Journal of Pacific Archaeology – Vol. 10 · No. 2 · 2019

– ARTICLE –

Discovery of Talasea Obsidian in a Post-Lapita Deposit on the Arnavon Islands, Solomon Islands

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ABSTRACT

This paper reports on the discovery and geochemical characterisation of an obsidian artefact recovered from a post-Lapita site on the Arnavon Islands situated between Choiseul and Santa Isabel in Solomon Islands. The flake is analysed using pXRF and sourced to the Talasea region of West New Britain in the Bismarck Archipelago. Obsidian is common in the Lapita sites of the Reef-Santa Cruz Islands of the eastern Solomons and Buka at the northern end of the archipelago, but only seven pieces have been recovered in the main island chain. The finding improves our understanding of the movement of obsidian and post-Lapita exchange in Solomon Islands.

Keywords: Solomon Islands; Talasea obsidian; post-Lapita

INTRODUCTION

Archaeological surveying carried out over the last sixty years in Solomon Islands has demonstrated that the distribution of obsidian in archaeological sites is extremely patchy (Walter and Sheppard 2017). There are no known sources of obsidian in Solomon Islands and the nearest sources are located in the Banks Islands in northern Vanuatu, Fergusson Island in the Louisiade Archipelago, the Willaumez Peninsula in West New Britain and the Admiralty Group in the northern Bismarck Archipelago (Figure 1). Of these sources, obsidian from the Talasea region of the Willaumez Peninsula, specifically the Kutau/Bao chemical grouping, has been shown to have been the most widely distributed in the western Pacific during prehistory (Sheppard, *et al.* 2010; Summerhayes 2009). In Remote Oceania, obsidian from this region has been recovered as far east as Vorovoro Island at a Lapita site in northeast Fiji, over 3400 kilometres from source (Ross-Sheppard, *et al.* 2013). West of the Bismarck Archipelago, it has also been found as far away as Borneo (Fredericksen 1997).

In Solomon Islands, obsidian from Talasea has so far been recovered in the Northern Solomons (Spriggs 1991; Wickler 2001) and in the far eastern end of the archipelago on Tikopia (Kirch and Yen 1982) and in Lapita sites in the Reef-Santa Cruz Islands. In the latter context, obsidian makes up a considerable fraction of the lithic sample and appears to have been imported in bulk directly from source – over 2000 kilometres to the west (Sheppard 1993).

Here we report on the discovery of a single obsidian flake, which has been characterised to the same source, from an excavation carried out at a post-Lapita site located on the Arnavon Islands. This uninhabited island group is located in Manning Strait between the provinces of Choiseul and Santa Isabel (Figure 2). The flake described here is one of less than a dozen pieces of obsidian that have been found in the main Solomon Islands chains and is the first to have been accurately characterised to Talasea.

OBSIDIAN DISTRIBUTION IN SOLOMON ISLANDS

The largest assemblages of obsidian tools recovered in Solomon Islands are from Lapita settlements in the Northern Solomons and Reef-Santa Cruz Islands. On Buka and Sohano Island, Wickler recovered more than 350 obsidian pieces from three Lapita reef sites. Of these, 21 flakes were found in excavated deposits while the rest were surface finds. All samples were sourced using density measurements; 87.1% were assigned to a Lou source and 1.4% to Talasea (Wickler 1995: 509). Wickler's findings were consistent with Spriggs' (1991: 237–239) observations from Nissan Island where he recorded a shift in relative abundances from Talasea obsidian in the aceramic (pre-Lapita) phase to Lou Island obsidian from the Lapita period onwards.

Obsidian artefacts recovered from three Lapita sites (SE-SZ-8, SE-RF-2 and SE-RF-6) located in the Reef-Santa Cruz Islands remain the largest obsidian assemblage that has been found in Remote Oceania. Of the 972 pieces recovered, which were characterised either by PIXE-PIGME or density, 97.5% were assigned to Talasea; 1.13% to Lou Island, and 1.23% to the nearby Vanua Lava source in the Banks Islands (Sheppard 1993: 123). A single flake was also sourced

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Submitted 25/7/19, accepted 15/9/19.

