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Cover photograph: Emu bones from Caveside (QVM.1974.2.5-7)

Tasmanian emu (*Dromaius novaehollandiae diemenensis*) at the Queen Victoria Museum and Art Gallery, Launceston: description, provenance, age

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Acknowledgements

This QVMAG Record is the result of a series of events which trace back to Paul Flood and Ross McNeill, who told me of some large bones they had seen in a cave at Mole Creek. The bones included those of an emu, one of the specimens discussed in this report. That discovery prompted a search of the QVMAG collection for other emus, of which we found several, including some of questionable provenance. At that stage the Plomley Foundation stepped in with funding to date a selection of specimens, underpinning the findings presented here. I thank the Plomely Foundation for its generosity. I also thank Senior Curator Natural Sciences, David Maynard, Collection Officer Natural Sciences, Tammy Gordon, and Library Coordinator, Andrew Parsons, for their advice and support throughout the project. I thank also the many other people at QVMAG and other institutions who assisted.

Abbreviations

AMS	accelerator mass spectrometry (radiocarbon dating)
ANU	Australian National University
BP	Before Present (by convention 'present' for dating purposes is 1/1/1950)
calAD	calibrated (years) anno Domini
calBC	calibrated (years) before Christ
cm	centimetres
DPIPWE	Department of Primary Industries, Parks, Water and Environment
g	grams
ka	kilo-annum (1000 years)
km	kilometres
m	metres
MIS	Marine Isotope Stage
mm	millimetres
QVMAG	Queen Victoria Museum and Art Gallery

Executive summary

In 2017 the Plomley Foundation allocated funding to review holdings of the Tasmanian emu (*Dromaius novaehollandiae diemenensis*) in the collection of the Queen Victoria Museum and Art Gallery, Launceston. The central purpose of the project was to clarify the age and provenance of the material, some of which had been regarded as doubtfully Tasmanian. In total, 27 lots of registered and unregistered material, comprising approximately 250 bones and bone fragments, minor pieces of eggshell and a dried tissue specimen, were examined. Associated documentation, including specimen labels, database entries, published and unpublished references, was consulted. Selected specimens were dated using the radiocarbon method. The results of this work are presented here as a descriptive inventory of emu holdings at QVMAG, with commentary on the condition, age and provenance of the material.

Some 13 registered lots comprising 17 bones in total are confirmed as Late Pleistocene in age, or are considered likely to be of this age. This material is older than 10 000 years BP and some of it may exceed the limits of radiocarbon dating (~50 000 years BP). Three samples of bone were dated at 37 909-33 764 calBC, 40 131-36 665 calBC and 40 799-37 138 calBC. These are the oldest dates yet obtained for emu in Tasmania. They sample the emu population at a time of colder climatic conditions and lower sea levels, when Bass Strait did not preclude mixing of emus in Tasmania and Victoria. The Pleistocene age material was collected in the Smithton area of north west Tasmania, from swamps and Scotchtown Cave.

In addition to bone, the Pleistocene age material includes three small fragments of emu eggshell. These were dated 15 839-15 421 calBC, providing hitherto disregarded evidence for the presence of emu on Flinders Island.

Some eight registered and unregistered lots comprising over 200 bones and bone fragments are confirmed as dating to the Holocene epoch, or are considered likely to be of this age. This material is younger than 10 000 years BP. Three samples of bone were dated 895-1021 calAD, 1021-1152 calAD and 1043-1223 calAD. The dated bones are from three partial emu skeletons collected in caves around Mole Creek in central northern Tasmania. These represent the most complete skeletal assemblages of Tasmanian emu in any public collection. A fourth, undated specimen comprises a single weathered femur fragment from Mt Cameron West on the far north west coast.

The most recent emu specimen in the collection is of broadly known age and dates to the mid-19th century. This is the celebrated dried emu leg from Ronald Campbell Gunn's residence at Newstead House in Launceston.

A further four registered and unregistered lots are confirmed as emu but may or may not be Tasmanian. Possibly, some of these are mainland emu material used for comparative purposes. An additional unregistered specimen was found not to be emu.

Summary details for the respective lots are provided in the table below.

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Lot name	QVMAG no.	Item	Locality	Age
Scotchtown Cave emu	QVM.2007.GFV.5	Phalanges (2)	Scotchtown Cave, Smithton	Late Pleistocene 37 909-33 764 calBC (SANU-56324)
	QVM.2005.GFV.45	Tibiotarsi (2)	Scotchtown Cave, Smithton	Late Pleistocene 40 799-37 138 calBC (SANU-56326)
	QVM.2006.GFV. 120	Tarsometatarsus	Scotchtown Cave, Smithton	Late Pleistocene 40 131-36 665 calBC (SANU-56325)
	QVM.2006.GFV. 121	Femur fragment	Scotchtown Cave, Smithton	Undated (probably Pleistocene)
Mowbray Swamp emu	QVM.1990.GFV.138	Tibiotarsus	Mowbray Swamp	Undated (probably Pleistocene)
	QVM.1990.GFV.139	Femur	Mowbray Swamp	Undated (probably Pleistocene)
	QVM.1990.GFV.140	Tarsometatarsus	Mowbray Swamp	Undated (probably Pleistocene)
	QVM.1990.GFV.141	Tarsometatarsus	Mowbray Swamp	Undated (probably Pleistocene)
	QVM.1990.GFV.142	Vertebra	Mowbray Swamp	Undated (probably Pleistocene)
	QVM.1990.GFV.143	Synsacrum	Mowbray Swamp	Undated (probably Pleistocene)
Irishtown tibiotarsus	QVM.1990.GFV.144	Tibiotarsus	Irishtown	Undated (probably Pleistocene)
Jackson egg	QVM.1965.GFV.0006	Eggshell fragments (3)	Flinders Island	Late Pleistocene 15 839-15 421 calBC (SANU-55616)
Mole Creek tibiotarsus	QVM.1991.GFV.54	Tibiotarsus	Mole Creek	Undated (probably Pleistocene)
Mole Creek (fractured) tibiotarsus	QVM.1489	Tibiotarsus	Unknown (recorded as Mole Creek)	Undated (probably recent)[1]
Dromaius Cave emu	QVM.2013.GFV.11	Tibiotarsus	Dromaius Cave, Mayberry	Holocene (see below)
	QVM.2016.2.008	Partial skeleton (approx. 70 total)	Dromaius Cave, Mayberry	1 021-1 152 calAD (SANU-49415)

[1] Here, 'recent' means post-European settlement of Australia. Strictly, this falls within the Holocene epoch (11,700 years BP to present).

Lot name	QVMAG no.	Item	Locality	Age
Caveside Emu A	QVM.1974.2.5	Synsacrum	Caveside-Mole Creek	Holocene (see below)
	QVM.1974.2.6	Femur	Caveside-Mole Creek	Holocene (see below)
	QVM.1974.2.7	Ischia (2)	Caveside-Mole Creek	Holocene (see below)
	QVM.1974.2.9	Skull and postcranial bones (approx. 66 total)	Caveside-Mole Creek	Holocene 1 043-1 223 calAD (SANU-56323)
Caveside Emu B	Unregistered (associated with QVM.1974.2.9)	Post cranial bones (approx. 90 in total)	Caveside-Mole Creek	Holocene 895-1 021 CALAD (sanu-52431)
Mt Cameron West femur	QVM.1993. GFV.146	Femur	Mt Cameron West	Unknown (probably Holocene)
Newstead House emu leg	QVM.2002.2.1	Dried lower leg	?St. Pauls Plains	19th century
Anomalous 'King Island' femur	Unregistered	Femur	Unknown (stored with King Island emu bones)	Undated (probably recent)
Anomalous 'King Island' tibiotarsus	QVM.1993.GFV.18	Tibiotarsus	Unknown (stored with King Island emu bones)	Undated (probably recent)
Pre-1897 femur	QVM.1480	Femur	Unknown	Undated (probably recent)
Sandy Cape putative emu vertebra	Unregistered	Vertebra (not emu)	Sandy Cape	Unknown (probably Holocene or recent)

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1.0 Introduction

The Tasmanian emu (*Dromaius novaehollandiae diemenensis*) is generally considered an island sub-species of the Australian emu (*Dromaius novaehollandiae novaehollandiae*). Dudley Le Souef (1856-1923) examined Tasmanian emu skins at the British Museum and then briefed the British Ornithologists' Club, which recorded the following in its bulletin for 1907-08:

> Mr D Le Souef informed the meeting that he had recently examined the collection of the skins of *Dromaeus* in the British Museum, and that among them he had discovered two specimens of the Tasmania emu, presented to that Museum by the late Ronald Gunn in 1838. These skins were of great interest, as the species was now extinct in Tasmania; and it was evident, from the specimens in the British Museum, that the emu of Tasmania was distinct from that of the continent (*Dromaeus novae-hollandiae*), having no black on the throat and fore-neck, these parts being entirely white. Mr Le Souef stated that the discovery of these facts confirmed the opinion which he had already expressed as to the distinctness of the two species of *Dromaeus*, based on a study of their eggs; and that the name *D. diemenensis*, which he had proposed for the Tasmanian emu, was now established by the examination of the skins above mentioned.

A century after this thrifty description, the taxonomic status of the putative Tasmanian species/sub-species is unresolved. Although accepted as a valid taxon under the Tasmanian *Threatened Species Protection Act 1995*, some bird systematists have reserved their position on this (Ridpath & Moreau 1966; Christidis & Boles 2008). Recently, DNA evidence suggests that Tasmanian emu genotype is indistinguishable from that of other island and mainland emu populations (Thomson *et al.* 2018). The degree of similarity or otherwise of the morphology (phenotype) is yet to be rigorously investigated.

A significant constraint on the discussion of possible differences in the morphology of the various emu populations is the dearth of comparative material from Tasmania. By comparison, King Island emu (*Dromaius ater*) is relatively well represented in public collections, chiefly because in the early years of the 20th century a considerable quantity of bones was collected from sandblows on the island. The unfortunate lack of specimens of Tasmanian emu was recognized by Le Souef's contemporary, Colonel. WV Legge, who expressed the view that 'it is most desirable that some search be instituted for the bones of our Tasmanian species' (Legge 1907). Little or nothing seems to have been done at the time.

