

# **ARCHAEOLOGICAL RESEARCH IN WEST NEW BRITAIN AND THE NATIONAL MUSEUM**

**November 2010**

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On site PXRF analysis of the newly discovered stemmed tool  
from Barema, West New Britain

**The project is affiliated with the National Museum of Papua New  
Guinea and the West New Britain Provincial Cultural Centre**

## **PARTICIPANTS**

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## **ITINERARY**

**November 8** Travel to Port Moresby.

**November 9** Fly to Hoskins; collect equipment at Mahonia Na Dari, travel to Bialla.

**November 10** Site recording at FADP and FADQ; PXRF analyses.

**November 11** Site recording FADR; Presentation to students at Bialla International School; presentation to staff at Hargy Oil Palm Plantation; site visits; travel to Mahonia Na Dari.

**November 12** Meeting with Director John Litom and staff at the WNB Provincial Cultural Centre; begin PXRF study of artifacts from WNB Provincial Cultural Centre.

**November 13-14** Conduct studies of artifacts from WNB Provincial Cultural Centre; stone tool flaking experiments; study of Bitokara artifacts from Walindi collection.

**November 15-18** Conduct studies of Reimann artefact collection.

**November 18** Presentation to students at WNB International School.

**November 19** Meeting with WNB Provincial Administrator; Bitokara analyses and flaking experiments.

**November 20** Complete flaking experiments and study of Bitokara artifacts; pack up.

**November 21** Fly to Port Moresby; Meeting with Dr. Andrew Moutu, Acting Director, National Museum and Art Gallery.

**November 22-26** Analyses of obsidian artifacts, National Museum and Art Gallery.

**November 22** Present seminar at the National Museum and Art Gallery; meetings with President and Deputy Presidents of the Board of Trustees.

**November 25** NBC radio interview.

**November 27** Visit to craft market; meeting with Dr. Moutu.

**November 28** Meeting with Mr. Heri; Return to Sydney.

## SUMMARY

Highly retouched, large obsidian artefacts, known as ‘stemmed tools,’ demonstrate that social networks among high status individuals stretched across the whole of Papua New Guinea as early as 7000-3300 years ago. Although the existence of these tools has been known for nearly 100 years, their significance was not fully understood until recent studies mapped out their spatial distribution and showed they were made using complex manufacturing techniques. As part of an ongoing research project to find out how stemmed tools were made and used and to reconstruct their role in these extensive trade networks, the team (1) constructed a new typology of stemmed tools; (2) conducted knapping experiments in conjunction with analyses of material from the Bitokara obsidian quarries; (3) analysed usewear and residues; (4) chemically characterised 84 stemmed tools from collections at the WNB Provincial Cultural Centre, the National Museum, Port Moresby and private collections; and (5) visited a new find spot at the Hargy Oil Palms, Ltd. Barema mill site near Bialla, West New Britain and characterised the obsidian tools and associated finds.

Results of analyses conducted on this trip have confirmed that stemmed tools with identical styles and modes of production were made using obsidian from sources located both on New Britain and Manus. The lack of scratches and polishes from use on the new Barema tool adds weight to the proposal that stemmed tools were not used in everyday activities and so had special, ritual or social significance. The complex methods used to make kombewa flakes as blanks for stemmed tools and also in the preparation of the elaborate notches that form the stem demonstrates that great skill and experience were required for their manufacture. A reanalysis of artifacts from site FCH, Talasea, has highlighted the important role that training and practice of skills played for the craft specialist producers of these extraordinary objects.

The team presented preliminary results of the analyses through powerpoint presentations and discussed the ongoing research with staff at the West New Britain Provincial Cultural Centre and Hargy Oil Palms, Ltd. A seminar about the research including demonstrations of the equipment used in the study was given at the National Museum and Art Gallery, Port Moresby to museum staff and students from the University of PNG. The team talked to pupils at Bialla and New Britain International Schools and gave a live interview on NBC radio.