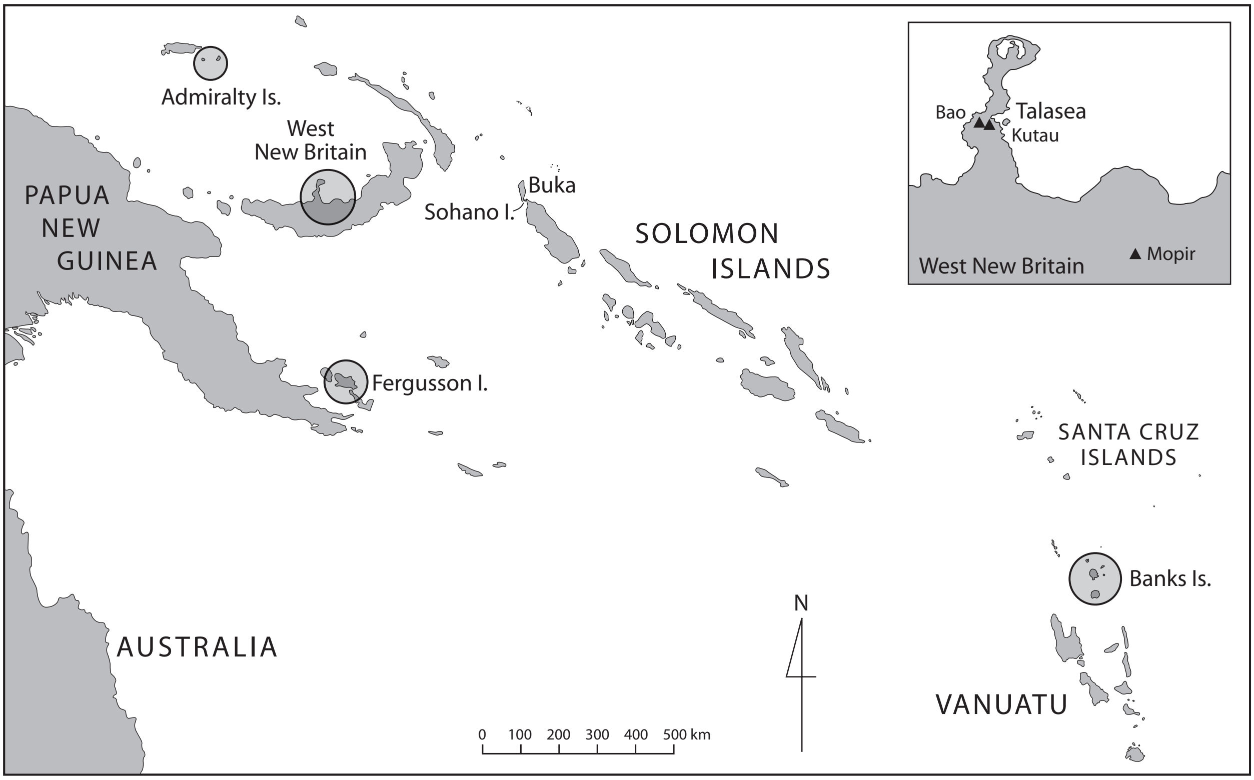

Figure 1. Map of part of the Western Pacific showing locations of major obsidian sources.

