

NEOLITHIC HUMAN MOVEMENT TO ISLAND SOUTHEAST ASIA: THE SEARCH FOR ARCHAEOBOTANICAL EVIDENCE

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ABSTRACT

*Evidence for Austronesian origins and spread during the Neolithic of Island Southeast Asia requires improvement. This paper suggests how recently developed archaeobotanical techniques may generate new types of evidence and considers how root crops, especially yam (*Dioscorea alata*), can be an indicator of movement. It also discusses the present state of research and the implications to the general Austronesian story of finding early or late evidence of the yam in the archaeological record.*

The building of narratives is for me, an ever important task of an archaeologist. With good narratives, we are able to understand our data better and communicate our understanding of the past to the general public. Narratives of human movement in the Neolithic past of Southeast Asia take center stage. The movement of people throughout Island Southeast Asia associated with the spread of Austronesian languages in this period captures the imagination of archaeologists in the region. This narrative covers peoples from the coast of Mainland Southeast Asia, Island Southeast Asia and the Pacific Islands. It is also an important narrative in the sense that, from the start, it is articulated from a natural multidisciplinary standpoint.

It is my aim here to contribute to the understanding of the movement of people from the Mainland to Island Southeast Asia. A deep interest in contributing to the discourse on the origin of the Austronesians is another objective. Presenting ways of acquiring new types of evidence to show human movement does this. Specifically, this is to be achieved through archaeobotanical means. It is also my purpose to discuss the progress of my research along these lines.

AUSTRONESIAN ORIGINS

In the dominant hypothesis of Bellwood (1978, 1985, 1991) and Blust (1988, 1995), the narrative starts geographically from present day Taiwan. Austronesians sailed

across the South China sea from the shores of Taiwan and slowly island hopped to the Philippines and Indonesia, then across to Rapa Nui in Polynesia and the island of Madagascar in the Indian Ocean, exploring and colonising all the major islands in between (Bellwood 1997; Blust 1995; Ehret 1976). In the span of roughly 5000 years, people were able to move slowly through the islands, settling on the coastal or near-coastal areas and major river valleys. Later, they penetrated the centres of these islands. In the process of this migration, languages were born from the original tongue and cultures were transformed all throughout the region.

After the years of slow spread and interaction, these people gave birth to diverse cultures and languages, maintaining similarities derived from the mother culture that crossed the China Sea. Most habitable islands in southeast Asia and the Pacific were colonised. In the cases where there was an older population already present on an island, interaction took place which influenced the way of life of the older population (Bellwood 1991).

The main source of evidence, as the label for the hypothesis will attest, is linguistic. The term Austronesian is a linguistic construct, the proto-language itself a reconstructed mother language for existing groups of languages such as Malayo-Polynesian and Oceanic (Ehret 1976; Bayard 1996). Within these groups of languages are the hundreds of languages spoken throughout Southeast Asia and the Pacific. It is from a string of studies of the lexicon of different Southeast Asian languages that a reconstruction of the Austronesian mother language was accomplished and, consequently, the question of origin of the mother language was addressed.

Questions abound and alternative narratives exist around the dominant story of origin and spread of Austronesians. While peripheral in terms of acceptance, they are nevertheless soundly argued. There is Wilhelm Solheim's Nusantao hypothesis which explains a south to north spread of culture in Southeast Asia. He conceptualised a people, the Nusantao, who interacted with various existing cultures in the region. This triggered the dispersal

of the Austronesian languages together with the spread of cultures and technologies (Solheim 1984, 1996).

There is also Meacham's critique of the Bellwood-Blust hypothesis centred on the use of the linguistic and archaeological data. Like Solheim, Meacham (1988) proposes that the Austronesian homeland was not around the Taiwan-South China coast area but rather within the vast triangular area encompassed by present day Taiwan, Timor and Sumatra. He backed up this hypothesis recently with his interpretation of excavation results from O-luan-Pi in Taiwan. Based on the tool assemblages found in the different layers, Meacham (1995) argued that not only was there a peopling of Taiwan from the Asian mainland but there was also contact with the islands to the south. This contact influenced the Taiwanese Neolithic.

Another alternative hypothesis comes in the rethinking of the old view that the spread of Austronesians into island Southeast Asia followed the coast of the South China Sea from Southern China to Borneo, up north to the Philippines and eastward towards Melanesia. This view was recently articulated by Tsang (1995) who presented findings from his excavations in the P'eng-hu islands, in the middle of the Taiwan strait, which he argued contradicted Bellwood's narrative.

