Ancient Lead Weight Found with Loisels Pumice near Hook Point, Fraser Island, Queensland

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Abstract

A lead weight was recovered between 2.2 and 2.4 m depth in stranded beach sands at the southern end of Fraser Island. Its isotope values indicate a close affinity with lead from mines in France. Pumice found with the lead occurs elsewhere at sites dated 480±100 y BP and 520±75 y BP, and one fragment appears to be Loisels Pumice, for which a similar radiocarbon age has been reported from New Zealand. The data are difficult to assess but suggest that the lead weight could have reached this ancient beach between 1410 and 1630 AD.

Hook Point, at the southern limit of Fraser Island, is formed by stranded postglacial foredunes that are interrupted in places by high dunes blown inland from some of the ancient beaches. During our study of this coastal strandplain we found a lead artifact in beach sands beneath a foredune 175 m inland from the modern beach. It was a piece of lead sheet, about 11 by 6 cm, which had been folded once from each side over the middle, and was pierced at one end by a hole (Figure 1). It weighed 121.6 g, and appeared to be a weight from a fishing net.

The landforms at Hook Point define separate stages in the development of the strandplain, with each new deposit of sand soon fixed by vegetation. In the area generally (Ward, 1977), the soils form a chronosequence (Jenny, 1941; White, 1997) and show differences in development according to the age of the parent deposit, the trend being towards fully-developed podzols, which occur at the innermost, western margin of the strandplain. The age of any particular site, in other words, is indicated by the morphology of the soil at that site. Briefly, in the area discussed here, the sands beside the modern beach have no soil horizons, and consist simply of sand piled by the wind as foredunes and blowouts above the water-sorted sand which rises to the former limit of wave action. These dunes are followed inland first by stranded foredunes with very pale grey-brown subsoils (Hook beach sand [Ward, 1977; Grimes, 1992]) and then by older stranded foredunes with clearly developed brown subsoils (Rooney Point beach sand). At other places on the strandplain the Rooney Point and Hook beach sands are separated by vegetated parabolic dunes (Cape dune sand) that pre-date European settlement for they were observed, at Sandy Cape, by Cook in 1770 (Beaglehole, 1955). Except for a bitumen road that lies behind the point, the landscape remains very largely in its natural condition. The present shore has been stable since at least 1878 (maps by Bedwell and Connor, 1875–8, publ. Admiralty, 1885).

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BMO'L: formerly Physics Department, Queensland University of Technology, Brisbane, Qld 4001;
DMP: Thermoluminescence Dating Laboratory, Department of Geography, University of Wollongong, Wollongong, NSW 2522.

Description of site

We examined the soil along a disused track between the bitumen road and the present shoreline (Figure 2), using a 75 mm diameter hand auger designed for use with loose sand. About 20 cm of sand was extracted at a time, and sieved for pumice. A scale marked on the auger provided depth control. Our drilling showed that the soil had not previously been disturbed, and deposits of Rooney Point beach sand, for a distance of about 50 m from the bitumen road, were followed seawards by Hook beach sand, for 150 m. These deposits consist, at depth, of firm, watersorted beach sand, with thin lenses of ilmenite, grading up to the loose, windblown sand of the contemporaneous foredune.

About 160 metres from the bitumen road and 3.5 metres south of the track (at 507590E 147670N, Figure 2), we found a lead weight and pumice in Hook beach sand at a depth of 2.2–2.4 m. The soil had a grey (Munsell colour 10YR6/1) organically-stained surface grading at 20 cm to greyish brown (10YR5/3) sand that changed gradually through pale yellowish brown (10YR6/4) sand at 50 cm to very pale brown (10YR7/3) sand at the 2.2–2.4 m level. Windpiled sand gave way to beach sand at –2 m. This degree of soil development is typical of Hook beach sand and showed that the site was undisturbed. Pieces of rusted iron sheeting were found on the track nearby, with some broken glass, but no foreign material occurred at the drill site.

The sand that adhered to the lead did not differ from the other sand at 2.2–2.4 m. It lacked any humus stain. There was nothing to show that the lead might have been lying near the ground surface at the side of the drill hole, where it could have been dislodged to fall into the hole, a possibility

Figure 1. Lead weight found at 2.2–2.4 m in sand near Hook Point. Our drilling tool, a hand-operated sand auger, made the two narrow scores near the top of the weight.

that was discussed at length at the time of the discovery. As far as we could tell, it had been in place at the level where we found it. The drilling was done carefully because we were searching for pumices that might enable regional correlation and dating of the stranded shorelines. The sand was moist and maintained the drilled hole. No collapse of the hole was seen or heard to take place. The three of us (WLW, IPL, GMR) who found the weight do not believe that it had fallen from a position near the ground surface.