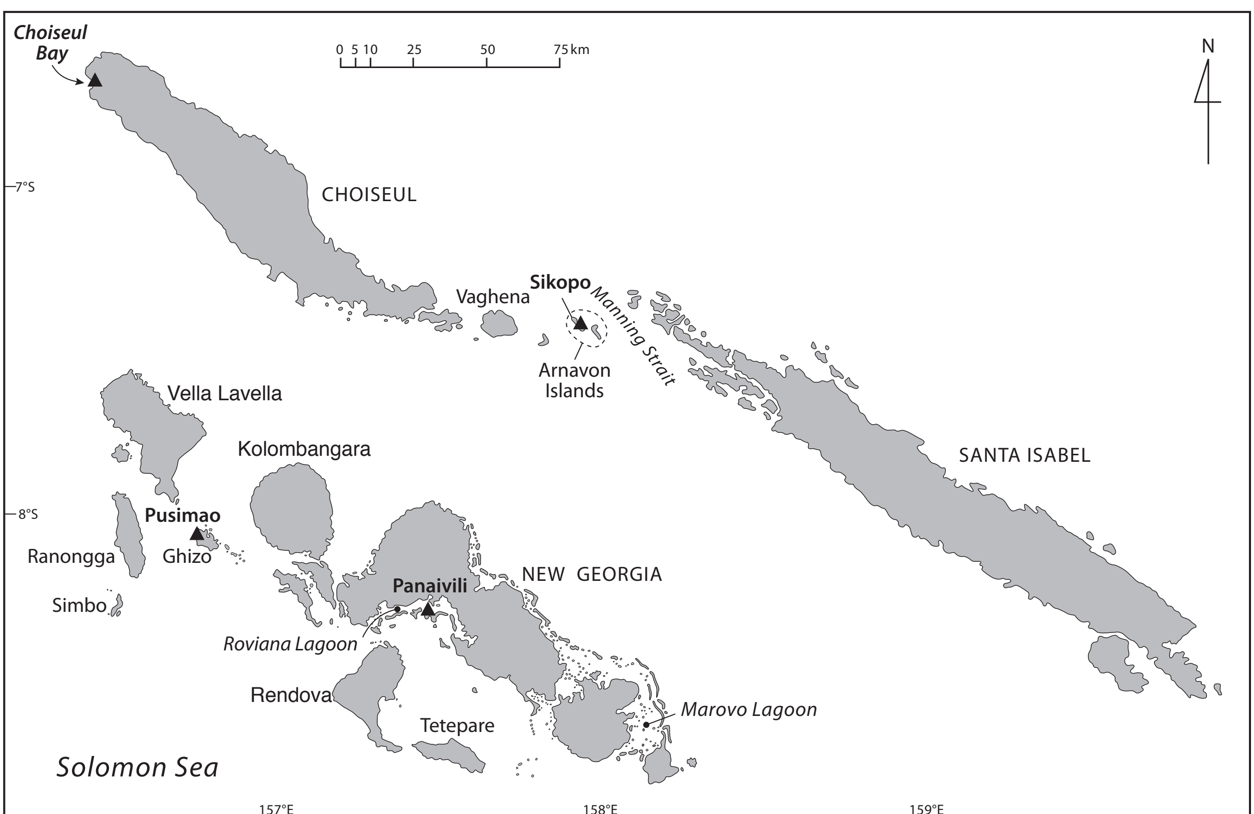

Figure 2. Map of western Solomon Islands displaying the known distribution of obsidian artefacts including the new discovery (black triangles represent locations of obsidian finds).

to West Fergusson (Green and Bird 1989). Reanalysis of the Reef-Santa Cruz Islands assemblage using pXRF confirmed these characterisations (Sheppard *et al.* 2010: Table 5). The pXRF approach was able to provide finer grained characterisations and 96% of the Talasea pieces were shown to have been derived from the Kutau/Bao chemical group. On Tikopia, 14 pieces of obsidian and 625 'basaltic glass' fragments were recovered in initial archaeological investigations by Kirch and Yen (1982: 256). An analysis of 13 pieces of the Tikopia obsidian using density analysis assigned 10 to the Banks Islands and three to the Admiralties sources (Spriggs, *et al.* 2010). Further geochemical characterisation of the Tikopia samples using LA-ICP-MS corroborated these groupings (Reepmeyer 2009). The Banks Islands obsidian was shown to have been procured throughout the entire occupational sequence of Tikopia, while the few pieces from the Admiralties were associated only with the earliest phase, the Kiki Phase (2900–2100 BP) (Spriggs, *et al.* 2010: 35).

In contrast to the northern and eastern peripheries of Solomon Islands where obsidian tools were used throughout the Lapita period, only seven examples have been recorded in the main island chain. These include a large obsidian blade found at Panaivili, an inter-tidal site in Roviana Lagoon (Reeve 1989: 55), five pieces of 'black glassy stone' collected alongside incised decorated ceramics in northwest Choiseul (Miller 1979: 87), and a 'single chunk of opaque obsidian/volcanic glass' collected at Pusimao, a ceramic site located on the northwest coast of Ghizo (Sheppard, *et al.* 2015: 71) (Figure 2). Geochemical characterisation of the Panaivili blade and pieces from northwest Choiseul is not well-documented, although it appears that they derive from the Admiralties (see Sheppard *et al.* 2015: 72–74). Only the Ghizo sample has had its geochemical results published and can be reliably compared to other sourcing studies (Sheppard *et al.* 2015). It was concluded from this analysis that 'the Ghizo sample is clearly unlike any of the known [Western Pacific] source samples and would appear to represent an unknown source' (Sheppard *et al.* 2015: 72). With this uncertainty, the authors acknowledged the possibility of a low-quality volcanic glass source located on northwest Choiseul or nearby Bougainville.

ARNAVON ISLANDS SAMPLE

The Arnavon Islands are made up of four small, low-lying coral reef islands, located about 40 km west of northwest Santa Isabel. In 2014, Walter recorded a complex of archaeological sites including artefact scatters, a rockshelter and coral mound shrines on the largest of the Arnavon Islands, Sikopo (Walter and Brooks 2014). The sites were concentrated around two large coral outcrops located near the centre of the three km square island, situated on flatland about two metres asl.