Out of all these contending views, Bellwood's hypothesis dominates because it fits with the linguistic view of Blust, whose views on the origins of the Austronesian language, while dominant, are also challenged within the linguistic discipline.

To my mind, the reason why it is difficult for those in the disciplines of archaeology and linguistics to agree on a single hypothesis lies in the nature of the evidence. Blust (1995) suggests that the variation in conclusions of linguists about Austronesian origins is due to the differences in their use of method and theory. He, more than any of his colleagues, seeks help from archaeology. He relies on the comparative pottery survey of Bellwood (1978, 1997) and the absolute dating of Neolithic sites, also presented by Bellwood, which shows a clear pattern of Neolithic archaeological sites decreasing in age with distance away from Taiwan. This coincides with his view on the Austronesian spread.

In my understanding of the evidence, at present, the comparative pottery and tool assemblage data are not sufficient to make unequivocal conclusions concerning the origins of the Austronesians. Likewise, the use of ethnographic analogies to look at the archaeology is a helpful tool but cannot stand as irrefutable evidence. The key issue then is how do we improve our evidence from an archaeological standpoint.

THE ROLE OF ARCHAEOBOTANY IN THE DISCUSSION

While linguistic evidence serves as direct evidence for the relationship and spread of languages in the region, it has to rely on archaeological evidence to put the sequences of language development into a time perspective. Pottery typologies can be used to monitor the movement of peoples throughout the islands of the Pacific but it is extremely difficult to use this as direct evidence of actual human movement. It is, at best, evidence for the range of one human group's contact with other groups, but one can only infer if there was actually any movement of people that went with the pottery. Having said this, it is still good practice to gather the greatest amount of evidence in the most diverse forms to better understand what happened in the past.

Specific to the question of Austronesian origins: what I am proposing is the addition of a new type of approach that has the potential to add good evidence, if not direct, of human movement. While archaeobotany had been a component in archaeological research in the past, it was and still is under-utilised in Southeast Asian research. It has, in particular, not been utilised to help answer the question of human movement connected with the spread of Austronesian languages and culture. Some limited archaeobotanical work has been carried out on the generation of direct evidence for human consumption of root crops in Polynesia through the study of the spread of taro and sweet potato (Hather 1994). It may be said that the major direction in archaeobotanical research in the region deals with questions pertaining to origins of agriculture and the correlation of rice cultivation with the ancestry of the pre-Austronesian and Austric speakers in Mainland Asia (Glover and Higham 1996), not the movement of peoples *per se*. The search for direct evidence of human consumption of tuberous plants in Southeast Asia is left in the sidelines.

Looking for a botanical indicator of human movement is the key component of my research. While rice is an obvious candidate, the origin of cultivated rice is still botanically problematic, like most of the cultivated plants in the region. There are exceptions of course, and one of them is in fact significant as an indicator of human movement and can be connected to the question of the Austronesian expansion. This plant is the ubiquitous greater-yam (*Dioscorea alata* Linn), presently found in almost all parts of Southeast Asia and the Pacific. This species of yam is known botanically to have been a product of human intervention. A cultivar from the outset, it originated in Mainland Southeast Asia, on the borderlands

of present day China, Thailand, Kampuchea and Laos (Burkill 1951, 1960).

Dioscorea alata cannot cross bodies of water like the China Sea or even the Strait of Malacca other than through human means. It is therefore potentially a very good indicator of human movement through those islands of Southeast Asia which were not part of the former Sundaland during the Pleistocene.

It is worth mentioning that ethnographically, throughout the Pacific, root crops, particularly yams, were favoured sea voyage food (Irwin 1992; Zayas 1994). We can infer that in the period when long sea voyages started, yams, *Dioscorea alata* included, were part of the food parcel of travellers. The challenge lies in looking for direct archaeological evidence. This means identifying remains of this specific species of yam in archaeological contexts.

The ability to identify root crop remains from archaeological sites has developed recently. With the exception of desiccated remains of *Solanum* sp. in South America, all discussion of human domestication and exploitation of root crops are based on inferences of tool functions and ethnographic data (Harris 1969, 1989; Alexander 1977). Not until the development of a method for identifying charred remains of root crops by Jon Hather (1994) was it possible to recognise the presence of root crop remains in an archaeological context; especially in a tropical setting.

