

**ARCHAEOLOGICAL FIELDWORK IN
WEST NEW BRITAIN, PNG
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Foundation, West New Britain Palm Oil, Ltd., Mahonia Na Dari**

NOTE: This report summarizes PRELIMINARY results compiled immediately following fieldwork. For confirmed and accurate data, please consult publications.

Front Cover

RESCUE ARCHAEOLOGY

**Excavation in progress at Area K, XIV, Numundo Plantation.
Clearance by bulldozer has removed the topsoil. Note small clusters of
shell, obsidian and mumu stones to the lower left, just to the right of the
truck, and in the grassy patch beyond the truck.**

SUMMARY

Fieldwork undertaken in West New Britain during two weeks in May/June 2000 has substantiated the results obtained in 1999. Archaeological material within the areas being developed for oil palm plantations is widespread, abundant, and significant for understanding the history of the Pacific region. Very brief and preliminary surveys on Numundo, Haella, Garu, Tili, Kulu-Dagi, and Lotomgan Plantations (Figures 1, 2) identified archaeological material at twenty-six previously unknown locations. The most important new findings are firstly, that the reasonably large quantity of material dating to the most recent period indicates that population in this region was considerably higher than previously estimated. It therefore seems likely that significant depopulation occurred as a consequence of European exploration and colonisation. Secondly, Pleistocene-aged material was found to be more widespread than expected. Thirdly, the existence of two eruptions which would have impacted on human land use was confirmed.

Three test excavations were carried out at Tili and Numundo Plantations in places threatened by erosion following clearing and terracing. Geological investigations on Numundo Plantation helped to clarify the stratigraphy of the Pleistocene tephra and identified a phreatomagmatic tephra that may be associated with the vent from a *maar* volcano which existed on the northern boundary of the plantation.

Meetings were held with the New Britain Palm Oil Ltd. (NBPOL) managing director and plantation managers, the director of the PNG Oil Palm Research Association (OPRA), and the WNB Provincial Cultural Centre to discuss plans for future research and collaboration. Assistance with cataloguing collections was provided to the WNB Provincial Cultural Centre. The team participated in the preparation of an EMTV film about West New Britain and made a preliminary photographic record of significant items in a local artifact collection.

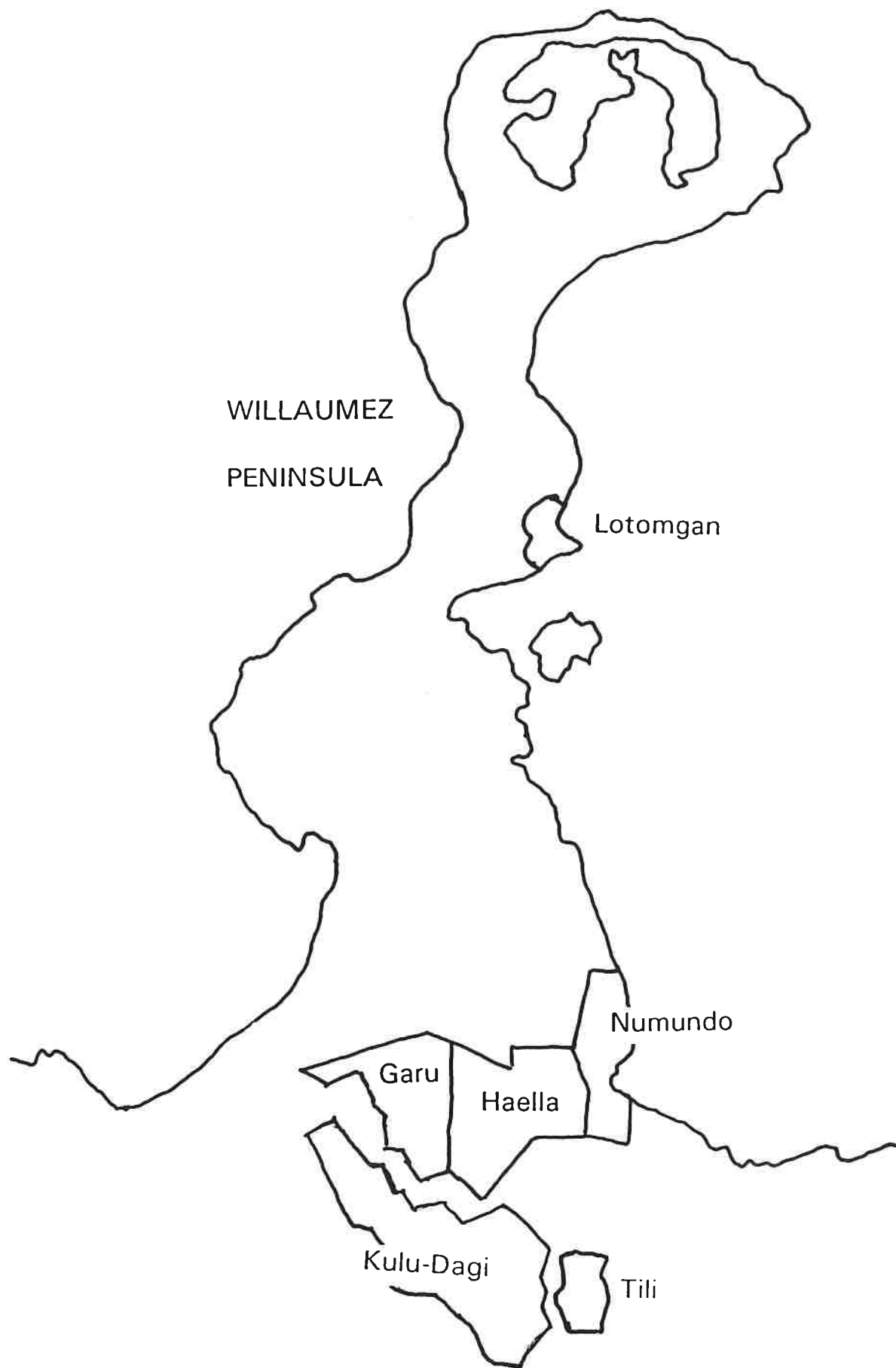


FIGURE 1 Location of areas where reconnaissance was carried out during 2000 fieldwork.



RECOMMENDATIONS

The 2000 fieldwork supports the general and specific recommendations made in the 1999 report and I urge NBPOL to continue their efforts to protect and conserve the very important sites at FAAH, FABM, and FABK on Numundo Plantation (Figure 3) and FABN on Boku Hill, Garu Plantation and to conduct watching briefs for new material revealed during ongoing and future developments. A number of further recommendations follow from this year's study.

1. Site FAAH is currently under threat from erosion of the standing section. The situation has considerably worsened in the past year. I recommend that measures be taken to divert surface water runoff away from the head of the current gully to prevent further damage.
2. Coconut trunks piled on top of the FABM hill have collapsed over the quarry face and have brought down soil from the upper levels. At present, the risk to the site is minimal and the small amount of material that has fallen down acts to protect the section. The area should be monitored to prevent a major collapse. If the whole section appears to be giving way to the weight of the tree trunks, then they should be carefully moved back away from the quarry face. If possible this should not be carried out with machinery. I recommend that any disturbance to the grassy part of the hill be avoided since a plastic pipe containing temperature measuring cells has been inserted into the eastern side of the FABM hill, about 10 metres downhill from the piled up coconut trunks. The location of the cells is marked with a small pile of stones, but care was taken to make the position as unobtrusive as possible. I also recommend that machine slashing of the hill itself be avoided, as is currently the practice.

I note that the basic principles recommended in 1999 (numbers 7-9) to guide further development have not been adopted. It is a serious concern that adequate assessment of archaeological resources in advance of clearing and terracing were not carried out at the Tili, Kulu-Dagi and Lotomgan plantations. Our work in 1999 demonstrated that significant damage to archaeological resources results from terracing and road building and the youngest,

surface material is also seriously disturbed by clearance activities. Araho's (1999) report on Kulu-Dagi recommended that further archaeological survey be completed before development, but this has not been the case. I therefore recommend the following measures to ameliorate the situation through local practices and better liaison with Papua New Guinea experts. Protecting and monitoring the irreplaceable archaeological resources need not be a costly exercise nor cause serious disruption to development. It is important to note that, although the Australian Museum research team is prepared to assist in the assessment and rescue of threatened archaeological resources in the region, we cannot be present in the area for more than a few weeks per year. It is therefore imperative that local solutions be found to preserve the unique and highly significant archaeological data of this region.