Whereas the extinction of the thylacine was anticipated by zoos and museums, which responded by collecting and trading thylacine material, this had no direct parallel for Tasmanian emu. Tasmanian emus appear to have disappeared from the wild by the 1860s and it has been suggested that the last captive bird died in 1873 (Le Souef 1904). Apparent similarity of Tasmanian emu and mainland emu may be partly to blame for the lack of early interest in collecting specimens of the former. Gunn (1852) had commented on possibly subtle differences in external morphology, but it is possible that the general perception at that time was that the respective emu populations were essentially the same animal. An unknown number of mainland emus were imported to Tasmania for use as pets or ornamental birds in the early to mid-19th century.

Fortuitously, in the years leading up to and following the First World War, skeletal remains of emus were discovered during drainage works in the Smithton district of north west Tasmania. Some of these were deposited at QVMAG, thanks to the interest and enthusiasm of Museum director Herbert Hedley Scott. In the 1940s, additional emu bones were collected by Scott's son Eric from Scotchtown Cave near Smithton. Later again, QVMAG curator RH Green recovered two partial emu skeletons from a cave at Mole Creek in the 1970s. Over following decades

a few other dribs and drabs trickled in, including, notably, a third partial emu skeleton discovered by Ross McNeill and Paul Flood in a cave at Mole Creek in about 2005.

The net result of these episodic acquisitions by QVMAG is that no other public collection in Australia holds a comparable number of specimens of Tasmanian emu. A review of this material was considered timely because certain specimens had been considered dubiously Tasmanian, due to the possibility that they post-dated the importation of mainland birds to Tasmania and might be mainland escapees or hybrids. This issue was addressed during this study by radiocarbon dating relevant bones. The material is exclusively from northern Tasmania and Flinders Island (Figure 1).

One of the main challenges encountered during the project was to verify, as far as practicable, the provenance of items collected over a period of about 170 years, during which time collecting practices and museum protocols have changed profoundly. Whilst it was not possible to verify the provenance of all specimens, some progress was made. It is hoped that the results of this work will be a useful foundation for more informed scientific research and presentation of Tasmanian emu, this island's only representative of the ratite group of birds.

Locality data for Tasmanian emu material held by QVMAG is plotted in Figure 1. Note: This project did not address QVMAG holdings of King Island emu (*Dromaius ater*).

2.0 Methods and reporting protocol

The bulk of the work for this project was undertaken at the QVMAG Royal Park precinct over a five-day period in October 2017. All confirmed and potential Tasmanian emu specimens and associated card labels were examined and photographed. Relevant records from QVMAG specimen databases, including scanned copies of HH Scott's acquisitions ledger for the period 1911-1930 (henceforth referred to as the 'old register'), were provided by Natural Science Collection Officer Tammy Gordon.

In this report, direct transcriptions of handwritten card labels, letters, ledger entries and similar sources are identified by indented italic text or, for short quotes, by enclosing them in inverted commas. Occasional editorial insertions and clarifications are provided in regular text (not italics) in square brackets. For example, [blank] means no original entry. Transcriptions of printed card labels and headings are provided in regular text with original abbreviations and capitalisations.

Measurements quoted in the text were taken using digital display vernier calipers, where the measurement is 150 mm or less. These results are reported to the nearest 0.1 mm. Measurements in excess of 150 mm (e.g. long bones) were made by resting the bone on a steel rule on a flat surface. A carpenter's steel square placed upright against the respective ends of the bone was used to align one end with the zero and to determine its length on the rule. The results are reported to 0.5 mm, corresponding to the gradations on the rule.

Samples for radiocarbon dating of bone were removed using a 'Dremel' tool. For larger bones, a small portion of bone (~500 mg) was excised using a cutting disk, whereas for smaller bones a hole was drilled into the bone whilst collecting the resultant powder. Eggshell was sampled by breaking off a small portion (~20 mg) after scoring the cuticle with a scalpel blade.

Radiocarbon dating was undertaken at the Australian National University radiocarbon dating laboratory, Canberra. The dating procedure for bone (Fallon *et al.* 2010) includes chemical pretreatment to extract and clean collagen according to an ultrafiltration protocol.[2] Acid is then used to remove the bone mineral and any exogenous carbonates,

[2] Source: http://rses.anu.edu.au/services/anu-radiocarbon-laboratory/laboratory-methods (downloaded 10/7/2018).

alkali is used to remove humic substances, and the sample is acidified to dissolve carbonate. The sample is then gelatinised by heating in a dilute acid, turning the insoluble collagen into soluble gelatin allowing large insoluble particles to be removed with a filter and small soluble molecules to be removed with an ultrafilter. Pretreatment of shell involves removing any soft white recrystallised material with a drill and then washing in dilute acid to remove at least 10% of its weight.

On advice from the laboratory, dating was not attempted on specimens coated in varnish as a museum procedure or on specimens which had been immersed for long periods in carbon-rich water (e.g. water-logged peat), due to the likelihood of sample contamination by extraneous carbon. This precluded dating of several important specimens from the Smithton area and one from Mole Creek. Furthermore, dating was considered to serve no purpose in the absence of reasonable certainty regarding provenance, such as whether the specimen was collected in Tasmania. Several specimens were excluded on this basis. One sample submitted for dating was rejected by the laboratory because of insufficient collagen (QVM.2005.GFV.45B).

Radiocarbon dating results received from the laboratory were calibrated to correct for global variations in carbon isotopes over geological time using the University of Oxford's online software OxCal 4.3.2 (Bronk Ramsay 2017). The calibration curve SHCal13 was applied (Hogg *et al.* 2013). Uncalibrated radiocarbon dates are reported in years before present (BP). By convention, radiocarbon BP is taken to be 1/1/1950. Calibrated radiocarbon dates are reported as a range at 95.4% probability, meaning that there is a 95.4% probability that the true age of the specimen falls within the range given. These dates are reported as calBC or calAD, which can be read as normal historical years. Radiocarbon dating is generally considered unreliable beyond 50 ka. Dates older than this are typically described as infinite dates.

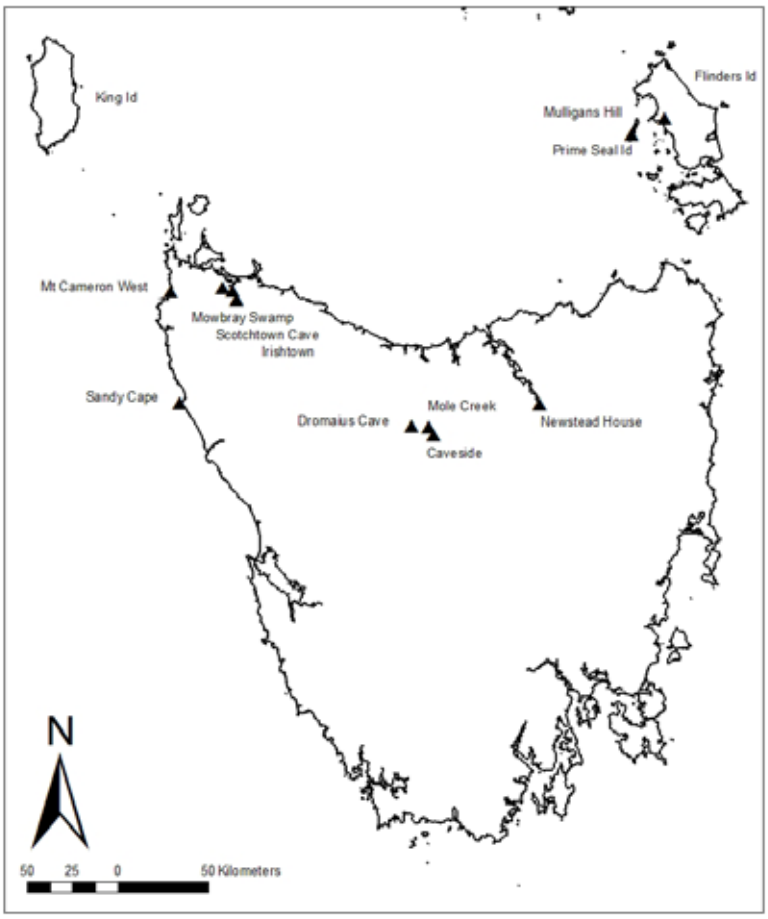


Figure 1. Map of Tasmania showing localities of emu fossil collections held by QVMAG.

3.0 Inventory of specimens

3.1 Scotchtown Cave emu bones (QVM.2005.GFV.45, QVM.2006.GFV.120-121, QVM.2007.GFV.5)

Plate 1. Scotchtown Cave tibiotarsi (QVM.2005.GFV.45). The radiocarbon date was obtained from the upper tibiotarsus.

Plate 2. Scotchtown Cave tarsometatarsus (QVM.2006.GFV.120).

Plate 3. Scotchtown Cave femur fragment (QVM.2006.GFV.121).

Plate 4. Scotchtown Cave phalanges (QVM.2007.GFV.5). The radiocarbon date was obtained from the larger bone.

Item(s)

2 x partial left tibiotarsi (QVM.2005.GFV.45)
1 x partial right tarsometatarsus (QVM.2006.GFV.120)
1 x right femur fragment (QVM.2006.GFV.121)
2 x phalanges (QVM.2007.GFV.5)

Provenance data

Card labels and the QVMAG digital database indicate that this set of specimens was collected by EOG Scott from Scotchtown Cave near Smithton in 1942. The database notes the following:

> Location described by EOG Scott as: "apparently a filled-in cave in a limestone formation opened up by Mr W Archer when quarrying in the northern face of a hill (approximately 300 yards long approximately 20 yards high) on W Ollington's property, near Smithton, Tasmania Gate of property 3.2 miles southerly from Smithton Council Chambers; March 1942."

The discovery of the rich bone bed exposed by quarrying at Scotchtown Cave, and Scott's role in salvaging material prior to destruction of the site by further quarrying, is discussed by Wylie (2013).

Description

Tibiotarsi (QVM.2005.GFV.45)

The two tibiotarsi fragments are both distal ends of bones fractured across the shafts (Plate 1). The specimens are 150 mm and 129 mm long, respectively. The form of the fractures is spiral in both cases. On the longer fragment the fracture appears somewhat fresh, exposing whitish chalky bone—possibly, this fracture occurred during or after collection. The fracture on the other bone bears traces of sediment, implying that it was already broken when exhumed from the cave. The distal ends of both bones are abraded to the point whereby most of their articular surfaces are lost. The bones are pale creamy-brown in colour with patchy black staining. Traces of reddish-brown sediment can be observed on both tibiotarsi. Prior to this study, a small rectangular piece of bone had been removed from towards the distal end of the shaft on the longer fragment.