The highest concentration of surface artefacts, which included pottery, chert flakes, coral files and shellfish remains, was found near an overhang at the eastern edge of a large upraised coral outcrop (Figure 3). In 2017, Radclyffe

Figure 3. Photograph of the site. Excavation square placed few metres from the face of the coral outcrop.

returned to Sikopo as part of his doctoral project in the region and with a research team carried out a 3 × 3 m² excavation at the site. The excavation revealed an approximately one metre deep cultural deposit containing pottery, faunal remains, worked shell and chert flakes. A series of nine AMS radiocarbon dates were produced from charcoal and *Trochus* shell recovered in the excavation and these indicated at least two phases of post-Lapita occupation. The first phase was dated using nutshell collected from the base of the cultural deposit (70–80 cm) to 796–693 calBP (two sigma) (OZX439). While the second phase dated to 631–516 calBP (two sigma) (OZX442) also using nutshell collected between 30–40 cm deep.

The obsidian flake was recovered in the excavation from a depth of 30–40 cm, aligning with the second phase of occupation. It measures 8.77 mm in length, 13.25 mm in width, 1.54 mm thick and weighs 0.13 g (Figure 4). Its small size suggests it may have been produced during the preparation of a core or the manufacture of a larger flake. Ripples running in opposing directions on the ventral and dorsal surfaces suggest percussive bipolar flaking was carried out. Possible usewear was evident on its distal margin.

Figure 4. Sikopo obsidian flake, ventral (top) and dorsal (bottom) surfaces.

METHODOLOGY

Geochemical characterisation of the flake was carried out in the Otago Archaeology Laboratories (OAL) using portable X-ray fluorescence (pXRF) analysis. A Bruker Tracer III-SD was used to target seven mid-Z elements (Fe, Ga, Rb, Sr, Y, Zr, Nb) using green filter settings (40 kV per channel, filament ADC = 30 µA, filter = 12 mil Al + 1 mil Ti + 6 mil Cu, runtime = 300 s).

Five readings were taken of the flake, each directed at different points on its ventral and dorsal surfaces. The flake completely covered the detector's field of view. Before and after the five readings of the flake were taken, a basalt standard (BHVO-2) was analysed as a quality control to assess the accuracy of the reported data (Table 1). A high level of accuracy was demonstrated for all elements utilised in the analyses, as has previously been shown in other obsidian characterisation studies carried out using the same machine (Specht *et al.* 2018). Geological samples selected to be compared with the flake were previously analysed at OAL using the same machine and settings as the archaeological sample. Calibration to parts per million (ppm) was undertaken on all samples using Bruker's factory OB40 calibration.

To assign the flake to the most likely Pacific obsidian source, principal component analysis (PCA) was employed and scatterplots were created using elemental ratios. PCA was undertaken using the MV-ARCH statistical program which first transforms or standardises the chemical compositional data using the base-10 logarithm (Wright 1989). For the plotting of elemental ratios, it was found that Rb/Y and Sr/Zr proved best in separating known sources.

Caution was taken in acquiring a reliable count from the flake due to its small size and thinness, as approximately 3 mm of thickness is generally recommended for X-rays to penetrate and produce a reliable geochemical reading

Table 1. *Comparison of United States Geological Survey (USGS) standards against Otago pXRF readings of BHVO-2 standard in parts per million (ppm). SD = standard deviation; RSD = relative standard deviation.*

	Fe	Ga	Rb	Sr	Y	Zr	Nb
University of Otago average (n=2)	79237.03	26.23	15.08	333.70	22.72	151.79	15.28
USGS values	86300.00	21.70	9.80	389.00	26.00	172.00	18.00
SD	365.78	1.00	0.06	1.44	0.19	2.17	0.07
RSD (%)	0.46	3.80	0.41	0.43	0.84	1.43	0.43

(Davis, *et al.* 2011). Despite this, consistent geochemical readings were replicated for each analysis of the flake (Table 2). Similar successes have previously been reported with small obsidian samples and the use of PCA and elemental ratios (e.g. Frahm 2016; Ross-Sheppard *et al.* 2013).

