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An aeolian sediment pulse at c. 28 kyr BP in southern Tasmania

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Abstract Thick aeolian deposits are uncommon in Tasmania but a 7-m-thick aeolian deposit containing two stratigraphic breaks, including one palaeosol, occurs as a gully infill at Cradoc Hill, 5 km east of the lower Huon River floodplain in southern Tasmania. The deposit was sampled at six depths for dating by thermoluminescence (TL) techniques. The entire deposit gave TL ages in the range 25–32 kyr BP (mean 28 kyr BP). One date of 41.4 kyr BP was discounted as being probably erroneous. In contrast to loess deposits of similar thickness in New Zealand, which have been dated and correlated with entire glacial periods, the Cradoc Hill aeolian sediments are interpreted to have been deposited in two stages over a relatively short time. As the prevailing winds in the region are westerly, the aeolian material is presumed to be derived from the Huon River floodplain in the vicinity of Egg Island, when the floodplain was occupied by a braided river; some of the sand component may also have been derived from locally outcropping sandstone rocks. Aeolian sediments of this age have not previously been recognised in Tasmania. A significant climate event that might explain a short and intense period of river aggradation and aeolian sediment supply has not been noted in either the pollen or $\delta^{18}O$ record. An alternative explanation for the erosion and subsequent aeolian deposition is that it resulted from natural or human-lit fires. Aboriginal settlement of Tasmania began around 35 kyr BP and the earliest recorded human settlement in the Huon catchment occurred at 28–29 kyr BP. A major erosion event in the mid-Huon Valley also occurred at about this time (27–29 kyr BP). Thus, Aboriginal settlement in the Huon catchment, erosion in the mid-Huon Valley, and deposition at Cradoc Hill are approximately contemporaneous. As older aeolian deposits are not present at Cradoc Hill, it is suggested that Aboriginal burning of vegetation rather than climatic influences may have caused both the middle Huon erosion event and aggradation downstream at about 28 kyr BP, providing a source of silt and fine sand which accumulated downwind, together with sand from local sources, as gully-infill sediments. We therefore suggest that as Aboriginal people reached southern inland Tasmania they may have had an influence on landscape stability, river morphology, and aeolian dust supply. This suggestion requires corroboration from other sites.

Keywords aeolian deposits; loess; erosion; Last Glacial; Aboriginal burning; Huon Valley, Tasmania; thermoluminescence; dating

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INTRODUCTION

Tasmanian aeolian deposits

In this paper we report on a 7-m-thick sedimentary deposit in the lower Huon Valley, southern Tasmania, which is interpreted to be aeolian in origin. Although aeolian sediments are locally common in Tasmania (Sigleo & Colhoun 1982; Colhoun 2002), Tasmanian lowlands lack the loess blanket that is common at similar latitudes in New Zealand (Eden 1987). New Zealand loess deposits are generally sourced from braided rivers; during cold climate episodes these braided rivers, having headwaters in recently uplifted axial mountain ranges exposed to frost action, mechanical abrasion and fluvial action, carried large amounts of sediment that formed extensive aggradation surfaces downstream (Palmer 1988). In contrast, Tasmania was tectonically stable during the Quaternary (Fitzsimons & Colhoun 1991). Consequently, Tasmania has no axial range, the mountains are lower (mostly 1000–1500 m altitude), and during the Last Glacial ice cover in south-west Tasmania was discontinuous and local (Colhoun & Fitzsimons 1990, fig. 1). Although outwash gravel terraces occur in places in Tasmania (e.g., Colhoun & Fitzsimons 1990, fig. 9), Tasmania lacks the classic terrace systems and associated loess deposits typically associated with braided rivers at similar latitudes in New Zealand (Milne 1973; Eden 1987), where the environment is likely to have responded similarly to regional climate changes (Fitzsimons & Colhoun 1991; Kiernan 1991).

In the Late Last Glacial the climate of Australia was not only colder than at present but also drier and more windy (Petit et al. 1981; Wasson 1983), and westerly winds in Tasmania deflated dust and saltated fine sand from dry floodplains, depositing it downwind on land surfaces of higher elevation (Sigleo & Colhoun 1982). The most prominent aeolian deposits in inland Tasmania are dunes, some of which have been dated to 15–25 kyr BP (Sigleo & Colhoun 1982). Following Tasmanian deglaciation after 10–15 kyr BP, vegetation and forest cover increased (Macphail 1979). As a result, sediment supply to streams was reduced, floodplains became vegetated or inundated by the rising sea level, and inland aeolian deflation and deposition ceased.

Site details

In November 2001 a landslide was reported on farmland recently planted in eucalypts in the lower Huon Valley, near Cradoc Hill at latitude 43°07′S (Fig. 1). Inspection showed that the landslide had occurred in gully infill sediments at the head of a valley developed in subhorizontal Triassic sandstone.