Tarsometatarsus (QVM.2006.GFV.120)

The shaft is fractured off cleanly 88 mm above the distal end (Plate 2). The T2 and T4 trochleae are missing and the remaining central trochlea is truncated towards the distal end. The bone is whitish in colour with a hard, chalky aspect. The surface is superficially marked in several places, in a manner suggestive of contact with a metal tool during excavation. The interior cavity of the bone is filled with dark brown material, likely a remnant of the cave fill where it was found. Flaky translucent coating on portions of the bone suggests local application of varnish or similar product.

Femur (QVM.2006.GFV.121)

This minor fragment is 60 mm in diameter, comprising a portion of the articular surface at the proximal end of the bone (Plate 3). The colour is yellowish-brown and the bone lacks the hard, chalky aspect of some other Scotchtown Cave fossils. Traces of brown soil are lodged in the pores of exposed cancellous bone; however, the majority of pores are free of sediment. The bone is coated in varnish or similar product.

Phalanges (QVM.2007.GFV.5)

The two toe bones are in good condition with no fractures or significant abrasion (Plate 4). One of the two is substantially larger than the other (length 55.5 versus 42.0 mm; weight 12.0 versus 5.3 g) and may be the first knuckle on the large central toe (i.e. DIII P1). The bones are creamy-whitish in colour with traces of reddish-brown sediment. The smaller phalange appears to have been coated with varnish or similar product; the larger appears uncoated.

Dating

Four samples were submitted for radiocarbon dating. Three returned results:

Sample	Laboratory code	Radiocarbon age	Calibrated age
QVM.2007.GFV.5 phalange	SANU-56324	33 109±681 BP	37 909-33 764 calBC
QVM.2006.GFV.120 tarsometatarsus	SANU-56325	35 793±935 BP	40 131-36 665 calBC
QVM.2005.GFV.45 tibiotarsus	SANU-56326	36 517±1024 BP	40 799-37 138 calBC

The laboratory report noted that the result for QVM.2006.GFV.120 (tarsometatarsus) should be treated with caution, due to low mass and percentage collagen yield; however, the stable isotope and carbon-to-nitrogen ratios were considered adequate. For QVM.2005.GFV.45 (tibiotarsus), the report noted that this also should be treated with caution. In this case collagen was not ultrafiltered, as low yield was suspected during chemistry. Again, despite low mass and percentage collagen yield, the stable isotope and carbon-to-nitrogen ratios were considered adequate. No date was obtained on tibiotarsus QVM.2005.GFV.45B (the shorter and more robust of the two tibiotarsi), due to poor preservation of bone collagen.

Discussion

Scotchtown Cave yielded one of the richest and most diverse Late Quaternary vertebrate fossil assemblages in Tasmania. Unfortunately, the cave was destroyed and only limited information is available on the nature of the bone deposit. A species list is provided by Gill and Banks (1956), who state that the cave contained an average depth of two feet (~0.6 m) of chocolate-coloured cave earth with numerous well-preserved bones. These authors interpret the site as a carnivore den, possibly because three large carnivore taxa were recorded there (see Gill 1953). Their species list for Scotchtown Cave does not record the presence of emu, suggesting that this was not recognised until the collection was examined more recently by QVMAG Collection Officer Craig Reid, who registered the specimens.

The three radiocarbon dates on Scotchtown Cave emu material cluster together and their calibrated ranges overlap, indicating that they are essentially contemporaneous. At ~34-41 ka, these are the oldest direct evidence for emu in Tasmania. The dates may in fact refer to a single emu, although the presence in the cave of two right tibiotarsi, one of which could not be dated, indicates that at least two emus died there. The dated emu or emus lived during MIS3, at time when global climatic conditions were becoming progressively colder leading up to the Last Glacial Maximum (MIS2).

Other bones from Scotchtown Cave are potentially older than the radiocarbon results reported here. Turney *et al.* (2008) cite a luminescence date of 56±4 ka for Scotchtown Cave sediment from material at QVMAG. Also, the presence of megafauna at this site suggests considerable antiquity, as megafauna is not known to have survived in Tasmania beyond about 45 ka BP or shortly after (Turney *et al.* 2008; Cosgrove *et al.* 2010; Gillespie *et al.* 2012).

3.2 Mowbray Swamp emu bones (QVM.1990.GFV.138-143)

Plate 5. Mowbray Swamp emu bones (QVM.1990.GFV.138-143) found by T Edwards and sold to the museum in 1924.

Item(s)

1 x synsacrum
1 x right femur
1 x right tibiotarsus
2 x tibiotarsi (pair)
1 x cervical vertebra

Provenance data

Card labels in HH Scott's hand, and entries in the old register for acquisition 1488, indicate that these specimens were purchased from T Edwards in October 1924 (Appendix). The locality is given as Mowbray Swamp near Smithton.

The bones are the subject of a brief article by Scott (1931), who reported:

> THE SMITHTON FIND.
>
> From an old contributor to our palaeontological series of vertebrate remains – Mr. Tom Edwards – there came to us in October, 1924, a synsacrum, 1 femur, 1 tibio-tarsus, 2 tarso-metatarsi, and 1 cervical vertebra of a Tasmanian Emu recovered from Mowbray Swamp. These were all associated bones absolutely mature, using the word in its true osteological sense – as applicable only to bones whose external texture manifest the highest muscular development and the super-ossification incidental thereto. Everything considered, and having due reference to published notes, I consider this bird to have been a female.

Scott went on to discuss aspects of the morphology of the bones.

The specific location and context of the bones on discovery is not recorded. It is likely that they were unearthed during the construction of drains to facilitate farming on hitherto swampy country, as per other vertebrate fossils collected in Smithton area in the early decades of the 20th century. Their darkly stained condition is comparable with that of these other fossils, including celebrated skeletons of '*Nototherium*' (*Zygomaturus*), which were found in ditches excavated into the characteristically peaty deposits of the area. Scott had previously purchased fossil material from T Edwards in 1915 (Scott 1915), noting in the Museum register that these bones were collected from a drain at Mowbray Swamp.

A map by Gill and Banks (1956, p. 16) shows a feature named 'Edward's Spring' off Mella Road, raising the possibility that T Edwards or his family owned the spring and found the emu fossil nearby. The spring is about 2 km north of where *Zygomaturus* was found on Lovell's Farm. The presence of the spring raises the further possibility that the bones were found in a spring mound deposit, as such features have yielded well-preserved vertebrate fossils elsewhere in the Smithton area (Banks *et al.* 1976; Horton & Murray 1980).

Additional evidence concerning the stratigraphic context of the Mowbray Swamp emu is available from the presence of sandy materials and tiny shell fossils lodged in crevices on the specimens. This can be observed most clearly on the synsacrum, where a number of shells are lodged within orifices on the ventral side of the bone. The shells have not been examined in detail and no identifications are reported here. However, it seems likely that these are freshwater snails, corroborating the inference that the fossil was preserved in a swamp or spring. The presence of fossils of freshwater molluscs, typically found interbedded with peats, marls and sands, has been reported from other sites around Smithton, including vertebrate fossil localities (Gill & Banks 1956; Banks *et al.* 1976; Colhoun *et al.* 1982).

Description

All the bones are darkly stained, presumably due to immersion in water-saturated peaty soil (Plate 5). The colour is mostly beige or brown—the tibiotarsus and synsacrum are noticeably darker than the other bones. All are heavily coated in varnish as a museum treatment.

Femur (QVM.1990.GFV.139)

The bone is complete except for moderate abrasion at the proximal end and lesser abrasion and minor cracks at the distal articular surface. A small cluster of granular pinkish clasts 2-4 mm in diameter can be observed lodged in a hollow at the distal end.

Tibiotarsus (QVM.1990.GFV.138)

Minor abrasion can be observed at both ends of the bone. Fine sand was noted falling out of crevices during handling.

Tarsometatarsi (QVM.1990.GFV.140-141)

The two tarsometatarsi are in excellent condition, being complete except for minor abrasion at their proximal ends. Unlike several other tarsometatarsi in the collection, the trochleae are intact.

Vertebra (QVM.1990.GFV.142)

The bone is somewhat abraded and has lost the lateral spine on one side.

Synsacrum (QVM.1990.GFV.143)

The synsacrum has suffered considerable damage. The fragile ischia and pubis bones are missing, as are portions of the dorsal ridge and the proximal and distal ends. Crevices on the underside of the bone are occupied by small mollusc shells up to about 4 mm diameter.

Dating

Smithton area swamp material was not selected for dating due to the risk that it is contaminated by younger carbon during prolonged immersion in water-logged soil and the more recent application of varnish.

Discussion

As discussed above, the Mowbray Swamp emu was probably collected from the peaty soil of a former swamp or spring mound. In the Smithton area, soils of this type have formed over Last Interglacial age marine sands and are considered Pleistocene in age (Gill & Banks 1956). Although undated, the fossil is therefore almost certainly

also of Pleistocene age and, together with the Irishtown tibiotarsus (QVM.1990.GFV.144), may be of greater antiquity than most or all other known Tasmanian emu fossils.

Gill and Banks (1956, p. 27) obtained infinite radiocarbon dates (>50,000 ka) for sediments associated with Mowbray Swamp marsupial fossils, as did Banks *et al.* (1976) for wood associated with a fossil of the large marsupial *Palorchestes* at Pulbeena. Gillespie *et al.* (2012, 2015) obtained finite radiocarbon dates on bone collagen from Mowbray swamp fossils, but considered these unreliable due to contamination. Evidence from a combination of pollen, fossil invertebrates and stratigraphy has been used to infer the character of the Late Pleistocene vegetation and environment of the Smithton area in the during the period when the Irishtown emu probably lived (Gill & Banks 1956; Banks *et al.* 1976; van de Geer *et al.* 1986; Colhoun *et al.* 1982).

3.3 Irishtown tibiotarsus (QVM.1990.GFV.144)

Plate 6. Irishtown tibiotarsus (QVM.1990.GFV.144).

Item(s)

1 x left tibiotarsus

Provenance data

The tibiotarsus, originally allocated number 1487 in the QVMAG collection, now QVM.1990.GFV.144, is recorded both as Smithton and Irishtown in HH Scott's original handwritten card labels. His entry in the old register is silent on locality (Appendix), whereas a short article published by Scott (1923) gives the locality as 'Irish Town' [sic]. The current QVMAG database lists the locality as Irishtown. There seems little doubt that the specific locality where the bones were collected is at, or near, the small hamlet of Irishtown, 8 km south of the regional centre, which is Smithton.