No material suited to radiocarbon dating occurred at the site. Sand taken for thermoluminescence analysis (by DMP) gave no satisfactory result, for several reasons: unsuitable grain size, poor laboratory reproducibility of natural glowcurves, and high surface residual thermoluminescence, the problems being further exacerbated by low annual radiation levels.

Source of lead

Natural deposits of lead have unique isotopic compositions. Consequently, the source of an artifact containing lead can be identified, if the lead is from a single orebody, by comparing the isotopic values with data from global ore deposits (Brill, 1970). For this purpose a small piece of the lead weight from Hook Point was dissolved (by BLG) in 6N HCl, the lead was separated by ion exchange and then further cleaned by electro-deposition in a 0.01N HNO_3 solution. The mass spectrometer gave the following isotopic ratios $^{208}Pb/^{206}Pb$, 2.1080±0.0003; $^{207}Pb/^{206}Pb$, 0.8576±0.0001; $^{206}Pb/^{204}Pb$, 18.268±0.009. In our discussion we assume that the lead forming the weight is from a single source.

Isotope values approaching those in the lead weight, but measurably different, include two leads from Australia (Hall's Peak and Rosebery) and others from the British Isles, France, Turkey, China and New Zealand. Isotope ratios like those of the lead weight occur in Sardinian, Portuguese and Spanish leads, and in lead from Largentière (France) and Rammelsberg/Meggen in Germany (data *in litt.* and unpublished data in the SIROTOPE database [Gulson, 1986]).

The closest agreement of the lead weight with mined sources (Figure 3) is for the French locations Les Anglais and La Rodde in the Haut-Allier mines of the Brioude-Massiac district (Marçoux and Brill, 1986), and for the Brousse, Rosier and Roure lead-silver veins in the Pontgibaud region (Marcoux and Picot, 1985).

Dating the lead

Lead recently extracted from its ore contains the radioisotope ^{210}Pb which, in the absence of ^{226}Ra (a parent of ^{210}Pb), can indicate the time elapsed since extraction, providing that extraction occurred in the last 50 years. When examined (by BMO'L) in 1983, the lead weight contained no ^{226}Ra and no ^{210}Pb. It follows that this lead had been mined before 1930.

The pumice at the site with the lead weight

Little & Ward (1980) report analyses of sea-rafted pumice collected mainly in southeast Queensland. This database now contains 453 pumices, each analysed for 16 elements. Pumice cannot be dated by direct measurement but contemporary shorelines contain similar pumices, and in several instances the age of a deposit is shown by dates for associated shells and wood. Two pieces of pumice found with the lead weight were large enough for study. The results were compared with the full dataset by numeric analysis, using fuzzy k-means (Bezdek, 1981; A.W. Ward *et al.*, 1992).

Sixty pumices (which we term Group B) resembled one of those found with the lead weight (#083, Table 1), and 8 others (Group XF) were like its companion (#078). The set with #083 occurs at 26 localities, three of which also contain pumices like #078.

Four specimens of Group B were collected in New Zealand and represent the sea-rafted Loisels Pumice (Wellman, 1962). The others are from stranded beaches at Broad Sound dated by Cook & Mayo (1977) and from littoral sands elsewhere in Queensland and New South Wales. The similar compositions suggest that these specimens are also Loisels Pumice but the Australian fragments are mostly too small to display distinctive lithic