The texture of the sediments, and the fact that the uppermost two layers (including the present-day soil) had the typical vertical cracks and mottling of soils with fragipans developed in loess in New Zealand (e.g., Perch-Gley Pallic soils of Hewitt 1998; McIntosh 1984, fig. 2), indicated that the soil parent material might be aeolian. The lower reaches of large rivers in New Zealand have been sources of large amounts of aeolian sediment during floodplain aggradation phases resulting from erosion in headwaters (Cowie 1964; Milne 1973), and we consider it possible that in previous drier and colder climates floodplains of the Huon River may have been a source of aeolian silt and fine sand. An aeolian origin for the sediments is plausible because they occur about 5 km east of the floodplain of the Huon River, which received fluvioglacial discharge from glaciers in its headwaters and several tributary streams, and because the prevailing wind is westerly. Therefore, a determination of the age of the Cradoc Hill sediments could help date periods of catchment erosion and consequent floodplain aggradation in southern Tasmania. For this reason the sediments were described and sampled for dating by ^{14}C and thermoluminescence (TL) methods.

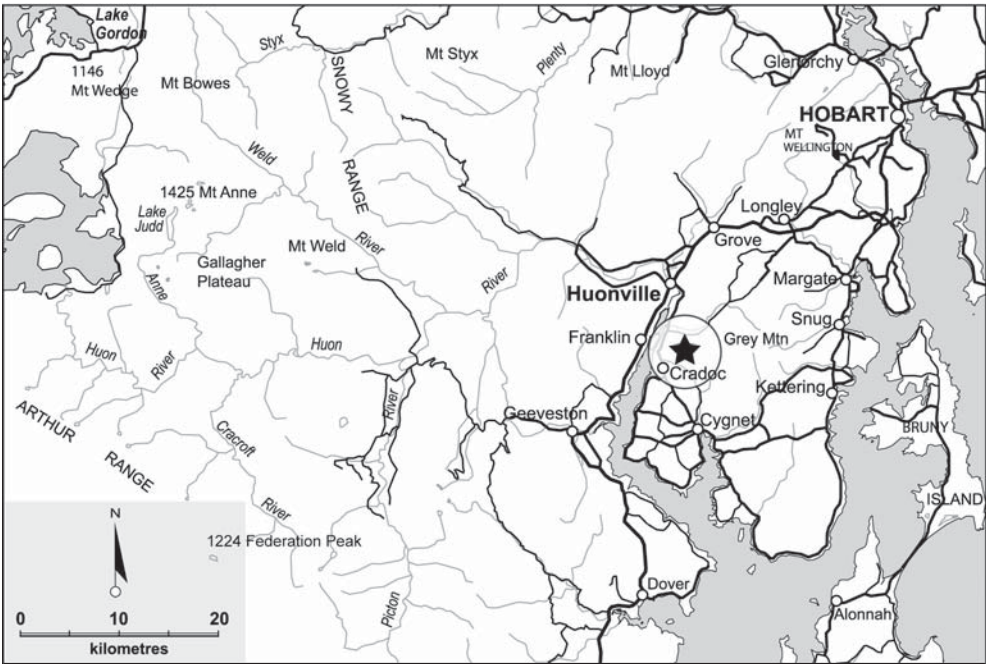

Fig. 1 Location map showing the Huon River catchment in southern Tasmania, Australia. The location of the described aeolian sediments at Cradoc Hill is indicated by the star symbol.

METHODS

The sediment column was described using the soil description methods of McDonald et al. (1984) (Table 1). Samples of soil c. 1000 cm^3 were carved using a knife and immediately wrapped in black plastic for TL dating. Where prismatic structure was present, the samples were aligned to ensure that the central core of each sample was in the centre of a prism, avoiding the grey veins (the main path for water movement) between prisms. The initial sampling was on 12 December 2001 when samples were taken from 2.40, 3.50, 4.75, and 6.80 m depth. Because of one apparently aberrant date (see below), a repeat sample of the 4.75 m sample was taken on 30 April 2003. In addition, a further sample was taken from 6.45 m depth. A sample from 0.75 m depth taken on 4 November 2003 completed the sequence. Wood fragments in the buried A1 horizon at 4.00–4.25 m depth were also sampled.

The TL samples were analysed using the 90–125 μm quartz grain size fraction which was separated from the centre of the bulk samples. The outer layers were utilised in the determination of the radiation flux levels using thick source alpha counting and atomic emission spectrometry. The combined additive and regenerative protocols used ensured that there was no change in TL sensitivity due to the particular laboratory procedure being followed. It was assumed that the TL level at the time of deposition was that level attained following a 24-h laboratory exposure beneath an ultraviolet lamp (Philips MLU 300W). TL dating was performed using the methods described by Shepherd & Price (1990) and Nanson et al. (1991).

Carbon dating was performed by AMS techniques at the University of Waikato, New Zealand, after pretreatment with hot 10% HCl and hot 1% NaOH. The NaOH-insoluble fraction was further treated with hot 10% HCl, filtered, rinsed, and dried.

RESULTS AND DISCUSSION

Field observations are detailed in Table 1 and Fig. 2, and TL ages in Table 2.

