– NOTE –

Radiocarbon Dates on Desiccated Moa (Dinornithiformes) Flesh from Inland Otago, New Zealand

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INTRODUCTION

Remains of soft tissues from extinct moa (Dinornithiformes), mainly desiccated sinew, muscle, skin, and feathers have been recovered rather seldom but their distribution is distinctive. Of 22 records of such finds accumulated between 1864 and 1987, 15 came from inland Otago (Anderson 1989: 67–68, Table 5.2), west of Dunedin in the southern South Island. Most were found in the late nineteenth century (13 records) in rockshelters, clefts or alluvial sediments and were regarded at the time as evidence of the survival of moa up to about AD 1800 (Hutton and Coughtrey 1874a). Improbable as this latter point is, it has not been tested by radiocarbon dating until now. Our particular impetus to do so, however, arises in another way. It is from research, again largely within inland Otago, on Maori artefacts which have also been made from various other kinds of soft tissues (flax, grasses, dog skin, bird skin, feathers etc.). A series of accelerator mass spectrometry (AMS) radiocarbon dates on these (Anderson *et al.*, n.d.) shows that they are exclusively late, post-AD 1650, which begs the question of why the age range does not extend across the full prehistoric period, beginning about AD 1300.

Leaving aside problems of small sample size, alternate propositions are: (1) that the age range represents a period of occupation in inland Otago when artefacts of these materials were first deposited or at least deposited much more often than earlier, and (2) that there was no significant temporal variation in the deposition of artefacts made from soft tissues and the age range is due to the selective survival of only the more recent artefacts of these kinds. Here we discuss this question by using the AMS radiocarbon ages of desiccated moa flesh from inland Otago to distinguish between the relative plausibility of the two propositions.

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RADIOCARBON DATING SAMPLES, METHODS AND RESULTS

At first sight it might seem that since moa were probably extinct by about AD 1500 the simple existence of surviving moa soft-tissue remains in inland Otago is sufficient evidence to falsify proposition (2) above. However, beyond a regional association with relatively low humidity, the circumstances of survival were not necessarily the same. The sites of artefactual soft-tissue survival are small clefts and shallow rockshelters offering protection from wind, rain and sun in most directions. The sites of moa soft-tissue discovery, where they are described adequately, include deep alluvial sediments (6–16 m deep) exposed by mining and dry, cool, wind-tunnel caves, as at Earnscleugh (Hutton and Coughtrey 1874b).

In order to make the comparison with sites of Maori soft-tissue artefact finds more exact we have chosen two suitable cases. These are, first, the desiccated foot (Figure 1) of *Dinornis novaezealandiae* (Otago Museum AV7476)

Figure 1. Part of a *Dinornis novaezealandiae* foot from Galloway (AV7476). Image courtesy of the Otago Museum.

Figure 2: *Megalapteryx didinus* leg (AV 7474), approx. 80 cm long. Image courtesy of the Otago Museum.

that came from a hole or cleft in schist, 1.8 m deep and open at the top, at Galloway Station, in 1874 (Hutton and Coughtrey 1874b). Second is the feathered leg (Figure 2) of *Megalapteryx didinus* (Otago Museum AV 7474) recovered from a small rockshelter under a block of schist in the upper Waikaia gorge about 1890 (Hamilton 1894).

A sample of 10 mm² of desiccated muscle and skin was excised from each specimen at the Otago Museum in 2009 and submitted to the Waikato Radiocarbon Laboratory for AMS radiocarbon dating. The samples were cleaned and ground and contaminants from older museum preservation procedures removed by soxhlet extraction with xylene, toluene, ether, acetone and distilled water (in an elutrope sequence). Samples were decalcified in 2% HCl, rinsed and dried, and then gelatinized at pH=3 with HCl at 90° for four hours. They were then ultrafiltered and freeze-dried. Isotopic analysis ($\delta^{15}N$, $\delta^{13}C$) and %C and %N on the gelatin were within expected ranges (see van Klinken 1999); C:N for Wk-27153 (*M. didinus*) was slightly elevated (Table 1) which might suggest a slight retention of impurities, but the gelatin was of good appearance.

The radiocarbon results (Table 1) show that the *D. novaezealandiae* foot (AV 7476) dates to the period, AD 1160–1280 (95.4% probability), immediately preceding or just overlapping human colonization. The *M. didinus* leg (AV 7474) was deposited within the early period of human occupation, AD 1300–1420 (95.4% probability). In fact it might have been from a hunted moa. There are no obvious butchery marks, but most of the muscle tissue is missing.

CONCLUSIONS

It follows from our initial discussion that if radiocarbon dates on soft tissues from moa overlapped the ages on perishable artefacts then they could not falsify proposition (2), and, incidentally, they would be of considerable intrinsic significance to estimating the age of moa extinction. Conversely, if the moa soft tissue dates were from the known period of moa-hunting, AD 1300–1500, or older, they could not falsify proposition (1). The latter is the case. These new data reinforce the improbability that preservation of moa soft tissues indicates late survival as opposed to distinctive environmental conditions. The same data suggest that if Maori artefacts made from soft tissues had been deposited in rockshelters or clefts at around the period of human colonization in the late 13th century then examples of them ought to have survived into the 19th century.

While, generally speaking, the concentration of per-

Table 1. *Results of AMS radiocarbon analysis of moa soft-tissue samples.*

OM No.	Lab. No.	$\delta^{15}N$	$\delta^{13}C$	%N	%C	C:N	Result BP	Calibrated age AD at 68.2%	Calibrated age AD at 95.4%
AV 7476	Wk-27152	6.8	–25.0	15.3	44.7	3.41	861±30	1205–1270	1160–1280
AV 7474	Wk-27153	8.3	–24.6	14.3	45.6	3.72	631±30	1315–1350 (44.2%) 1385–1405 (24%)	1300–1420

ishable artefacts to inland Otago is a function of the unusually dry climate there, that cannot explain their restriction to the late period of Maori prehistory, if our initial radiocarbon ages on desiccated moa flesh can be taken as representative of other such samples. An alternative explanation needs to be sought in the history of human use of the regional landscape (Anderson *et al*. n.d.). Moa-hunting sites in inland Otago were generally located in the open, where very low survival of perishable artefacts could be expected by exposure to sun, wind and rain, and where no moa soft tissues have survived. The inland region seems then to have been substantially abandoned following the extinction of moa and destruction of dry forest by AD 1500. When occupation resumed it may have been of a nature that found rockshelters and clefts more useful living sites and repositories than had earlier been the case, and they afforded greater protection. More radiocarbon dating of soft tissue remains of moa and examples of perishable material culture is needed to investigate this matter further.

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