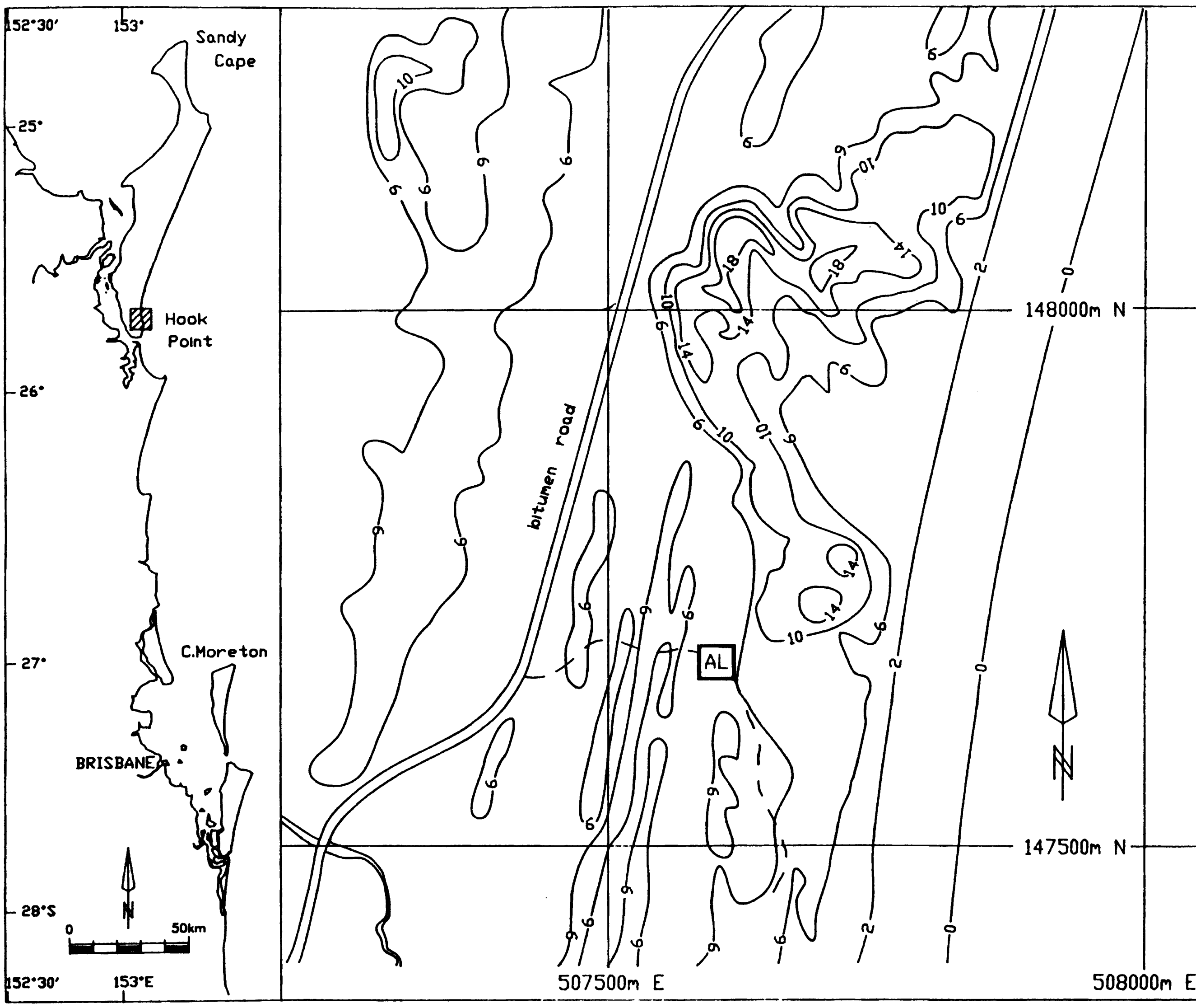

Figure 2. Part of Hook Point, based on a manuscript map prepared by the Australian Surveying & Land Information Group, Department of Administrative Services. Smoothed contours at 2 m, then at 4 m intervals above mean sea level. The lead weight was found at site AL.

characters, and our identification is based simply on the fuzzy analysis of the chemical composition. Group B is common in Hook beach sand, and at one site charcoal provides a date of 520±75 y BP (Minner Dint, Moreton Island, *Pandanus* drupe, I-11095, Hall, 1980).

Group XF has been found at three places in Hook beach sand, one being 28 m seawards of charcoal yielding a date of 480±100 y BP (*Banksia ?integrifolia*, Flinders Beach, Stradbroke Island, Beta-5151, Cullen, 1982).

Age of Loisels Pumice

Wellman (1962) noted that sea-rafted pumice, after being stranded onshore, might be reworked later by the sea and be stranded again at a younger shoreline. Pullar *et al.* (1977) found Loisels Pumice in places above, and in other places below Kaharoa Ash, a volcanic air-fall deposit (dated about 770±20 y BP [Froggatt & Lowe, 1990], i.e., calibrated to 1258 to 1283 AD, [after Stuiver & Reimer, 1993]). McFadgen (1982, corrected after McFadgen & Manning, 1990) estimated the age of Loisels Pumice to be 519–680 y BP (i.e., 1270 to 1431 AD). Osborne *et al.* (1991) gave their best estimate for the arrival of Loisels Pumice as 915 to 1030 AD but Froggatt & Lowe (1990) thought the ages formed two clusters and might indicate more than one event. In 1994 McFadgen provided new calendar ages, using the CALIB radiocarbon/tree ring conversions of Stuiver and Reimer (1993). He concluded that the "best current estimate for the arrival of Loisels Pumice is the age range 660–510 calendar years BP", i.e., 1290 to 1440 AD.

