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GRETCHEN RASCH, Lake Okareka, Rotorua



SHORT NOTE

Mummified moa remains from Mt Owen, northwest Nelson

Discovery: During the Christmas period 1986-87, members of the New Zealand Speleological Society were in northwest Nelson at Mt Owen, a marble mountain with well-developed karst features and many caves. On 7 January 1987, several cavers were excavating a route through a debris choke to link two caves, when they saw some moa remains. As muscle and skin tissues still adhered to the bones, Paul Wopereis spoke to me by radio.

This discovery was greeted with tremendous excitement at the National Museum of New Zealand because mummified remains of moas are very rare (10 previous records). On 8 January, J. A. Bartle, M. Strange and I went to the expedition's camp at Lake Bulmer on Mt Owen to examine the discovery for the National Museum.

The site: The mummified remains were found in Blowhole Cave where it connects with Whalesmouth Cavern, grid reference S26 c 934 947. The site is 1160 m a.s.l., which is about 100 m below the upper limit of forest and about 716 m below the summit of Mt Owen (1876 m).

The bones and tissues were disarticulated, scattered vertically through 2 m of rockfall debris. The tissue was attached only to those bones which were within the area swept by a strong draught of air between the two caves. Bones not in the draught had no tissue and were damp, and so the tissue had been preserved mainly by the drying effect of this air flow.

Skeletal remains: From characters outlined by Worthy (1988) the remains were identified as one *Megalapteryx didinus* (Owen). As the bones were fairly disassociated, several elements are lost, but those present include: right side of mandible; vertebrae including the atlas, axis, 10 cervical and 2 thoracic vertebrae; 5 thoracic ribs, 5 sternal ribs; left and right (LR) coracoid-scapulae; pelvis; LR tibiotarsi; LR fibulae; LR tarsometatarsi; complete complement of left phalanges, 9 R phalanges. A left femur found 10 m away from the other remains is regarded as belonging to this bird. Many tracheal rings were also present. The remains are now in the National Museum of New Zealand (catalogue number S 23808).

Tissue remains: Best preserved was the tarsometatarus and associated toes of the left foot (Fig. 1, 2). The pads and dorsal scales are present, although the horny claws of the terminal phalanges are missing. Much muscle tissue has been preserved on this tarsometatarus, but a large piece, showing scutes and feather pits, had become separated from the bone at the tibiotarsal

articulation. The phalanges of the right foot are free and bare of tissue, but much tissue remains on the proximal tarsometatarsus. The left tibiotarsus (sacrificed for 14C dating) and fibula have no preserved tissue adhering to them, but the equivalent right elements do. The pelvis has a large piece of skin on its dorsal surface, beneath which are muscle and connective tissues, particularly in the iliac region. Similar tissues are retained on some ribs and vertebrae. In addition many loose strips of muscle and two large muscle blocks were found separated from bones. A few fragmentary feathers were found with the loose tissue. Some of this tissue is being studied by G. Chambers of the Biochemistry Department, Victoria University of Wellington.



FIGURE 1 — Dorsal view of the left foot of Mt Owen specimen of M. didinus



FIGURE 2 — Ventral view of left foot of Mt Owen specimen of *M. didinus*

(Photos: National Museum)

Age of remains: The left tibiotarsus, fossil record number M28/f250, was radiocarbon dated, using bone collagen, by the Institute of Nuclear Sciences (DSIR). The age estimate, based on the Libby half-life ($T\frac{1}{2} = 5568$ yr) was 3350 \pm 70 yr BP. A sample of dried flesh was also dated, giving an age estimate, based on Libby ($T\frac{1}{2} = 5568$ yr), of 2120 \pm 310 yr BP. I consider the age based on bone collagen to be more reliable because bacterial contamination of the flesh may easily have introduced, even at low levels, modern carbon to the sample.

Size of the bird: Measurements of the long bones of the Mt Owen specimen are femur 231 mm, tibiotarsus 352 mm, tarsometatarsus 158 mm. The length ranges for bones of this species given by Worthy (1988) for specimens from Honeycomb Hill Cave, northwest Nelson, are femur 220-315 mm, tibiotarsus

340-490 mm, tarsometatarsus 150-220 mm. The Mt Owen specimen therefore was a small individual of the species.

Discussion: Although some 10 records of mummified moa tissue are known (Atholl Anderson, pers. comm. 1987), all are from the southern central region of the South Island. Only three records of *M. didinus* with preserved tissue were known previously (Oliver 1949): The type of the species, which is held in the British Museum (A16) and was collected from Oueenstown in 1876, is a complete skeleton with much tissue; a leg, consisting of articulated bones, muscle, skin and feathers, found in the Old Man Range, is now in the Otago Museum (C.68.2); and a skeleton with well-preserved tissue on the head and neck region, collected from the Cromwell area, is now in the National Museum of New Zealand (NMNZ \$400).

The excellent preservation of these three specimens led Oliver (1949) to say that the remains were "well under a thousand years old", resulting in the theory that this was the last species to become extinct (Oliver 1949: 151). However, a specimen of Anomalopteryx didiformis from Echo Valley near Lake Te Anau, now in the Southland Museum and Art Gallery, has preserved tissue (Forrest 1987). So have *Emeus* remains from Earnscleugh Cave (Coughtrey 1875), Dinornis remains from Knobby Range (Hutton 1875) and Tiger Hill (Hector 1871), and some bones of Pachyornis elephantopus from "Otago" (A. Anderson, pers. comm. 1987). Thus specimens of several species have preserved tissue. The common factor is not the species but the location: all are from caves in the dry central regions of Otago and Southland. Whereas these have been preserved by the dry atmosphere, the Mt Owen specimen was preserved by the drying action of air movement.

The Mt Owen specimen is the first moa with preserved tissue that has been dated. An age of over 3300 years for this specimen clearly shows that similar remains need not be young.

ACKNOWLEDGMENTS

The scientific acumen of the cavers who discovered these remains and brought them to the attention of the National Museum is greatly appreciated. Permission to retrieve the remains was given by New Zealand Forest Service, without whose co-operation this most significant find could not have been described or studied. The co-operation of P. Wopereis and C. Smith in examining and retrieving the specimens was essential to the outcome of this investigation. M. Strange took the photographs and, together with J. A. Bartle, excavated most of the recovered material.

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