The morphological identification of cell tissues in charred form is a technique well suited for the generation of direct evidence of human consumption of tuberous plants. This method was applied in Polynesia with the identification of parenchyma remains belonging to *Ipomoea batatas* Lam. (Hather 1994). However, the material was not identified to the species through clear morphological indicators on the charred remains. The species concerned was inferred through historical background information of root crop introduction in Polynesia. The identification of charred tuber remains to the species will be the biggest challenge in the search for evidence of human movement.

In a nutshell, the method used concentrates on extracting charred remains by sieving before subjecting the matrix to flotation. Potential tuberous remains are sorted, based on morphological features of the remaining cell structure of the charred material, and concentrating on materials which are likely to be remains of parenchyma cell tissues. With a reference collection of different charred tubers/root crops and varieties of *Dioscorea alata*, it is possible to match the diagnostic features of the charred archaeological material with modern material using Scanning Electron Microscopy (SEM) (Hather 1993; Paz 1997). When attempting to analyse a sample, one looks for the diagnostic features in the charred remains such as

cell sizes, cell shape, the nature of the vascular tissues, druses (globular masses of needle-like crystals on cell walls) and the presence of carbonised starch grains. Species identification depends on the occurrence of at least two of these diagnostic features. With this method at hand, and proper control of carbon dates, one can place the remains of root crops in a time scale and see how they can show human movement or affect the different hypotheses on the movement and origin of Austronesian speakers.

PROGRESS OF WORK

In order to increase the chances of generating the direct evidence needed to show human movement from charred botanical remains, progress must be made in various aspects of the research. An appropriate methodology has to be developed, plant taphonomy (deposition patterns) have to be established and excavation sites need to be chosen.

Taking methodology first, a sieving experiment which subjects a known amount of charred root crops to two types of retrieval technique (direct flotation of the matrix and dry sieving through 4 mm meshes before the matrix is floated off) has almost been completed. The aim is to see if there is significant breakage of charred parenchyma when subjected to direct flotation during the process of retrieval and if dry sieving the matrix will limit the breakage of the charred material. At this stage, a couple of interesting observations, which may be significant, can be made.

Firstly, tubers when charred in a sandy matrix produce hard charred parenchyma, be the plant *Dioscorea* spp. or a *Colocasia* spp. In contrast, if tubers are charred when there is no matrix, flaky and airy charred parenchyma which disintegrate into small fragments easily result.

Secondly, there is no significant difference in terms of breakage between the samples which are directly floated and those which undergo initial sieving (full report on experiment soon to be written).

As far as understanding deposition processes is concerned, to help direct the search for charred remains more efficiently, my personal ethnoarchaeological observations reinforce the assumption that charred parenchyma can end up in the archaeological record. Observations made on root crops, wild tubers used in the Sierra Madre Mountains of Luzon, Philippines, generated the following insights.

There is a good chance that tuberous food will get charred if it is prepared by boiling or direct roasting. When boiled, the skin is usually peeled before or after boiling and the peelings are thrown in a midden or left scattered around the habitation area. If the tubers are roasted, the charred surface is scraped off to get to the edible parts. At Landing, General Nakar, in the Sierra Madre (Figure 1), I