3. In the interest of protecting the cultural heritage of the region, NBPOL should seek to form a liaison with archaeologists at the National Museum and Art Gallery and the WNB Provincial Cultural Centre. Assistance with identification and monitoring of cultural material can be obtained from John Namuno or his successor at the Provincial Cultural Centre where the artifacts should be stored pending assessment. Findings should also be reported to Nick Araho, Acting Curator for Prehistory, National Museum and Art Gallery, Port Moresby, who can also offer advice.
4. NBPOL staff employed during further development of Kulu-Dagi and Lotongam plantations and other planned developments should be encouraged to report findings of obsidian pieces to supervisors, who should make small sample collections of disturbed surface material and label these with their locations. Buried artifacts should be left in place. Pottery is much more difficult to recognise but employees could be made aware that it may be uncovered. GPS records or notations on a plantation map for each location where material has been identified should be made.
5. In the future, before development begins, all affected areas should be properly assessed through survey and test excavation. Further monitoring should be carried out during road building, terracing and construction because these activities uncover buried deposits whose presence cannot be adequately predicted in advance.

FIELDWORK IN 2000

The fieldwork carried out in 2000 combined with the results of ongoing research on material collected during 1999 have further demonstrated the importance of the Willaumez Peninsula for understanding the prehistory of the Pacific region (e.g. Torrence *et al.* 1999a; Torrence in press a, in press b). The excellent conditions of preservation caused by the high frequency of volcanic activity and associated falls of tephra, combined with the excellent record of environmental change, settlement, and trading patterns dating from the late Pleistocene period (estimated at about 35,000 years ago) up to the present (cf. Torrence *et al.* 2000; Summerhayes and Allen 1993; Summerhayes *et al.* 1998), make this region unique and very important for Pacific archaeology. Due to the early history of obsidian movement, the Willaumez Peninsula has already received international recognition. Furthermore, the finding of well stratified material dating to the Pleistocene period at site FABM also means that this region should play an invaluable role in the reconstruction of the very early history of colonisation and settlement of the Pacific islands. It is therefore pleasing that we have worked successfully with New Britain Palm Oil, Ltd. to rescue data from some sites which have been disturbed during recent land clearing and terracing.

The major aims of this year's fieldwork were to assess the scale and environmental variability of land under current development for oil palm (Figure 2) and to discuss our research with key people in the company, the Provincial Cultural Centre, and other local research organisations--including the PNG Oil Palm Research Organisation, Mahonia Na Dari Research Station, and the European Union Nature Centre--in order to assist planning for a proposed long-term archaeological research project in the region. The areas visited in 2000 are shown in Figure 1. In the meantime, rescue of threatened sites is also a very high priority (Figures 4, 5). We therefore examined the condition of sites discovered previously and monitored areas on Numundo plantation which had been cleared since our previous fieldwork (Front cover). An attempt was also made to evaluate the archaeological resources on Tili plantation and to rescue threatened material (Figure 6). Only short visits were made to Kulu-Dagi and Lotomgan plantations and a brief transect survey was carried out on Haella and

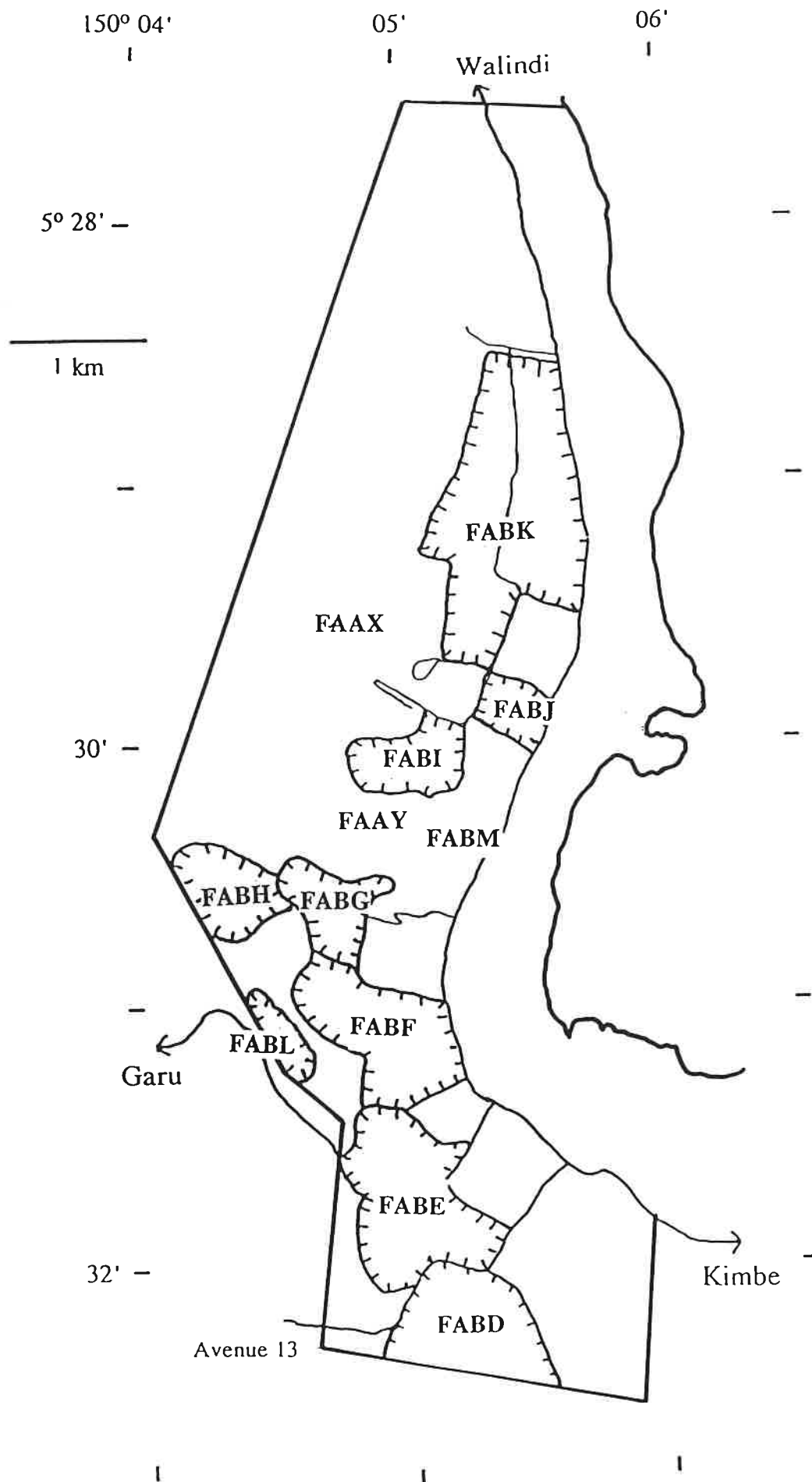


FIGURE 3 Site Codes assigned to Numundo Plantation.

Garu plantations. Additional fieldwork objectives were to carry out geological studies of the tephra sequences (Figures 5, 8-10) and to install ground temperature monitoring equipment which will facilitate the application of obsidian hydration dating methods (Figure 11).

Archaeological Results

As a result of fieldwork during 1996-9, 14 sites have been added to the PNG national register held by the National Museum in Port Moresby: 13 on Numundo Plantation (Figure 3) and 1 on Garu Plantation. Since the spatial extent of buried artifact distributions cannot be sufficiently delimited, areas rather than specific find-spots were often assigned a code. Within each plantation roman numerals have been used to designate test excavations and arabic letters are used for well-defined surface scatters (Figure 7; cf. Figure 3 in Torrence *et al.* 1999b). The codes which were assigned by the PNG National Museum after the 1999 report are summarised in Table 1 and shown on Figure 3. As in previous years, we have adopted the tephra stratigraphy and associated dates summarised by Machida *et al.* 1996 and Torrence *et al.* 2000 as the basis for assigning archaeological material to chronological periods. A summary of the periods identified in the study area is provided in Table 2. Period 2a is an addition based on this year's fieldwork. A list of the places where archaeological material was recorded in detail in 2000 is provided in Table 3. PNG site codes are forthcoming.

Lotomgan Plantation

A single morning was spent at Lotomgan. This region is significant because it is located close to the Gulu obsidian outcrops near Voganikai village. Very little is known about the use of this source since so few sites have been recorded in this part of the Willaumez Peninsula. It would be interesting to know if, like the Baki source on Garua Island, the Gulu source was mainly used locally. To date very few pieces of Gulu obsidian have been detected in sourcing studies of collections from outside the Peninsula region.

A foot survey was carried out on the upland plateau which is straddled between two prominent hills, both of which have active hot springs. The more northerly one may be chosen for executive housing, but there are no roads and we did not examine it. At the time of our



FIGURE 4 Fieldwork in progress.