## RESEARCH IN 2010

### PROJECT OBJECTIVES

The overall aim of our archaeological research in West New Britain was to conduct a series of analyses designed to test the idea that large, elaborately worked obsidian stemmed tools dating from before 7000 up to 3300 years ago represent the earliest evidence for social complexity in the Pacific region (e.g. Cover photo; Figure 1).



Figure 1 Stemmed tool found at the Barema mill manager's house site (FADP).

Since a great deal of care, skill and expertise was required in the manufacture of the shiny, fragile and highly distinctive stemmed tools, they probably functioned as status items (Araho *et al.* 2002; Rath and Torrence 2003; Specht 2005; Torrence 2003; 2004). In addition, the existence of widespread social networks between high status individuals is suggested by the very large spatial distribution of the artifacts (e.g. Torrence and Swadling 2008; Swadling 2005; Swadling and Hide 2005). Most recently, the discovery that stemmed tools with identical complex forms were made from obsidian obtained from both West New Britain and Manus obsidian sources (Torrence *et al.* 2009) has provided additional evidence for complex social relations at this early date.

The research in 2010 had four major objectives. The first was to improve our knowledge of how stemmed tools were made and used through detailed technological, typological and usewear/residue studies of artefacts in existing collections.

Usewear/residue studies require high powered microscopic analyses conducted with highly specialised equipment (e.g. Kononenko 2007; Kononenko *et al.* 2010a, 2010b). Recently, Kononenko *et al.* (2010c) pioneered the use of small digital microscopes. A subsidiary aim of the fieldwork was to test out the capacities of this portable equipment in situations outside the laboratory.

A second objective was to conduct experiments replicating ancient techniques of stone tool manufacture to expand knowledge about how the stemmed tools were made as well as to evaluate the degree of skill required to fashion them. These studies were designed to complement traditional technological and typological approaches.

Thirdly, the research aimed to determine the sources of the obsidian used in the manufacture of stemmed tools. By linking the location where the tool was discarded in the past with the geological source of the obsidian, prehistoric social networks can begin to be reconstructed. To achieve this objective, the team introduced the use of portable X-ray fluorescence (PXRF) to PNG archaeology as a technique for measuring the chemical composition of the obsidian used in the tools (cf. Sheppard *et al.* 2010; Jia *et al.* 2010; Phillips and Speakman 2009) (Cover photo).

Finally, just before we left Sydney we were invited to visit Hargy Oil Palms, Ltd in Biella to give advice about a stemmed tool that had recently been unearthed during bulldozing in preparation of building a new house (Figure 1). By visiting the site, we hoped to reconstruct the original stratigraphic context of the tool and estimate the age of this exciting new find.

## **COLLECTIONS RESEARCH**

The research focused on three major collections of stemmed tools in Papua New Guinea: National Museum and Art Gallery (Port Moresby); West New Britain Provincial Cultural Centre (Kimbe); and the Reimann private collection (Kimbe). At the National Museum 29 published and unpublished examples of large stemmed tools and related material were made available for study. Unfortunately, several published examples could not be located during our visit. We also studied 195 artifacts from site FCH as part of the construction of a new stemmed tool typology and to expand the

analysis of stemmed tool manufacture. In Kimbe we analysed 6 stemmed tools at the WNB Cultural Centre, but unfortunately a number of the artifacts photographed on previous visits are no longer in the collection. The Reimann collection included 39 stemmed tools. In addition to the major collections, the team studied 1 complete and 4 broken (in 9 fragments) stemmed tools recently recovered from a construction site at Hargy Oil Palms, Ltd. (Bialla).

## **BUILDING A TYPOLOGY**

As archaeological research in the Willaumez Peninsula of West New Britain has progressed since the 1970's when obsidian stemmed tools were first recognized as a distinctive category, our knowledge of variation among these artifacts has greatly expanded, but the enormous variety in the sizes, shapes, and method of manufacture is still poorly understood. How much variation is due to changes through time in 'fashion', types of exchange and/or ritual, or differences in function? The first step in addressing these questions is to set up a scheme of classification to enable comparisons across time and space.

