka, S. 1972 *Leadership and socio-economic change in Sinasina, New Guinea highlands.* Canberra: Australian National University, New Guinea Research Unit Bulletin no.45

Hawkesworth, J. 1773 *An account of the voyages ... by Commodore Byron, Captain Wallis, Captain Carteret and Captain Cook...* , (3 vols). London: Strahan and Cadell

Healy, A.M. 1967 *Bulolo, a history of the development of the Bulolo Region, New Guinea.* Canberra: Australian National University, New Guinea Research Unit Bulletin no.15

Hedley, C. 1892 Uses of shells among the Papuans. *In* Thomson, J.P. *British New Guinea.* London: Philip

Heekeren, H.R. van 1958 *The Bronze-Iron Age of Indonesia.* 'S-Gravenhage: Martinus Nijoff, Verhandelingen von het Koninklijk Instituut voor Taal-, Land- en Volkenkunde, Deel XXII

Heeres, J.E. 1899 *The part borne by the Dutch in the discovery of Australia, 1606-1765.* Leiden and London: Royal Dutch Geographical Society

Heider, K.G. 1969 The Dongson and the Dani: a skeuomorph from the West Irian Highlands. *Mankind* vol.7(2):147-8

Henty, E.E. 1969 *A manual of the grasses of New Guinea.* Lae: Department of Forests, Division of Botany, Botany Bulletin no.1

Hetzel, B.S. and P.O.D. Pharoah (eds) 1971 *Endemic cretinism.* Goroka: Institute of Human Biology, Monograph Series no.2

Hide, R.L. 1969 Worms and sickness. *Mankind* vol.7(2):149-51

Hides, J.G. 1935 *Through wildest Papua.* London: Blackie

1936 *Papuan wonderland.* London: Blackie

Hinton, A. 1972 *Shells of New Guinea and the Central Indo-Pacific.* Port Moresby: Robert Brown & Associates and Jacaranda Press

Hipsley, E.H. 1950 Some items of interest regarding salt consumption amongst native peoples of New Guinea. *Food and Nutrition Notes and Reviews* vol.7(14):15

1964 The example of New Guinea. *South Pacific Bulletin* July:45-50

and N.E. Kirk 1965 *Studies of dietary intake and the expenditure of energy by New Guineans.* Noumea: South Pacific Commission, Technical Paper no.147

Historical Records of Australia (1915) Series 1, Governor's Despatches: vol.V:1803-June 1804; vol.VI:July 1904-August 1806

Hockings, P. 1968 On giving salt to buffaloes: ritual as communication. *Ethnology* vol.7(4):411-26

Hodge, F.W. (ed) 1959 *Handbook of American Indians north of Mexico.* Pt.2 (Bureau of American Ethnology, Smithsonian Institution, Bulletin 30). New York: Pageant Books

Hoffman, A. n.d. Letter to editor *Nachrichten über Kaiser Wilhelmsland* 1894-8 (translated by H.A. Thomson). Canberra: Australian National University Library, microfilm

Hogbin, I.H. 1935 Trading expeditions in northern New Guinea. *Oceania* vol.5(4):375-407

1947 Native trade around the Huon Gulf. *Journal of the Polynesian Society* vol.56:242-55

1951 *Transformation scene.* London: Routledge & Kegan Paul

Holzknecht, K. 1957 Über töpferei und tontrommeln der Azera in Ost-Neuguinea. *Zeitschrift für Ethnologie* vol.82: 97-111

Hood, F.A. 1936 New Guinea jewellery. *Walkabout* vol.2(10): 25-6

Hooley, B.A. and S. Terit 1972 Preparation of salt among the Buang, New Guinea. *Man* (n.s.) vol.7(2):319-22

Howlett, D.R. 1962 *A decade of change in the Goroka Valley, New Guinea: land use and development in the 1950's.* Canberra: Australian National University, Department of Geography, PhD thesis (unpublished)

Hughes, I.M. 1966 *Availability of land, and other factors determining the incidence and scale of cash cropping in the Kere Tribe, Sina Sina, Chimbu District, New Guinea.* Sydney: University of Sydney, BA (Hons) thesis (unpublished)

1969 Some aspects of traditional trade in the New Guinea Central Highlands. Adelaide: ANZAAS Congress in symposium: Human adaptation and cultural change in Melanesia

1970 Pigs, sago and limestone. *Mankind* vol.7(4): 272-8

1971 *Recent neolithic trade in New Guinea: the ecological basis of traffic in goods among stone-age subsistence farmers.* Canberra: Australian National University, Department of Human Geography, PhD thesis (unpublished)

1973 Stone-age trade in the New Guinea inland: historical geography without history. *In* Brookfield, H. (ed) *The Pacific in transition: geographical perspectives on adaptation and change.* London: Edward Arnold

1974 Traditional trade. *In* Ford, E. (ed) *Resource Atlas of Papua New Guinea.* Brisbane: Jacaranda Press

in press (a) The use of resources in traditional Melanesia. *In* Winslow, J. (ed) *The Melanesian Environment: change and development.* Canberra: Australian National University Press

in press (b) Traditional trade. *In Encyclopaedia of Papua New Guinea*, supplementary volume. Melbourne: Melbourne University Press in association with University of Papua New Guinea

in press (c) Sago. *In Encyclopaedia of Papua New Guinea*, supplementary volume. Melbourne: Melbourne University Press in association with University of Papua New Guinea