Stratigraphy and soils

Three sediment layers were identified in the deposit, and within these layers soil horizons were recognised and described (Table 1). The topmost layer is 4.0 m thick and has a sandy loam to sandy clay loam texture. The middle layer is 1.8 m thick and has a sandy clay loam to silty clay texture. The lowermost layer is >1.5 m thick and has a sandy loam to sandy clay loam texture.

The surface soil is classified as a yellow Dermosol (Isbell 1996) and the buried soil at 4.0–5.8 m (forming the middle layer) is similarly classified. Both the surface and buried soils would be classified as Pallic soils in the New Zealand Soil Classification (Hewitt 1998). The combination of yellow/brown and grey mottles throughout the deposit is typical of Pallic soils that have experienced seasonal oxidation and reduction (Hewitt 1998). As previously mentioned, soil morphology is typical of soils formed in loess in New Zealand. An aeolian origin is supported by: (1) the total absence of gravels in the deposit; (2) the horizontal stratification; (3) the absence of features indicating erosion channels typical of high-energy stream flows in narrow-sided gullies (Rosgen 1996); and (4) the presence of unstratified and apparently randomly distributed organic and charcoal flecks throughout the deposit (Table 1), which are most readily explained as the remains of vegetation buried under accumulating dust.

The 10-cm-thick strong brown colour at the base of the second layer is commonly found in silty New Zealand aeolian deposits that overlie coarser-textured deposits (Bruce 1973, fig. 5 and p. 553), and we interpret this layer to be the result of a strong oxidation of iron resulting from an abrupt change in soil permeability rather than a result of pedological processes such as podzolisation.

Age of deposit

The young carbon date (Wk10555, 215 ± 64 yr BP) obtained for the woody material in the buried A1 horizon at 4.00–4.25 m depth indicates that this material is the remains of deep penetrant roots of the native trees that previously grew on the present-day surface soil of the site. This carbon date therefore has no stratigraphic significance.

Six TL ages fall into the range 25.3–31.8 kyr BP and a seventh has a value of 41.4 kyr BP (Table 2). In general, the length of the temperature plateaux gives an indication of palaeodose reliability. As the majority of the plateaux exhibited by the present samples extended over more than 300–500°C, the palaeodose determinations are considered to be reliable.

The age of the repeat sample W3425 (28.2 ± 1.7 kyr BP), when considered in relation to the age obtained on the first sample at this depth (W3159–41.4 ± 2.1 kyr BP), and the ages obtained on samples above and below (Table 2), strongly suggests that the initial age determined at this level is incorrect. It is noticeable that the annual radiation dose (ARD) level determined for the original sample is approximately 25% lower than that measured for the repeat sample (2937 ± 53 μGy/yr compared with 3878 ± 58 μGy/yr) and 31% lower than the mean value for all samples (4274 μGy/yr). Given that the palaeodose derived for the initial sample is much the same as those measured for all other samples (122 Gy compared with the mean value of 115 Gy), this lower ARD results in a correspondingly greater age. If the mean ARD value is applied to the palaeodose determined for the original sample, an age of 27.4 kyr BP results. This is in keeping with the ages determined for all other samples taken from this sedimentary sequence. Although we cannot explain the apparently aberrant 41.4 ± 2.1 kyr BP age with certainty, the most likely reason for the aberrant age seems to be leaching of radionuclides from this particular sample, possibly because of inadvertent inclusion of a grey vein in the analysed subsample.

The ages of samples do not increase steadily with depth: most fall within two standard deviations of one another. From this evidence we conclude that the entire sedimentary sequence has been deposited rapidly over a period of around 7000 years (25–32 kyr BP), but possibly over a much shorter time period at about 28 kyr BP. (The dating technique used cannot resolve the exact time span more accurately.) The prominent A1 horizon developed at the top of the second layer (Fig. 2) indicates that during deposition there was a depositional hiatus allowing organic matter accumulation and A1 horizon development. Deposition rates of about 1 mm per year or more are implied.

Table 1 Stratigraphy of Cradoc gully infill deposits.

Depth (m)	Description	Samples	Interpretation
0–0.20	Very dark greyish brown sandy loam		Present-day A1 horizon (topsoil)
0.20–2.90	Yellowish brown sandy clay loam (20% clay est.) 30% light brownish grey mottles 20–100 mm diameter and as veins 20 cm diameter, in net pattern above 100 cm depth, mostly vertical below; coarse prismatic peds; strong; light yellowish brown organic stains on surface of peds; few quartz gravels 2–5 mm diameter; many fine pores 1–2 mm diameter, after roots; abundant charcoal flecks.	W3520 0.75 m W3280 2.40 m	Aeolian sediment
2.90–3.50	Brownish yellow medium sandy loam; 70% light grey mottles.	W3281 3.50 m	Aeolian sediment
3.50–4.00	Olive yellow sandy loam; 20% light grey mottles; many charcoal flecks; some vertical wood fragments 5 mm diameter, continuous with traces in horizon below.		Aeolian sediment
4.00–4.25	Dark grey silty clay; abundant charcoal flecks; many wood fragments 5 mm diameter.	C14 wood fragments 4.00–4.25 m	Buried A1 horizon in aeolian sediment
4.25–4.50	Brownish yellow sandy clay loam (25% clay est.); 30% light brownish grey veins 50–100 mm diameter.		Aeolian sediment
4.50–5.70	Strong brown sandy clay loam (25% clay est.); 30% light brownish grey mottles 10–20 mm diameter; coarse prismatic structure; strong.	W3159 W3425 4.75 m	Aeolian sediment; strong brown colour may indicate a hydrological discontinuity*
5.70–5.80	Strong brown sandy clay loam (25% clay est.); coarse prismatic structure; strong.		Aeolian sediment
5.80–7.30+	Yellow sandy loam (15% clay est.); 30% light brownish grey mottles, horizontal; many charcoal flecks and some old roots and root traces (Fe stains); massive; weak.	W3426 6.45 m W3282 6.80 m	Aeolian sediment