Research on stemmed tools has identified two broad categories which potentially have different functions. The first are the large, highly retouched artifacts that were exchanged over long distances within Papua New Guinea and into West Papua (Torrence and Swadling 2009; Torrence *et al.* 2009). These are thought to have had a ceremonial function and possibly served as status items (Araho *et al.* 2002; Rath and Torrence 2003; Specht 2005; Torrence 2003; 2004). The majority of these are casual finds made over a hundred years ago or from recent surface collections. Only broken or incomplete examples have been recovered from firm stratigraphic contexts. The second group consists of much smaller stemmed tools from surface collections and excavations of sites only in West New Britain. Many of these were probably used in ordinary, utilitarian tasks, although some were used to cut and pierce skin, perhaps in a ceremonial context (Kononenko and Torrence 2009; Kononenko *et al.* 2010b).

A preliminary typology of stemmed tools by Araho *et al.* (2002) identified two major groups that were differentiated by the method of manufacture which determines the form of the blank that was retouched. The distinction between Type 1 (blades) and Type 2 (kombewa flakes) is still valid but is far too broad to encompass the large variety of forms within both these groups. For this reason Torrence and Kononenko

have begun a new scheme of classification which encompasses both the two major groupings. The new typology takes into account blank form, body shape, symmetry and depth of notches and stem shape.



Figure 2 Robin Torrence and Nina Kononenko using the Reimann collection to build a typology for stemmed tools.

The creation of a comprehensive typology of stemmed tools benefited greatly from the opportunity to study the large collections of tools in the Reimann collection (Figure 2) and from FCH at the National Museum originally studied by Araho (1996), since these incorporate a wide range of types and include both the large supposedly ‘ceremonial’ types as well as the small, potentially functional artifacts.

## STEMMED TOOL MANUFACTURE

Araho *et al.* (2002) also proposed a sequence of stages (‘reduction sequence’) to describe how Type 2, kombewa stemmed tools were made, based mainly on studies of surface assemblages collected at the FQT Lambe Gully site at Bitokara Mission (Talasea) and the large surface assemblage from site FCH on nearby Bamba beach. At that time several parts of this manufacturing sequence were poorly understood: in particular, methods for the initial preparation of the core, removal of the kombewa flake and the preparation of the notches. Another set of questions that required further investigation was raised by preliminary experiments by Kononenko and Kim Ackerman to replicate this technology. On the basis of their experience, they proposed that the production of large Type 2 tools required high levels of expertise,

suggesting that stemmed tools had been made by highly skilled, specialist workers (cf. Rath and Torrence 2003).

To improve knowledge about how Type 2 tools were made and to assess the role of skill and practice, the team used two approaches. The first involved detailed study and recording of 153 diagnostic pieces of debitage (flakes and cores) derived from the manufacture of stemmed tools. The study sample was obtained from Bitokara Mission some years ago for the purpose of constructing a stone wall and is now stored at Walindi Plantation. A representative sample of these artifacts was deposited at the WNB Cultural Centre and another group is stored at Mahonia Na Dari until funds can be found to ship it to the National Museum. Since this collection contains many more kombewa cores than have been collected through archaeological research at the obsidian quarries, it has enabled us to gain a far better understanding of the range of strategies used by ancient knappers to produce the blades and kombewa flakes used in the production of stemmed tools.

Although analysis of the data is still in progress, it is clear that kombewa flakes were made by a range of strategies including both striking across the bulb created on a core after splitting a cobble or removal of the bulb from a large flake. As predicted by Araho (1996), multiple kombewa flakes could also be removed from a single large core. To test the validity of reconstructions made by studying the debitage, Kononenko successfully manufactured a range of kombewa flakes from both cores and flakes (Figure 3). A major factor identified was the need for a hammerstone with enough mass to split a cobble, but not too large in size.



Figure 3 Nina Kononenko experimenting with techniques for splitting obsidian nodules.