Hunter, J. 1793 *An historical journal of the transactions at Port Jackson and Norfolk Island ...* . London: Stockdale

Hurley, F. 1924 *Pearls and savages.* New York: Putnam

Huxley, T.H. 1935 *Diary of the voyage of HMS Rattlesnake* (ed Julian Huxley). London: Chatto & Windus

Index Kewensis 1895 (1960 ed) Volumes I, II and supplement to 1970. Oxford: Oxford University Press

Jack-Hinton, C. 1972 Discovery. Pp 246-257 *Encyclopaedia of Papua and New Guinea.* Melbourne: Melbourne University Press

Jukes, J.B. 1847 *Narrative of the surveying voyage of HMS Fly, commanded by Captain F.P. Blackwood ...* 2 vols. London: Boone

Kalix, Z. n.d. [1962] *Salt.* Canberra: Department of National Development, Bureau of Mineral Resources, Mineral Resources of Australia Summary Report no.42

Keil, D.E. 1973 Pottery of the northern portion of the Bena Bena Census Division, Eastern Highlands District and of the Nahu-Rawa Census Division, Madang District... . Evanston: Northwestern University, Department of Anthropology (unpublished paper)

Key, C.A. 1972 The mineralogy of the pottery finds at Aibura. Appendix 3 *in* White, J.P. *Ol Tumbuna.* Canberra: Australian National University, Research School of Pacific Studies, Department of Prehistory, *Terra Australis* 2.

n.d. [1968?] Ceramic technology and ceramic analysis in Melanesia. Canberra: Australian National University, Research School of Pacific Studies, Department of Prehistory, MS

n.d. [1969?] The mineralogy of the pottery finds at Aibura. Canberra: Australian National University, Research School of Pacific Studies, Department of Prehistory, MS

Klein, W.C. (ed) 1953 *Nieuw Guinea De Ontwikkeling op Economisch, Sociaal en Cultureel Gebied, in Nederlands en Australisch Nieuw Guinea.* S'Gravenhage: Staats-drukkerij en Uitgeverijbedrijf

Koenigswald, G.H.R. von 1968 Classification of some stone tools from Java and New Guinea. *Asian and Pacific Archaeology Series* 2:112-38. Honolulu: University of Hawaii, Social Science Research Council

Kolff, D.H. Jr 1840 *Voyages of the Dutch Brig of War 'Dourga'* (translated by G.W. Earl). London: James Maddon

Kroeber, A.L. 1941-2 Culture element distribution. *University of California Anthropological Records* vol.6(5):1-6

Laade, W. 1969 Ethnographic notes on the Murray Islanders, Torres Strait. *Zeitschrift für Ethnologie* vol.94(1):33-40

Labillardière, M. 1800 *Voyage in search of La Pérouse... 1791-1794.* London: Stockdale (Facsimile edition 1971. Amsterdam: Israel and New York: Da Capo

Lampert, R.J. 1967 Horticulture in the New Guinea Highlands - C14 Dating. *Antiquity* vol.41:307-9

1972 Hagen axes. Canberra: Australian National University, Research School of Pacific Studies, Department of Prehistory (unpublished paper)

Landtman, G. 1927 *The Kiwai Papuans of British New Guinea: a nature-born instance of Rousseau's ideal community.* London: MacMillan and Co. Ltd.

1933 *Ethnographical collection from the Kiwai district of British New Guinea, in the National Museum of Finland, Helsingfors (Helsinki).* Helsingfors (Helsinki): Commission of the Antell Collection

Lane-Poole, C.E. 1925 *The forest resources of the Territory of Papua and New Guinea.* Melbourne: Victorian Government Printer for Commonwealth of Australia

Langdon, R. 1966a Captain Bampton's journal. *Journal of Pacific History* vol.1:185,186

1966b Forgotten French navigator blazed new trails in the South Pacific. *Pacific Islands Monthly* vol.37(5): 81-5

Laracy, H.M. 1969 *Catholic missions in the Solomon Islands 1845-1966.* Canberra: Australian National University PhD thesis

Lauer, P. 1970a Amphlett Island pottery trade and the Kula. *Mankind* vol.7(3):165-76

1970b *Pottery traditions in the D'Entrecasteaux Islands of Papua.* Canberra: Australian National University, Research School of Pacific Studies, Department of Prehistory, PhD thesis

1972 A neglected aspect of New Guinea pottery technology: firing. *Pottery in Australia* vol.11(1):7-16

Laurie, E.M.O. and J.E. Hill 1954 *List of land mammals of New Guinea, Celebes and adjacent islands 1758-1952.* London: British Museum (Natural History)

Lawrence, P. 1956 Lutheran Mission influence on Madang societies. *Oceania* vol.27(2):73-89

1964 *Road Belong Cargo.* Melbourne: Melbourne University Press

and M.J. Meggitt 1965 *Gods, ghosts and men in Melanesia.* Melbourne: Oxford University Press

Leahy, M.J. 1930-1934 *Diaries.* Canberra: National Library of Australia MS 384/1-7

1936 The Central Highlands of New Guinea. *Geographical Journal* vol.87(3):229-60

and M. Crain 1937 *The land that time forgot*. Sydney: Hurst & Blackett

Lee, I. (Mrs C.B. Marriott) 1920 *Captain Bligh's second voyage to the South Sea*. London: Longmans