Upper--Checking sections to determine stratigraphic position of artifacts found on the road (Lotomgan, Site 2).
Lower--Recording a section and sampling material still in situ (Tili, Site 4).

survey the plateau area was under discussion as a possible compound site. The area has been cleared and at least the top 25 cm of soil and subsoil has been heavily disturbed. A fairly dense scatter of obsidian was observed at the eastern end of the plateau and a small sample collected. The artifacts appear to come from the upper, post-Dakataua layer. A very brief truck survey was carried out on roads in the terraced foothills located between the compound and the current coastal bush camp (Figure 4). The typical tephra sequence with a W-K2 tephra overlain by coarse tephra from the Dakataua (1000 BP) eruption was noted in several sections, but no artifactual material was found in situ. Tephra from more recent Dakataua eruptions (which are occasionally visible on Garua Island) was not observed. A thin scatter of obsidian artifacts was noted over this whole terraced area, but we were not able to assess their stratigraphic position.

Although Lotomgan is archaeologically quite important because of its proximity to an obsidian source, our project is unlikely to carry out significant research here because the tephra sequence differs from the southern end of the peninsula and significant daily travel time would be required. The plantation should, however, be subject to more detailed archaeological survey while freshly cut sections are still available. Furthermore, it would be interesting to assess differences in the history of land use between the low lying coastal land and the inland hills.

Kulu-Dagi Plantation

A single one-half day trip was made to Kulu-Dagi to meet with the managers and gain an impression of the archaeological resources and potential threat to these from land clearance and terracing. Previously, Araho (1999) visited the proposed plantation site as part of the EIS and recorded the existence of recent burial sites and a small hill with spiritual connections. These places were later visited by Namuno (ms.) but no artifacts were recorded. Namuno (personal communication) has also collected information about an old village site (known as 'old Tili village') in the vicinity of the plantation. We did not visit these locations, but pending permission from the local landowners for whom these are significant places, further investigation would be desirable.

During our short visit, reasonably dense artifact scatters were located in 2 locations at Kulu-Dagi. Site 1 at the current workmen's bush camp was previously visited and surveyed

more carefully by Araho. It consists of an extensive lithic scatter, but the original location of the archaeological material is unknown and may have been completely destroyed when the area was levelled by bulldozer. Location 2 is a small, relatively well-defined scatter of obsidian flakes located on a small rise above the surrounding flat land and adjacent swamp. The area was visible because it has been cleared as Avenue 15. Examination of bulldozer push and shovel pits indicate that the artifacts probably date primarily to Period 6, although levelling for the road has completely obliterated Period 8 contexts. A single obsidian flake was found on Avenue 14 between Roads 6 and 7 (Site 3) but was not collected. It may indicate the presence of an intact site nearby or one that has been destroyed through road-building. No artifacts were seen on the surface of the area proposed for the new compound, but the ground was being bulldozed during our visit and so conditions were not ideal. Obsidian is often not visible in freshly disturbed ground until it has been washed by rain.

Preliminary analysis of a ditch section indicates that the region we surveyed (roughly bounded by Avenues 14, 15 and roads 5-7) was extremely wet, if not entirely underwater until at least after the emplacement of the W-K3 tephra (c. 1800 years ago). It is therefore unlikely that archaeological material earlier than this period is present, but an environmental study to reconstruct the history of this landscape is certainly merited.

The finding of several artifact scatters in an area that was quite swampy until recently drained and which had been characterised by very low population densities in the recent past was very surprising given the short time spent and small amount of ground surveyed. Several factors must be considered in evaluating these very preliminary impressions of artifact densities. Firstly, swamps contain many valuable food and building resources and would certainly have been exploited in the past. It is therefore possible that the artifact scatters reflect higher population densities than at present. Whether the Kulu-Dagi region would have been occupied permanently in the manner of the recent occupants, who have subsisted on hunting and gathering supplemented by shifting cultivation, or were visited by people resident elsewhere on a seasonal or intermittent basis would be an interesting and important research topic. Secondly, the relatively high density of cultural material in the Kulu-Dagi area suggested by our brief survey could be the product of low intensity land use over a relatively long period, such that artifacts have been widely scattered over the whole area, rather than concentrated at particular places. This seems unlikely since the artifacts probably post-date



FIGURE 5 Geological and Archaeological sampling in progress.

Upper--Geological study and sampling of tephra sequence at Tili Compound.

Lower--Archaeological test excavation at Tili Plantation, Site 1.

the W-K4 tephra or 1500 years ago (based on information from site 1). It seems more likely that past land use in this region was much more intense than in the modern period. Whatever the explanation for the obsidian scatters noted at Kulu-Dagi, our brief visit has convinced us that further research in this region is justified. These preliminary results also indicate that study to reconstruct landscape history should be carried out and that we should reconsider the role of the low-lying land on Garu Plantation which we had previously ignored.

Tili Plantation

Many of the same issues raised by the Kulu-Dagi were also highlighted by our findings at Tili Plantation, where several mornings were spent carrying out truck surveys. In the limited time available, we did not make a comprehensive survey of the plantation but sampled landforms and targeted exposed sections. Nine new archaeological sites were recorded (cf. Figures 4, 5, 6, Table 3). Site 6 has a full set of Witori tephras and is therefore a likely spot for a test excavation, but no artifacts were observed. We were also surprised that no artifacts were seen at the Tili compound despite the excellent preservation of Witori tephras (Figure 5) and the presence of obsidian scatters at similar low, relatively flat hills elsewhere on the Plantation (e.g. site 8).

The history of landforms at Tili as in the other low lying regions in the Willaumez Peninsula is dominated by the volcanic history. A detailed study would greatly assist in identifying which land surfaces were available for human settlement in the various periods, but our observations have provided a tentative history. The plantation is situated between the last vestiges of the foothills of Mt. Faure on the east and the Kulu River to the west. The foothills preserve the full Witori sequence along some of the flatter ridges, but in most places W-K1 and W-K2 tephras have been eroded into the wetlands to the west and have formed a relatively stable land surface. In these cases the W-K3 tephra is underlain by red clays, but the upper sequence is intact. Extensive scatters of obsidian were observed on all the foothills that were surveyed, including sites 1, 2, 8-10. All of these have been terraced and are very disturbed, especially the small, steep hills on the eastern side of the road. Very black deposits of material and artifacts dating to periods 6-8 were observed in section at site 8. A similar situation occurs sites 1 and 2 where one meter square test excavations were carried out. The test excavations produced cultural material for periods 6-8 with rarer, small pieces of obsidian