Kononenko also made a large number of experiments to explore methods for creating deep notches on the flake blanks. By comparing flake scars from different techniques with the scar patterns on the stemmed tools in the Reimann and Barema collections, it seems that free hand percussion with a heavy hammerstone was the most commonly used technique, although dense wood may have been used in some instances. The shape and weight of the hammerstone also proved to be a potentially limiting factor since it is difficult to strike flakes from within the small and restricted area of the notch with a rounded stone cobble. Future experiments will be made using tools constructed out of dense clam shell since these have a high mass to volume ratio and can be shaped to fit into the small notches.

Based on her experiments, Kononenko concluded that skill must have been a key factor in the production of stemmed tools and that practice would have been an important element in preparing to retouch the large tools, particularly with regard to the preparation of notches. The presence in the Reimann collection of several irregular artifacts from Talasea bearing a series of notches supports this hypothesis, originally proposed by Akerman. A re-examination of the small stemmed tools from FCH has led us to propose the hypothesis that this assemblage resulted from practice and/or training in the manufacture of kombewa flakes and especially in the production of the notches used to create the stem (Figure 4). Since the entire surface collection is geared only to practice, this site may represent a workshop or ritual place dedicated to training in stemmed tool production.



Figure 4 Examples of practice notches made by 'experts' and/or 'novices.'

## USEWEAR/RESIDUE ANALYSES

The analysis of usewear and residues was made using two digital microscopes enabling magnifications up to 400x. Despite systematic examination, very few of the tools bore any visible traces of use because the edges had been extensively damaged since their deposition or the original surfaces had been removed by weathering. This is not surprising because all except the Barema samples come from surface contexts and/or have been extensively handled since their collection and some have been reused and reflaked (cf. Specht 2005). The loss of edges is also not unexpected given the fragility of obsidian edges and the speed of hydration in tropical, humid environments. Residues resembling blood were identified on a few tools, but these yielded negative results when tested the hemastix<sup>R</sup> strips and are more likely to be modern contamination (Figure 5).



Figure 5 Nina and Francis using digital microscope to examine a tool for blood residues.

Usewear was observed in only a very few cases. These traces will be interpreted following extensive comparison with the experimental reference collection housed at the Australian Museum. Significantly, the relatively thin edges of the complete Barema tool proved to be pristine, so the artifact had not been used. This important result adds support to the hypothesis that the large, elaborate stemmed tools functioned within a ceremonial context. It also suggests that the tools had been deliberately and carefully placed at the site just below the top of the hill, possibly within a special ritual context, such as a men's house.

## PXRF STUDY

A major aim of the study was to measure the chemical composition of the stemmed tools using portable x-ray fluorescence spectrometry, a new technique that has been rapidly adopted in archaeology for the study of obsidian trade (cf. Sheppard *et al.* 2010; Jia *et al.* 2010; Phillips and Speakman 2009) (Cover photo). The results will then be matched to the known composition of the geological sources in the Pacific region which have been extensively tested previously by Sheppard *et al.* (20010) and replicated by this team on the Bruker instrument used in this study. The resulting spatial distribution of the tools provides a proxy for the scale and nature of social networks during the period of stemmed tools (e.g. Torrence and Swadling 2009; Torrence *et al.* 2009). Measurements were made on 84 artifacts, including 73 stemmed tools and 11 others chosen to enhance the sample as examples of key debitage types or to ensure good representation of the Manus sources (Figure 6). Only 10 were sampled from site FCH since 24 artifacts have previously been analysed by PIXE-PIGME and had only identified the Kutau/Bao, West New Britain source at that site (Araho et al 2002: 74).



Figure 6 Peter White and Henry Baul conducting PXRF analysis of Reimann collection, Kimbe.

The major source regions in Papua New Guinea can easily be identified by reading the PXRF spectrum, but assignment to subsource requires more detailed study of the source reference sample and the application of multivariate analyses. These studies will be made during 2011. Preliminary results presented in Table 1 show that, not surprisingly, all of the stemmed tools found on New Britain are derived from local sources. One exceedingly large blade (40 cm long) from the National Museum had been originally catalogued as from Manus despite the total lack of provenience information, but it was assigned to New Britain on the basis of the results of PXRF analysis.