Le Souef, A.S., H. Burrell and E. le G. Troughton 1926 *The Wild Animals of Australasia*. London: Harrap

Lett, L. 1935 *Knights errant of Papua*. London: Blackwood

1944 *The Papuan achievement*. Melbourne: Melbourne University Press

Leur, J.C. van 1967 *Indonesian trade and society* (translated by Holmes, J.S. and A. van Marle). The Hague: van Hoeve

Lewis, A.B. 1923 *The use of sago in New Guinea*. Chicago: Field Museum of Natural History, Leaflet no.9

Lidicker, W.Z. and A.C. Ziegler 1968 *Report on a collection of mammals from eastern New Guinea*. Berkeley and Los Angeles: University of California Press, University of California Publications in Zoology, vol.87

Lindt, J.W. 1887 *Picturesque New Guinea*. London: Longmans, Green

Lovett, R. n.d. [*c*.1910] *Tamate, the life and adventures of a Christian hero*. London: Religious Tract Society

Lubbock, A. 1968 Owen Stanley in the Pacific. *Journal of Pacific History* vol.3:47-63

Lyne, C. 1885 *New Guinea*. London: Sampson Low, Marston, Searle & Rivington

Lyng, J. n.d. [*c*.1919] *Our new possession*. Melbourne: Melbourne Publishing Co.

1925 *Island films, reminiscences of "German New Guinea"*. Sydney: Cornstalk Publishing Co.

Maahs, A.M. 1950 Salt-makers of the Wahgi. *Walkabout* vol.16(1): 15-17

1955 Salt-makers of New Guinea. *Natural History* vol.64(7):352-4

MacFarlane, W.V., B. Howard and E. Hipsley 1964 Water and salt metabolism of the Chimbu. *Proceedings of the Australian Physiological Society* May 26

B. Howard, B. Scroggins and S.L. Skinner 1968 Water, electrolytes, hormones and blood pressure of Melanesians in relation to European contact. Washington: Paper to XXIV International Congress of Physiological Sciences. (Abstract published as No.822, *Proceedings of the International Union of Physiological Sciences* vol.VII, 274, Washington)

McAlpine, J.R. 1969 Climate of the Kerema-Vailala Area. *In Lands of the Kerema-Vailala area, Papua-New Guinea*. Melbourne: Commonwealth Scientific and Industrial Research Organisation, Land Research Series, no.23

1970a Climate of the Goroka-Mt Hagen area. *In* Haantjens 1970

1970b Population and land use in the Goroka-Mt Hagen area. *In* Haantjens 1970

and J.C. Saunders 1970 Map of forest types and land use intensity, Goroko-Mt Hagen area. *In* Haantjens 1970

McCarthy, J.K. 1963 *Patrol into yesterday*. Melbourne: Cheshire

McFarlane, S. 1888 *Among the cannibals of New Guinea*. London: London Missionary Society

MacGillivray, J. 1852 *Narrative of the voyage of HMS Rattlesnake, commanded by the late Captain Owen Stanley 1846-1850*. 2 vols. London: Boone

MacGregor, W. 1895 British New Guinea. *Scottish Geographical Magazine* vol.11(4):161-80

McKee, H.S. 1955 Salt supply problems in Papua and New Guinea. *South Pacific Commission Quarterly Bulletin* vol.5(3):25-6

Macknight, C.C. 1969 *The Macassans*. Canberra: Australian National University, Research School of Pacific Studies, Department of Prehistory, PhD thesis

and A.G. Thorne 1968 Two Macassan burials in Arnhem Land. *Archaeology and Physical Anthropology in Oceania* vol.3(3):216-22

MacMillan, D. 1957 *A squatter went to sea*. Sydney: Currawong

MacMillan, N.J. and E.J. Malone 1960 *The geology of the eastern Central Highlands of New Guinea*. Canberra: Department of National Development, Bureau of Mineral Resources, Report no.48

Major, R.H. 1859 *Early voyages to Terra Australis,...* London: Hakluyt Society (reprinted n.d. New York: Franklin)

Malinowski, B. 1915 The natives of Mailu. *Transactions and Proceedings of Royal Society of South Australia* vol.39: 494-706

1922 *Argonauts of the Western Pacific*. London: Routledge & Kegan Paul

Massal, E. and J. Barrau 1956 *Food plants of the South Sea Islands*. Noumea: South Pacific Commission, Technical Paper no.94

Matthiessen, P. 1963 *Under the mountain wall*. London: Heinemann

Maude, H.E. 1966 The cruise of the whaler 'Gypsy'. *Journal of Pacific History* vol.1:193,194

Mauss, M. 1966 *The gift* (translated by I. Cunnison). London: Cohen & West

Mayr, E. 1941 *List of New Guinea birds*. New York: American Museum of Natural History

and E.T. Gilliard 1954 Birds of central New Guinea. *Bulletin of the American Museum of Natural History* vol.103, article 4

Mead, M. 1938 *The mountain Arapesh: 1. An importing culture*. New York: American Museum of Natural History, Anthropological Papers vol.36(3)

Meggitt, M.J. 1956 The valleys of the Upper Wage and Lai Rivers, Western Highlands, New Guinea. *Oceania* vol.27(2):90-135