A handwritten display card by Scott states that the bone was found in a swamp by Mr EH Fenton in 1920 and donated to the Museum by Fenton and Mr Willes on 24/8/1920. Scott (1923) later published a brief account of the find:

> THE EXTINCT TASMANIAN EMU.
>
> Of the extinct Tasmanian Emu I have to record the finding of a tibio-tarsus, which was recovered from the Pleistocene swamp at Irish Town, N.W. Tasmania, during some draining operations carried out in 1920. Our Museum is indebted to Mr Willes, of this city, and to the finder of the bone—Mr E H Fenton—for this interesting specimen, which, from its long immersion in the swamp, must be, beyond all doubt, the leg-bone of a Tasmanian Emu. Unfortunately, the bone is broken at its proximal end, the shaft terminating 44 mm. below the femoral articular platform. If the amount named be allowed for, it exactly agrees with a second similar-sized bone to be dealt with presently.

Scott went on to present measurements of the bone and to compare these with the Newstead House emu leg (QVM.2002.2.1).

Description

The proximal end of the bone is broken and/or eroded away, shortening the overall length by several centimetres—Scott (1923) estimated

that about 75 mm of the length was missing. The distal end is fairly intact but also somewhat abraded. The bone on the shaft is cracked superficially and some few hundred microns of outer bone has flaked off over a considerable portion of the surface. The colour is dark brown to beige and noticeably lighter where the surficial bone has exfoliated off. The bone is heavily coated in varnish (Plate 6).

Dating

Smithton area swamp material was not selected for dating due to the risk of contamination by younger carbon during prolonged immersion in water-logged soil and the more recent application of varnish.

Discussion

This bone bears comparison to the Mowbray Swamp emu (QVM.1990.GFV.139)—both specimens are darkly stained by organic compounds suggestive of prolonged immersion in carbon-rich soil water. Their age may be broadly contemporaneous with that of other Mowbray Swamp vertebrate fossils including megafauna (i.e. Late Pleistocene).

The probable antiquity of the specimen seems not to have been appreciated at first by curator Scott. His card label states that 'the bone came from a fully adult bird, and was apparently buried in the swamp for 50 years at least'. As noted above (see Mowbray Swamp emu QVM.1990.GFV.139), more recent estimates of the age of fossil bones from the Smithton area differ from Scott's initial assessment by three orders of magnitude. Scott (1923) later presented a more informed assessment of the age of the specimen:

> The point to be noted here is that the bone is beyond all question of Tasmanian origin, since its inclusion into the peaty matrix of the swamp was certainly at a much earlier date than that at which any mainland Emus were imported into Tasmania, and therefore *it stands as the earliest known specimen of a Tasmanian tibio-tarsal shaft.* [emphasis added]

Although presently undated, it is indeed possible that, together with the Mowbray Swamp emu, these are the most ancient fossils of Tasmanian emu collected to date.

3.4 Jackson egg (QVM.1965.GFV.0006)

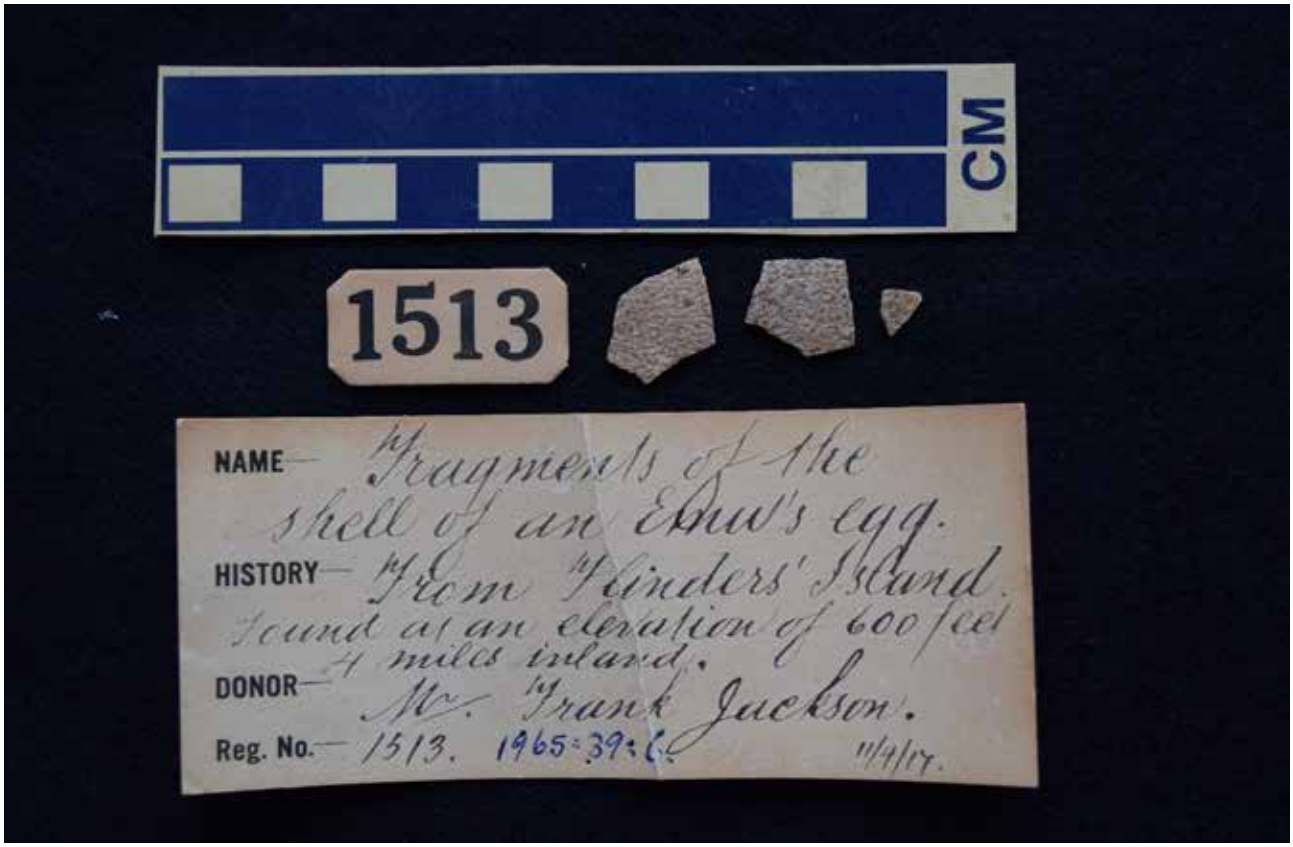


Plate 7. The Jackson egg – three fragments of emu eggshell found on Flinders Island by Frank Jackson in 1917, with original label in HH Scott's hand.

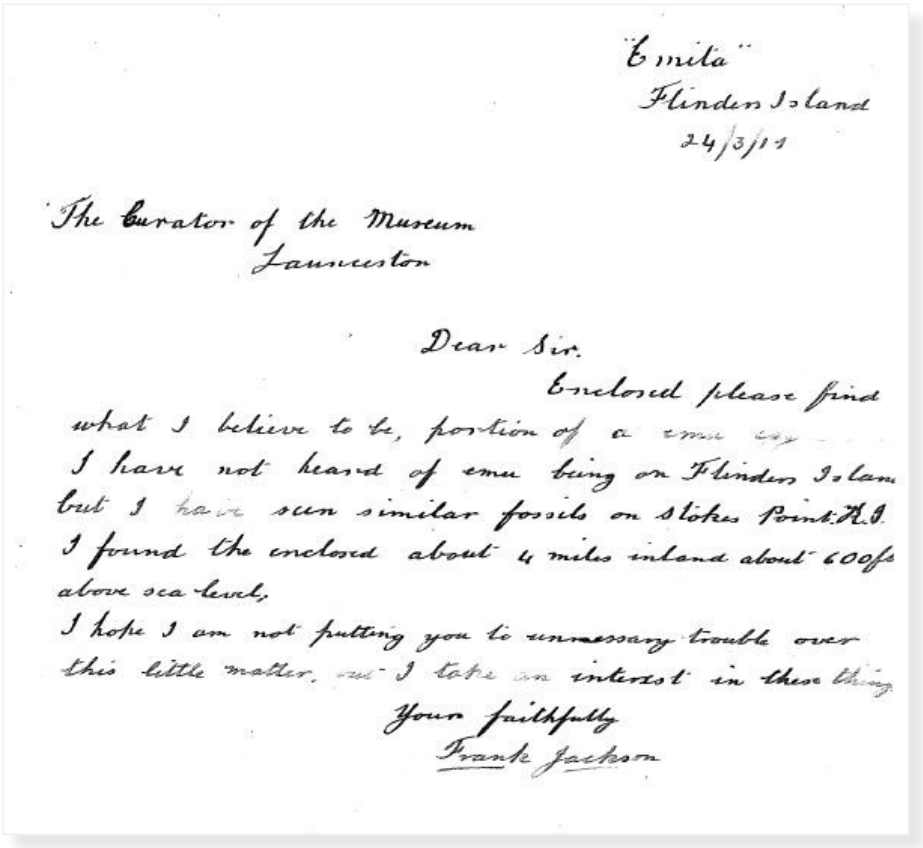
Items

3 x fragments of eggshell

Provenance data

The small fragments of eggshell referred to here as the Jackson egg were listed by HH Scott on line 1513 of the old register. That entry and an original card label give the locality as Flinders Island, the finder as Mr Frank Jackson and the date of the acquisition as 11/4/1917 (Appendix).

The key reference to the finding of the egg is a succinct handwritten note by Jackson dated 24/3/1917 (Plate 8). The note is held by QVMAG and presumably accompanied the specimen on arrival at the Museum. The locality is specified somewhat precisely as 4 miles (6.4 km) inland and about 600 feet (180 m) above sea level. Jackson stated that he believed the sample to be a portion of emu egg and that he had seen similar fossils at Stokes Point on King Island. The reference to 'fossil' assumes particular significance in the light of the radiocarbon result discussed below.



"Emita"
Flinders Island
24/3/17

The Curator of the Museum
Launceston

Dear Sir.

Enclosed please find what I believe to be, portion of a emu egg. I have not heard of emu being on Flinders Island but I have seen similar fossils on Stokes Point R.I. I found the enclosed about 4 miles inland about 600ft above sea-level.

I hope I am not putting you to unnecessary trouble over this little matter, as I take an interest in these things.

Yours faithfully
Frank Jackson

Plate 8. Frank Jackson's letter of 24/3/1917 to the Queen Victoria Museum, Launceston.