COLLECTION	ARTIFACT TYPE	MANUS	WEST NEW BRITAIN
<b>WNB Cultural Centre</b>	Stemmed		6
	Other		3
<b>Reimann collection</b>	Stemmed		35
	Other		4
<b>Barema (FADP)</b>	Stemmed		7
<b>National Museum</b>	Stemmed	2	13
	Other	4	
	FCH Stemmed		10
<b>Totals</b>		6	78

Table 1 Preliminary results of PXRF analyses



Figure 7 Nearly identical stemmed tools sourced by PXRF to two different sources.

Left: Manus obsidian (76.3.141 Site GGI on Lou Island, Manus).

Right: West New Britain obsidian (87.85.40 Site CTF 2.2 at Mangum, East Sepik).

The positive identification of two stemmed tools from Manus as coming from sources probably on Lou Island is a highly significant result (Table 1). The other four Manus artifacts are recent spear points that were included to provide a comparison. The two Manus stemmed tools include a prismatic blade that is identical to another from East Sepik assigned to West New Britain using PXRF and supported by a previous PIXE-PIGME analysis (Swadling and Hide 2005) (Figure 7) and a large retouched kombewa flake (Figure 8). Confirmation that the tool had a retouched stem was achieved with the help of an x-ray at a local hospital (Figure 8). This latter tool, purchased from a villager on Lou Island in the 1970s, had presumably been collected from a prehistoric site and then rehafted into a carved wooden haft. Two similar examples from Manus, reported as in the Stuttgart Linden-Museum (Nevermann 1934: 341, fig. 193) show that recent reuse of stemmed tools is not uncommon.



Figure 8 Alu Guise with x-ray of an obsidian stemmed tool from Manus now incorporated within a modern haft (lying on table).

The preliminary PXRF results are very important because they confirm a study using PIXE-PIGME and ICPMS analyses of a single artifact that stemmed tools with identical forms were made using obsidian derived from both Manus and New Britain sources (Torrence *et al.* 2009). Although separated by a long sea journey, during the period c. 7000-3300 years ago these two islands were obviously participating within the same social networks and may even have been in competition to provide the large stemmed tools that eventually circulated as far as West Papua and Bougainville.



These new analyses indicate that a radical rewriting of PNG prehistory is required to account for the initiation and flourishing of long distance interaction well before the time of Lapita pottery.

## HARGY SITES AND SECTIONS

Three new archaeological sites were recorded within the region managed by the Hargy Oil Palms, Ltd. The first site, FADP, is on a slope just below the top of a broad, level hill situated above the Barema river and has dramatic views to the north and east (Figure 9).

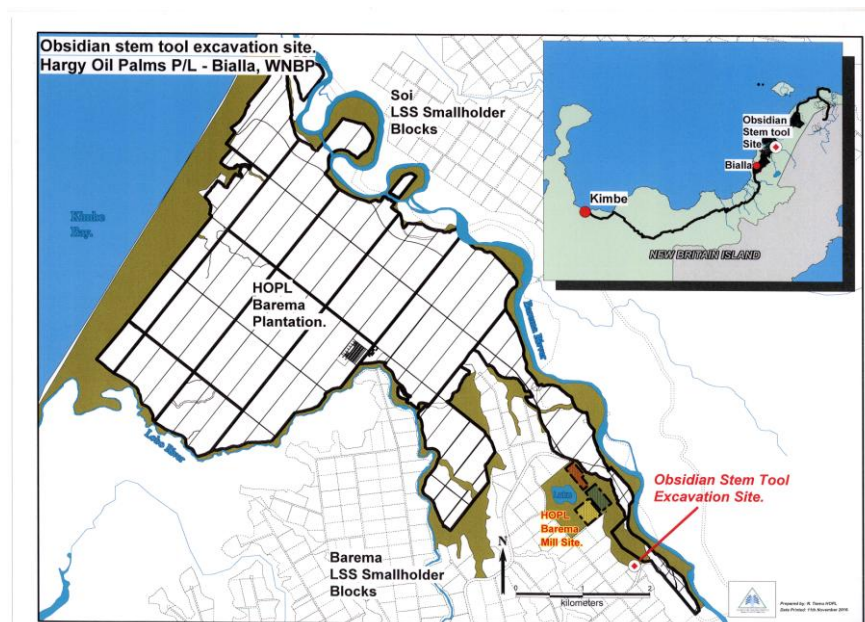


Figure 9 Location of Barema Mill Manager's House Site (FADP), West New Britain (Courtesy of HOPL and Richard Tiamu).