1957 The Ipili of the Porgera valley, Western Highlands District. *Oceania* vol.28(1):31-55

1958a The Enga of the New Guinea Highlands: some preliminary observations. *Oceania* vol.28(4): 253-330

1958b Salt manufacture and trading in the Western Highlands of New Guinea. *Australian Museum Magazine* vol.12(10):309-13

1971 From tribesmen to peasants: the case of the Mae Enga of New Guinea. *In* Hiatt, L.R. and C. Jayawardena (eds) *Anthropology in Oceania.* Sydney: Angus & Robertson

1974 'Pigs are our hearts!' The Te exchange cycle among the Mae Enga of New Guinea. *Oceania* vol.44 (3):165-203

Meyer, H. 1910 *Das deutsche Kolonialreich* Vol.II. Leipzig: Bibliographisches Institut

Mihalic, F. 1957 *Grammar and dictionary of Neo-melanesian.* Westmead (NSW): Mission Press

Moresby, J. 1874 Recent discoveries at the eastern end of New Guinea. *Journal of the Royal Geographical Society* vol.44:1-14

1875 Discoveries in eastern New Guinea by Captain Moresby and the officers of HMS *Basilisk. Journal of the Royal Geographical Society* vol.45:153-70

1876 *New Guinea and Polynesia: discoveries and surveys in New Guinea and the D'Entrecasteaux Islands.* London: Murray

Morga, A. de 1868 [1609] *The Philippine Islands...* (translated by H.E.J. Stanley). London: Hakluyt Society

Morphett, T. n.d. (a) *Transcript of tape-recorded interviews.* Port Moresby: University of Papua New Guinea, Department of History

n.d. (b) [1967?] *I have lived in two ages.* Transcript of radio programme (unsourced)

Morrell, B. 1832 *A narrative of four voyages...* New York: Harper

Mott, W.D. 1947 Report on the Samberigi Reconnaissance Survey. Appendix 4 *in* F.J. Rickwood & S.J. Paterson 1950. *Report on the Upper Sirebi Reconnaissance Survey.* Sydney: Australasian Petroleum Co. Pty.Ltd., and Island Exploration Co. Pty.Ltd.

Mowat, F. 1952 (1968 ed) *People of the deer.* London: Sphere

Moyne, Lord 1936 *Walkabout.* London: Heinemann

and K. Haddon 1936 The Pygmies of the Aiome Mountains, Mandated Territory of New Guinea. *Journal of the Royal Anthropological Institute* vol.66:269-90

Mulvaney, D.J. 1969 *The prehistory of Australia.* London: Thames & Hudson

Munsell Color Company 1929-60 *Munsell Book of Color.* (pocket ed). Baltimore

Murray, J.H.P. 1912 *Papua or British New Guinea.* London: T. Fisher Unwin

Nature 1879 Geographical Notes vol.19(491)

Nautical Magazine and Naval Chronicle 1846 vol.15; 1847 vol.16. Letter to editor, anon

Neuhauss, R. 1911 *Deutsch Neu-Guinea* 3 vols. Berlin: Reimer (vol.1 translated in part by Thomson, H.A.) Canberra: Australian National University Library, microfilm

Newman, P.L. 1965 *Knowing the Gururumba*. New York: Holt, Rinehart and Winston

Nilles, J. 1942-5 Digging-sticks, spades, hoes, axes and adzes of the Kuman people in the Bismarck mountains of east-central New Guinea. *Anthropos* vol.37-40:205-12

1943 Natives of the Bismarck mountains, New Guinea. Pt I. *Oceania* vol.14(2):104-23

1944 Natives of the Bismarck mountains, New Guinea. Pt II. *Oceania* vol.15(1):1-18

1953 The Kuman people: a study of cultural change in a primitive society in the Central Highlands of New Guinea. *Oceania* vol.24(1):1-27

n.d. [1970?] The Kuman-English dictionary. Kundiawa: mimeographed

Noakes, L.C. 1939 Geological Report on the Chimbu-Hagen Area. Canberra: National Library of Australia (processed, 22 pp)

Nowell, C.E. (ed) 1962 *Magellan's voyage around the world, three contemporary accounts*. Evanston: Northwestern University Press

Oliver, R. 1964 Reflections on the sources of evidence for the pre-colonial history of East Africa. *In* Vansina, J. *et al.* (eds) *The historian in tropical Africa*. London: Oxford University Press

Ollier, C.D., D.P. Drover and M. Godelier 1971 Soil knowledge amongst the Baruya of Wonenara, New Guinea. *Oceania* vol.42(1):33-41

Oomen, H.A.P.C. and M.W. Corden 1970 *Metabolic studies in New Guineans: nitrogen metabolism in sweet potato eaters*. Noumea: South Pacific Commission, Technical Paper no.163

Oosterwal, G. 1961 *People of the Tor*. Assen: van Gorcum

Oremling, F.J. 1956 *The Timor problem: a geographical interpretation of an underdeveloped island* (2nd impression). Groningen: Wolters and S'Gravenhage: Nijhoff

Orr, J.B. and J.L. Gilks 1931 *Studies of nutrition: the physique and health of two African tribes*. London: His Majesty's Stationery Office, Medical Research Council, Special Report Series no.155

Paijmans, K. 1969 Vegetation of the Kerema-Vailala area. *In Lands of the Kerema-Vailala Area, T.P.N.G.* Melbourne: Commonwealth Scientific and Industrial Research Organisation, Land Research Series, no.23