*A similar layer described as a “basal orange horizon” by Bruce (1973) occurs in Southland–Otago loess in New Zealand, typically where silt loam deposits overlie coarser-textured deposits such as sands (Bruce 1973, p. 553 and fig. 5).

Table 2 Analytical details and ages determined for TL samples. The uncertainty levels represent 1 SD.

Analytical details	W3520	W3280	W3281	W3159	W3425 (repeat for W3159)	W3282	W3426 (repeat for W3282)
Sample depth (m)	0.75	2.40	3.50	4.75	4.75	6.80	6.45
Plateau region (°C)	275–400	250–500	275–500	275–500	275–500	250–500	275–425
Analysis temperature (°C)	325	375	375	375	375	375	375
Palaeodose (Grays)	114 ± 5	116 ± 5	112 ± 8	122 ± 6	110 ± 7	101 ± 5	139 ± 7
K content (% by AES)	2.50 ± 0.05	2.50 ± 0.05	2.50 ± 0.05	2.10 ± 0.05	2.45 ± 0.05	2.65 ± 0.05	1.95 ± 0.05
Rb content (ppm assumed)	100 ± 25	100 ± 25	100 ± 25	100 ± 25	100 ± 25	100 ± 25	100 ± 25
Moisture content (% by weight)	18.9 ± 3	6.7 ± 3	10.0 ± 3	20.9 ± 3	16.2 ± 3	17.9 ± 3	14.8 ± 3
Specific activity (Bq/kg U+Th)	70.4 ± 2.0	79.1 ± 1.4	90.9 ± 2.7	61.1 ± 1.4	89.5 ± 2.4	68.1 ± 1.4	207 ± 5
Cosmic contribution (µGy/yr assumed)	190 ± 25	144 ± 25	131 ± 25	120 ± 25	120 ± 25	98 ± 25	98 ± 25
Annual radiation dose (µGy/yr assumed)	3575 ± 55	4154 ± 65	4217 ± 64	2937 ± 53	3878 ± 58	3613 ± 52	5509 ± 77
TL age (kyr)	31.8 ± 1.4	27.9 ± 1.3	26.6 ± 1.8	41.4 ± 2.1	28.2 ± 1.7	27.9 ± 1.5	25.3 ± 1.3

Origin of deposit

Aggrading alluvium would provide a source of wind-blown dust, as it does in present-day New Zealand valleys containing braided rivers (McGowan et al. 1996; McGowan 1997). However, the absence of regional loess in the vicinity of the Huon Valley indicates that deposition from aeolian suspension (aerosols) is unlikely. The texture of the deposit and the absence of dunes nearby rules out a dunesand origin. The texture of the Cradoc Hill deposit indicates that it may be an accumulation of "coversand" (Zonneveld 1980). Coversand deposits are widespread in Holland where they are called "dekzand" and are thought to have resulted from surface movement of sand and snow in winter storms as described by Zonneveld (1980). Mineralogical analysis has shown that local rocks contribute to coversands (Zonneveld 1980, p. 146) and aeolian deposits from mixed sources (braided river floodplains several kilometres upwind and local rocks) have been described in New Zealand by Eden et al. (1987). Hence, the local Triassic sandstone as well as material from the Huon floodplain may have contributed to the Cradoc Hill deposits.

Thin (<50 cm) surface layers of sand of aeolian origin are widespread in south-east Tasmania (McIntosh 1999; Osok & Doyle 2004), and on the locally extensive doleritic soil parent material they can be readily detected by their quartz-dominated mineralogy which contrasts with that of the underlying weathered dolerite (Osok & Doyle 2004). These observations indicate that in south-east Tasmania thin coversand deposits are more widespread than previously thought, although to date they have not been formally recognised. The peculiarly thick deposit at Cradoc Hill may have resulted from the unusual combination of a deep gully, a gully orientation providing a sediment trap in the lee of the prevailing wind, and proximity to a major coversand source area.

