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Kutau/Bao Obsidian – Extending its Eastern Distribution into the Fijian Northeast

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ABSTRACT

This paper reports on the discovery and geochemical sourcing of an obsidian flake from a Lapita site on Vorovoro Island off the northeast coast of Vanua Levu, Fiji. The flake is sourced using pXRF to the Kutau/Bao source located on the Willaumez Peninsula, West New Britain in the Bismarck Archipelago.

Keywords: Fiji; Kutau/Bao Obsidian; Lapita

INTRODUCTION

The Kutau and Bao geochemical group is comprised of obsidian outcrops located in the Talasea region of the central Willaumez Peninsula on West New Britain in the Bismarck Archipelago. This chemical grouping contains well recorded obsidian flows, from which material was obtained and widely distributed during the Lapita era (Torrence *et al*. 1992, Summerhayes 2009). Indeed, of 966 obsidian pieces recovered by Green (1976) from three Lapita sites in the Reef/Santa Cruz Group of the south-eastern Solomon Islands in the early 1970s, Sheppard *et al*. (2010: 27) report 94.6% of the specimens to originate from these sources, a straight-line transfer distance of 1860 km notwithstanding. Obsidian recovery from more recent excavations in Vanuatu (Galipaud and Sweete Kelly 2007, Reepmeyer *et al*. 2010), New Caledonia (Sand and Sheppard 2000) and Fiji (Nunn 2007, Irwin *et al*. 2011) extend this distribution even further across the Lapita landscape of Remote Oceania, as well as towards the west in island Southeast Asia (Bellwood and Koon 1989). Here we report a recent discovery of an obsidian flake, sourced to Kutau/Bao, from a Lapita site on Vorovoro Island off the northeast coast of Vanua Levu, Fiji. This flake presently marks the eastern-most distribution for this source, being 3425 km[5] distant from the collection locale.

VOROVORO AND THE OBSIDIAN FLAKE DISCOVERY

The Vorovoro Lapita site was recorded by Burley in 2009 with subsequent test excavations of 8 m^2 carried out in 2010 (Burley 2012). It is a hamlet-sized occupation positioned on a coral sand tombolo on the small island of Vorovoro off the northeast coast of Vanua Levu (Figure 1). Two AMS radiocarbon dates on wood charcoal of 2918 ± 27 BP (Wk-29330) and 2896 ± 27 BP (Wk-29329) place it among the earliest dated Lapita sites in Fiji (Burley 2012: 9). Vorovoro Island has no agricultural soils, no fresh water, and its off-shore collection reef is restricted, challenging typical explanations for Lapita settlement. The site, however, is positioned at the head of Mali Passage, a substantive channel through the offshore Cakaulevu barrier reef. Burley accordingly argues the site to have a strategic and logistical role in the Lapita settlement of northern Fiji. Test excavations and surface collection recovered an assortment of western Lapita style pottery sherds with fine dentate application, restricted zone markers, complex motifs, flat-bottomed dishes and other characteristic features. A small assemblage of lithic debitage (n=41) also was recovered, with the dominant material being quartz.

The Vorovoro site presently is positioned in back-beach gardens of Tui Mali, high chief of Vorovoro and Mali Island peoples. Substantial numbers of ceramic

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5 This distance is calculated using Google Earth and represents a direct line measurement from the Talasea region to Vorovoro Island. The actual transport distance by canoe would add substantially to this number.