Panoff, F. n.d. [1969] Food and faeces: a Melanesian rite. Canberra: Australian National University, Research School of Pacific Studies, Department of Anthropology and Sociology (seminar paper)

1970 Maenge remedies and conception of disease. *Ethnology* vol.9(1):68-84

Panoff, M. 1970 Marcel Mauss's *The Gift* revisited. *Man* (n.s.) vol.5(3):60-70

Papua, Annual Reports 1907-1936. Melbourne: Government Printer

Peel, G. 1947 *Isles of the Torres Straits.* Sydney: Current Book Distributors

Pospisil, L. 1963a *The Kapauku Papuans of West New Guinea.* New York: Holt, Rinehart and Winston

1963b *Kapauku Papuan economy.* New Haven: Yale University Press, Yale University Publications in Anthropology no.67

Powell, W. 1883a Visits to the eastern and north-eastern coasts of New Guinea. *Proceedings of the Royal Geographical Society of Australasia (New South Wales Branch)* vol.5: 505-17

1883b New Guinea and the Western Pacific. *Proceedings of the Royal Colonial Institute* vol.15:7-39

Purdy, J. 1816 *The oriental navigator... .* London: Whittle and Laurie

Rand, A.L. and E.T. Gilliard 1967 *Handbook of New Guinea birds.* London: Weidenfeld & Nicolson

Rappaport, R.A. 1967 Ritual regulation of environmental relations among a New Guinea people. *Ethnology* vol.6(1):17-30

1967 [1968] *Pigs for the ancestors.* New Haven: Yale University Press

1971 The flow of energy in an agricultural society. *Scientific American* vol.224(3):116-32

Ray, S.H. (ed) 1907 *Reports of the Cambridge Anthropological Expedition to Torres Straits* vol.3., *Linguistics.* Cambridge: Cambridge University Press

Read, K.E. 1966 *The high valley.* London: Allen & Unwin

Reay, M. 1959 *The Kuma.* Melbourne: Melbourne University Press

Reeves, S.C. and M. Dudley 1969 *New Guinea social science field research and publications 1962-67.* Canberra: Australian National University, New Guinea Research Unit Bulletin 32

Reichard, G.A. 1933 *Melanesian design.* 2 vols. New York: Columbia University Press

Rendel, J.M. 1970 The time scale of genetic change. *In* Boyden, S.V. (ed) *The impact of civilisation on the biology of man.* Canberra: Australian National University Press

Ride, W.D.L. 1970 *A guide to the native mammals of Australia.* Melbourne: Oxford University Press

Riley, E.B. 1923 Sago-making on the Fly River. *Man* vol.23 (91):145,146

n.d. [1932?] A Kiwai vocabulary. *In* Ray, S.H. *A grammar of the Kiwai language, Fly Delta, Papua.* Port Moresby: Government Printer

Robbins, R.G. 1960 The anthropogenic grasslands of Papua and New Guinea. Pp 313-29 in *UNESCO Symposium on the Impact of Man on Humid Tropics Vegetation* (Goroka, Territory of Papua and New Guinea). Canberra: Government Printer

1963 Correlations of plant patterns and population migration into the Australian New Guinea Highlands. *In* Barrau, J. (ed) *Plants and the migration of Pacific peoples.* Honolulu: Bishop Museum Press

1968 Vegetation of the Wewak-Lower Sepik area. *In* Haantjens 1968

1970 Vegetation of the Goroka-Mt Hagen area. *In* Haantjens 1970

Roces, A.R. 1968 Philippine jewelry - pre-historic ornaments. *Esso Silangan* vol.13(3):18-28

Romilly, H.H. 1887 *The western Pacific and New Guinea* (2nd ed) London: Murray

1889 *From my verandah in New Guinea.* London: Nutt

1893 *Letters from the western Pacific and Mashonaland 1878-1891.* (edited by S.H. Romilly). London: Nutt

Ross, W.A. 1969 The growth of Catholicism in the Western Highlands. *Journal of the Papua and New Guinea Society* vol.2(2):59-64

Roux, C.C.F.M. 1e 1950 *De Bergpapeoa's van Nieuw-Guinea en hun woongebied.* Leiden: Brill

Rowley, C.D. 1958 *The Australians in German New Guinea, 1914-1921.* Melbourne: Melbourne University Press

1965 *The New Guinea villager.* Melbourne: Cheshire

Salisbury, R.F. 1956a Vocabulary of the Siane language of the eastern highlands of New Guinea. *Micro-Bibliotheca Anthropos* vol.24:x-xiv;1-39

1956b Asymmetrical marriage systems. *American Anthropologist* vol.58:639-55

1962 *From stone to steel.* Melbourne: Melbourne University Press for the Australian National University

1970 *Vunamami.* Berkeley: University of California Press

Sande, G.A.J. van der 1907 *Nova Guinea. Uitkomsten der Nederlandsche Nieuw-Guinea-Expeditie in 1903... Vol. III, Ethnography and Anthropology.* Leyden: Brill

Sarramégna, R. 1965 *Poisonous gastropods of the Conidae family found in New Caledonia.* Noumea: South Pacific Commission

Saunders, J.C. 1957 Vegetation. *In Lands of the Gogol-Upper Ramu area, New Guinea.* Canberra: Commonwealth Scientific and Industrial Research Organisation, Division of Land Research and Regional Survey, Divisional Report no.57/2

