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BUANG MERABAK: EARLY EVIDENCE FOR HUMAN OCCUPATION IN THE BISMARCK ARCHIPELAGO, PAPUA NEW GUINEA.

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This paper reports new radiocarbon estimates for the age of human occupation of Buang Merabak, an archaeological site in central New Ireland, Papua New Guinea (Fig. 1). Previously, the oldest radiocarbon date for human occupation in New Ireland was 35,410 ± 430 BP (Leavesley and Allen 1998:80). The radiocarbon determinations reported here, although preliminary, may extend the first evidence of human occupation in New Ireland to beyond 40,000 BP (uncalibrated) and indirectly support the evidence presented by Groube et al. (1986) and Chappell et al. (1994), for the occupation of the Huon Peninsula at a similar antiquity.

Background

The archaeological potential of the Buang Merabak cave site was first identified by Allen et al. (1984:13) and later excavated under the auspices of the Lapita Homeland Project (Allen and Gosden 1991). The mouth of the cave is ca.10 m wide and the roof is ca. 8 m high. The cave extends back ca. 30 m and is joined to a second larger chamber by a small passage. It is situated at the base of a series of transgressive fringing coral terraces formed during the lower Miocene to Pliocene, known as the Lelet limestone (Hohnen 1978:2). The initial excavations indicated a substantial deposit of midden material and stone artefacts directly on top of the corroded limestone bedrock, 165 cm below the present ground surface (Rosenfeld 1997). There was no culturally sterile deposit between the cultural material and the bedrock. A radiocarbon determination on shell previously collected from the site, ANU-6614, returned an age of 31,990 ± 830 BP for the lowest level of human occupation (Balean 1989). A subsequent conjoin analysis of midden bone fragments tested the integrity of the deposit and determined that, although the uppermost layer of the site was disturbed, the Pleistocene layers were largely intact (Leavesley and Allen 1998). The analysis concluded that much of the deposit remained relatively free of the post-depositional processes that might have caused the vertical redistribution of the cultural material.

The 2000 excavation

The site was re-excavated by Leavesley as part of a project to investigate the nature of Pleistocene colonisation and subsequent economic developments and interactions in the Bismarck Archipelago. The re-excavation was undertaken utilising 5 cm spits and bedrock was identified at a depth of 2 m. The excavation identified a deeper deposit and a potentially richer midden than the previous 1985 excavation. This allowed for the dating of cultural material at a depth not previously possible. Two shell samples collected from the prehistoric midden deposit were submitted for radiocarbon determination. The shells explicitly fit the criteria described elsewhere as shell midden material. Gosden and Robertson (1991) describe the nature of a southern New Ireland shell midden as containing larger individuals of the larger available taxa in the earliest layers of occupation (Gosden and Robertson 1991, Rosenfeld 1997). The pattern of midden shell deposition is repeated at both Matenkupkum and Buang Merabak (Spriggs 1997:37) and the shells utilised for this analysis were consistent with it. The determinations reported here were from shells excavated from Spit 40, immediately above the bedrock.