The site had been bulldozed to provide a level surface for the new mill manager's house. During the levelling operation, workers identified and rescued a large intact stemmed tool (Figure 1) that bears striking similarity to another example from Kandrian reported by Specht (2005: 376, fig. 28.2). Later careful surface survey of the backdirt and surrounding area yielded 9 retouched fragments some of which could be refitted. Based on the shapes, colouring, and thickness of the pieces, we estimate that at least 4 additional retouched artifacts had been deposited at the same located as the preserved stemmed tool. There was also a relatively thin scatter of small, non-cortical flakes at the site. After preliminary study, all the artifacts were left in the care of staff at Hargy Oil Palms, Ltd.

Based on discussions with workmen present when the tools was found and a consideration of the slope of the original ground surface, it first appeared that the stemmed tools were found at a level comparable to just above the surface of the original road partly preserved at the back of the site: i.e. about 1 metre below the surface. This would, however, place the artefacts in an unlikely context within a very thick volcanic tephra based on a study of the section of the hillside preserved at the back of the site (Figure 10).

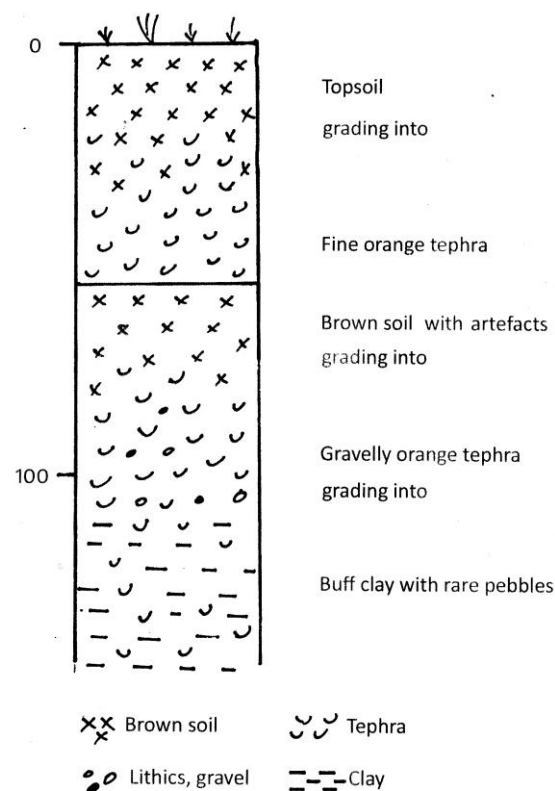


Figure 10 Section preserved at the back of the levelled terrace at FADP  
(Drawn by Peter White).

Given the stratigraphy in the section, it seems more likely that the original context of the artefact was a brown soil formed on the surface of the deep basal tephra: e.g., about 0.5 metres below current ground surface. This layer was buried by a more recent eruption represented by a thin, fine orange tephra. Although an obsidian artefact was observed within the current topsoil layer of the section, two non-obsidian artifacts were also recovered from the lower brown soil, one of which has a distinctive stem (Figure 11).



Figure 11 Flaked stone tool from the Barema mill manager's house site (FADP).

Based on consultations with Chris McKee (Geophysical Observatory, Port Moresby), who has done extensive geological fieldwork in the region and who briefly examined tephra samples, photos, and section drawings from the FADP site, it is likely that the very thick tephra unit at the base of the site is Pleistocene in age and the thin orange tephra overlying the brown soil is the Witori W-G unit dated elsewhere to around 1200 years ago. This interpretation of the stratigraphy would confirm the hypothesis that the stemmed tools were derived from the buried soil horizon. A small sample of charcoal obtained from the brown soil in the section (Figure 2) may help refine the dating for the Barema stemmed tools and could therefore contribute greatly to our understanding of large stemmed tools.