1970 Forest resources of the Goroka-Mt Hagen area. *In Lands of the Goroka-Mount Hagen area, Papua New Guinea.* Melbourne: Commonwealth Scientific and Industrial Research Organisation, Land Research Series no.27

Saville, W.J.V. 1926 *In unknown New Guinea.* London: Seeley Service

n.d. A vocabulary of the Mailu-language. London: London Missionary Society (roneoed)

Scarr, D. (ed) 1968 *A cruize in a Queensland labour vessel to the South Seas* by Giles, W.E. Canberra: Australian National University Press

Schuster, M. 1969 Die maler vom May River. *Palette* 33:4-18

Schwartz, T. 1963 Systems of areal integration. *Anthropological Forum* vol.1(1):56-97

Seligman, C.G. 1910 *The Melanesians of British New Guinea.* Cambridge: Cambridge University Press

Semenov, S.A. 1964 *Prehistoric technology* (translated by Thompson, M.W.) London: Cory, Adams and Mackay

Shackleton, N. and C. Renfrew 1970 Neolithic trade routes re-aligned by oxygen isotope analyses. *Nature* vol.228(12):1062-5

Sharp, A. 1960 *The discovery of the Pacific Islands.* Oxford: Clarendon Press

1963 *The discovery of Australia.* Oxford: Clarendon Press

1968 *The voyages of Abel Janszoon Tasman.* Oxford: Clarendon Press

Shepard, A.O. 1957 *Ceramics for the archaeologist.* Washington D.C.: Carnegie Institution

Shepherd, E. 1971a Akmana: a new name in the continuing story of New Guinea exploration. *Pacific Islands Monthly* vol.42(4):41-9

1971b From stone to steel ... Akmana, 1929. *Pacific Islands Monthly* vol.42(5):37-40

Shineberg, D. 1967 *They came for sandalwood.* Melbourne: Melbourne University Press

1971 Guns and men in Melanesia. *Journal of Pacific History* vol.6:61-82

Simpson, C. 1953 *Adam with arrows.* Sydney: Angus and Robertson

1954 *Adam in plumes.* Sydney: Angus and Robertson

Sinclair, J.P. 1966 *Behind the ranges.* Melbourne: Melbourne University Press

1969 *The outside man.* Melbourne: Lansdowne

Souter, G. 1963 *New Guinea, the last unknown.* Sydney: Angus and Robertson

Spinks, K.L. 1934 Mapping the Purari Plateau, New Guinea. *Geographical Journal* vol.84(5):412-16

1936 The Wahgi River Valley of central New Guinea. *Geographical Journal* vol.87(3):222-5

Springhall, J.A. 1969 The use of selected local ingredients for pig rations in the Territory of Papua and New Guinea. *Papua and New Guinea Agricultural Journal* vol.21(2):76-87

Stanhope, J.M. 1968a Blood pressures of the Tinam-Aigrom people, near Simbai, Madang District. *Papua and New Guinea Medical Journal* vol.2(2)

1968b Competing systems of medicine among the Rao-Breri, lower Ramu River, New Guinea. *Oceania* vol.39(2):137-45

Steadman, L.B. 1971 *Neighbours and killers.* Canberra: Australian National University PhD thesis

Steinbauer, F. 1969 *Concise dictionary of New Guinea Pidgin (Neo-Melanesian).* Madang: Kristen Pres

Stevens, H.N. (ed) 1930 *New light on the discovery of Australia as revealed by the journal of Captain don Diego de Prado Y. Tovar* (translated by Barwick, G.F.). London: Hakluyt Society, vol.LXIV

Steward, J.H. (ed) 1963 *Handbook of South American Indians, vols.1-6.* New York: Cooper Square Publishers (First published 1946 Washington D.C.: Smithsonian Institution, Bureau of American Ethnology, Bulletin 143).

and L.C. Faron 1959 *Native peoples of South America.* New York: McGraw-Hill

Stokes, J.L. 1846 *Discoveries in Australia... during the voyage of HMS Beagle in the years 1837-43* 2 vols. London: Boone

Strathern, A.J. 1968 Sickness and frustration: variations in two New Guinea highlands societies. *Mankind* vol.6(11): 545-51

1969a *Kor-nga poklambo* or *ui mbo?* Hagen magic stones. *Archaeology and Physical Anthropology in Oceania* vol.4(2):91-6

1969b The significance of names among the Wiru. Canberra: Australian National University, Department of Anthropology and Sociology, seminar paper

1971 *The rope of moka: big-men and ceremonial exchange in Mount Hagen, New Guinea.* Cambridge: Cambridge University Press

1972 *One father, one blood.* Canberra: Australian National University Press

and M. Strathern 1971 *Self-decoration in Mount Hagen.* London: Duckworth

Strathern, M. 1965 Axe types and quarries. *Journal of the Polynesian Society* vol.74(2):182-91

1966 Note on linguistic boundaries and the axe quarries. *In* Chappell, J. Stone axe factories in the highlands of east New Guinea. *Proceedings of the Prehistoric Society* (n.s.) vol.32:96-121

1969 Stone axes and flake tools: evaluations from two New Guinea Highlands societies. *Proceedings of the Prehistoric Society* (n.s.) vol.35:311-29

Strauss, H. and H. Tischner 1962 *Die Mi-Kultur der Hagenberg-Stämme im östlichen Zentral-Neuguinea.* Hamburg: Cram, de Gruyter