Regional context

Although the Cradoc Hill aeolian deposit can be attributed to a period when extremely harsh (dry and cold) conditions prevailed, three characteristics of the deposit require explanation:

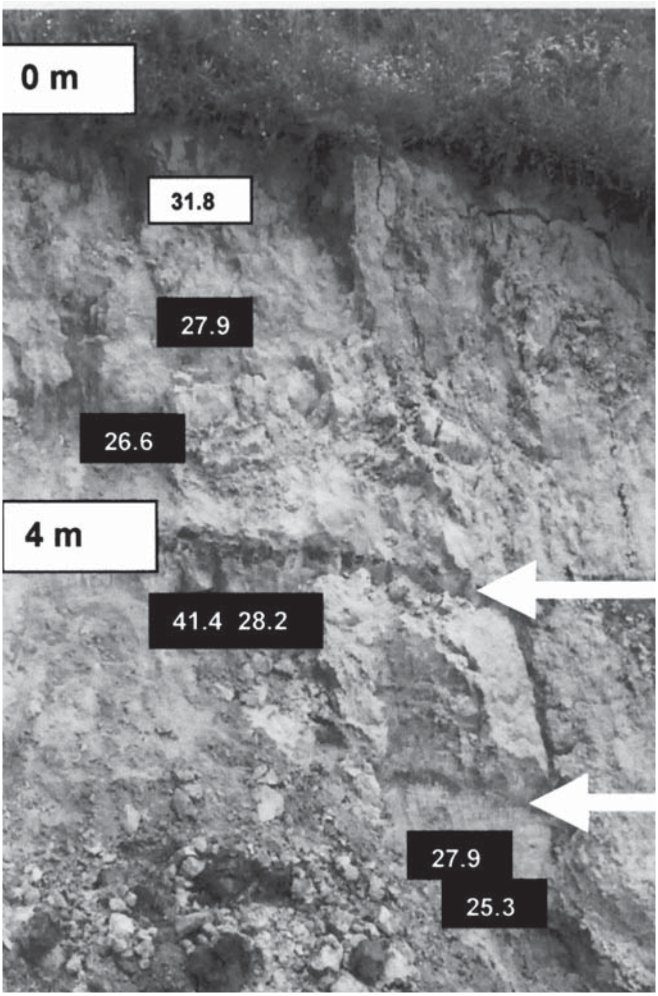

Fig. 2 The landslide backwall at Cradoc Hill, showing prominent buried A1 horizon (top arrow) and strong brown colour (bottom arrow) probably marking a hydrological discontinuity. Black rectangles indicate actual sampling sites for TL samples. Dates (kyr BP) from Table 1 are shown within rectangles. The white rectangle with the date 31.8 kyr BP indicates the sampling depth and date for the uppermost sample (at 0.75 m depth); the actual sample was taken from a position to the left of the field of view of the photograph.

(1) the absence of post-25 kyr BP aeolian sediments; (2) the absence of aeolian sediments older than 32 kyr BP, despite the multiple glaciations that are known to have occurred in south-west Tasmania (Colhoun & Fitzsimons 1990); and (3) the short time span recorded in the deposit, which implies a rapid deposition rate.

At Cradoc Hill there is no aeolian accumulation of similar age to Last Glacial Maximum (15–25 kyr BP (McGlone et al. 1993)) loess in New Zealand (Eden 1987), or to 15–25 kyr BP dune sands in Tasmania (Sigleo & Colhoun 1982), or to 13–25 kyr BP aeolian deposits elsewhere in Australia (Wasson 1983). Absence of deposits <25 kyr BP may simply reflect the fact that, after the upper layer was deposited at Cradoc Hill, the gully landform was filled with sediment, and once it was filled the slight depression remaining no longer provided a protected depositional zone in the lee of the prevailing winds.

The sediments at Cradoc Hill are slightly older than the dunes described by Sigleo & Colhoun (1982) and appear to precede the transition of lowland subalpine shrublands and woodlands to alpine herbfields at 25 kyr BP which was a result of the climate becoming colder and drier at this time (Colhoun & van de Geer 1986, 1987; Gibson et al. 1987; van de Geer et al. 1989; Kiernan 1991; Colhoun et al. 1994; Colhoun 2000). Significantly, the evidence indicates that aeolian sediments equivalent to the last significant phase of loess deposition in New Zealand, which occurred between approximately 25 kyr BP and 10 kyr BP (Eden & Froggatt 1988) during the last stadial of the Otira Glacial (Suggate 1990), are entirely absent from Cradoc Hill.

The marine $\delta^{18}O$ record for a site near western Tasmania (Colhoun et al. 1994) shows a slight rise in temperature between 30 and 25 kyr BP so the deposits cannot be explained by cooling temperatures. Extreme drought would favour aeolian activity, and, given the likelihood that climatic changes in the Southern Hemisphere middle latitudes were broadly synchronous during the Last Glacial (Fitzsimons & Colhoun 1991), it may be significant that drought was inferred to explain fine scree deposits dated 29 kyr BP in New Zealand (McIntosh et al. 1990).