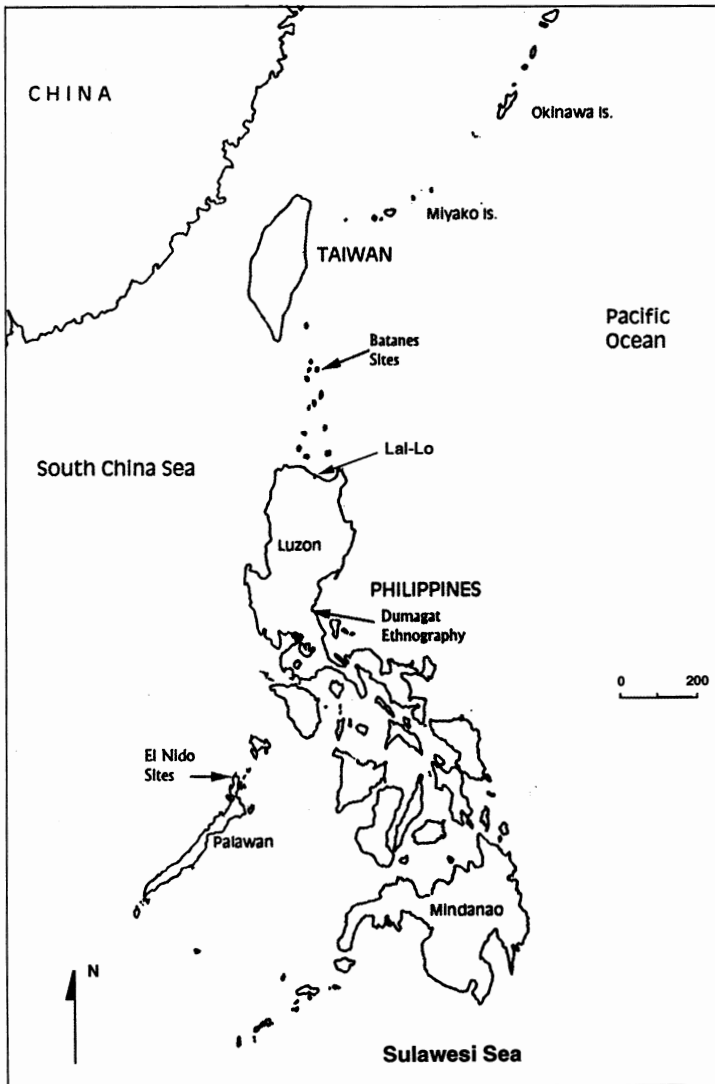


Figure 1: The Philippines: places mentioned in the text.

observed the preparation of a sweet dish called *ginataan* made from various varieties of yams and cassava. Scrutinising the peelings I noticed that they mostly had layers of parenchyma tissue. Later on I was told that the peelings were deposited in a nearby midden pit and that the midden was occasionally set on fire. Observing the Dumagat roast two small tubers of taro from a swidden field, I found that the scraping was carried out near the camp fire so as to be able to eat the tubers while still hot.

The significance of these observations to the recovery of fossil material is crucial. Gathering samples of the scrapings of roasted taro from our camp floor, I mounted and analysed the best fragments on a SEM stub (Figures 2a, 2b). In the process I found that parenchyma tissues are

identifiable in the scrapings. I was not lucky enough to get a clear view of vascular tissues. My confidence increases on the likelihood of possible existence and identification of fragments of vascular tissues on charred scrapings of yams, given that the vascular bundles of yams tend to be near the surface (yam tubers have stem structures).

In order to identify the archaeological material to species, a good reference collection is essential. I am building my reference collection by gathering various varieties of root crops. To date, I have collected a total of 43 root crops and wild tubers. Out of these samples, eight are cultivars of *Dioscorea alata* and five are of wild tubers. The wild tubers were collected during ethnographic work in the Sierra Madre and at El Nido on Palawan (Figure 1). These wild tubers are ethnographically known to have been eaten frequently in the past but are now only considered to be famine or forest-travel food.

All the samples were analysed. An average sample of 6.5 x 6.5 x 2.5 cm of parenchyma from each tuber was treated in an alcohol and formalin solution, stained thin sections were then made and the remaining material was stored for future bio-chemical work and as a reserve. Roughly the same amount of parenchyma from each sample was sun dried and later charred in an oven at 275° C. These samples will be used for SEM analyses. Another set of samples was charred fresh and, in most cases, samples charred without a matrix of sand were also charred. I have started to collect samples sieved and floated from recent archaeological excavations. At present I concentrate on the Philippines, not only because of logistical limitations, but also because existing hypotheses for the origin and spread of the Austronesians may be effectively tested using these islands. The sites comprise two categories: those deliberately chosen, and those which are convenient.

I was fortunate to be able to join the excavations of Tsang Cheng-hwa of Academia Sinica in Taipei and the National Museum of the Philippines at the two important shell midden sites of Capina and Supnet near Lal-lo, Lower Cagayan Valley of northern Luzon, and was able to gather samples of charred materials from identified cultural layers within these middens. The results of the C-14 dating of these sites suggest that the lower layers date to about 5000 bp while the upper layers date to about 4000 bp, well inside the time corridor pertinent to the Austronesian dispersal (Tsang Cheng-hwa, pers. comm.).