Thomson, B. (ed) 1915 *Voyage of HMS 'Pandora'... to arrest the mutineers of the 'Bounty'.* London: Edwards

Thomson, J.P. 1892 *British New Guinea.* London: Philip

Torres, L.V. de 1607 Relation to the King of Spain, from Manila, 12th July. Tr. Dalrymple in Major, R.H. 1859: *Early voyages to Terra Australis...* . London: Hakluyt Society. *cf.* translation Stanley in Antonio de Morga, 1868 [1609] *The Philippine Islands...* . London: Hakluyt Society

Townsend, G.W.L. 1968 *District officer.* Sydney: Pacific Publications

Townsend, W.H. 1969 Stone and steel use in a New Guinea society. *Ethnology* vol.8(2):199-205

Trotter, C. 1884 New Guinea: a summary of our present knowledge with regard to the island. *Proceedings of the Royal Geographical Society* vol.6(4):196-216

Troughton, E. 1941 [6th edition 1957] *Furred animals of Australia.* Sydney: Angus and Robertson

Tuckson, M. 1966 Pottery in New Guinea. *Pottery in Australia* vol.5(1):91-6

Vansina, J. 1965 *Oral tradition: a study in historical methodology.* London: Routledge and Kegan Paul

R. Mauny and L.V. Thomas (eds) 1964 *The historian in tropical Africa.* London: Oxford University Press

Vayda, A.P. 1972 Pigs. Pp 905-8 vol.2 *Encyclopaedia of Papua and New Guinea.* Melbourne: Melbourne University Press in association with the University of Papua New Guinea

A. Leeds and D.B. Smith 1961 The place of pigs in Melanesian subsistence. *Proceedings of the 1961 Annual Spring Meeting of the American Ethnological Society* pp 69-77

Verhofstad, J. 1966 Glaucophanitic stone implements from West New Guinea. *Geologie en Mijnbouw* vol.45:291-300

Vial, L.G. 1938 Exploring in New Guinea. *Walkabout* vol.4(12): 12-23

1939 Natives of our mandate. *Walkabout* vol.5(6):21-4

1940 Stone axes of Mount Hagen, New Guinea. *Oceania* vol.11(2):158-63

1941 Down the Wahgi, a New Guinea patrol. *Walkabout* vol.7(9):16-20

1942 They fight for fun. *Walkabout* vol.9(1):5-9

Vicedom, G.F. and H. Tischner 1943-8 *Die Mbowamb* 3 vols. Hamburg: Cram, de Gruyter

Villiers, J.A.J. de (editor & translator) 1906 *The East and West Indian mirror, being an account of... the Australian navigations of Jacob le Maire.* London: Hakluyt Society

Waddell, E.W. 1968 *The dynamics of a New Guinea Highlands agricultural system.* Canberra: Australian National University PhD thesis

1972 *The mound builders.* Seattle and London: University of Washington Press. (The American Ethnological Society Monograph 53)

Wade, L.K. 1968 *The alpine and sub-alpine vegetation of Mt Wilhelm, New Guinea.* Canberra: Australian National University PhD thesis

and D.N. McVean 1969 *Mt Wilhelm studies I. The alpine and sub-alpine vegetation.* Canberra: Australian National University, Research School of Pacific Studies, Department of Biogeography and Geomorphology Publication BG/1

Wagner, R. 1967 *The curse of Souw.* Chicago and London: University of Chicago Press

1969a A marriage among the Daribi. *In* Glasse, R.M. and M.J. Meggitt (eds) *Pigs, pearlshells and women.* Englewood Cliffs: Prentice Hall

1969b Daribi and Foraba cross cousin terminologies: a structural comparison. *Journal of the Polynesian Society* vol.79(1):91-8

1972 *Habu.* Chicago and London: University of Chicago Press

Walker, D. 1966 Vegetation of the Lake Ipea region, New Guinea Highlands. 1, Forest, grassland and 'garden'. *Journal of Ecology* vol.54:503-33

Wallace, A.R. 1869 *The Malay archipelago: the land of the orang-utan, and the bird of paradise* 2 vols. London: Macmillan

Ward, R.G. and D.A.M. Lea (eds) 1970 *An atlas of Papua and New Guinea.* Glasgow and Harlow: Collins-Longman in association with the University of Papua New Guinea, Department of Geography

Warner, W.L. 1964 [1937] *A black civilization.* New York, Evanston and London: Harper and Row

Watson, J.B. 1965a From hunting to horticulture in the New Guinea Highlands. *Ethnology* vol.4(3):295-309

1965b The significance of a recent ecological change in the Central Highlands of New Guinea. *Journal of the Polynesian Society* vol.74(4):438-50

Watson, V. 1955 Pottery in the Eastern Highlands of New Guinea. *Southwestern Journal of Anthropology* vol.11:121-8

Werner, E. 1911 *Kaiser Wilhelmsland.* Freiburg: Herdersche

West, K.G. 1939 A morning in Mirani. *Walkabout* vol.5(8):17-19

White, J.P. 1967 *Taim bilong bipo: investigations towards a prehistory of the Papua-New Guinea Highlands.* Canberra: Australian National University, Department of Anthropology and Sociology, PhD thesis