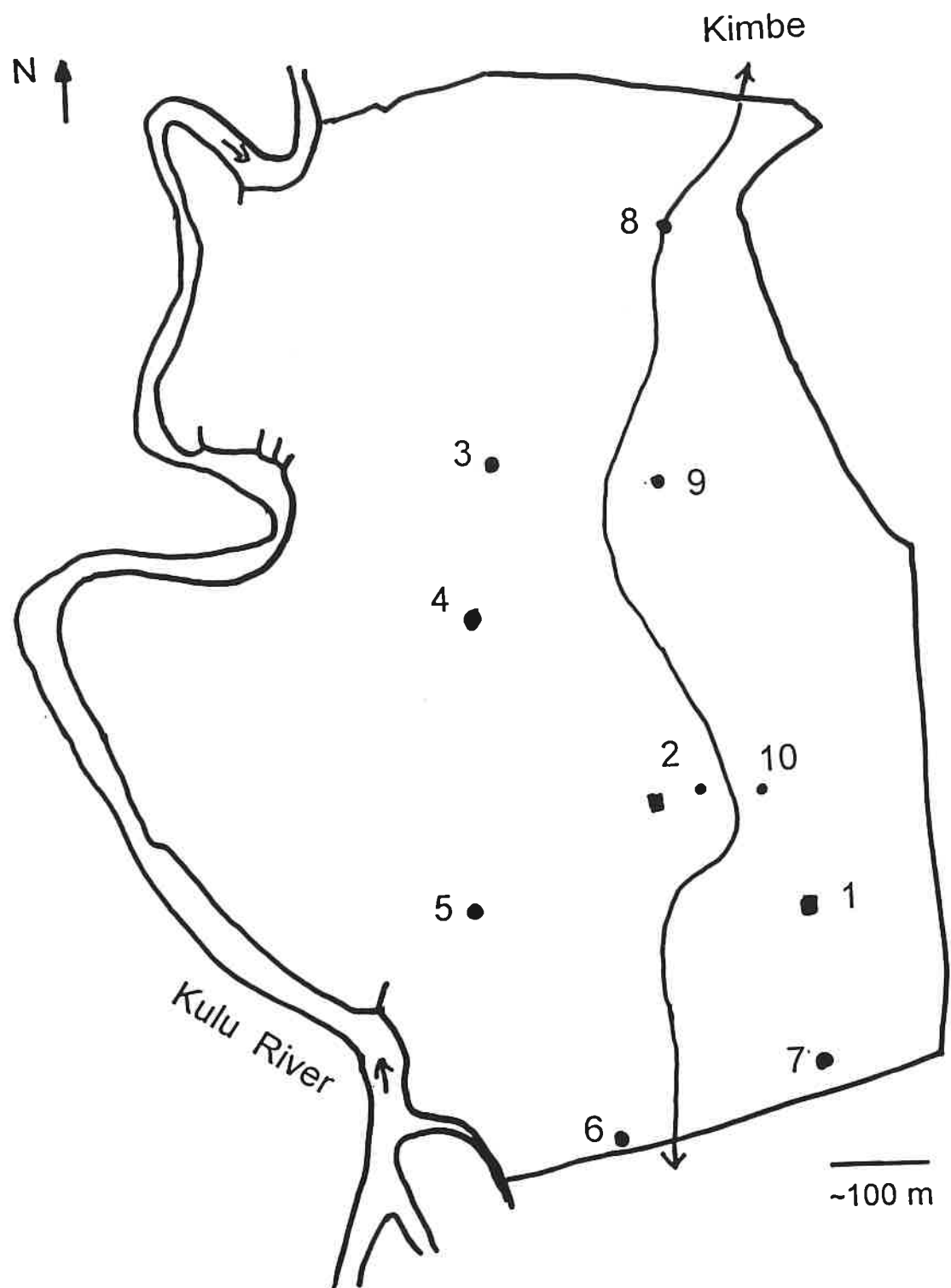


FIGURE 6 Archaeological sites studied at Tili Plantation in 2000.

in periods 3 and 4. These results suggest that it is possible to reconstruct a long history of human land use at Tili. The relative abundance of obsidian artifacts in period 4 at site 1 (i.e. contemporary with Lapita pottery) is especially intriguing and will assist in the study of recolonisation after the major W-K2 volcanic event. We did a brief walk up one of the gravel logging roads that led into the forest and further into the foothills, because obsidian artifacts had been reported in that vicinity, but visibility was extremely poor. Additional survey with the informant will be carried out in future work.

The low lying land has had a much shorter history. It appears that a lake or swamp was progressively filled up and dried out during the Witori sequence. Perhaps due to the original configuration of the pre-Witori landscape, the dry land dips slightly from the west and up to the east. The current compound site, for example, is a remnant of this landscape. In most places the W-K2 tephra has been redeposited and reworked, but W-K3 represents airfall tephra onto relatively dry land. At some time in the recent past, the dry land formed by the tephra sequence has been dissected by movements of the Kulu River and by tributary streams so the current low lying land at Tili is quite undulating. Artifacts were observed on the surface in the eroded land surface at sites 3-5, 7. No material was found in situ and no dark soils with high organic content were observed. Given the degree of disturbance created by plantation development, we estimate that most of the material collected is derived from deposits dating to the past 500-1000 years.

In summary, Tili plantation has a number of archaeological sites dating back at least to 4,000 years ago, although a number of these have suffered extensive damage due to terracing. As with the case of Kulu-Dagi, the density of artifacts dating to the past 1,000 years or less is quite high and attests to the importance of swamp and riverine resources for the previous inhabitants. Reconstructing the history of human land use in relation to environmental changes induced by the airfall tephras will form a major component of future research at Tili plantation—and also at Haella and Garu—and comprises an important complement to the parallel analysis begun in 1999 of the effects of changes in the configuration of the coastal plain at Numundo plantation, also product of infilling by the Witori tephras.

Haella and Garu Plantations

No reconnaissance was carried out on Haella in 1999 since at that time our work was focussed on recently disturbed deposits and rescue excavations. In contrast, the 2000 fieldwork was aimed at planning future research, which is likely to focus on a transect across the southern end of the Willlaumez Peninsula. It was therefore important to gain an impression of environmental variability, preservation of deposits, and abundance of archaeological material in this plantation. One morning was spent driving across two east-west transects of Haella plantation supplemented by one brief stop at Garu Plantation. We began on the eastern boundary of Haella following Avenue 10, then 11 and finally 12 to the western boundary where we turned north on Road 9 up to the Compound. After a brief visit to Boku Hill, we were guided to site 6 by Peter Kambu and then returned along the old Garu road to get a sample of the Garbuna foothills. Along the route we stopped at random intervals at places where sections were exposed in road cuts. This means that we largely focussed our search on higher ground. The number of spots chosen for survey was restricted by our limited time..

At every place where we stopped to investigate the ground surface, obsidian artifacts were found (Table 3). The abundance of archaeological material in this region is quite staggering. In general, a sparse scatter of artifacts was noted within the disturbed top (c. 20 cm) of the profile suggesting that the material dates to the past 1500 years at most. In all places where a good section was preserved, the full Witori and Hoskins tephra sequences were present, including the low lying land of site 4, where the airfall tephra was deposited and has remained in water-logged conditions. It seems likely that much older material is well preserved on the higher ground within the central part of Haella as well as on the foothills region to the north. This contrasts with the hills at Tili where extensive erosion of the W-K2 tephra into the surrounding swamp has occurred. A geomorphological reconstruction of the region would assist in identifying which areas in the low lying sectors were suitable for human habitation at various periods in the past.

In 1999 a relatively dense scatter of obsidian artifacts from a terrace section to the west of her house, near the base of the hill which is the executive housing site, was reported to us by Allison Spence, but the site was not recorded. This year a dense scatter of obsidian

artifacts was observed on the slope to the west of the manager's house (site 2). It has also spread across the perimeter road. The artifacts are not in their original context, which is not surprising given the amount of road building and levelling that has taken place along the top of the executive housing site. Given the presence of Lapita pottery and stemmed tools on Boku Hill on Garu Plantation, it seems likely that this hill might also contain significant archaeological material and further ground survey to determine whether in situ deposits have been preserved is merited.

While auguring into Pleistocene age tephra which now form the modern surface at the top of the hill (in Mike Hoare's garden), two obsidian artifacts were recovered at 30 cm and 85 cm below current ground surface. It therefore seems likely that Pleistocene material is preserved on Haella plantation as on Numundo but in a very different topographic setting. Cross correlating the sequence here with site FABM to place these artifacts in their chronological context would be very difficult but should be attempted. In addition, a programme of auguring on this hill might provide a better indication of the quantity and spatial patterning of Pleistocene material and identify a location (outside of the private houses and gardens) where test excavation could be profitable. For ease of recording, we have proposed that the entire executive housing site be assigned a single site code.

Site 6a, an obsidian scatter dispersed in and among rocks of an old hot springs at the head of a small valley and also close to an active fresh water spring may have been associated with megapode exploitation some time in the past. We were unable to ascertain whether the artifacts were in their original position or had eroded from the surrounding hills. Obsidian artifacts disturbed by road building were also noted on the hill to the west (site 6b). It would be interesting to determine the age of the hot springs and the nature of the association of artifacts with these deposits.

Numundo Plantation

Limited truck and foot surveys were carried out at FABL (Area L) and Area K (Front cover, Figures 2, 3, 8) since these places have been cleared and/terraced since our fieldwork in 1999. The picture obtained previously for FABL of reasonably abundant obsidian flakes dated mainly to Periods 6 and 7 was confirmed again in 2000, but older deposits are also likely to be preserved as the W-K2 tephra was observed in one terrace section. Since this area