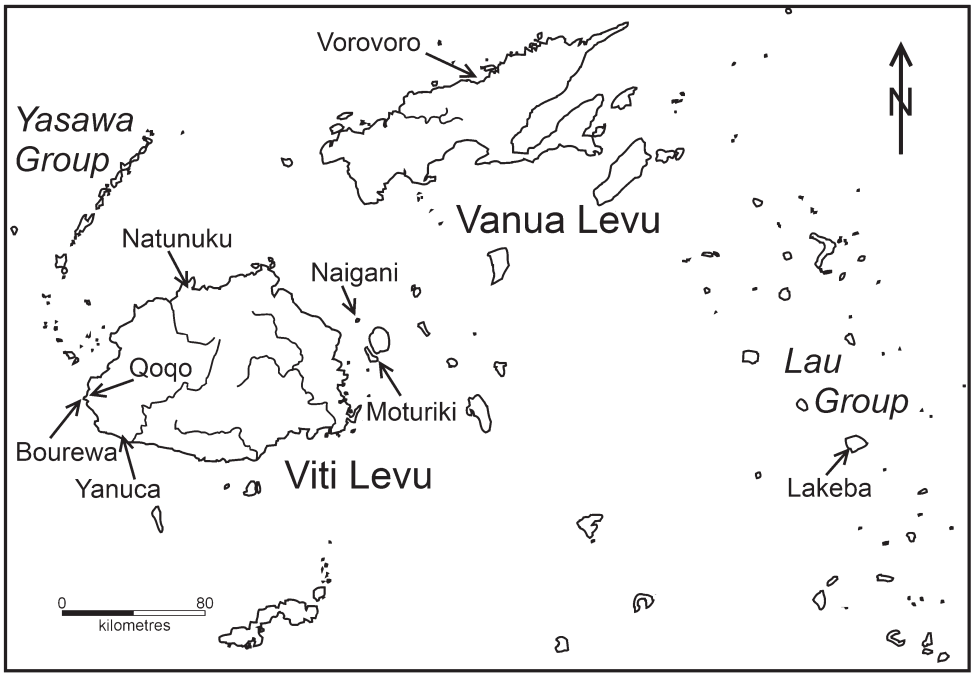

Figure 1. Excavated Lapita sites in Fiji including Vorovoro off northeast coastal Vanua Levu. Bourewa and Naigani are the two other Fijian sites with Kutau/Bao obsidian.

sherds and other materials from both Lapita and immediate post-Lapita periods are scattered across the garden surface as a consequence of planting and replanting activities over the past two to three millennia. Not surprisingly, much of the Vorovoro site's stratigraphic integrity is now lost, albeit limited *in situ* deposits do occur (Burley 2012: 8). In August 2012, Sand and Balenaivalu visited the Vorovoro site accompanied by participants in a Vanua Levu heritage workshop sponsored by the Institute of Archaeology of New Caledonia and the Pacific-IANCP (Noumea) and the Fiji Museum. About 25 individuals searched the garden surface for archaeological remains and especially decorated Lapita sherds, resulting in an additional collection of dentate stamp and incised pieces. Also discovered by Sand in the central area of the old tombolo was a flake of dark translucent obsidian that, at least visually, appeared to be from a Bismarck Archipelago source.

GEOCHEMISTRY AND DETERMINATION OF SOURCE

The obsidian flake (Figure 2) is 27 mm long, 17 mm wide with a maximum thickness of 5 mm, and a weight of 2.04 g. Its size and striking platform characteristics suggest it was produced through direct percussion from a prepared core. Intentional or use-related edge retouch occurs along one margin, including a probable notch. To potentially identify the flake's source origin, the Fiji Museum sent the specimen to Ross-Sheppard at the University of Auckland Anthropology Laboratory for pXRF (portable X-ray fluorescence) analysis. The laboratory has an Innov-X Delta

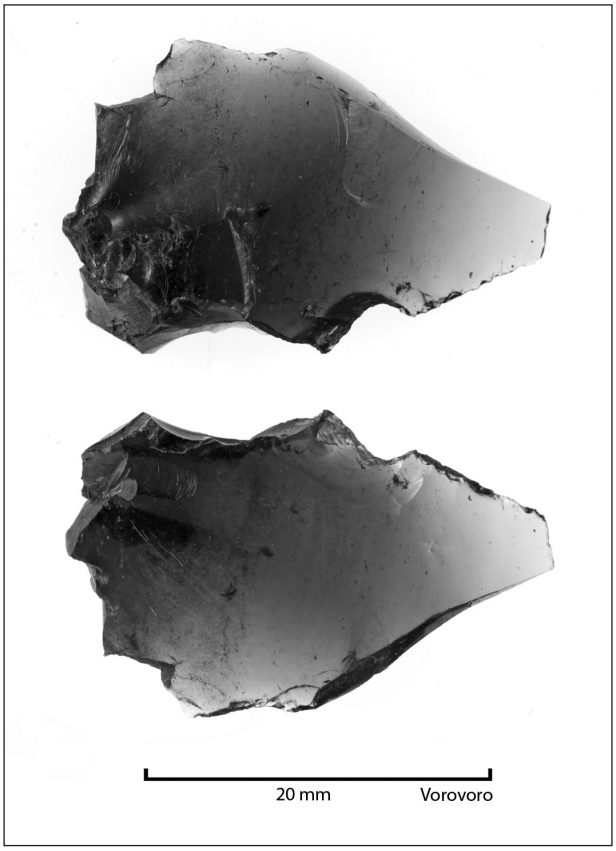

Figure 2. Vorovoro obsidian flake from Kutau/Bao source. Photo by Tim Mackrell, Department of Anthropology, University of Auckland.