At a mid-Huon Valley site adjacent to the present Huon River, Colhoun & Goede (1979) described alluvial fan deposits which overlay floodplain deposits of the Huon River. The floodplain deposits (indicating a relatively stable forested environment) were dated at 39.6–53.4 kyr BP whereas the overlying alluvial fan deposits gave dates of 29.34 (+3.08, –2.22) kyr BP and 27.4 (±2.90) kyr BP. Colhoun & Goede (1979) concluded that “the accumulation of the alluvial fan gravels had commenced by this time” (29.34 (+3.08, –2.22) kyr BP) and that it was probable that reduced vegetation cover facilitated greater erosion and deposition. They suggested that climatic deterioration was responsible for the erosion. However, later palynological and marine $\delta^{18}O$ studies from south-western Tasmania (Colhoun et al. 1994, fig. 6) indicated a slight warming between 30 and 25 kyr BP, not a cooling. It therefore appears that the mid-Huon Valley erosion event described by Colhoun & Goede (1979) was contemporary with the Cradoc Hill aeolian sediments and that climate change was not the primary determinant of either the erosion event in the mid-Huon Valley or the deposition event at Cradoc Hill.

An alternative explanation for these events is that they relate to the first arrival of people in the Huon Valley. Aboriginal settlement of Tasmania is known to have begun no later than 35 kyr BP (Cosgrove et al. 1990; Cosgrove 1995) and the earliest known human occupation in the Huon catchment is represented by the deposits dated 28–29 kyr BP in Bone Cave in the Weld River valley (Cosgrove 1995). Thus, human occupation in the Huon catchment, the deposits at Cradoc Hill, and the alluvial fan deposits in the mid-Huon Valley may have been contemporaneous. It therefore appears possible that early human incursion into the Huon catchment had an effect on land stability and initiated erosion in the Huon catchment and the consequent deposition at Cradoc Hill. Deposition of fan alluvium into the mid-Huon valley would have increased sediment supply in the Huon River, down to the sea. As the prevailing winds in the region are westerly, the Huon River floodplain in the vicinity of Egg Island would have been a source of aeolian material, when this floodplain was occupied by a braided river prior to post-Glacial sea level rise.

Early Aboriginal settlers in Tasmania are likely to have increased fire frequency (Jackson 2000) as did the early Polynesian settlers in New Zealand (McGlone 2001). Infrequently burnt forest has a thicker understorey and accumulates more litter than frequently burnt forest. It can be assumed that the lowland subalpine woodland and shrubland occupying south-western Tasmania (Colhoun et al. 1994) during the Last Glacial had a relatively large biomass that was probably reduced drastically and permanently by the first and subsequent human-lit fires: the probable increase in fire frequency in south-west Tasmania after Aboriginal settlement has been implicated in the “ecological drift” from woodland or scrub to moorland in this region (Brown & Podger 1982; Jackson 2000). Elsewhere in Tasmania, Aboriginal land use and more frequent fires after human settlement has shifted the structure and composition of forests towards more fire-tolerant vegetation associations having lower understorey biomass (Duncan & Brown 1995; Duncan 1996).

The effect of early fires on the erosion-prone and poorly-structured soils (Grant et al. 1995) formed in the widespread Precambrian quartzites and conglomerates (Tasmania Department of Mines 1975, 1976) of the mid- and upper Huon Valley would have been more intense than the effect of later fires, because in the later fires the biomass (fuel) would already have been depleted by earlier fires. Thus, the environmental effects in the years immediately following the first arrival of humans in the Huon Valley at 28–29 kyr BP (Cosgrove 1995) could have been both greater than those occurring earlier in the absence of human influences, and those occurring later, as the landscape came to equilibrium with a new vegetation distribution and fire regime.

The above inferences do not prove cause and effect. Except for deposits at habitation sites (Sigleo & Colhoun 1982; Cosgrove 1995) clear proof of human influence on prehistoric landscape stability is difficult to obtain. In the absence of such evidence, the circumstantial method of correlating dated erosion or deposition events at one site with evidence of dated Aboriginal occupation at another is an imperfect tool for inferring the effect on the landscape of human arrival, but the best we have available.

Although we suggest that the aeolian sediments at Cradoc Hill and the thick 27–29 kyr BP fan alluvium in the mid-Huon Valley may have been primarily a consequence of erosion resulting from greater fire frequency following the first human settlement in the Huon Valley catchment, rather than a consequence of climatic influences alone, dry windy conditions during the Last Glacial (Petit et al. 1981; Wasson 1983) would undoubtedly have assisted fire spread.

CONCLUSIONS

Aeolian sediments at Cradoc Hill in the Huon Valley of southern Tasmania have ages determined by TL methods of 25–32 kyr BP (mean 28 kyr BP) and are interpreted to have formed predominantly from wind-blown sediment transported by westerly winds from the nearby aggrading floodplain of the Huon River, and from locally outcropping sandstone. A buried A1 horizon in the sediments indicates that there was a significant hiatus during their deposition.