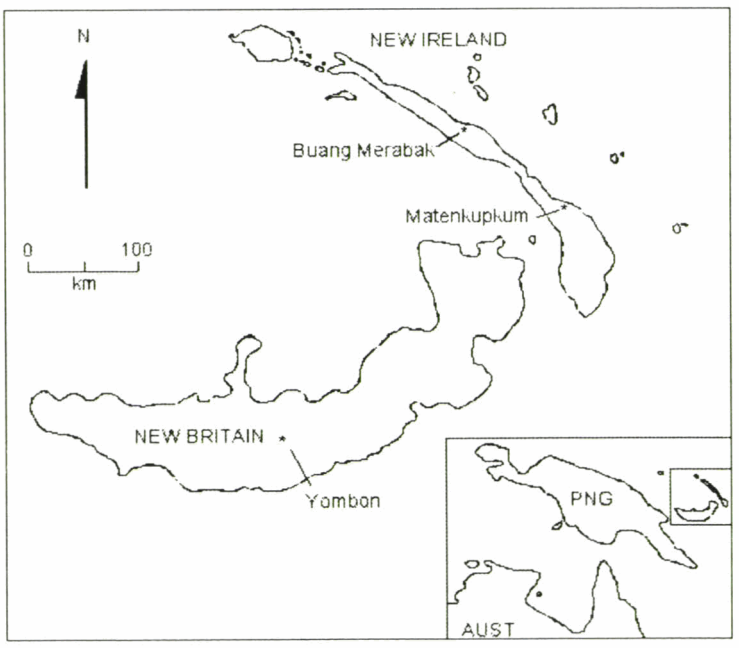

Figure 1 Map indicating sites mentioned in the text.

Samples for analysis

The samples consisted of two complete shells, one *Turbo argyrostoma* and the other *Purpura persica*. Prior to analysis, ~500mg of carbonate was cut from the columella of each shell, and the surface cleaned by dissolving approximately 50% of the sample in dilute hydrochloric acid. The sample was then washed with milliQ water, dried, and loaded, along with ~5mls of anhydrous phosphoric acid into the low-blank target preparation line at the Research School of Earth Sciences, ANU (Bird et al. 1999).

After evacuation of the extraction line, the phosphoric acid was added incrementally, and the carbon dioxide released from the sample was collected sequentially during the dissolution. Two graphite targets were made from each sample, one from the carbon dioxide liberated at ~40-60% dissolution, and a second at ~80-95% dissolution. The $^{14}C/^{13}C$ ratios of the graphite targets were measured by accelerator mass spectrometry on the 14UD accelerator at the ANU.

Results

The *Purpura persica* sample returned ages of 33,270 ± 560 and 32,440 ± 570 (see Table 1). The determinations overlap at one standard deviation and therefore may be considered contemporaneous at ca. 33,000 BP. Two determinations were also obtained from the *Turbo argystoma* sample and returned ages of 39,090 ● 550 BP and 40,090 ± 570 BP. Again, the determinations overlap at one standard deviation and therefore may be considered contemporaneous at ca. 39,000-40,000 BP (Table 1). The age estimates have not been corrected for the marine reservoir effect or calibrated to absolute years. The impact of the marine reservoir effect may serve to reduce their antiquity by up to ca. 440 years. Calibration to absolute years could serve to increase their antiquity by ca. 3000 years (Gillespie 1998:172) although the precise nature of calibration for this period is, as yet, unclear (Pettitt and Pike 2001:416-417). While an earlier human presence has been suggested in Australia (Turney et al. in press; Roberts et al. 1990), these are the oldest radiocarbon occupation dates obtained from sites in New Guinea and the Bismarck Archipelago region.

The disparity between the two sets of determinations suggests the site was the subject of both natural and cultural formation processes. While any interpretation of the determinations is preliminary, there are a number of observations that support the conclusion that the dates represent human behaviour:

(i) Humans were the only terrestrially based predators that frequently prey on shellfish in New Ireland. Prior to the human colonisation, there weren't any natural, cave-dwelling, terrestrially based predators of shellfish. Before ca. 20,000 BP, the largest known mammals were *Pteropus* sp. bats. A number of bird taxa have also been identified in New Ireland (Steadman *et al.* 1999). It is unlikely that any of these taxa would prey on shellfish, particularly shellfish of the sizes indicated in Table 1.

(ii) Post-depositional processes almost certainly had a role in the formation of the site. There were no sterile deposits between the cultural layers and the bedrock. Therefore, the shell could not have moved from a non-cultural to a cultural layer by way of post-depositional processes.

(iii) The possibility of a sub-fossil shell finding its way into the site must also be considered. The likelihood of a marine shell surviving in a coastal marine environment for ca. 5000 to 8000 years, from the time of the mollusc's death, until collection by humans, appears unlikely in the extreme although cannot ultimately be discounted.