Series analyzer (Rh anode, Si drift detector, 8–40keV, 5–200μA). All samples were analyzed using the instruments soil mode which uses three beams to detect 29 elements. Each analysis took 180 seconds, 60 seconds for each beam. The Vorovoro specimen was analyzed three times, each analysis being on a different surface. Twelve elements were measured reliably and are reported in Table 1. Also measured for comparative analysis were archived samples from varied obsidian/volcanic glass sources in Near and Remote Oceania as far east as Samoa and Tonga (Sheppard *et al.* 2010). Machine consistency and precision were maintained through intermittent measurement of ANU 2000 Wekwok, NIST SRM-278 (powdered obsidian from Clear Lake, Newbury Crater Oregon) and Mayor Island 9.3 (internal University of Auckland) standards. Measurements for the NIST SRM-278 external standard are reported in Table 2. Elemental values were calibrated by linear regression to the three aforementioned standards.

For comparative analysis, the three sets of Vorovoro measurements were incorporated within a bivariate plot of Rb Log 10 and Y Log 10 for previously measured source region samples (Figure 3). This clearly illustrates a Vorovoro specimen relationship with the Willaumez Peninsula region. Equally important, it illustrates a distinction of this sample from volcanic glass sources in Samoa and northern Tonga (Tafahi), both in much closer proximity to the site. The Vorovoro specimen was then positioned in a bivariate plot for Mn Log 10 and Sr Log 10 for previously measured Bismarck Archipelago obsidian sources specifically (Figure 4). This plot illustrates the clear grouping of the Vorovoro sample with the Kutau/Bao source. Although not detailed here, discriminant analysis and principal component analysis using K, Zn, Ca, Ti, Mn, Fe, Rb, Sr, Zr, Pb, Y and Nb support this interpretation.

Table 1. *pXRF element measurements in parts per million for Vorovoro sample.*

Element	Analysis 1	Analysis 2	Analysis 3
K	33014.4	33781.3	33130.5
Zn	39.1	43.1	38.8
Ca	8122.3	9008.4	8108.4
Ti	1346.9	1477.3	1316.9
Mn	456.3	487.3	464.7
Fe	9575.8	10064.5	9564.5
Rb	61.9	64.3	62.6
Sr	195.7	211.6	200.7
Zr	138.1	145.2	140.8
Pb	10.7	12.1	11.3
Y	22.0	24.2	23.7
Nb	3.6	3.4	4.5

Table 2. *pXRF element measurement in parts per million for NIST 278*

pXRF NIST 278 (N=10)				Certified Values	
ppm	Mean	SD	CV	Mean	Error
K	34036.5	84.1	0.002	34534.3	166.0
Zn	50.6	1.1	0.023	55.0	Recommended
Ca	6973.7	105.6	0.015	7025.5	14.3
Ti	1386.6	38.6	0.028	1468.7	42.0
Mn	405.4	2.9	0.007	402.0	15.5
Fe	14307.5	40.2	0.003	14278.7	140.0
Rb	126.4	0.7	0.005	127.5	0.3
Sr	63.6	1.8	0.028	63.5	0.0
Zr	275.0	2.6	0.009	*290.0	30.0
Pb	17.4	1.0	0.059	16.4	0.2
Y	40.9	0.5	0.011	*39.0	5.0
Nb	16.8	0.6	0.037	*18.0	5.0