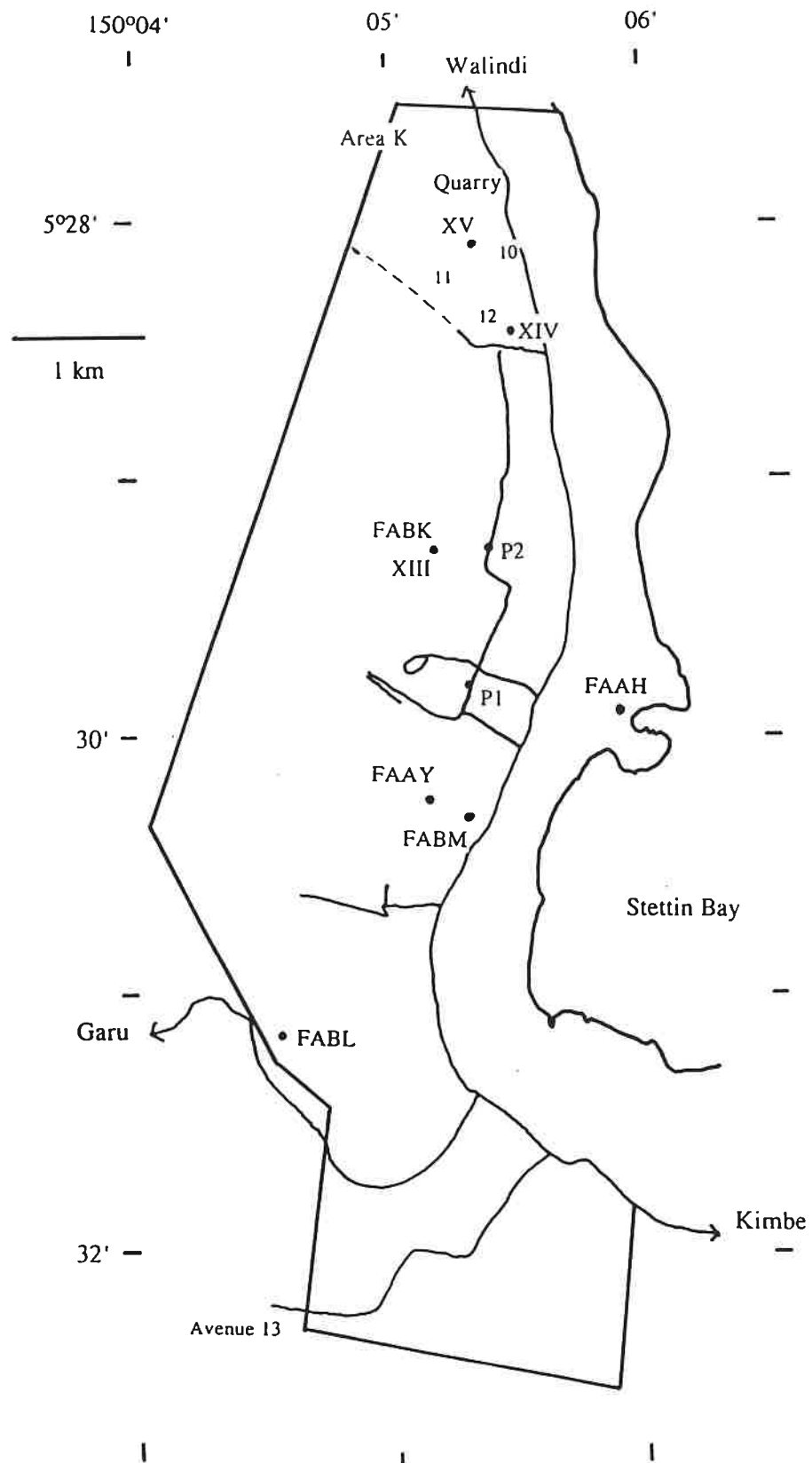


FIGURE 7 Numundo Plantation. Location of sites, sections, surface scatters, and phytolith sampling spots investigated in 2000.

is situated on the watershed between the coastal plain and the inland foothills of Haella, further investigation through test pitting is merited.

In Area K very dense scatters of obsidian and marine shell within a very black soil were observed at three locations (10-12). As seen in section along the main road and in test pit XIV, there appears to have been heavy use of this semi-circular ridge during the past 1500 years, with a possible gap represented by an indeterminate Hoskins tephra (possibly W-H4). The W-K4 tephra is poorly preserved here so it is difficult to assess whether shell as old as 1500 years has been preserved or, more likely, whether settlement during the past 500 years has completely disturbed the W-K4 tephra and associated soil. Radiocarbon dating is required to get accurate dates for the two layers of obsidian and shell recovered from the XIV test pit. It is also worth noting that 5 pieces of pottery (2 of which had incised decoration) were recovered from the soil on the W-K2 tephra (i.e. roughly contemporary with Lapita style pottery in the region) and a relatively large quantity of obsidian flakes was found under a phreatomagmatic layer which is stratified under W-K2 (cf. below).

A very thick deposit consisting of multiple, cemented layers of paired coarse plinian and phreatomagmatic tephras was also observed at section XV and a single artifact was found 9 cm below a layer of coarse stones just immediately below this welded tephra. This is further underlain by interbedded Pleistocene age tephras and soils (Figures 8, 10) (cf. geology section below) but no further artifacts were noted. It seems likely that the events represented by this distinctive layer of varying thicknesses in Area K is the same as the 'blocky' layer recorded at Area J in 1999, which also overlies a soil layer containing obsidian artifacts.

Finally, 10 additional artifacts were collected from various levels in the section at FABM during analysis and sampling of tephras (Figure 9). The number of levels which contain cultural material has been substantially increased. Again the dark, well-developed soil between tephras C and D appears to have the densest distribution of artifacts, but it is notable that material is widespread throughout the time period represented by the sequence of the 8 Pleistocene tephras. This new information suggests that this area was fairly heavily used in the past and was repeatedly reoccupied after each volcanic event. The highly retouched tip of a stemmed tool was found in the soil directly under W-K2 and probably dates to the early Holocene. In contrast to the 1999 sample, nearly all the artifacts are retouched and all but one

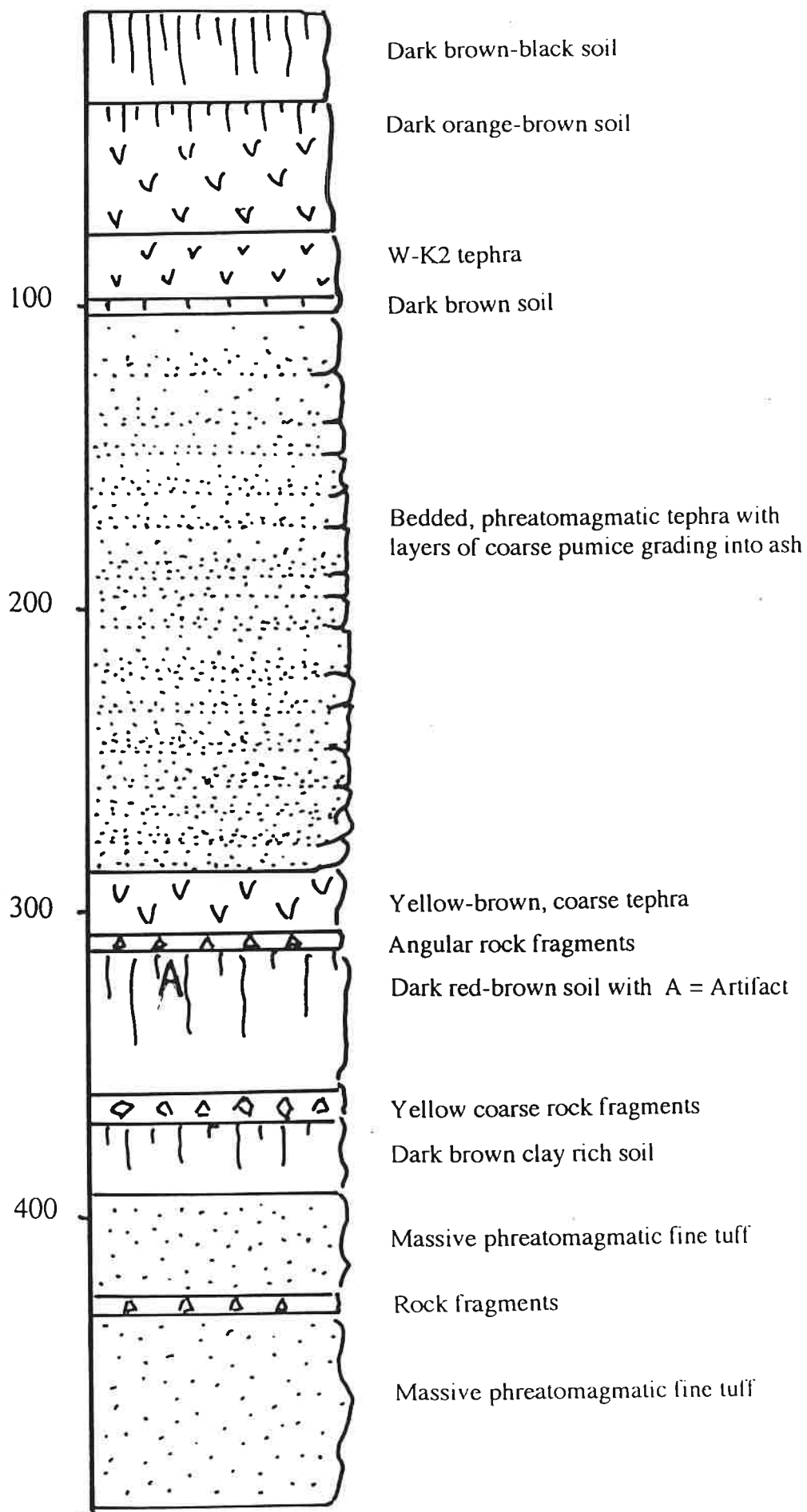


FIGURE 8 Area K, Section XV showing banded, phreatomagmatic and coarse airfall tephtras probably dated to the Early Holocene period (c. 10,000-6,000 years ago).