1969 Typologies for some prehistoric flaked stone artefacts of the Australian New Guinea Highlands. *Archaeology and Physical Anthropology in Oceania* vol.4(1): 18-46

1972 *Ol tumbuna.* Canberra: Australian National University, Research School of Pacific Studies, Department of Prehistory, *Terra Australis* 2

Wichmann, A. 1909 *Entdeckungsgeschichte von Neu-Guinea*, vol.1. Leiden: Brill

1910 *Entdeckungsgeschichte von Neu-Guinea*, vol.2. Leiden: Brill

Williams, F.E. 1924 *The Natives of the Purari Delta.* Port Moresby: Government Printer, Territory of Papua, Anthropology Report no.5

1932 Trading voyages from the Gulf of Papua. *Oceania* vol.3(2):139-66

1936 *Papuans of the Trans-Fly.* Oxford: Clarendon Press

1939 Report on the grasslanders. Appendix to *Papua. Annual Report for 1938-39*:39-67

1940 Natives of Lake Kutubu, Papua. *Oceania* vol.11(2):121-286

Williamson, G. and W.J.A. Payne 1959 *An introduction to animal husbandry in the tropics.* London: Longmans, Green

Willis, I. 1969 Who was first? *Journal of the Papua and New Guinea Society* vol.3(1):32-45

Wills, P.A. 1956 Sodium and potassium in Australian foods. *Australian Journal of Experimental Biology* vol.34:165-171

1958 Salt consumption by the natives of the Territory of Papua and New Guinea. *Philippine Journal of Science* vol.87(2):169-77

Wilson, B.R. and K. Gillett 1971 *Australian shells.* Sydney: Reed

Wilson, T.B. 1835 *Narrative of a voyage round the world...* London: Sherwood, Gilbert and Piper

Wiltgen, R.M. 1969 Catholic Mission plantations in mainland New Guinea: their origin and purpose. Pp 329-62 in *The history of Melanesia (second Waigani seminar).* Canberra: Australian National University, Research School of Pacific Studies and the University of Papua and New Guinea

Winstedt, R. 1953 *Dictionary of colloquial Malay.* Singapore: Kelly and Walsh

Wollaston, A.F.R. 1912 *Pygmies and Papuans.* London: Smith, Elder

Womersley, J.S. and J.B. McAdam 1957 *The forests and forest conditions in the Territories of Papua and New Guinea.* Port Moresby: Government Printer

Worsley, P.M. 1951 N.N. Mikloukho-Maclay, pioneer of Pacific anthropology. *Oceania* vol.22(1):307-14

1955 Early Asian contact with Australia. *Past and Present* no.7:1-11

1968 *The trumpet shall sound.* (2nd ed) New York: Schocken

Wright, M. 1965 *If I die.* Melbourne: Lansdowne

Wurm, S.A. 1964 Australian New Guinea Highlands languages and the distribution of their typological features. *American Anthropologist* vol.66(4), Pt 2:77-97

1967 Linguistics and the prehistory of the south-western Pacific. *Journal of Pacific History* vol.2:25-38

Yonge, C.M. 1930 *A year on the Great Barrier Reef.* London: Putnam

Yule, H. and A.C. Burnell 1968 *Hobson-Jobson, a glossary of colloquial Anglo-Indian words and phrases.* London: Routledge and Kegan Paul

Z'graggen, J.A. 1968 Comparative and typological studies in languages of the western Madang District, New Guinea. Canberra: Australian National University, Department of Linguistics, roneoed

1969 *Classificatory and typological studies in languages of the western Madang District, New Guinea.* Canberra: Australian National University, Department of Linguistics, PhD thesis

Zöller, H. 1891 *Deutsch-Neuguinea und meine Ensteigung des Finisterre-Gebirges.* Stuttgart: Union Deutsch Verlagsgesellschaft

TERRITORY OF PAPUA AND NEW GUINEA

ADMINISTRATION DOCUMENTS

Department of Agriculture, Stock and Fisheries

File 19-1-11, Salt Manufacture - Garoka (CH) District

Department of Forests

Map, n.d., Jimi Timber Area

Patrol Correspondence

Resident Magistrate, Delta Division, Kikori, 18-7-30, affidavits by Michael Joseph Leahy and Michael Ignatius Dwyer.

Patrol Reports

Austen, L., Kikori 15-4-23
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Saunders, H.M., Kikori, 15-1-23
Seefeld, P.A.F., Chimbu 16 of 56-7
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Taylor, J.L., 1933, Purari River Headwaters Area
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Wakeford, E.J., Kundiawa 2 of 49-50
Wearne, C.R.G., Wabag 1 of 49-50

Wearne, C.R.G., Wabag 4 of 49-50
Wolsey, J.R., Chimbu 6 of 55-6
Woodward, R.A., Kikori, 29-9-22 (4 of 22-3?)

Station Correspondence

Goroka, District Office
10-4-47, J.L. Taylor a/DO, to the Department of Agriculture, Stock and Fisheries, Port Moresby

Kerema, Resident Magistrate's Office
1938, anon., J2 (Acc.48)
6-2-39, from Commonwealth Analyst, J2 (Acc.48)

Kundiawa, Sub-district Office
5-6-47, J.A. Costelloe ADO, to DO, Goroka
2-11-51, K.W. Jones a/ADO, to DC, Goroka (File 17/1)

Station Diaries

Kundiawa, 25-1-1938 - 6-1-1941