* Consensus Values from Hollocher *et al.* 1995

IMPLICATIONS AND CONCLUSION

The discovery of a piece of Kutau/Bao obsidian at the Vorovoro site off the west coast of Vanua Levu in Fiji provides additional insight into the Oceanic distribution and importance of this material for early Lapita colonists. Within Fiji, there are two other sites where Kutau/Bao obsidian has been recovered (Figure 2). One, Bourewa on the southwestern coast of Viti Levu, had a single obsidian core present (Nunn 2007). Perhaps significantly, Bourewa and Vorovoro have an equivalent radiocarbon age and, at least to this stage, appear to be founder colonies either linked to each other or from separate but contemporaneous Lapita migrations into Fiji (Burley 2012). The second site, Naigani, has three obsidian flakes and is slightly later in time. Irwin *et al.* (2011:12) suggest the presence of obsidian here may be the result of 'direct transportation' rather than 'down-the-line exchange', and that Naigani also may be related to the initial colonization event. Obsidian has not been recovered from other Lapita sites in Fiji with western Lapita type ceramics. Whether this is a consequence of sampling, earlier field recovery methods or reflects isolation from the original homeland after first settlement remains to be determined through future studies. However, the number of excavated early Lapita settlements in Fiji are few, including no more than six or seven sites, and the presence of Kutau/Bao obsidian in three seems telling of its importance on the early colonization landscape. That the total number of recovered specimens amounts to no more than five pieces is no doubt illustrative of the exceptional distances it had to travel from source (see Clark and Anderson 2009: 417).

The movement of West New Britain obsidian into Remote Oceania seemingly occurs only during the initial episode of Lapita settlement (Summerhayes 2009). For Va-

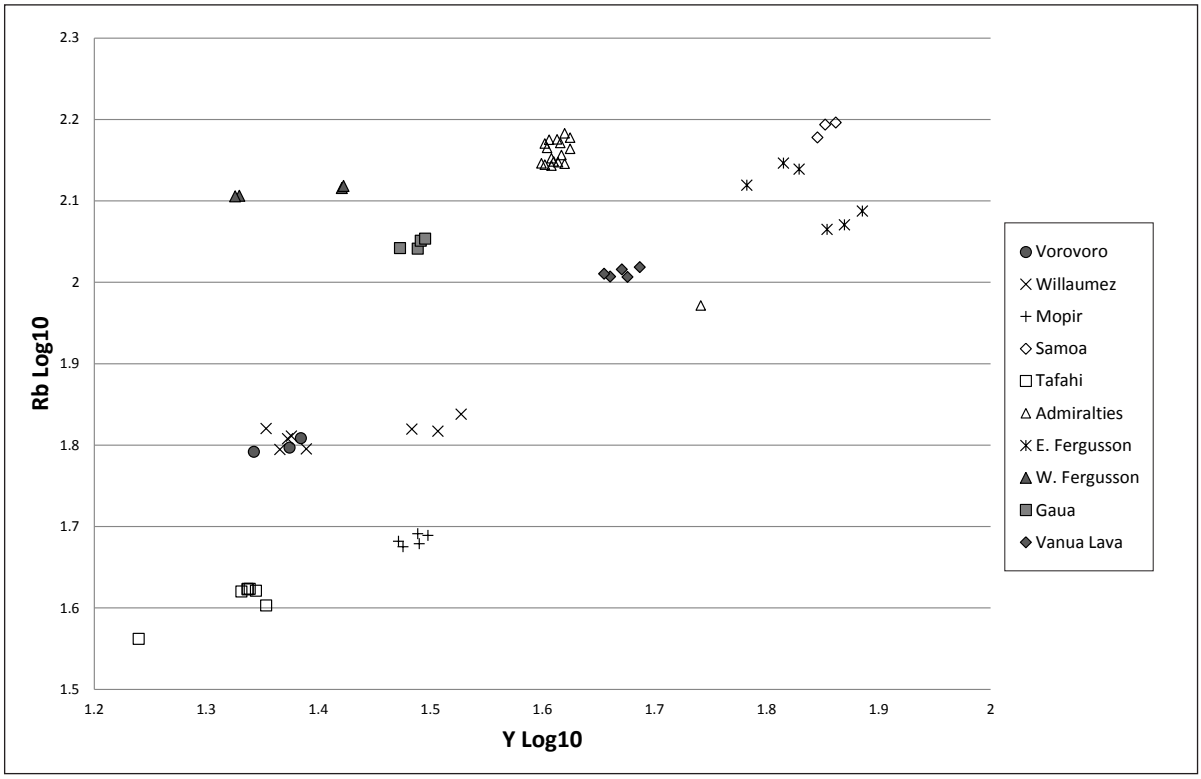

Figure 3. Vorovoro plot of Rb Log 10 Vs. Y Log 10 against Oceanic source regions:

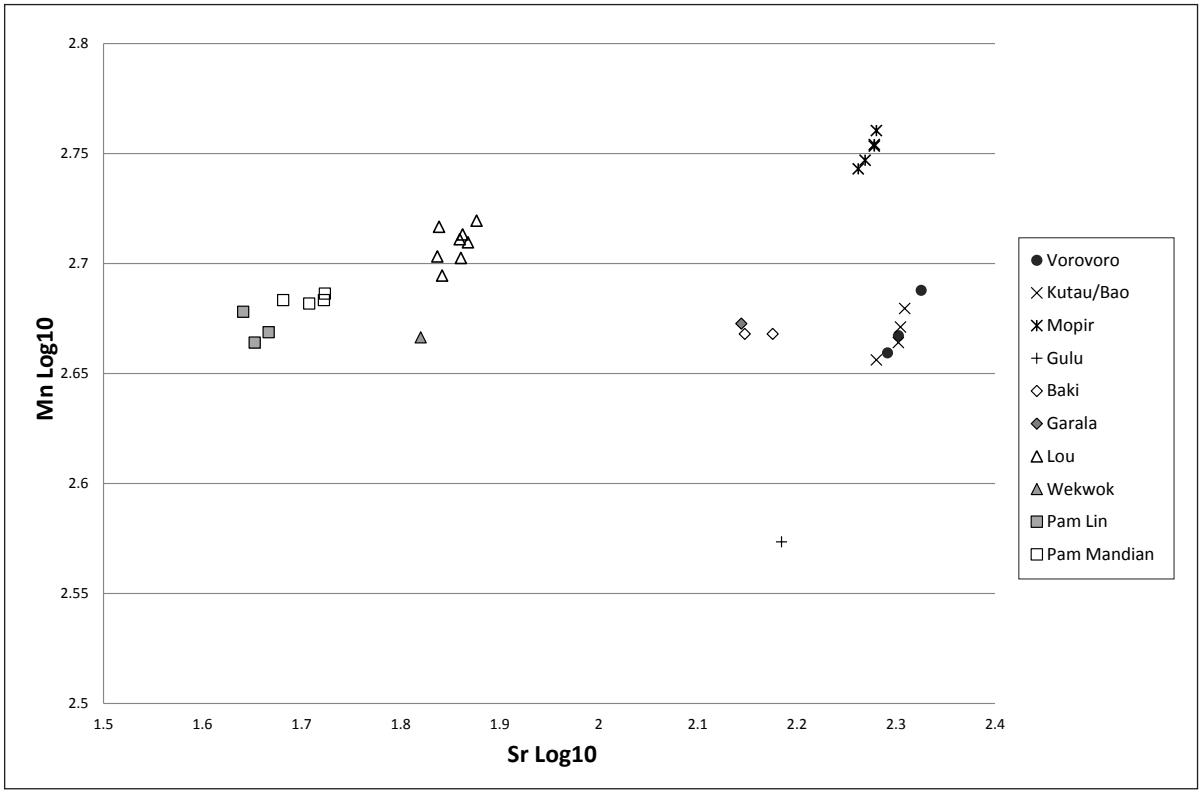

Figure 4. Vorovoro plot of Sr Log 10 vs Mn Log 10 against Bismarck Sources
(excluding SW Manus which would be an outlier on this graph).

nuatu, Reepmeyer *et al*. (2011: 217) are explicit in their statement that western obsidian importation ceased 'sometime prior to 2800 BP'. The Fijian data do not contradict this claim and the subsequent extension of Lapita colonisation into Lau and Tonga dating ca 2850 BP is also in support. Bismarck Archipelago obsidians do not occur in either the Lakeba (Lau) or Nukuleka (Tonga) sites, each being an initial Lapita settlement node (Best 1984, Burley *et al*. 2010). Yet the recognition and importance of obsidian for production of cutting tools was not lost. Rather it fostered discovery of a northern Tongan volcanic glass source(s) which, ultimately, was widely distributed throughout the Tongan archipelago as well as Lau from Lapita through post-Lapita periods (Burley *et al*. 2011, Reepmeyer *et al*. 2012).