RESULTS

The PCA closely clustered the five sets of Sikopo measurements with the West New Britain sources (Figure 5). These sources included the chemical groupings of Kutau/

Table 2. *pXRF element measurements in parts per million (ppm) for five analyses of Arnavon Islands sample.*

Element	1	2	3	4	5
Fe	12296.8	13069.5	13326.6	12745.6	12527.7
Ga	27.1	22.5	24.4	22.0	25.1
Rb	70.5	70.7	75.1	72.7	68.4
Sr	241.5	248.0	242.8	239.7	242.3
Y	24.9	25.4	25.9	26.2	26.1
Zr	161.8	165.8	166.2	163.9	163.7
Nb	7.5	5.6	5.8	6.5	6.6

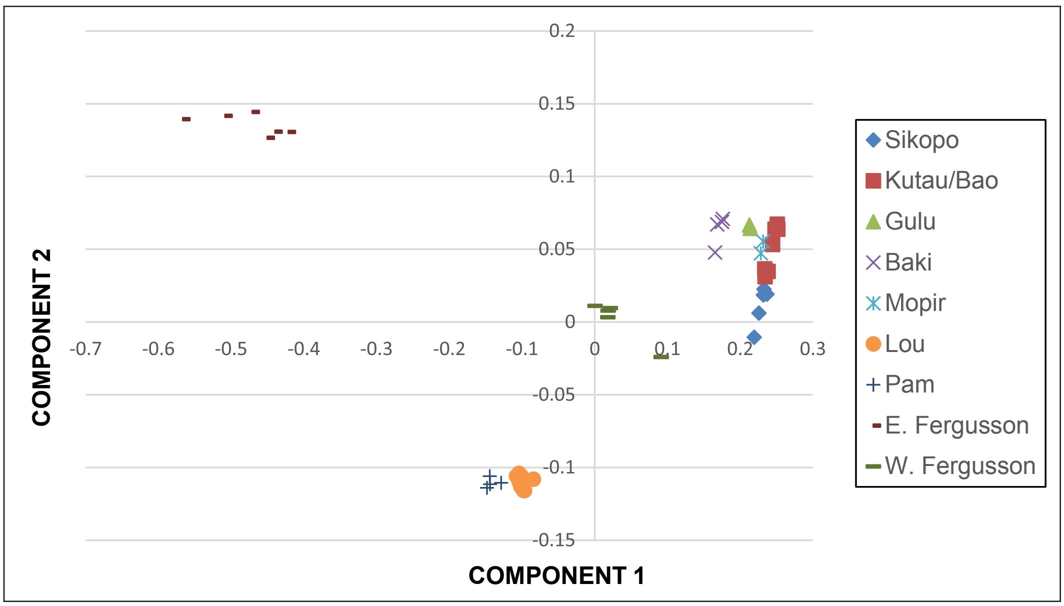

Figure 5. Principal component analysis (PCA) plot of Sikopo obsidian against Near Oceania sources.

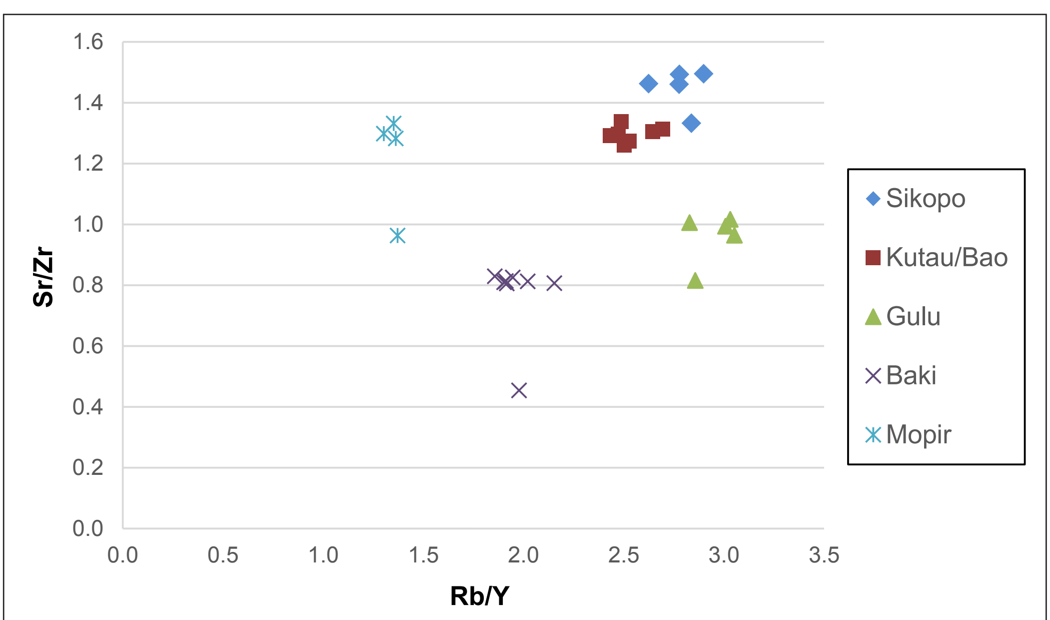

Figure 6. Scatter plot of Rb/Y vs Sr/Zr of Sikopo obsidian against New Britain sources.