Aeolian sediments of this age have not previously been recognised in Tasmania, and a significant climate event that might explain a short and intense period of river aggradation and aeolian sediment supply has not been noted in either the pollen or $\delta^{18}O$ record (Colhoun et al. 1994). As Aboriginal settlement of Tasmania began around 35 kyr BP (Cosgrove et al. 1990; Cosgrove 1995) and the earliest recorded human settlement in the Huon catchment occurred at 28–29 kyr BP (Cosgrove 1995), and a major erosion event in the mid-Huon Valley is known to have occurred at 27–29 kyr BP (Colhoun & Goede 1979), it is suggested that erosion resulting primarily from Aboriginal burning of vegetation rather than climatic influences may have caused the Huon River floodplain to aggrade, providing a source of silt and fine sand which accumulated downwind as aeolian gully-infill sediments.

Further studies of Quaternary sediments in the Huon Valley and elsewhere in Tasmania will be required to elucidate the relative importance of climatic and anthropogenic processes governing local erosion and deposition.

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REFERENCES

Brown, M. J.; Podger, E. D. 1982: Floristics and fire regimes of a vegetation sequence from sedgeland-heath to rainforest at Bathurst Harbour, Tasmania. *Australian Journal of Botany 30*: 659–676.

Bruce, J. D. 1973: A time-stratigraphic sequence of loess deposits on near-coastal surfaces in the Balclutha district. *New Zealand Journal of Geology and Geophysics 16*: 549–556.

Colhoun, E. A. 2000: Vegetation and climate change during the Last Interglacial–Glacial cycle in western Tasmania, Australia. *Palaeogeography, Palaeoclimatology, Palaeoecology 155*: 195–209.

Colhoun, E. A. 2002: Periglacial landforms and deposits of Tasmania. *South African Journal of Science 98*: 55–63.

Colhoun, E. A.; Goede, A. 1979: The late Quaternary deposits of Blakes Opening and the middle Huon Valley, Tasmania. *Philosophical Transactions of the Royal Society of London B286*: 371–395.

Colhoun, E. A.; Fitzsimons, S. J. 1990: Late Cainozoic glaciation in western Tasmania, Australia. *Quaternary Science Reviews 9*: 199–216.

Colhoun, E. A.; van de Geer, G. 1986: Holocene to middle last glaciation vegetation history at Tullabardine Dam, Western Australia. *Proceedings of the Royal Society of London B29*: 177–207.

Colhoun, E. A.; van de Geer, G. 1987: Vegetation history and climate before the maximum of the Last Glaciation at Crotty, western Tasmania. *Papers and Proceedings of the Royal Society of Tasmania 121*: 69–74.

Colhoun, E. A.; van de Geer, G.; Fitzsimons, S. J.; Heusser, L. E. 1994: Terrestrial and marine records of the last glaciation from western Tasmania: do they agree? *Quaternary Science Reviews 13*: 293–300.

Cosgrove, R. 1995: Late Pleistocene behavioural variation and time trends: the case from Tasmania. *Archaeologica Oceania 30*: 83–104.

Cosgrove, R.; Allen, J.; Marshall, B. 1990: Palaeoecology and Pleistocene human occupation in south central Tasmania. *Antiquity 64*: 59–78.

Cowie, J. D. 1964: Aokautere Ash in the Manawatu District, New Zealand. *New Zealand Journal of Geology and Geophysics 7*: 67–77.

Duncan, F. 1996: Lowland forests and woodlands in northeast Tasmania. *Record, Queen Victoria Museum, Launceston 103*: 97–106.

Duncan, F.; Brown, M. J. 1995: Edaphics and fire: an interpretative ecology of lowland forest vegetation on granite in northeast Tasmania. *Proceedings of the Linnean Society of New South Wales 115*: 45–60.

Eden, D. N. 1987: Stratigraphy and chronology of Seaview Formation, Awatere Valley, South Island, New Zealand. *In*: Liu Tungsheng *ed*. Aspects of loess research. Beijing, China Ocean Press. Pp. 216–230.

Eden, D. N.; McIntosh, P. D.; Reynolds, J. 1987: Sources of loess in the Kaiwera-Mimihau District, Southland, New Zealand. *New Zealand Journal of Geology and Geophysics 30*: 307–316.

Eden, D. N.; Froggatt, P. C. 1988: Identification and stratigraphic significance of distal Aokautere Ash in three loess cores from eastern South Island, New Zealand. *In*: Eden, D. N.; Furkert, R. J. *ed*. Loess: its distribution, geology and soils. Rotterdam, A. A. Balkema. Pp. 47–58.

Fitzsimons, S. J.; Colhoun, E. A. 1991: Pleistocene glaciation of the King Valley, western Tasmania, Australia. *Quaternary Research 36*: 135–156.

Gibson, N.; Kiernan, K. W.; Macphail, M. K. 1987: A fossil bolster plant from the King River, Tasmania. *Papers and Proceedings of the Royal Society of Tasmania 121*: 35–42.

Grant, J.; Laffan, M.; Hill, R.; Neilsen, W. 1995: Forest soils of Tasmania. Hobart, Forestry Tasmania. 189 p.

Hewitt, A. E. 1998: New Zealand soil classification. Landcare Research Science Series 1. Lincoln, Manaaki Whenua Press. 133 p.