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References

Bellwood, P. & Koon, P. 1989. Lapita colonists leave boats unburned! The question of the Lapita links with Island Southeast Asia. *Antiquity,* 63: 613–622.

Best, S. 1984. Lakeba: the prehistory of a Fijian Island. Ph.D. Thesis, Department of Anthropology, University of Auckland.

Burley, D. V. 2012. Exploration as a strategic process in the Lapita settlement of Fiji: The implications of Vorovoro Island. *Journal of Pacific Archaeology,* 3(1): 22–34.

Burley, D. V., Barton, A., Dickinson, W. R., Connaughton, S.P. & Taché, K. 2010. Nukuleka as a founder colony for west Polynesian settlement: New insights from recent excavations. *Journal of Pacific Archaeology,* 1(2): 128–144.

Burley, D. V., Sheppard, P. J. & Simonin, M. 2011. Tongan and Samoan volcanic glass: pXRF analysis and implications for constructs of ancestral Polynesian society. *Journal of Archaeological Science,* 38: 2625–2632.

Clark, G. & Anderson, A. 2009. Colonisation and culture change in the early prehistory of Fiji, In: G. Clark & A. Anderson (eds.) *The Early Prehistory of Fiji*. Canberra: ANU E Press, pp. 407–437.

Galipaud, J.C. & Sweete Kelly, M.C. 2007. Makué (Aore Island, Santo, Vanuatu): A new Lapita site in the ambit of New Britain obsidian distribution, In: S. Bedford, C. Sand & S. Connaughton (eds.) *Oceanic Explorations. Lapita and Western Pacific Settlement*. pp. Canberra: ANU E Press, pp.151–162.

Green, R. 1976. Lapita sites in the Santa Cruz group, In: R. Green & M. Cresswell (eds.) *Southeast Solomon Islands Culture History*. Wellington: Royal Society of New Zealand, pp 245–265.

Hollocher, K., Fakhry, A., & Ruiz, J. 1995. Trace element determinations for USGS basalt BHVO-1 and NIST standard reference materials 278, 688 and 694 by inductively coupled plasma-mass spectrometry. *Geostandards Newsletter,* 19(1): 35–40.

Irwin, G., Worthy, T. H., Best, S., Hawkins, S., Carpenter, J. & Matararaba, S. 2011. Further investigations at the Naigani Lapita site (VL 21/5), Fiji: excavation, radiocarbon dating & palaeofaunal extinction. *Journal of Pacific Archaeology,* 2(2): 1–13.

Nunn, P. D. 2007. Echoes from a distance: progress report on research into the Lapita occupation of the Rove Peninsula, southwest Viti Levu Island, Fiji, In: S. Bedford, C. Sand & S. P. Connaughton (eds.) *Oceanic Explorations: Lapita and Western Pacific Settlement*. Canberra: Australian National University, Terra Australis 26, pp 163–176.

Reepmeyer, C., Spriggs, M., Bedford, S. & Ambrose, W. 2010. Provenance and technology of lithic artifacts from the Teouma Lapita site, Vanuatu. *Asian Perspectives,* 49(1): 205–225.

Reepmeyer, C., Clark, G. & Sheppard P., 2012. Obsidian Source Use in Tongan Prehistory: New Results and Implications. *The Journal of Island and Coastal Archaeology,* 7(2): 255–271.

Sand, C. & Sheppard, P. 2000. Long distance prehistoric obsidian imports in New Caledonia: Characteristics and meaning. *Earth and Planetary Sciences,* 331: 335–243.

Sheppard, P., Trichereau, B. & Milicich, C. 2010. Pacific obsidian sourcing by portable XRF. *Archaeology in Oceania,* 45: 21–30.

Summerhayes, G. R. 2009. Obsidian network patterns in Melanesia: Sources, characterization and distribution. *IPPA Bulletin,* 29: 109–123.

Torrence, R., Specht, J., Fullagar, R. & Bird, R. 1992. From Pleistocene to present: Obsidian sources in Wests New Britain Papua New Guinea. *Records of the Australian Museum Supplement,* 15: 83–99.