Description

The Jackson egg comprises three angular fragments of eggshell (Plate 7). The two larger pieces are compact polygonal shards measuring 17.3 x 13.5 mm and 15.7 x 14.8 mm across their main axes, while the third piece is broadly triangular and measures 6.7 x 4.6 mm. In total, the sample comprises about two square centimeters of shell. The combined weight prior to sampling was 0.68 g, the two larger being 0.32 and 0.34 g and the other 0.04 g. The edges of the fragments do not obviously match with each other and apparently derive from non-contiguous portions of eggshell.

The external cuticle displays the diagnostic knobbly texture of emu egg. The colour is pale yellow-brown on the exterior surface and creamy white on the interior surface. Under low magnification, the outer cuticle has a bleached pearly aspect interspersed with irregular patches of whitish opaque material (Plate 9). The whitish component is interpreted as a secondary mineral coating rather than an original feature of the egg.

Dating

A sample of the smallest piece of the eggshell was submitted for radiocarbon dating and returned a result of 14 458±46 BP (SANU-55616). This translates to 15 839-15 421 calBC.

Discussion

The original identification of the eggshell as that of emu by Frank Jackson, which HH Scott concurred with, is correct based on the texture of the outer cuticle, which cannot be confused with that of any other Australian bird (Beruldsen 1980). Whilst the colour is yellowish-brown rather than the characteristic dark green of emu eggshell, this is consistent with the tendency of emu eggs to bleach rapidly (Williams & Vickers-Rich 1991). Eggshell thickness (1.04-1.11 mm) compares closely with the value of 1.1 mm for Australian emu cited by Williams (1981). This considerably exceeds eggshell thickness in the majority of large birds and is diagnostic for emu and large extinct ratites (Williams & Vickers-Rich 1991).

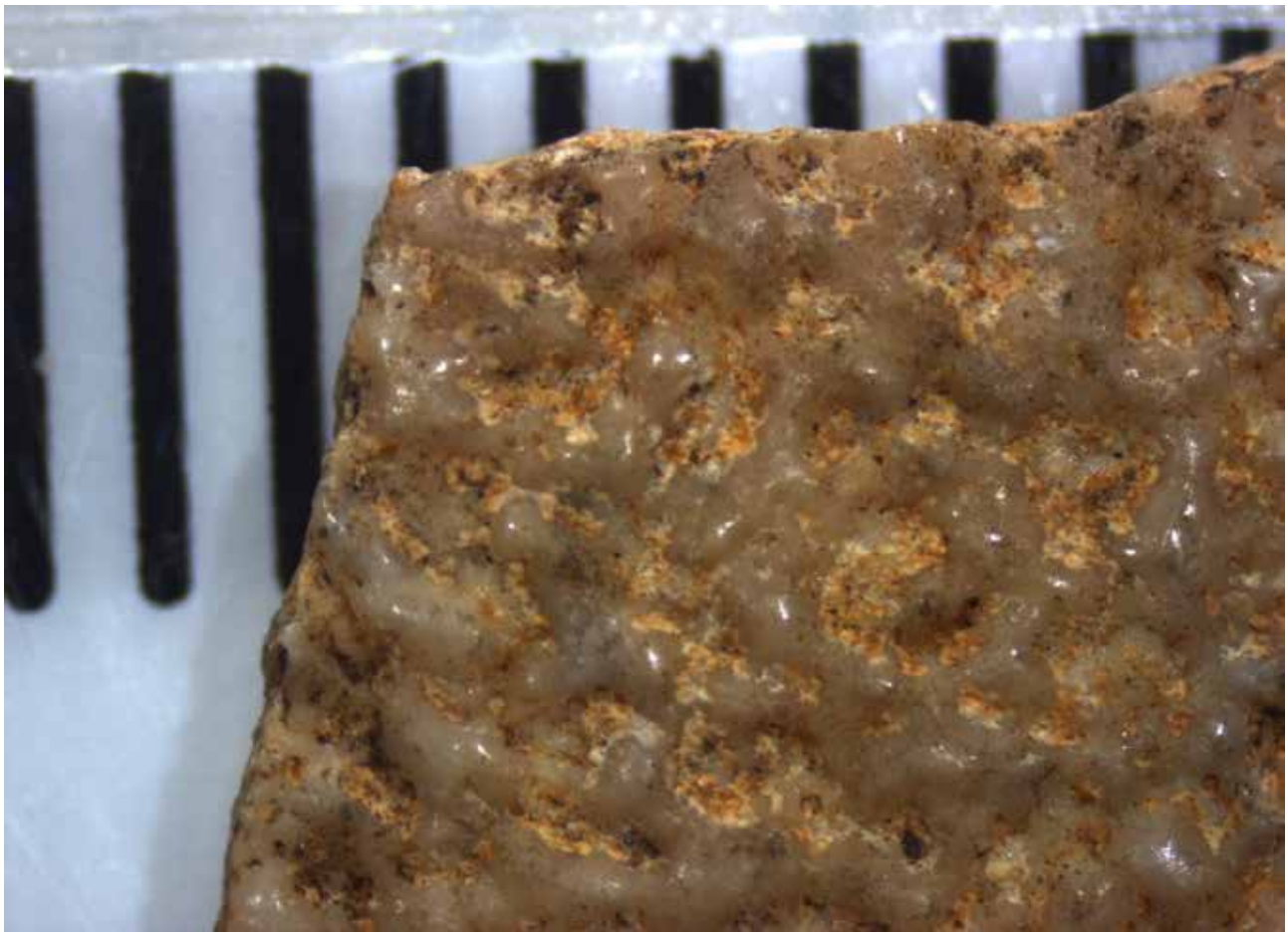


Plate 9. Outer cuticle of the Jackson egg under low magnification, illustrating the bleached colouration and traces of presumed mineral coating. The scale is in millimetres.

Scott exhibited the Jackson egg at a reading to the Royal Society of Tasmania in 1923, during which he discussed emu material from King Island and the Tasmanian mainland. An account of the meeting by *The Examiner* newspaper referred to 'a scrap of egg shell that as far as was known was the only material evidence of the emu having ranged on Flinders Island' (Anon 1923). Curiously, Scott (1923) did not refer to the eggshell in his published version of the presentation.

The eggshell was not acknowledged in the scientific literature until four decades later, when Jeanette Hope mentioned it briefly in her PhD thesis on island biogeography in Bass Strait, dismissing the find as a fragment of an ornamental emu egg taken to Flinders Island by a settler (Hope 1969, p. 232). Hope later published a summary paper which did not recognise any record of emu on Flinders Island (Hope 1973). Serventy (1967) was aware that Frank Jackson claimed to have found emu eggshell on Flinders Island, stating incorrectly that museum collections held no specimens of emu from Bass Strait islands other than King Island. Emu is not listed in *The Birds of Flinders Island* by Green (1969), although this reference focuses on extant species. Sutherland and Kershaw (1971) acknowledged Jackson's finding of emu eggshell on Flinders Island but expressed doubt regarding the provenance. Flinders Island is not referenced in an otherwise comprehensive reviews of fossil emus by Patterson and Rich (1987) or Australian fossil birds by Baird (1991). More recently, Hume *et al.* (2018) referenced the Jackson egg as possible evidence for a Flinders Island species or subspecies of emu.

The calibrated radiocarbon date—15 839-15 421 calBC (SANU-55616)—demonstrates conclusively that the Jackson is not recent eggshell and cannot be a fragment of ornamental egg. Rather, it is a Late Pleistocene fossil preserved from MIS2 following the Last Glacial Maximum. This was a time of rapid

climatic amelioration when Flinders Island became isolated from mainland Australia and Tasmania by rising post-glacial seas.

The radiocarbon result resonates with the words of the finder, Frank Jackson, who referred to the specimen as a *fossil*. Jackson was a keen amateur naturalist and an astute observer who searched for evidence of former Aboriginal occupation on Flinders Island. Whilst we know only that Jackson found the specimen at elevation several kilometres inland of Emita township, it seems possible that he chanced upon it whilst searching the ground for Aboriginal stone tools.

Unlike on King Island, emus were not present on Flinders Island or other parts of the Furneaux Group when Europeans arrived there at the turn of the 18th century. Fossil evidence for their presence in the Furneaux Group has previously been recorded from Prime Seal Island, 6 km west of Flinders Island. Here, a stratified human occupation deposit at Mannalargenna Cave was found to contain abundant emu eggshell within layers bracketed by radiocarbon dates of 20.6 and 14.3 ka BP (Brown 1993). Emu eggshell was not detected within the final circa 6 ka of occupation deposit, which ceased about 8 ka BP, suggesting either that emus were no longer taken as food or they had become scarce or extinct at about 14 ka BP. Emu is not recorded from bone-bearing sediment at Ranga Cave on Flinders Island, which samples Furneaux Group fauna of an undefined period prior to about 8 ka BP (Hope 1969), or from the Palana sandblow, which samples it more recently (Hope 1973).

In summary, the Jackson egg provides evidence for the presence of Late Pleistocene emu on Flinders Island. The date on this specimen broadly corroborates the age of the youngest dated layers containing emu shell at Mannalargenna Cave on Prime Seal Island, constraining the timing of extinction of emu in the Furneaux Group to circa 14-15 ka BP or later.

3.5 Mole Creek tibiotarsus (QVM.1991.GFV.54)

Plate 10. Mole Creek tibiotarsus (QVM.1991.GFV.54).

Item(s)

1 x right tibiotarsus

Provenance data

The locality for the tibiotarsus, specimen 1489 in the old Museum register, is listed as 'Sassafras Farm, Mole Creek', or simply 'Mole Creek' on card labels and the current Museum database. The finder is listed as EW Clarke and the acquisition data as 13/3/1931. The specimen is briefly described in a paper by Scott (1931):

> THE MOLE CREEK FIND. From Mr E. W. Clarke, of Mole Creek, we have received a tibio-tarsus of the Tasmanian Emu. This falls into line with our conceptions of the female bird. It is shorter, but mutilation in the item of post-mortem rubbing and grinding accounts for about 12 mm., the remainder coming within the range of individual variation.

Reference to Sassafras Farm in the old register could refer to one of several farms on Sassafras Creek, west of Mole Creek township. It is not stated that the bone was collected in a cave, although pitfall caves are present in the vicinity of Sassafras Creek and three other lots of emu bones have been found in caves in the Mole Creek area.