Isbell, R. F. 1996: The Australian soil classification. Collingwood, CSIRO. 143 p.

Jackson, W. D. 2000: Nutrient stocks in Tasmanian vegetation and approximate losses due to fire. *Papers and Proceedings of the Royal Society of Tasmania 134*: 1–18.

Kiernan, K. W. 1991: Glacial history of the Upper Derwent Valley, Tasmania. *New Zealand Journal of Geology and Geophysics 34*: 157–166.

MacPhail, M. K. 1979: Vegetation and climates in southern Tasmania since the last glaciation. *Quaternary Research 11*: 306–341.

McDonald, R. C.; Isbell, R. F.; Speight, J. G.; Walker, J.; Hopkins, M. S. 1984: Australian soil and land survey field handbook. Melbourne, Inkata Press. 190 p.

McGlone, M. S. 2001: The origin of the indigenous grasslands of southeastern South Island in relation to pre-human woody ecosystems. *New Zealand Journal of Ecology 25*: 1–15.

McGlone, M. S.; Salinger, M. J.; Moar, N. T. 1993: Paleovegetation studies of New Zealand's climate since the Last Glacial Maximum. *In*: Wright, H. E.; Kutzbach, J. E.; Webb, T.; Ruddiman, W. F.; Street-porter, F. A.; Bartlein, P. J. *ed*. Global climates since the Last Glacial maximum. Minneapolis, University of Minneapolis Press. Pp. 294–317.

McGowan, H. A. 1997: Meteorological controls on wind erosion during foehn wind events in the eastern Southern Alps, New Zealand. *Canadian Journal of Earth Science 34*: 1477–1485.

McGowan, H. A.; Sturman, A. P.; Owens, I. F. 1996: Aeolian dust transport and deposition by foehn winds in an alpine environment, Lake Tekapo, New Zealand. *Geomorphology 15*: 135–146.

McIntosh, P. D. 1999: Problem soils: aeolian deposits on dolerite. *Forest Practices News* (Tasmania) *1*: 17.

McIntosh, P. D. 1984: Genesis and classification of a sequence of soils formed from aeolian parent materials in East Otago, New Zealand. *Australian Journal of Soil Research 22*: 219–242.

McIntosh, P. D.; Eden, D. N.; Burgham, S. J. 1990: Quaternary deposits and landscape evolution in north-east Southland, New Zealand. *Palaeogeography, Palaeoclimatology, Palaeoecology 81*: 95–113.

Milne, J. D. G. 1973: Maps and sections of river terraces in the Rangitikei Basin, North Island, New Zealand. New Zealand Soil Bureau Report 4.

Nanson, G. C.; Price, D. M.; Short, S. A.; Young, R. W.; Jones, B. G. 1991: Comparative uranium-thorium and thermoluminescence chronologies for weathered alluvial sequences in the seasonally dry tropics of Northern Queensland, Australia. *Quaternary Research 35*: 347–366.

Osok, R.; Doyle, R. 2004: Soil development on dolerite and its implications for landscape history in southeastern Tasmania. *Geoderma 121*: 169–186.

Palmer, A. S. 1988: Loess source and provenance in New Zealand. *In*: Eden, D. N.; Furkert, R. J. *ed*. Loess: its distribution, geology and soils. Rotterdam, A. A. Balkema. P. 161.

Petit, J-R.; Briat, M.; Royer, A. 1981: Ice age aerosol content from East Antarctic ice core samples and past wind strength. *Nature 293*: 391–394.

Rosgen, D. L. 1996: Applied river morphology. Pagosa Springs, Wildland Hydrology. 390 p.

Shepherd, M. J.; Price, D. M. 1990: Thermoluminescence dating of Late Quaternary dune sand: Manawatu/Horowhenua area, New Zealand: a comparison with ^{14}C age determinations. *New Zealand Journal of Geology and Geophysics 33*: 535–539.

Sigleo, W. R.; Colhoun, W. A. 1982: Terrestrial dunes, man and the late Quaternary environment in southern Tasmania. *Palaeogeography, Palaeoclimatology, Palaeoecology 39*: 87–121.

Suggate, R. P. 1990: Late Quaternary and Pliocene glaciations of New Zealand. *Quaternary Science Reviews 9*: 175–197.

Tasmania Department of Mines 1975: Geological atlas 1:250 000. Hobart, Department of Mines.

Tasmania Department of Mines 1976: Geological atlas 1:250 000. Port Davey, Hobart, Department of Mines.

van de Geer, G.; Fitzsimons, S. J.; Colhoun, E. A. 1989: Holocene to middle Last Glaciation vegetation history at Newall Creek, western Tasmania. *New Phytologist 111*: 549–558.

Wasson, R. J. 1983: Late Quaternary palaeoenvironments in the desert dunefields of Australia. Proceedings of the SASQUA International Symposium, Swaziland, 29 August–2 September 1983. Pp. 419–432.

Zonneveld, J. I. S. 1980: Tussen de bergen en de zee. Utrecht, Bohn, Scheltma & Holkema. 339 p.