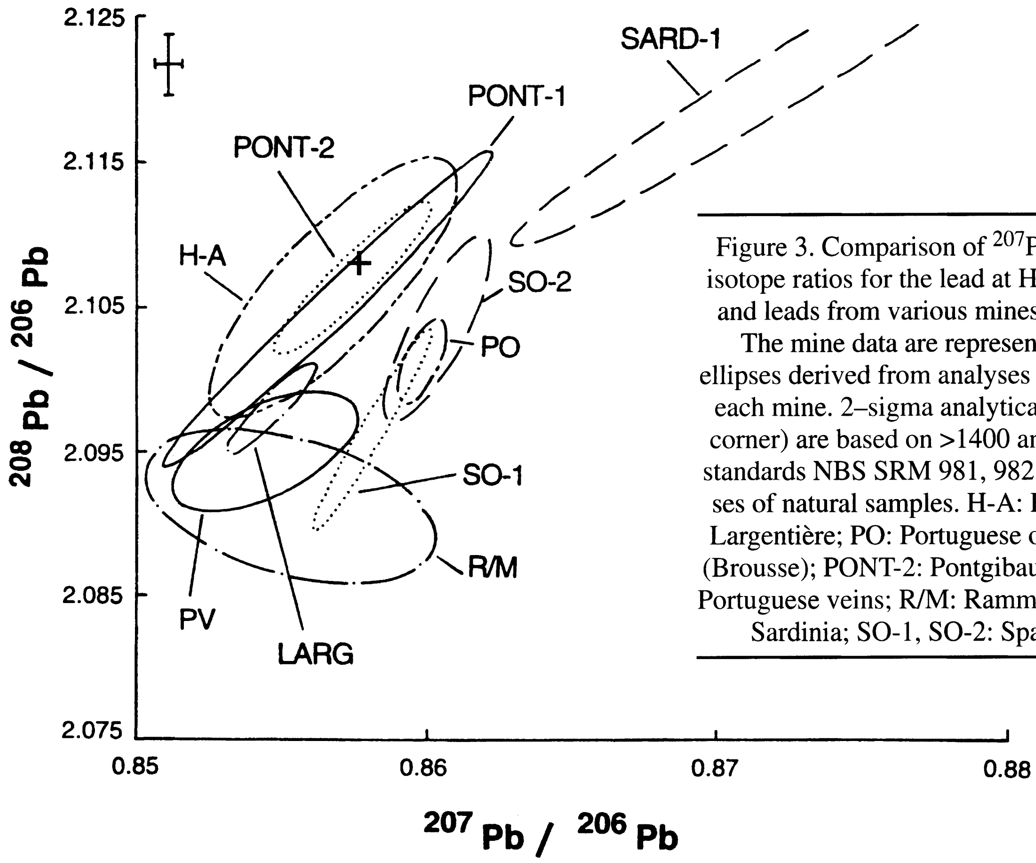

Figure 3. Comparison of $^{207}Pb/^{206}Pb$ and $^{208}Pb/^{206}Pb$ isotope ratios for the lead at Hook Point (+ ; this report) and leads from various mines that have similar values. The mine data are represented by 95% confidence ellipses derived from analyses of numerous samples from each mine. 2–sigma analytical error bars (top left-hand corner) are based on >1400 analyses of international Pb standards NBS SRM 981, 982, Pb18 and replicate analyses of natural samples. H-A: Haut-Allier veins; LARG: Largentière; PO: Portuguese ores; PONT-1: Pontgibaud (Brousse); PONT-2: Pontgibaud (Rosier and Roure); PV: Portuguese veins; R/M: Rammelsberg/Meggen; SARD-1: Sardinia; SO-1, SO-2: Spanish ores (2 districts).

Discussion

The radiocarbon date of 520±75 y BP associated with pumice group B (i.e., with Loisels Pumice) at Minner Dint is, in calendar years (Stuiver & Reimer, 1993), 1406 to 1471 AD (mean 1436 AD). This age range overlaps and confirms the later part of the age range attributed to Loisels Pumice by McFadgen (1994) and suggests that this occurrence is a primary deposit. The date of 480±100 y BP, with pumice group XF at Flinders Beach, has multiple intercepts on the calibration curve, giving two possible age-ranges: 1410 to 1520 AD and 1569 to 1627 AD (mean 1446 AD). The first of these age ranges for Group XF overlaps the range for Loisels Pumice and suggests that the two pumice groups may be contemporary, as is implied, but not proven, by their occurrence together at Hook Point. On these grounds, the age of the Hook Point site would appear to lie between 1410 AD, the limiting maximum age of Group XF, and 1440 AD, the youngest limiting age for a primary Loisels Pumice. It also follows that the lead weight was left onshore in this period.