The results of the C-14 dating of these sites suggests that the lower layers fall within the 5000 bp range while

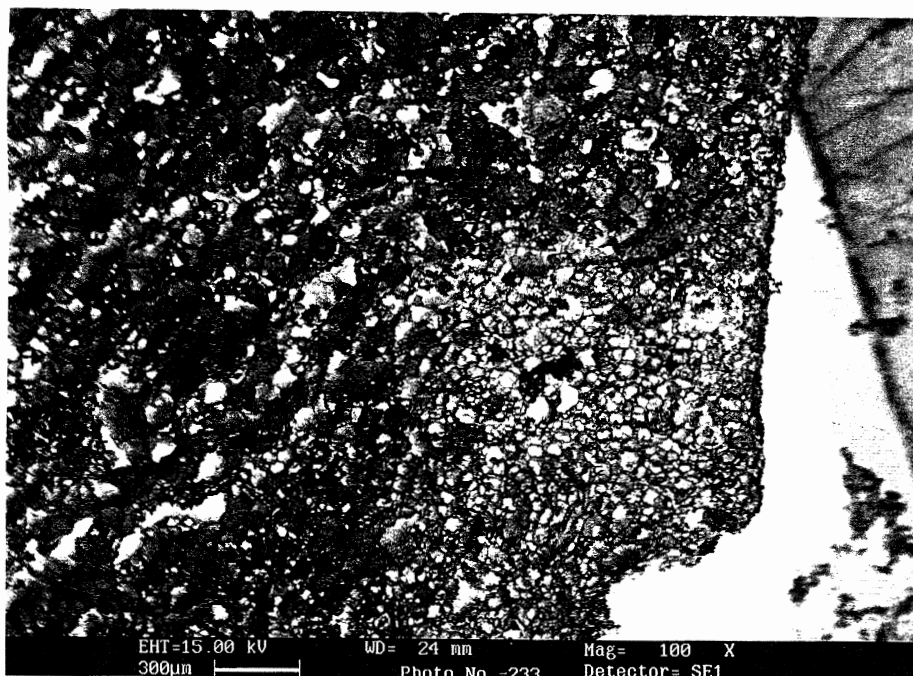


Figure 2a: SEM images of one of the fragments collected from the Dumagat hearth.

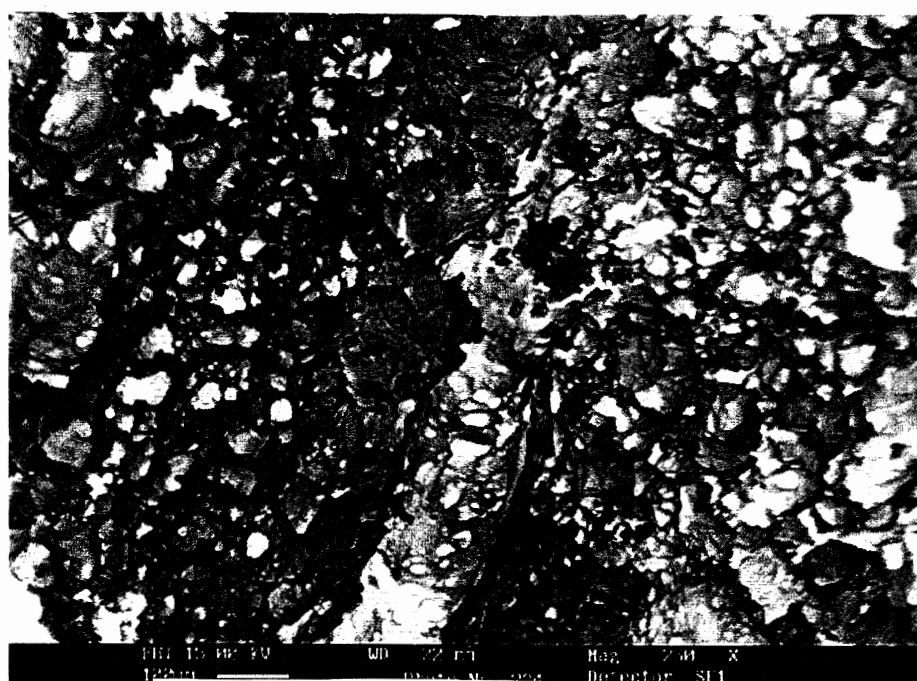


Figure 2b: In the above specimen, cell structures can be seen as well as possible vascular tissue.

the upper layers are all within the 4000 range, well inside the time corridor pertinent to the Austronesian discourse (Tsang Cheng-hwa pers. comm.).