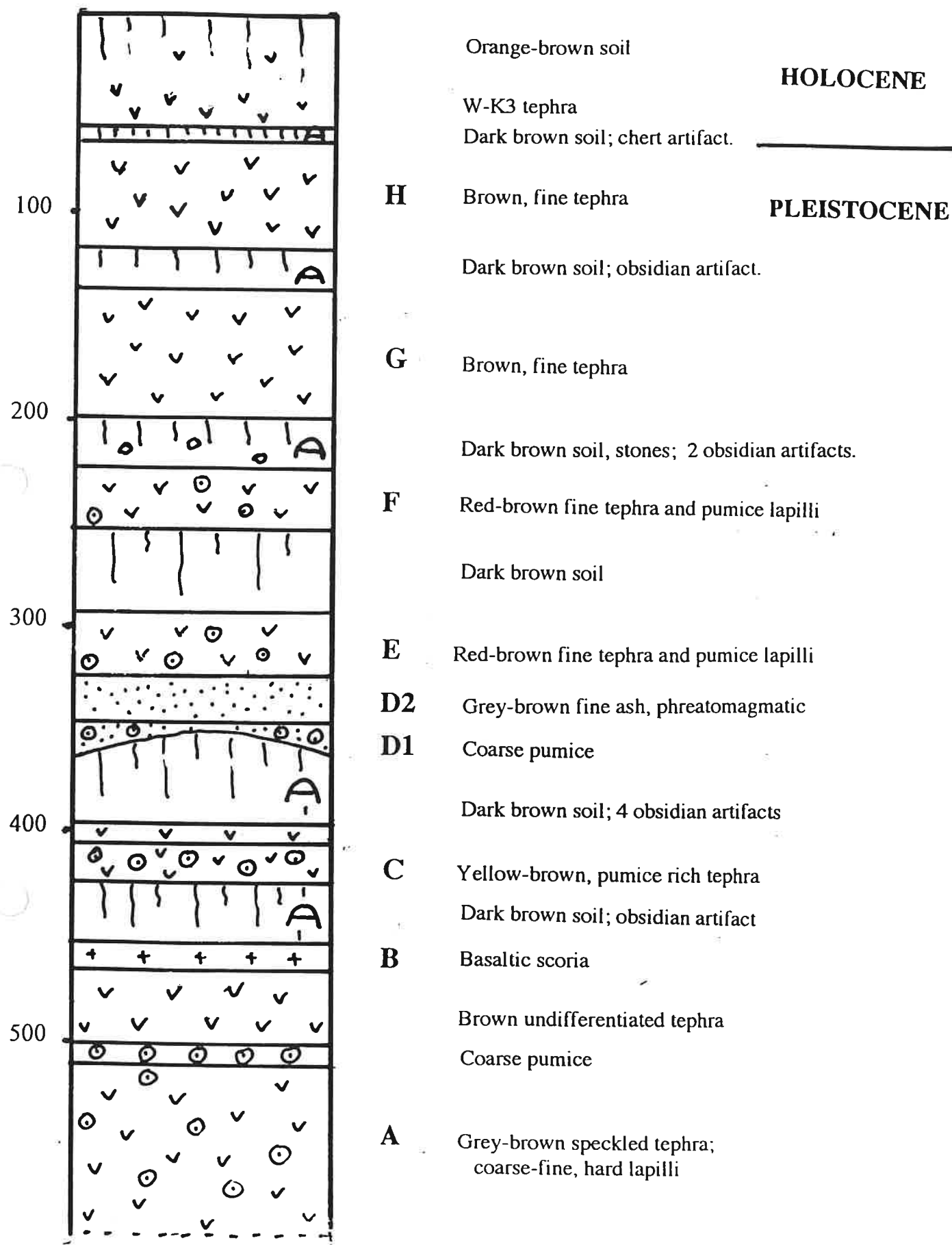


FIGURE 9 Section at FABM showing layers of Pleistocene tephra and location of artifacts recovered in 2000.

are made from obsidian. The exception is a retouched flake made from a dark brown chert whose origin is unknown but is unlikely to be the Yombon region (inland Kandrian), where Pleistocene deposits have also been found (Pavlidis and Gosden 1994).

Geological studies

In order to understand changes in human land use over the past 35,000 years or so for which there is evidence in this region, the archaeological record needs to be understood in conjunction with changes in the geological and biological components of the environment. To achieve this aim, collaboration with geology, geomorphology, and paleobotany is required. For this reason, scientists from these specialties have been integral to our ongoing archaeological research. This year geologists Chris McKee (Geophysical Observatory, Port Moresby) and Professor Hugh Davies (UPNG) visited a number of sections during their short periods in the field area and helped to clarify a number of issues raised in 1999 as well as to confirm the basic stratigraphy used to interpret the archaeological sequences. McKee sampled the full range of Holocene tephras so that a geochemical (major and minor elements) analysis, which will complement the probe analysis of glasses carried out by Jackson (Torrence *et al.* 2000) and confirmed in 1999 by Davies (private communication), could be carried out. In visiting key sections McKee also corroborated the existence of an eruptive period of volcanic activity which occurred some time between the major events of W-K3 and W-K4, as proposed in the 1999 report (Torrence *et al.* 1999b: 12). The occurrence of a soil separating the very thin phreatomagmatic and pumice lapilli layers of this event from W-K3 suggests that it may be related to W-K4, but further study is needed to clarify its position. W-K 3.5 was observed at Tili, Kulu-Dagi and Numundo Plantations.

McKee studied the sequence of Pleistocene tephras at FABM and FAAY. With closer inspection than was possible in 1999, he was able to identify additional layers in the upper part of the section. Artifacts were present in most of these (Figure 9). Tephra B was found to contain relatively fresh basaltic scoria that suggests a local, non-Witori source. Samples were taken from a number of the Pleistocene tephra units for geochemical analysis and from Tephra A for luminescence dating. Large samples from the soil between Tephras C and D were collected for radiocarbon dating. This technique was trialled without success in 1999,

but Parr will experiment with different methods for extracting carbon from the soil to see if a large enough sample size can be obtained.

Davies and McKee also visited the quarry on the northern end of Numundo Plantation where the section is comprised of c. 50 metres of indurated, thinly-bedded, gently-dipping tephra which are made up of large clasts suspended in a matrix of coarse ash (Figure 10). The coherence of the tephra signifies that it was wet when deposited and the poor sorting and large size of the airfall boulders suggests that the source is close by. On the basis of an examination of the aerial photographs, McKee has identified that the quarry is located on an arcuate ridge and that there is a similarly shaped ridge approximately 500 metres to the north. The general configuration of the area around the quarry, therefore, is consistent with that of a low angle volcano and is similar to the *maar* type which is typically formed by hydrovolcanic activity in low-lying areas where there is an abundance of water.

It also seems likely that the proposed *maar* is the source for the bedded tephra of varying thickness studied by Davies at section XV in Area K (Figures 8, 10) and discovered in Area J in 1999. The layer is stratified under W-K1 tephra (6,000 years ago) and above very eroded Pleistocene tephra in Area J and seals a layer of obsidian artifacts at several locations. PIXE-PIGME analyses undertaken in 1999 have shown that obsidian artifacts recovered under this layer in Area J are mainly derived from the Kutau source, which dominates the Holocene assemblages of West New Britain and is not represented among the artifacts from the FABM Pleistocene site. It therefore seems reasonable to suppose that the date of the *maar* volcano is somewhere in the very late Pleistocene or early Holocene. As yet no organic material has been recovered from under the indurated tephra layer, but it may be possible to obtain obsidian hydration dates from the buried artifacts and these which will help tie down the date of this eruption.

Since the distinctive wet tephra has not been found further south than Area J, the immediate impacts of the *maar* eruption are likely to have been extremely localised. Still, it will be interesting to discover what effects this event had on human settlement at Numundo Plantation and whether its impact was experienced further afield.



FIGURE 10 Evidence for a Maar volcano on Numundo Plantation.

Upper--Quarry at Numundo Plantation. The large clasts scattered among layers of fine and coarse airfall tephra indicate that the vent is nearby.
Lower--Area K, Section XV with thick layer of interbedded phreatomagmatic and coarse airfall tephra stratified under the W-K2 tephra and overlying Pleistocene soils and tephra. An obsidian artifact was recovered just under the blocky layer.

Phytolith Analysis

Jeff Parr has initiated PhD research aimed at reconstructing the history of vegetation in relation to volcanic history and human land use through the study of phytoliths (plant fossils) from various contexts at Numundo Plantation. A large number of samples were collected for this purpose in 1999 and in 2000 Parr concentrated his efforts on the Pleistocene deposits at FABM, with a supplementary collection in test pit XIV. One of the most distinctive soil layers in this region is a very black lens formed on top of the W-K tephra, which may or may not be associated with artifacts. Torrence *et al.* (1999b: 14-15) proposed that this layer represented very intense human land use following the immigration of people from the north as a consequence of the Dakataua eruption dated to about 1,000 years ago. In order to assist in the testing of this hypothesis, Parr increased the number soil samples from the soil on W-K4 by including places where artifacts were not present (labelled P1 and P2 on Figure 7). He focused this work in Area J, near where putative agricultural pits have been discovered in Test Pit XI.