This result makes the presence of a manufactured article of European origin on this coast, long before Cook's survey in 1770, difficult to explain. Indeed, the dates precede Magellan's arrival in the Pacific in 1520. Earlier European visits that might be implied by the Dieppe maps, especially the Dauphin chart of 1530, perhaps indicate that the Spanish or Portuguese had reached the east Australian coast before Cook (McIntyre, 1977; R. Ward, 1982, 1987; Richardson, 1984; Mulvaney, 1989; Wallis, 1981) but these supposed contacts are all much later than 1440 AD. Consequently, we suggest other possibilities that are consistent with our observations.

One possible interpretation is that the Loisels Pumice and Group XF at Hook Point were already onshore, and were reworked to this beach after European settlement, when the lead weight appeared. This hypothesis conflicts with the observed soil development at the site, which is markedly greater than that found on coastal sands emplaced shortly after European settlement, e.g., at Skirmish Point, Bribie Island, near Brisbane, which show no subsoil B horizon development.

Another explanation is that the site is a secondary one with respect to Loisels Pumice but a primary one with respect to Group XF and the lead weight. This is more attractive for it requires only a short space of time for the arrival of the two pumices and the lead weight (and is thus consistent with the soil development). Moreover, the two apparent calendar ages for Group XF (1410 to 1520 AD and 1569 to 1627 AD) cover, in the first case, the advent of Magellan (and also the explorations that are supposedly recorded by the Dieppe maps) and, in the second case, other European voyagers, any of whom could have lost a weighted fishing net.

We conclude that the lead weight was originally in place at the level where we found it, was formed of lead mined in France, was mined before 1930, and reached this site at some time between 1410 and 1627 AD.

		Na %	K %	Ca %	Mg %	Fe %	Al %	Ti %	P ppt
#083		3.138	0.722	2.544	0.528	2.71	4.12	0.350	852
Group B,	mean [61]	2.879	0.678	2.652	0.520	3.00	7.19	0.362	737
	S.D.	0.445	0.300	0.587	0.127	0.62	1.30	0.099	529
#078		2.064	0.601	3.132	0.695	5.12	1.52	0.368	1389
Group XF,	mean [9]	2.320	0.842	2.887	0.607	4.73	6.53	0.657	1208
	S.D.	1.017	0.350	0.435	0.357	1.18	2.45	0.427	525
Loisels Pumice									
#056		3.227	0.721	3.202	0.562	3.370	6.740	0.446	588
#058		3.221	0.722	3.489	0.644	3.660	6.810	0.569	600
#067		3.279	0.731	2.877	0.546	3.520	6.910	0.498	613
#068		3.263	0.735	2.781	0.549	3.460	6.930	0.481	611
mean		3.248	0.727	3.087	0.575	3.500	6.850	0.499	603

		Mn ppt	Zn ppm	Cu ppm	Co ppm	Ni ppm	Rb ppm	Li ppm	Sr ppm
#083		1140	139.6	6.9	25.1	12.4	16.3	13.8	149
Group B,	mean [61]	1006	72.0	7.6	22.2	16.3	15.5	12.3	176
	S.D.	175	17.3	6.3	7.3	3.6	8.2	2.3	53
#078		1361	179.8	18.9	30.1	19.0	14.4	11.7	215
Group XF,	mean [9]	1306	112.0	23.1	25.1	15.4	24.7	14.7	291
	S.D.	221	37.2	16.5	7.1	7.6	11.9	5.4	155
Loisels Pumice									
#056		1168	95.8	7.9	27.5	16.1	20.4	12.7	115
#058		1199	94.3	12.5	29.4	17.3	20.3	12.5	118
#067		1241	94.7	10.8	25.0	16.2	19.7	13.1	130
#068		1260	95.4	7.4	25.0	14.6	19.8	13.2	62
mean		1217	95.1	9.7	26.7	16.1	20.1	12.9	106

Table 1. Analytical data for pumices #083 and #078 collected at Hook Point, means for groups B and XF, and data for Loisels Pumice from Port Ohope, N.Z. The means include #083 and #078.

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