The character of the FADP site is strikingly similar to the FABN site at Boku Hill, Garu plantation near Kimbe (Torrence 2004). In both cases several stemmed tools were found as a consequence of levelling the ground across an area near the top of a highly prominent hill. The absence of a dense scatter of artifacts at FADP that would suggest the presence of a settlement is notable, but in neither case is it possible with current evidence to determine if the tools were found within a domestic, ritual or mortuary context. This is an important question that might be usefully addressed in further excavations placed uphill from the manager's house where deposits are still preserved. Test pits located near the disturbed area at FABN proved to be inconclusive, but further analysis of the FABN assemblages and stratigraphy might be warranted given the new finds at FADP.

The team also examined highly disturbed thin surface scatters of obsidian flakes at the Barema mill site (assigned site code FADQ) (Figure 9). At this location the



topsoil has been heavily disturbed down to 20-30 cm. Two small shovel pits were dug in a region where clearance of the forest was minimal. From this cursory investigation, it appears that the same stratigraphy at FADP is also present at FADQ and that the majority of the artifacts were originally deposited within a soil buried under a thin tephra. Clearly, there was prehistoric activity on this large relatively level terrace, but given the low density of artifacts, the nature of land use would be difficult to reconstruct without extensive additional research and excavation.

Finally, a small number of obsidian flakes were found eroded from terrace walls located just below the Hargy Guest House (site FADR). A stratigraphic section was located in which charred wood was preserved within the upper yellow tephra layer (perhaps equivalent to the upper tephra at FADP). Radiocarbon dating of samples taken from the section would help test whether this is the W-G tephra and could therefore help construct a regional tephra-chronology for the region.

## **REPORTING AND CONSULTATION**

The team met regularly with staff at the WNB Provincial Cultural Centre to give a powerpoint presentation about the background to the research, provide ongoing updates on results, and discuss various matters concerning National Cultural Property in the province. Staff members Henry Baul and Francis observed and helped with artefact analyses and Baul also accompanied the team to New Britain International School. Torrence donated offprints of recent publications to the West New Britain Provincial Cultural Centre and other stakeholders including Mahonia Na Dari Library and the National Museum and Art Gallery.

Kononenko gave demonstrations of stone tool manufacture for residents at Mahonia Na Dari, tourists, and local community members. The team visited Bialla International School and New Britain International School where they explained to the children and teachers how stone tools were made and why they were important for the archaeology of West New Britain. A set of experimental tools was donated to New Britain International School and the WNB Provincial Cultural Centre.



Figure 12 Teaching archaeology at Bialla International School.

In Port Moresby the team presented a seminar for museum staff and UPNG students led by Dr. Matthew Leavesley and demonstrated the use of the PXRf and digital microscope equipment. They were also fortunate to meet with the President, and Deputy Presidents of the National Museum Board of Trustees as well as the acting Director. Before leaving the country, the team met with Mr. Dairi Arua Heri, a key informant in Torrence's ongoing research on Central Province ethnographic material culture.

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Mary Kimbe, Henry Baul, and Francis provided liaison with the West New Britain Provincial government, loan of artifacts, and assistance with the PXRf analyses. President of the Board of Trustees, Julius Violaris, Deputy Presidents Andrew Abel and Maria Kopkop, Acting Director, Dr. Andrew Moutu and staff of the National Museum and Art Gallery were very generous with their time, advice, and extensive knowledge. Herman Mandui organised our seminar and facilitated access to the collections and archives. In the stores we were ably assisted by Alu Guise and Basil. We also thank Eka Hriehwazi and Asi Sando for hospitality, Henry Arifeae for organising the NBC interview, and Dr. Matthew Leavesley (UPNG) for help with the seminar at the National Museum.

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