It may be relevant that the old register contains an entry for marsupial bones collected in a cave at Mole Creek by EC Clarke and received by Scott in December 1914. Scott referred to EC Clarke in a published paper of 1931, stating that Clarke had been 'induced to collect osteological specimens from such caves as were immediately available to him'. The paper goes on to state that Clarke's collection included 'almost every animal living in Tasmania to-day' (sic). Based on their different initials, between 1914 and 1931 Scott received bones from two Clarkes at Mole Creek (EC Clarke and EW Clarke); alternatively, he may have dealt with one Clarke but on occasion wrongly recorded his second initial.

Whereas the Mole Creek locality suggests that the tibiotarsus was found in a cave, cave bones typically exhibit yellow, beige or reddish colours. In contrast, the dark brown colour of this bone bears comparison with Mowbray Swamp fossils, which are stained by organic-rich soil water. Interestingly, the general colour and size of the Mole Creek (right) tibiotarsus implies that it, and the Mowbray Swamp (left) tibiotarsus (QVM.1990.GFV.138), could be taken as a matching pair. In fact, beyond their superficial similarity, there is no evidence to suggest that the two lots of specimens are related.

It is possible that the Mole Creek tibiotarsus was unearthed during an excavation—for example, construction of a drainage ditch. The country east of Mole Creek was formerly known as the Western Marshes and extensive drains were dug between Ugbrook and Caveside (which

is several kilometres from Sassafras Creek). Burial in waterlogged soil could account for the dark colouration; on the other hand, the bone is heavily coated with varnish or similar product, which may have altered or concealed the original colour.

It is important to note that QVMAG holds a second emu tibiotarsus attributed to Clarke from Mole Creek in 1931. The second tibiotarsus—referred to in this report as Mole Creek (fractured) tibiotarsus ('QVM.1489')—is discussed in the following chapter.

Description

The bone is abraded at the proximal ends, exposing the spongey interior, but otherwise complete (Plate 10). A significant crack extends along and partly around the shaft at the proximal end. The colour is uniformly yellowish-brown, possibly in part due to the application of varnish, imparting a somewhat sticky feel to the bone when handled. A small plug of what appears to be dark sediment is lodged in a hollow at the distal end.

Dating

This specimen was not selected for carbon dating because of the potential for contamination from the varnish or similar product with which it has been impregnated.

Discussion

The tibiotarsus is in good condition and looks 'old'—it is unfortunate that the specimen is coated and not suitable for radiocarbon dating. The lack of more detailed original documentation is also unfortunate and it is not possible here to provide a more precise definition of when, where and how the bone was collected. Possibly, Scott himself lacked these details, which would account for the fact that he made no record of them.

3.6 Mole Creek (fractured) tibiotarsus ('QVM.1489')

Plate 11. Mole Creek (fractured) tibiotarsus ('QVM.1489') (below), alongside Mole Creek tibiotarsus (QVM.1991.GFV.54) (above). Both bones bear the old registration number '1489' and are attributed to Clarke at Mole Creek in 1931. The intact tibiotarsus is discussed under a separate entry.

Item(s)

1 x partial left tibiotarsus in two pieces

Provenance data

This specimen bears the number 1489 inked on the bone, apparently referencing a line entry of that number in the old register. The entry refers to a tibiotarsus from Mole Creek given to the museum by EW Clarke on 13/3/1931. Similarly, a more recent card label attached to bone states:

> *Donated by E.W. Clarke 13.iii.1931*
> *Transferred from Geology collection c. 2012 where it was found in back of store with other H.H. Scott material. Recent, not fossil.*

It is considered very unlikely that the entry for 1489 in the old register refers to the fractured tibiotarsus shown in Plate 11. This is because the register references a bone in 'fairly good order [but] rubbed proximally', as does a published reference to the specimen by Scott (1931), who mentioned damage from 'post-mortem rubbing and grinding'. In contrast, this specimen is missing the proximal end and is prominently broken across the shaft into two parts. Additionally, the length of the tibiotarsus cited in Scott's paper agrees more closely with QVM.1991.GFV.54.

If, as proposed here, Scott's entry for 1489 does not refer to the fractured tibiotarsus, then this bone is of indeterminate provenance.

Description

The bone is fractured into two pieces (Plate 11). The longer portion is 275 mm long, representing one side of the shaft produced by an extended lengthwise fracture. The nature of the fracture is suggestive of an injury to fresh, green bone, as opposed to older, dry bone. The shorter portion is 134 mm long and comprises the distal portion of the same bone. The proximal end is missing. The colour varies from yellowish-white to greyish-brown. A distinct transition from darker to lighter coloration can be seen part way down the shaft, in a manner suggestive of staining due to partial burial in, or contact with, hummus or sediment. A small quantity of fine sandy greyish-brown sediment was observed attached to the interior surface of the fractured shaft. Despite being fractured into two halves, the bone is unweathered and appears rather fresh compared to most other material examined in this study. Traces of dried soft tissue remain attached at the distal extremity.

Dating

This specimen was not selected for carbon dating because the provenance is uncertain.

Discussion

As noted above, this tibiotarsus appears to have been confused with another bone (Mole Creek tibiotarsus: QVM.1991.GFV.54). If this interpretation is correct, then the fractured tibiotarsus is wrongly recorded on the label and QVMAG database. Available evidence for alternative interpretations of provenance is fairly minimal. The bone is certainly from an emu. It presents as a somewhat stained, incomplete but not obviously mineralised or weathered item suggestive of a found object exposed for a period in the environment. It is not a professionally prepared osteological specimen; it might be from a cave but nothing obviously confirms this. The fact that the bone retains traces of soft tissue implies that it cannot be of any great antiquity, unless preservation conditions were exceptional, which is possible under certain conditions (e.g. desiccated thylacine carcasses found in caves on the Nullarbor Plain). Unfortunately, these observations and inferences provide no real clarity regarding the actual origin and history of this enigmatic specimen.

3.7 Dromaius Cave partial skeleton (QVM.2013.GFV.11, QVM.2016.2.008)

Plate 12. Dromaius Cave tibiotarsus (QVM.2013.GFV.11). This bone was collected and registered in 2013, prior to collection of the remainder of the skeleton in 2016.

Plate 13. Dromaius Cave emu bones (GFV.2016.2.2008). From left to right, the unbagged long bones are: tarsometatarsus, fibula, tibiotarsus and femora. The bagged bones include phalanges, fragments of ribs, vertebrae and a minor piece of the skull. The collection includes two bones (not shown here) stored separately in inert gas, to ensure optimal preservation.

Item(s)

QVM.2013.GFV.11
1 x left tibiotarsus in 4 pieces
1 x unidentified bone fragment (not emu)

QVM.2016.2.008
This collection comprises approximately 70 pieces of bone, representing roughly half this number of individual bones. The more complete bones are:

2 x femora
1 x right tibiotarsus
2 x fibulae
2 x tarsometatarsi
10 x phalanges
2 x cervical vertebrae
~9 x sternal ribs

?synsacrum (fragments)
?scapulocoracoid (fragments)
Skull (fragment of maxilla)

QVMAG also holds a quantity of marsupial bones, notably *Macropus rufogriseus* and *Thylogale billardierii*, collected during the excavation of QVM.2016.2.008 in 2016; also, samples of sediment, charcoal and gravelly residue retained after washing the excavated spoil to extract smaller bone content.

Provenance data

The provenance of this most recent Tasmanian emu acquisition by QVMAG is not in question. The bones were found in a cave at Mayberry near Mole Creek by Ross McNeill and Paul Flood in about 2005. Both men were then employed by the Parks and Wildlife Service at the Marakoopa Cave field centre and, in their free time, found and explored caves, including caves on land owned at that time by Deidre Smith. Within one of these caves, McNeill and Flood noted the presence of numerous bones, a small sample of which they collected and gave to Smith, who forwarded it to QVMAG in February 2005. The larger bone in the sample was recognised as emu by Craig Reid (QVMAG), who registered it as QVM.2013.GFV.11.

McNeill and Flood reported the discovery of the bones to the (then) Nature Conservation Branch of the Department of Primary Industry, Parks, Water & Environment (DPIPWE). A follow-up investigation by the Parks and Wildlife Service and Natural Values Conservation Branch of DPIPWE confirmed that the cave contained a rich repository of pitfall bones. Unaware that McNeill and Flood were using the name Cemetery Cave, Eberhard (2014) applied the name Dromaius Cave, referencing the emu bones.

The land containing the cave was subsequently purchased by the Crown as an addition to the Mole Creek Karst National Park. Over three days in April-May 2016, the author, supported by David Maynard (QVMAG), David Thurrowgood (QVMAG) and Kieren Mitchell (Australian Centre for Ancient DNA, University of Adelaide), excavated the remainder of the emu skeleton. Following collection and sampling on site for DNA analysis, the bones were transferred to QVMAG for cleaning and drying.

Description

QVM.2013.GFV.11

The proximal end of the tibiotarsus is fragmented and incomplete. The remainder is broken into two roughly equal portions by a transverse fracture across the shaft. Much of the bone is coated in light brown clayey silt from the cave. The colour is otherwise light creamy-yellow. The bone feels light and potentially brittle. An unidentified bone fragment 69 mm long, probably macropod long bone, is held under the same registration number.

QVM.2016.2.008

The bones are variously fractured and abraded. For example, the proximal ends of both femora are missing; their distal ends have survived but in fairly abraded condition. The left tarsometatarsus has lost the central trochlea, whereas the right tibiotarsus has lost the proximal end via a sharp spiral fracture across the upper part of the shaft. Many of the smaller bones are broken or incomplete.

Traces of brown clay silt can be observed adhering to the bones in some cases; however, the majority of sediment was removed when the bones were cleaned at QVMAG. Three bones (femur, tarsometatarsus, phalanges) are stored separately in argon gas to assist preservation. The bones vary in colour from pale orange to creamy-yellow. They are light and somewhat chalky in texture; there is no obvious evidence of mineralisation of their fabric.

The left tibiotarsus and right femur were sampled for DNA and radiocarbon dating.

Dating

The right femur (field no. DC/2016/1) returned a radiocarbon date of 1 010±30 BP (SANU-49415). Calibrated, this becomes 1 021-1 152 calAD.

Discussion

Dromaius Cave comprises a narrow entrance in the base of a low limestone cliff. Such is the narrowness of the surface opening that it is difficult to envisage that it could entrap an emu. However, it can be assumed that the entrance was formerly more spacious, prior to partial blockage by fallen boulders. This possibility is corroborated by the fact that recovery of the emu bones was delayed when a tree fell across the cave, dislodging sizeable boulders from the slope above. It was necessary to remove boulders that had fallen onto the entrance before work in the cave could continue.