Bao, Gulu, Baki and Mopir. Importantly, the cluster distinguished the Sikopo sample from the Admiralties sources, Lou and Pam, from where the external distribution of obsidian appears to have increased leading into the post-Lapita period (Summerhayes 2004: 150–151). For the PCA, it was found that the first component accounted for 85.17% variability, and the second component 11.75%, making a total of 96.92% for the first two components. Narrowing down the source of the Sikopo flake to a singular chemical grouping within West New Britain, the scatter plot of Rb/Y and Sr/Zr demonstrated that it clustered closest with Kutau/Bao (Figure 6).

DISCUSSION AND CONCLUSIONS

Obsidian is infrequently encountered in the archaeological record of the main Solomon Islands chain. Furthermore, there is no robust stratigraphic or temporal information associated with obsidian anywhere in this region. An exception to this may include the obsidian blade found at the inter-tidal site of Panaivili. The site is not stratigraphically secure but did produce ceramics that were dated from a charcoal inclusion extracted from the cross-section of a sherd to 2335–1925 calBP (two sigma) (AA33504) (Felgate 2003: 455). The recovery of the Sikopo sample is significant, therefore, in being both well-provenanced and reliably dated. Its assignment to a Talasea source, however, does raise some questions.

So far, the regional trend, identified in the Bismarck Archipelago (Summerhayes 2004: 150–151) and Nissan Island (Spriggs 1991: 237–239), is of Admiralties obsidian becoming more common and widespread than Talasea obsidian after the early Lapita period. This is consistent also with the reported, but still inadequately documented, attribution of the Choiseul obsidian pieces recovered by Miller (1979) to Lou in the Admiralties group. Whether the Sikopo sample survived from a much earlier period of occupation on the Arnavons which is yet to be detected or it represents importation during the period reflected in the radiocarbon record of the site is unclear. If the latter, the Sikopo obsidian sample was most likely acquired through some form of down-the-line exchange rather than direct importation. Ethnographically documented networks of exchange between New Britain, Nissan, Buka, Bougainville, Shortland Islands and Choiseul certainly gives credibility to this explanation (e.g. Blackwood 1935).

A number of authors have suggested that long-distance exchange systems may have been integral to maintaining social and ancestral ties with the Bismarck Archipelago during the Lapita period (Sheppard 1993; Torrence and Summerhayes 1997; Skelly, *et al.* 2016). The overall paucity of obsidian in the post-Lapita period in Solomon Islands could well be a reflection of changes in the relationship between colony and homeland, as well as adaptive replacement of obsidian with locally sourced alternatives. Chert for instance, which is naturally abundant in Makira, Ulawa, Malaita and to a lesser extent in northwest Santa Isabel, is found in large quantities in archaeological sites in and around Manning Strait. Explanations regarding an apparent lack of prehistoric importation and utilisation of obsidian throughout much of Solomon Islands remain ambiguous. As archaeological surveying continues in the region, a clearer picture is likely to emerge.

Acknowledgements

The authors are very grateful to the Solomon Islands National Museum, Isabel Provincial Office and The Nature Conservancy (TNC) for supporting archaeological research on the Arnavon Islands and in the wider region. In particular, we thank Grinta Ale'eke-Bemama, Eddie Kopala, Frank Halette, Dolova Wilson, and the Arnavon Islands rangers for their committed assistance in fieldwork. *Tagio tumas!* Sincere thanks also to TNC facilitators Richard Hamilton, Willie Atu, John Pita and Henry Kaniki. Anne Ford, Peihua Wu and Phil Latham assisted with pXRF analysis, and Les O'Neill produced the figures. We also thank two reviewers for their feedback. Radiocarbon dates were awarded by Australia's Nuclear Science and Technology Organisation (ANSTO). The Archaeology Programme and Southern Pacific Archaeological Research (SPAR), University of Otago, contributed to field costs for Radclyffe and Walter.

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