Temperature Monitoring Cells

Although radiocarbon chronology is the most widely used technique for dating archaeological deposits, it has a number of limitations for this project. Firstly, organic preservation in the very wet, acidic, volcanic soils of this region is very poor and so many contexts cannot be dated using this method. Secondly, radiocarbon dating is very limited for the time periods less than 500 years ago or more than c. 40,000 years ago. Thirdly, the technique is relatively expensive, especially the AMS method which is demanded by the typical small sample sizes which we obtain (c. \$1000 per date). An alternative method, obsidian hydration dating, has been shown to be a very useful supplement to radiocarbon dating even in tropical conditions where erosion of the surface can take place (e.g. Ambrose 1998) and excellent results have been obtained recently from sites on Garua Island (Torrence and Stevenson in press).

In order for one to calculate a calendar date based on the amount of hydration that has taken place since an obsidian artifact was flaked, the air temperature which the artifact has experienced must be estimated. The preferable method is to monitor ground temperature for



FIGURE 11 Dating Techniques.

Upper—Obsidian hydration dating. Auguring a hole for placing cells which will measure ground temperature.

Lower—Luminescence dating. Hammering in a plastic tube to take a sample of volcanic tephra. The sample cannot be exposed to light.

the context where the artifact was obtained. Since every site cannot be studied, several measurements are made and used as estimates. We therefore installed a set of temperature monitoring cells (designed by Ambrose) at the FABM site, representing the coastal plain and Mike Hoare's garden at the top of the executive housing site on Haella plantation as a sample of the inland, upland region. A hole was augured at each location (Figure 11) and then a plastic pipe containing cells placed at 1.50, 1.00, 0.75, 0.50, 0, 0.25, 0.10 m depths was lowered into the hole, the pipe was surrounded by dirt and then filled up to current ground level. The sample tubes and cells will be recovered in 2001 and sent to Ambrose for analysis and conversion to ground temperatures.

Experimental Archaeology

The WNB archaeological team has been developing methods for the identification and interpretation of ancient starch grains as a way of reconstructing past land use and diets. Discussions were held with Ian Orrell concerning the possibility of establishing an experimental archaeological site in the grounds of OPRA so that preservation of starch grains and movement through volcanic soils could be monitored over a period of at least five years. Although he is very willing to assist in this experiment, the sediments at the station are comprised of at least 2 m of coarse pumice and no buried soils are present. The construction of the site would therefore have to depend on bringing in soils from elsewhere, but that may be an advantage because the nature of the introduced soils would be controlled. The future of the experimental archaeology project will depend on success in outside funding and local assistance with the location and transportation of appropriate sediments.

Ian Orrell has also graciously offered to assist the WNB project in obtaining and manipulating raster files of aerial imagery for the study region.

Provincial Cultural Centre

Chantal Knowles helped John Namuno at the WNB Provincial Cultural Centre make a catalogue of the collections housed there. Although John Normu kept excellent records, very little cataloguing has been carried out in recent years since the Centre has not employed a

Curator. The need for a basic catalogue recording the original provenience of the artifacts is especially imperative since Namuno is no longer employed by the WNB government and will be leaving Kimbe in the next few months. Currently, he is donating his time in order to keep the Centre running. The future of this very important Cultural Centre is now very much in doubt. Outside assistance and pressure on the WNB government is needed to prevent the loss of the collections and the further deterioration of this historic building. Our archaeological project has made donations to the Centre in the form of books, equipment and displays and will continue to do so as far as possible, but local efforts need to be substantially increased.

John Ray's Collection

An avid amateur, John Ray, has assembled a large collection of stone items and ceramics derived from the province. The stone consists mainly of ground stone axes purchased from local people, although a pestle and some drilled discs are also in the collection. He has also obtained a number of highly retouched, stemmed obsidian artifacts from the Talasea region and near Boku Hill on Garu plantation. His interests are well known locally and people regularly offer him stone artifacts for sale, especially since the Cultural Centre no longer has funds to acquire material. Recently, he has been told about the existence of several large mortars and one was delivered to his office while we were in the field. The National Museum was informed and expressed interest in purchasing the object.

The potsherds mainly come from surface and underwater collecting on Boduna Island (PNG registered site FEA) which has been previously investigated by Ambrose and Gosden (1991) and Specht *et al.* (1989). On the basis of radiocarbon dating and the types of decoration on the pottery recovered, previous work had concluded that the site probably belonged to the mid or so-called 'Western' style of Lapita pottery. John Ray's collection, however, contains numerous examples of extremely fine dentate stamping that is more typical of the earlier, 'Far Western' Lapita style of decoration. In addition, he has recovered 3 sherds which have molded noses combined with intricate dentate decoration around the eyes, forehead and nose. These faces resemble the sherd reported recently by Summerhayes (1998) from a 'Far Western' context on Ambittle Island in New Ireland province and they provide additional evidence for the incidence of tattooing at this time.

Ray's collection indicates that there is a very significant and highly important underwater component to the FEA site. This locality requires careful excavation and study if stratigraphic and contextual information is to be preserved, but the integrity of the site is now seriously threatened because Ray's activities have attracted much interest and visitation by local, ex-patriates has increased. There is also local knowledge of Lapita pottery on Garala (Schaumann) Island (site FEM) where ceramics (very few with decoration) can also be collected at low tide.

The National Museum in Port Moresby has been made aware of the potential hazards to archaeological sites and national cultural property caused by amateur collectors. John Ray is now keeping a catalogue and recording provenience for his collection, but more could be done to improve the record keeping and copies of his lists need to be filed in the National Museum. At present Ray is acting as a substitute for the Cultural Centre which has virtually closed down since Namuno's forced retirement. The loss of the Curator position and recently the Director, security problems with the Centre, and its extremely run-down state have seriously damaged its reputation as a repository for local cultural heritage. An obvious solution is to re-establish and enhance the activities of the Cultural Centre, rehabilitate the building, and to increase its profile among the ex-patriate population

FUTURE RESEARCH PLANS

Funds for further archaeological fieldwork to be initiated in 2001 have been applied for from the Australian Research Council by Torrence and for environmental work by Boyd. Results will be known in November. If the grant is successful, supplementary funds will also be sought, particularly for specialised components of the fieldwork.

A number of specialist analyses initiated in 1999 will be continued and expanded. These will assist in planning further fieldwork: pollen (Leigh Jago, Garu Plantation); phytoliths (Jeff Parr, Numundo Plantation); geochemical and thin section characterisation of tephra (McKee and Davies); obsidian sourcing using PIXE-PIGME; obsidian hydration dating; and radiocarbon dating. In addition, a GIS system for recording and analysing the spatial data needs to be established and keyed into existing aerial photographs. When combined with current data on the history of land forms, it will be possible to stratify the

study region into different zones according to a number of environmental factors (distance from sea, elevation, etc.) as well as potential for preservation of archaeological deposits of various ages. Detailed plans for further survey work and excavation will then follow. Combined with areal wide coverage, systematic excavation is also planned for sites FABM and FABN.

CONCLUSIONS

The brief archaeological survey carried out in May/June 2000 has demonstrated that archaeological material is both abundant and reasonably well preserved across all the oil palm plantations visited. Periods 6-7 are best preserved, but there are also substantial deposits dating to earlier periods, including the Pleistocene. Deposits dated to the most recent past have suffered the most destruction due to development activities. Most of the current coastal plain on Numundo and much of the low lying land bordering the Kulu river system was underwater until Period 5, or even later in many cases, and so these areas are unlikely to contain older archaeological material, but they do have a surprisingly high density of artifacts. The relative abundance of obsidian artifacts from the most recent periods is much higher than would be expected given recent estimates of population density. For example, in 1965 before recent resettlement schemes the local population was estimated at only 'about 14 persons per square mile' (Fleming and Kibble 1980), but the archaeological record attests to much higher populations in both the distant and recent pasts. It is therefore probable that the area suffered significant population decline, possibly as a consequence of the three closely-spaced Hoskins eruptions, which are dated very roughly to the past 500 years, or more likely as a result of disease introduced during the early period of European exploration and contact. The recent history of population is a new subject that the team plans to target as high priority in future work.