Beyond the constriction at the entrance and the first few metres beyond, the cave falls away vertically and becomes progressively more open, shortly intersecting a high rift 1-2 m wide. The base of the rift is a flattish floor at a depth of about 10 m below the entrance. This portion of the cave is episodically inundated by groundwater, which invades the cave from lower levels in the karst system after heavy rain. The emu bones were found at the base of the rift close to the fall line below the cave entrance, together with the bones of macropods. The site represents a classic cave pitfall, containing the remains of animals which have perished after falling into the entrance and becoming entrapped. Several of the emu leg bones were found in semi-articulated condition; others were scattered nearby at the surface or buried in silty sediment to a depth of 10 cm (Plate 14).

The emu fossil comprises a partial skeleton in about 70 pieces, including the major bones of both legs in substantially intact condition. Significant portions of the skeleton are missing, such as the majority of the skull (represented only by a small fragment of maxilla), most of the vertebrae and the synsacrum. The provenance of the bones is not in doubt and the particulars of their finding and recovery are now on record (this report; see also Eberhard 2014). These facts underpinned selection of this specimen for analysis of Tasmanian emu DNA. The DNA analysis, as reported by Thomson *et al.* (2018), found that the Tasmanian emu genotype differs little from that of the extant Australian mainland populations and the extinct populations of King Island and Flinders Island.

The Dromaius Cave emu is one of three partial emu skeletons recovered from caves at Mole Creek. It is a singular fact that all three emus returned similar radiocarbon dates: 1021-1152 calAD (Dromaius Cave), 1043-1223 calAD (Caveside Emu A) and 895-1021 calAD (Caveside Emu B). This clustering of fossils at around 900-1200 AD is at least suggestive of increased abundance of emus in the Mole Creek area during this period.

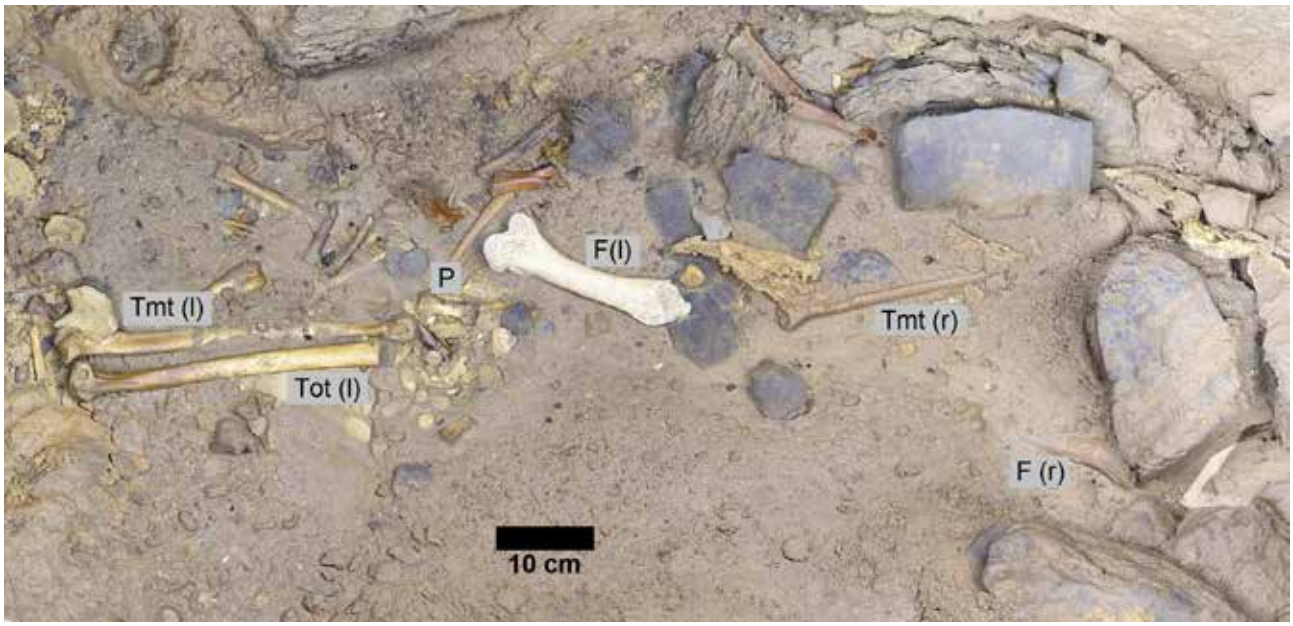


Plate 14. Dromaius Cave emu bones prior to excavation in April 2016. F: femur; Tmt: tarsometatarsus; Tot: tibiotarsus; (l): left; (r): right.

3.8 Caveside Emu A partial skeleton (1974.2.5-7, 9)

Plate 15. Caveside Emu A partial skeleton. The synsacrum (SY), femur (FE) and ischia (IS) are registered as QVM.1974.2.5, QVM.1974.2.6 and QVM.1974.2.7 respectively; the remainder of the bones are registered as QVM.1974.2.9.

In this report 'Emu A' refers to the larger of two partial emu skeletons recovered from a cave in the Caveside-Mole Creek area by R Green and A Alexander in 1972-74. This material was registered by Green in four lots: QVM.1974.2.5, QVM.1974.2.6, QVM.1974.2.7 and QVM.1974.2.9. Green did not register Emu B, which is discussed under a separate entry (see Caveside Emu B below). The two emus are referred to here as 'Caveside emus', in order to reduce scope for confusion with other emu material collected from the Mole Creek area.

Plate 16. View of the cranium and mandible of Caveside Emu A (part of QVM.1974.2.9).

Item(s)

Emu A is represented by 70 bones registered in four lots.

QVM.1974.2.5
1 x synsacrum

QVM.1974.2.6
1 x left femur

QVM.1974.2.7
2 x ischia

QVM.1974.2.9
1 x cranium (two pieces)
1 x mandible (two pieces)
22 x vertebrae
2 x fibulae
2 x scapulacoracoid
2 x humeri
2 x tibiotarsi
2 x tarsometatarsi
14 x ribs
7 x false ribs
13 x phalanges

Provenance data

The card labels and database entries against the four registration numbers on the specimens indicate that the synsacrum (QVM.1974.2.5), femur (QVM.1974.2.6) and detached ischia (QVM.1974.2.7) were collected by A Alexander from a cave near Mole Creek in 1972. The remainder of the skeleton, including the skull (QVM.1974.2.9), was collected by QVMAG curator RH Green from 'a small limestone cave' between Mole Creek and Caveside on 11/3/1974. There is no reason to believe that all these items were not collected from the one cave, together with additional unregistered material discussed under the entry for Caveside Emu B.

The following additional details are recorded against QVM.1974.2.9 on the QVMAG digital database:

> Remains first discovered by Mr Arthur Alexander of Stoodley, 1972. From newspaper cutting "The bird had apparently fallen into the cave through a small hole in

the roof and died of starvation when unable to escape."

The newspaper cutting referenced above has not been sighted.

Description

Synsacrum (QVM.1974.2.5)

The body of the synsacrum is largely intact with minor abrasion at the distal end exposing the spongey interior tissue. The slender ischia and left pubis are broken off. The bone is somewhat weathered on the left side, which is affected by surficial flaking across about half of the surface. The right side is virtually unweathered. The ventral surface shows traces of whitish mineral deposit, possibly calcium carbonate deposited by cave drips. The bone is creamy white in colour. Lack of staining or sediment lodged in crevices indicates that the bone has not been buried.

Femur (QVM.1974.2.6)

Some abrasion can be observed on the upper side at the distal end, exposing cancellous bone. The bone is otherwise virtually unweathered, intact and remarkably 'fresh' in general aspect. The colour is pale creamy white, with some evidence of light sediment staining on the central and distal portions of shaft.

Ischia (QVM.1974.2.7)

These two fragments of the synsacrum are in similar condition to the main portion of it (see QVM.1974.2.5 above). The reference to 'ribs' on the card entry is incorrect.

Skull and post cranial bones (QVM.1974.2.9)

The majority of bones in this lot are intact and in good condition. Fractured and/or incomplete bones include the right side scapulacoracoid, several ribs—three have been glued—and the skull, which is incomplete. The tibiotarsi and tarsometatarsi are in almost perfect condition. The vertebrae are somewhat worn and several have lost parts of their spinous portions. The bones vary in colour from whitish or creamy to pale brown. The right tibiotarsus is affected by a slight greenish tinge on the middle portion of the shaft, in a manner suggestive of moss or algal growth. The opposite side of the same bone and parts of several others display patches of whitish deposit, possibly calcium carbonate deposited by cave drips. Traces of brown soil can be observed lodged within pores at the proximal ends of the tarsometatarsi.

Dating

A sample of bone from the right tibiotarsus returned a radiocarbon date of 927±37 BP (SANU-56323), which translates to 1043-1223 calAD.

Discussion

The collection history of the Caveside emus, as gleaned from RH Green's card entries, can be summarised as follows:

- 1972. Mr A Alexander of Stoodley (18 km north of Mole Creek township) collected several large bones found by him in a cave between Mole Creek and Caveside.
- 7/2/1974 Alexander forwarded the bones to QVM.
- 11/3/1974 Green returned to the cave and collected the additional bones, including an emu skull and portions of the skeleton of a second emu.

The various registration numbers imply that Green registered the initial donations by Alexander in three lots (QVM.1974.2.5-7), prior to himself visiting the cave and recovering additional bones two years later. It can reasonably be assumed that when all the bones were in front of him, Green recognised that the collection represented two emus, one larger and more complete than the other. He registered the bones of the larger animal in one lot (QVM.1974.2.9). As he had already separately registered the bones previously collected by Alexander, also of the larger bird, these retained their separate registration numbers (QVM.1974.2.5-7). Database entries for these initial specimens state that they were originally incorrectly entered as Cape Barren goose, (*Cereopsis novaehollandiae*). Possibly, the database error occurred because at one time emu material was stored in a drawer adjacent to Cape Barren goose material (T Gordon, pers. comm.).

Green's rationale for not registering the bones of the smaller emu is noted on the card entry: 'I have not registered these [other emu bones] because of their fragmented nature + confusion with the other bird.' In other words, it seems he decided not to register this portion of the collection because the damaged condition of some bones meant that they could not be confidently allocated to either the larger or the smaller bird. In fact, a proportion, including the femur, tibiotarsus and multiple vertebrae, clearly belong to the second smaller bird. It is unclear why Green choose not to register at least some of these bones as a separate lot.