(iv) There is little evidence to support the suggestion that 'old shell' may have been brought to the site. During the Late Holocene, 'old shell' (specifically *Tridacna* sp.) has elsewhere been utilised for the manufacture of shell artefacts (Moir 1990). The shell specimens submitted to the radiocarbon laboratory in this study were collected from a matrix of food refuse debris consistent with other New Ireland shell middens (Gosden and Robertson 1991) and did not exhibit evidence of manufacture.

The presence of two specimens with divergent ages in the same excavation unit may be the result of one of three processes. First, the ages may reflect a slow rate of deposition at the site after its initial occupation around 40,000 BP. This is supported by the presence of relatively large individual shells in the lower levels of the site (Balean 1989). Second, the data may be indicative of some mixing of the archaeological deposits within the lower layers. Or, third, a shell in the order of ca. 4500 to 8000 years older than the rest of the deposit may have made its way into the midden as a result of complex and as yet unknown processes. While present evidence tends towards human causation, further investigations will clarify the situation.

Conclusion

While the data presented here is problematic it presents an extremely interesting possibility of the first humans arriving in New Ireland by ca. 39,000-40,000 years ago. If so, it suggests that occupation of the Bismarck Archipelago may have been the result of deliberate voyaging (Allen and Gosden 1996:184) and taken place without any significant pause once humans had colonised the Huon Peninsula. Alternatively, if further analyses conclude humans did not occupy Buang Merabak prior to ca. 33-35,000 BP we can only speculate over the remarkable events that lead to the deposition of this individual shell into the midden.

Testpit	Spit	Lab. #	Material	Age BP	Specimen height (mm)	Specimen length (mm)
TPIB	40	ANUA-15808	*Turbo argyrostoma* 42-59%	39,090 ± 550	36.95	60.75
TPIB	40	ANUA-15809	*Turbo argyrostoma* 95-99%	40,090 ± 570		
TPIB	40	ANUA-16302	*Purpura persica* 63-69%	33,270 ± 560	30.04	66.05
TPIB	40	ANUA-16303	*Purpura persica* 83-89%	32,440 ± 570		

Table 1 Radiocarbon dates for Buang Merabak (a background of 0.1±0.02 pmC has been subtracted from the measured ^{14}C activities).Two determinations were run for each of the two individual shells.

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BONE SAMPLING FOR ISOTOPE ANALYSIS

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Isotope analysis has been frequently used in archaeology as a means for inferring human and faunal palaeodiet and climatic change through time (Ayliffe and Chivas 1990; Pate 2000). Isotope analysis uses a variety of extraction techniques to isolate bone collagen, hydroxyapatite or cholesterol that can then be analysed through GC (gas chromatography), GC/MS (gas chromatography/mass spectrometry), IRM-GC/MS (isotope ratio monitoring-gas chromatography/mass spectrometry) or similar techniques. Although much credence has been given to isolating the different portions of bone and problems associated with diagenesis (Klinken 1999), little information is available on actual bone sampling techniques. Past work on sample preparation has focused on sampling shell (Shackleton 1973), lipid and cholesterol extraction (Evershed et al. 1995; Stott and Evershed 1996), the effects of burial on bone (Nicholson 1998) and preparation of bone for sampling (Ambrose 1990). Minimal study has been conducted regarding the acquisition of samples prior to analysis.

Most isotope studies are able to sample whole bone or large portions of bone (Pate 1997; 1998a; 1998b), or in the case of faunal analysis, segments of deliberately broken bone (Pate and Noble 2000; Pate, et al. 1998). Some projects (Owen unpublished) are bound by permissions to remove only small sections of bone for the purposes of isotope analysis. This report will detail the sampling methodologies employed by Owen (unpublished) to remove less than 1g of suitable bone from individual human femora; a technique that was utilised during the Swanport human bone collagen isotope sampling programme.