I plan to excavate settlement sites in the main island of Batan in the Batanes Islands (Figure 1), hoping to find cultural deposits significant to the research problem. The Batanes Islands are an obvious strategic area to look for evidence of human movement during this early period of occupation in the region as they are the first landfalls to be reached when sailing southeast from Taiwan. Palawan and the Sulu Archipelago are other landfalls of significance because of their proximity to the former Sundaland.

DIRECTION OF THE RESEARCH

From the experience of trying to gather material to resolve this research problem, I came to the conclusion that material gathering entails minimum difficulty. Aside from sites earmarked for excavation, it is possible to attach to any on-going excavation to look for charred parenchyma with minimal disturbance to the objectives set for the site by the main excavator. This proved to be the experience in Lal-lo. As far as looking at additional material is concerned, soil samples gathered from other relevant sites excavated in the past may also be investigated for charred tuber remains. Apart from the Southern Philippine sites of Sanga-sanga in Tawi-tawi, samples from sites dug by Glover and Bellwood, in Sulawesi and Borneo respectively, may also be analysed.

In the near future, my research may take new directions. Biochemical work on yams and taro might be pursued to help elucidate the sequence of spread of these root crops in Island Southeast Asia. The biochemical methods employed by Matthews and Terauchi (1994) on taro and yam species (*Dioscorea bulbifera*) in northern Australia may also be useable in Island Southeast Asia. More importantly, the method of analysing *Dioscorea alata* DNA used in the Caribbean by a team from the University of Frankfurt (Asemota *et. al.* 1996) can be adopted in Southeast Asia, especially now that we have a growing reference collection of cultivars (although the preferred parts of the plant for DNA extraction are young leaves or shoots of plants, not tubers and corms).

CONCLUSIONS

This research depends on the premise that *Dioscorea alata* originated and developed in Mainland Southeast Asia. If this is accepted, what remains to be accomplished is to identify charred remains of this root crop in archaeological contexts. Biochemical techniques may help establish the sequence of spread, but they cannot set this sequence in a solid time frame. Morphological identification of datable

charred remains is therefore the best way to look for direct evidence and remedy this matter.

If *Dioscorea alata* can be positively identified in the archaeological sites of the Bashiic islands and Luzon in the Philippines (the dates for these sites fall within the 5000-6000 bp time horizon that Bellwood proposes), this may support the dominant Austronesian spread hypothesis. If, on the other hand, the identified material turns out to be much older than the time horizon proposed, then a re-thinking of that hypothesis is called for and the contending theories require further investigation.

We now, minimally, have the opportunity to detect archaeological evidence for the consumption of root crops and tuberous plants. If all goes well, we have the possibility of adding more solid evidence for the movement of people from the mainland to the islands of Southeast Asia.

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PERSPECTIVES ON THE BIRD'S HEAD OF IRIAN JAYA, INDONESIA

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The Bird's Head Peninsula of Irian Jaya has long been an area neglected by New Guinea Studies. Only in the late seventies, interest began to focus more intensively on this scientifically important border area between Austronesian and Papuan languages and cultures. In the early nineties, this led to the creation in The Netherlands of the Irian Jaya Studies programme ISIR, which organizes and coordinates multi-disciplinary research on the Bird's Head Peninsula. Within this framework, study of the peninsula has reached a peak, with research being conducted in the area by scientists from different disciplines: *anthropology, archaeology, (ethno)botany, demography, development administration, geology and linguistics*. The diverse perspectives of these disciplines are subject to constant internal debate. Through ISIR and other research initiatives, there is a growing body of data on and insights into the various disciplines concerned with this fascinating area, with each discipline developing its own specific perspectives on the Bird's Head. These perspectives were presented during the First International Conference *Perspectives on the Bird's Head of Irian Jaya, Indonesia*, organized by ISIR in cooperation with the Indonesian Institute of Sciences LIPI (Jakarta) and the International Institute for Asian Studies ILAS (Leiden) and held at Leiden University, 13-17 October 1997. Researchers were informed on current perspectives in many disciplines to facilitate integration of findings into wider, interdisciplinary frameworks and to stimulate international debate within and between disciplines. As a result of the Conference, the forty-two contributions in these Proceedings present a wealth of recent developments from various disciplines in New Guinea Studies.

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