The preservation of material from the earliest periods will be restricted to areas of higher ground, both on the coast and inland. It is very significant that early material has been noted on Tili, Haella, and Garu plantations. The relationship between inland and coastal resources and human land use has been seriously under-researched in Pacific archaeology. The research area offers excellent potential for correcting the previous over emphasis on the coast. The existence of a *maar* volcano and associated tephra deposits at Numundo provides the opportunity to compare the impacts of local volcanic events with the more far reaching effects of the subsequent Witori eruptions. The finding of artifacts buried deep in very old clay deposits on the executive hill at Haella indicates that Pleistocene archaeology is much more widespread than had been anticipated, providing the opportunity for a comparative study of human land use between the Holocene and Pleistocene periods.

Finally, as a result of this field trip, I have confirmed my decision to limit fieldwork over the next five years or so to the area within a transect stretching across the southern end of the Willaumez Peninsula and taking in the region of Numundo, Haella, Tili, Kulu-Dagi, and Garu plantations (Figure 1). This mirrors the proposal for research funds made to the Australian Research Council in February 2000. Although NBPOL will be expanding oil palm plantations significantly in the northern part of the Peninsula, it is not feasible for my research team to extend the work to the proposed research to the new areas. Special arrangements for recording disturbed contexts and conducting rescue excavations at Lotomgan, Volupai and other new developments will need to be made by NBPOL working in collaboration with local government and the Prehistory Department at the National Museum, although the Australian Museum is certainly prepared to assist in an advisory capacity or through the Australian Museum Business Services to carry out archaeological assessments.

COMMUNICATION OF RESULTS

At the beginning of the field trip Torrence, White, and Knowles presented short talks at the National Museum and Art Gallery in Port Moresby about their past and future research and these were followed by a prolonged discussion with staff members. Torrence returned an obsidian stemmed tool from Boku Hill to the National Museum. It had been collected by the team in 1999 and had since undergone conservation at the Australian Museum. It is hoped that the artifact will be put on display in the 'Archaeology in West New Britain' exhibition currently on display at the National Museum. Vincent Tuka and students from the University of Papua New Guinea also participated in the seminar. Plans were discussed for participation by University students in future excavations. In West New Britain the team met with John Namuno of the Provincial Cultural Centre on several occasions. Knowles donated a set of enlarged and mounted historical photographs to the Cultural Centre for display. Araho and Torrence guided an EMTV film crew to several archaeological sites in the region and the crew also visited the Research Station to film artifacts collected during the fieldwork and important finds from John Ray's collection. Torrence gave a short talk about archaeology in the region and showed artifacts to students from Hoskins High School at the Mahonia Na Dari Saturday school.

ACKNOWLEDGEMENTS

We are very grateful to the Papua New Guinea Biological Foundation for assistance with funding. Torrence is supported by an Australian Research Council Senior Fellowship. Our research would not be possible without the friendly assistance and support from many people in West New Britain too numerous to name individually. Mahonia Na Dari Research Station provided excellent facilities and the staff gave logistical support. Thanks to Peter Damm of the Nature Centre for assistance. Many staff from NBPOL were gracious in allowing access to the plantations and for providing maps and advice. Nick Thompson provided historical records, Ron Senior lent us a vehicle, Kerry Hart was our guide on two occasions, and Mike Hoare enabled us to install temperature measuring equipment in his

garden and provided hospitality. Thomas Nason deserves special mention for reporting obsidian finds to his supervisor and guiding us to the site location. Awi Zukepa, John Pange, and Peter Kambu assisted at Tili and Garu respectively. John Namuno, Frank Lewis and Cecilie Benjamin also provided invaluable assistance to Knowles. John Ray shared his private collection with us. We thank the following for assistance with permits and visas: National Museum and Art Gallery, National Research Institute, West New Britain Provincial Cultural Centre, PNG Consulate in Sydney. Professor Hugh Davies hosted us in Port Moresby and established collaboration with the Department of Geology, University of Papua New Guinea. Assistance of various kinds from the following was also important: OPRA, Walindi Resort, Kimbe Bay Shipping Agencies, Niugini Tours. Peter White made the drawings and helped in the preparation of this report.

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ITINERARY

May 25 Torrence, White, and Knowles fly to Port Moresby; meet with Davies.

May 26 Torrence, White and Knowles present seminar on current research and proposed fieldwork to staff at the National Museum and Art Gallery. Parr flies to Port Moresby.

Torrence, White, Knowles, Parr, and McKee fly to Hoskins, collect truck from Ron Senior and set up project at Mahonia Na Dari.

May 28 Team meets with Ian Dixon, NBPOL and later with John Namuno, WNB Provincial Cultural Centre.

May 29 Team visits Kulu Dagi and Tili Plantations and meets with Jamie Graham; meeting with Mike Hoare.

May 30 McKee departs.

May 31 Team visits Lotomgan Plantation and meets with Greg Mamando.

June 1 Meeting with Nick Thompson; visit to PNG Oil Palm Research Association.

June 2 Davies and Araho arrive.

June 3 Torrence gives talk to Hoskins High School students.

June 5 Davies departs.

June 6 Araho guides EMTV team to obsidian quarry at Bitokara Mission.

June 7 EMTV team visits excavations on Numundo Plantation.

June 8 Team conducts survey transect on Haella and Garu Plantations.

June 9 Torrence, White and Parr return to Sydney. Araho returns to Port Moresby.

June 16 Knowles returns to Sydney.

Table 1 Site Codes Assigned to Numundo and Garu Plantations (1996-99)

(cf. Figure 1)

FAAH Lapita site on hill near mangroves; section at gully head; test pits VIII, IX

FAAX: Gardens near Bantum's house at top of hill

FAAY: Small hill near cattle yards, test pit V

FABD: Area A, Baure Hill; test pits I, XII

FABE: Area B

FABF: Area C; test pits II, III, X

FABG: Area D; surface scatters 1, 2, 3

FABH: Area E; test pit IV

FABI: Area G; surface scatters 8, 9

FABJ: Area I; surface scatter 7

FABK: Area J; surface scatters 5, 6; test pits VII, XI; section XIII

FABL: Area L; surface scatter 4

FABM: Pleistocene site; section VI

FABN: Boku Hill, Garu Plantation

Table 2 Chronological Periods Represented in the Survey Area

<u>Period</u>	<u>Stratigraphic Position</u>	<u>Date</u> (years before present)	<u>Cultural Material</u>
Period 1	Pleistocene tephra	pre-?10,000	Retouched obsidian and chert flakes
Period 2	Under W-K1 tephra and above Pleistocene tephra	?-6,000	Small obsidian flakes, Split cobble
Period 2a	Under phreatomagmatic tephra and above Pleistocene tephra (limited to Areas J and K?)	?	Obsidian flakes
Period 3	Soil on W-K1 tephra and/or under W-K2 tephra	6,000 - 3,500	Obsidian flakes, Stemmed tools
Period 4	Soil on W-K2 tephra	3,500 - 1,800	Lapita pottery, Obsidian flakes
Period 5	Soil on W-K3 tephra	1,800-1,200	Obsidian flakes
Period 6	Soil on W-K4 tephra	1,200-500	Obsidian flakes
Period 7	Soils associated with W-H tephra	Less than 500	Obsidian flakes
Period 7a	Between W-H4 and W-H5 tephra	Less than 500	Obsidian flakes
Period 8	Modern topsoil	Less than ?200	Obsidian flakes, Groundstone axes, Sea shells, Pottery, Glass

Haella									
Site 1	150 04 29.2	5 31 41.2	--	--	--	--	--	C?	C?
Site 2	150 03 30.6	5 31 57.6	R	R?	--	--	C?	C?	?
Site 3	150 02 49.9	5 31 51.3	--	--	--	--	--	C?	C?
Site 4	150 01 48.8	5 31 51.2	--	--	--	--	--	--	R
Site 6a	150 00 40.8	5 29 34.2	--	--	--	--	--	--	C
Site 6b	150 00 35.0	5 29 34.0	--	--	--	--	--	C?	C?
Site 7	150 01 20.3	5 30 22.0	--	--	--	--	--	?	R
Garu									
Site 5	149 59 50.7	5 30 58.9	--	--	--	--	--	C?	C
Lotomgan									
Site 1	150 04 18.5	5 15 26.8	Obsidian artifacts (common) are Post-Dakataua tephra (past 1,000 years)						
Site 2	150 03 53.2	5 14 43.2	Date for obsidian artifacts (common) is unknown.						
Kulu-Dagi									
Site 1	150 00 37.2	5 36 05.8	Date for obsidian artifacts (common) is unknown.						
Site 2	150 01 46.6	5 34 05.5	--	--	--	--	--	C	0?
Site 3	150 01 54.2	5 34 06.5	Date of single artifact is unknown.						

Key

- Period not observed
- 0, No cultural material observed for Period
- P, Pottery present
- G, Glass present
- S, Sea shells present

Obsidian artifacts

- R, Rare
- C, Common
- A, Abundant