The presence of multiple emu skeletons in a single Tasmanian cave is unusual but not without precedent (e.g. Scotchtown Cave). Importantly, Emu A is more complete and in better condition than any other known Tasmania emu fossil. The survival of the fragile skull is especially noteworthy. Only two other portions of Tasmanian emu skull are held in Tasmanian public collections and both are minor fragments only—e.g. the tip of a mandible collected at Dromaius Cave (QVM.2016.2.8) and a minor fragment in the TMAG collection.

The context of the bones in the cave is not known. For example, were the bones scattered on the cave floor or found in partly articulated condition? Were some of them buried in sediment and if so what was its nature? Were the two emu skeletons close together or separate? Such details would provide useful insights into the taphonomic history of the fossils. Locality information is also sketchy, other than that the bones were found in a small limestone cave of the pitfall type between Mole Creek and Caveside, an area which contains many possible candidate pitfalls.

The radiocarbon result indicates that both Emu A and Emu B died hundreds of years prior to European settlement of Tasmania. Emu A is the younger of the two by between about 58 and 338 years, based on the calibrated age ranges. The radiocarbon results dispel any doubt that these emus are genuine Tasmanian birds, as opposed to imported mainland escapees or hybrid descendants, as has been suggested might be the case. In fact, these possibilities are not countenanced in a printed card which may at one time have been displayed with the specimen. The card states:

> THESE BONES ARE PART OF THE SKELETON OF AN EMU. THEY WERE FOUND RECENTLY IN A CAVE NEAR MOLE CREEK, TASMANIA.
>
> EMUS WERE ONCE COMMON IN TASMANIA BUT DIED OUT HERE OVER 100 YEARS AGO.
>
> VERY LITTLE TASMANIAN EMU MATERIAL HAS SURVIVED AND SUCH FINDINGS ARE OF SCIENTIFIC IMPORTANCE AS THEY HELP TO BUILD UPON OUR KNOWLEDGE OF THE BIRD.

3.9 Caveside Emu B partial skeleton (associated with QVM.1974.2.9)

Plate 17. Caveside Emu B post cranial bones (associated with QVM.1974.2.9). Approximately 50 smaller fragments are not shown in this image. The long bone (tibiotarsus) closest to the scale was sampled for dating.

In this report 'Emu B' refers to the smaller of two partial emu skeletons recovered from a cave in the Caveside-Mole Creek area by RH Green (QVM) and A Alexander in 1972-74. The larger, more complete skeleton of Emu A was registered by Green in four lots: QVM.1974.2.5, QVM.1974.2.6, 1974.2.7 and 1974.2.9. Green did not register Emu B.

Item(s)

This specimen comprises approximately 90 bones and bone fragments:

1 x synsacrum (fragment)
1 x sternum (fragment)
17 x vertebrae
1 x right femur
1 x right tibiotarsus
2 x radii
2 x ulnae
7 x ribs (plus fragments)
false ribs (fragments)
minor fragments (circa 50)

Provenance data

The Caveside Emu B is not registered, although it is associated with the registered Caveside Emu A (QVM.1974.2.9) collected by RH Green from 'a small limestone cave' between Mole Creek and Caveside on 11/3/1974. One of two otherwise virtually identical card labels for QVM.1974.2.9 includes a note by Green on the reverse side. This refers to the unregistered bones:

> These bones were collected together with QVM.1974.2.9 + some belong to that Emu. However, others including the femur, tarsus + vertebrae are from another Emu, smaller, + probably a female. I have not registered these because of their fragmented nature + confusion with the other bird.

For further details see the entry for Caveside Emu A (QVM.1974.2.5-7, 9).

Description

The bones are moderately weathered and porous (Plate 16). Very few bones are whole and many are reduced to minor fragments. The more intact pieces include vertebrae (especially the small caudal elements) and the femur, although portions of both ends are worn away or otherwise lost. The tibiotarsus is represented only by the

shaft of the bone with the extremities gone.

The colour of the bones is pale brown. Some bear traces of brown soil and/or whitish mineral precipitate, potentially calcium carbonate deposited by cave dripwater. Close observation of the femur and tibiotarsus reveal patterns of shallow transverse scratches up to 2 cm long. These features are discoloured with sediment and cannot be attributed to damage from handling during or after collection. A circular depression fracture a few millimetres in diameter at the distal end of the femur is suggestive of a puncture from an animal bite mark. The tibiotarsus had been previously cut across the shaft with a mechanical tool and was re-sampled at this point for radiocarbon dating during this study.

Interestingly, the fragments include a small piece of what may be the horny external structure of the beak.

Dating

A sample of bone from the tibiotarsus returned a radiocarbon date of 1,120±22 BP (ANU-52431). This result intersects the SHCal13 calibration curve at two points, implying a 26.4% probability that the true age of the sample lies between 895 and 934 calAD and a 69.0% probability that it lies between 958 and 1021 calAD. The laboratory report states that the carbon to nitrogen ratio and stable isotope results do not suggest any major source of contamination in the sample, but the date should be viewed with less confidence than normal because the sample weight was low and yielded a small percentage of dateable material. If the date is inaccurate, it is most likely to be too young.

Discussion

This intriguing specimen represents a second animal (Emu B) collected from the same cave as the virtually complete skeleton of another, larger bird (Emu A: QVM.1974.2.5-7, 9). The card label by Green states that Emu B is probably female. In fact, most ratite birds including emus display pronounced reversed sexual size dimorphism (i.e. males small, females large). Compared to Emu A, the bones are less complete, more weathered and darker in colour. Unfortunately, as discussed under Emu A, key details regarding the context of the bones in the cave are lacking and, indeed, the cave where they were collected is not known.

The radiocarbon result indicates that Emu B died nearly a thousand years prior to European settlement of Tasmania. It is younger than Emu A by decades to centuries. At 1021 calAD, the upper limit of the calibrated age aligns with the lower limit of the calibrated age of the Dromaius Cave emu (GFV.2016.2.2008), also from the Mole Creek area.

3.10 Mt Cameron West femur (QVM.1993.GFV.146)

Plate 18. The very weathered Mt Cameron West emu femur (QVM.1993.GFV.146).

Item(s)

1 x right femur, shaft

Provenance data

The relevant labels and database entry provide minimal details for this specimen, which is recorded only as collected at Mt Cameron West in north west Tasmania in 1935. There is no reason to doubt that the bone is genuine Tasmanian emu, beyond the remote possibility that it is derived from a stray imported mainland bird, or the nebulous concern that the Tasmanian emu population interbred with imported mainland birds during the 19th century. Wild emus were not known to be present in north west Tasmania in historical time; however, imported captive birds were kept at Circular Head in the 1850s (Gunn 1852, Dickson 1926).

Description

The bone is extremely weathered and comprises approximately 50% of the distal portion of the shaft (length 114 mm; weight 106.8 g). The bone generally is pitted and locally paper-thin. The cancellous interior has been largely stripped away. The specimen is a pale, creamy colour and looks bleached and brittle. Minor traces of an unknown reddish-orange coating are present towards the distal end.

Dating

The specimen was not selected for dating because sampling would cause significant damage to an already fragile specimen.

Discussion

A locality and date is attached to this specimen (Mt Cameron West, 1935); however, the finder and circumstances of discovery are unknown. The bleached, weathered condition of the bone suggests prolonged exposure to the elements, potentially consistent with the condition of bones collected from coastal sandblows. Sandblows commonly contain significant concentrations of bone in the form of lag deposits following deflation of formerly overlying sand. The majority of King Island emu material in public collections was obtained from such features.

Coastal dunes around Mt Cameron West are affected by several large sandblows. If the femur was indeed collected from a sandblow then this does little to constrain its age. Dunes on other parts of the Tarkine coast have returned thermoluminescence dates of Holocene to Late Pleistocene age—i.e. hundreds to tens of thousands of years (McIntosh *et al.* 2009)—implying that the femur could be equally old or young. This, and the imperfect condition of the bone, limits its value for morphological analysis and most other purposes. However, the specimen extends the known range of Tasmania emu to the far north west of the island.

3.11 Newstead House emu leg (QVM.2002.2.1)

Plate 19. Newstead House emu leg (QVM.2002.2.1).

Plate 20. Detail of the foot of the Newstead House emu leg. Note the ragged aspect of the tissue at the missing toe.

Item(s)

1 x lower right leg (tarsometatarsus) and foot of emu; bone and soft tissue in dried condition.

Provenance data

This specimen is listed on line 1486 of the old Museum register, which dates the acquisition to 9/2/1921 and states that the specimen was 'obtained from the late Ronold [sic] Gunn from St Pauls Plains (bird hatched from egg by a Turkey hen)' (Appendix). Various associated card labels repeat or add to these basic details, including a handwritten display card by HH Scott, which states:

> Part of the leg of the now extinct Tasmanian Emu. This specimen once formed part of the collection of the late Ronald Gunn Esq, + is of special interest as its study called out the first suggestion that the Emu of this Island was distinct in species from the Australian form. Gunn's note that that effect, was published in the Proceedings of the Royal Society of Tasmania for 1852 (Page 170). Given to the Museum by the Trustees of the Gunn estate. (NO-1486).

Gunn himself corroborated elements of this account in a letter to the Royal Society in 1851, which published this extract:

> A leg of a Tasmanian emu is now in my possession, and so far as I can judge from it, as a very imperfect specimen, there are differences in the arrangement and size of the scales, which may justify the separation of the Tasmanian emu from that of New Holland. Still farther research and examination are necessary.

Aspects of the provenance of this specimen are explored further in the discussion section below.

Description

The specimen is 522 mm long from the head of the tarsometatarsus to the end of the extended central toe. It is dried 'flat' with the toes depressed downwards and aligned with the tarsometatarsus bone. In life, this posture would be unnatural for a standing emu. The inside toe is missing below the first knuckle and the soft tissue at the injury has a ragged, torn aspect with no obvious indication of healing. The outer scaly layer of skin has largely been stripped off around the tarsometatarsus. The skin generally is shrivelled and cracked, exposing underlying tissue and bone.

Dating

This specimen was not selected for dating because it is recent material.

Discussion

This celebrated emu leg is figured in the book *Treasures of the Queen Victoria Museum and Art Gallery* (QVMAG 2006, p. 101). It is also referenced in several other publications (Gunn 1852; Scott 1923; Vickers-Rich & Rich 1993, Hume 2017). It would appear that this is the only surviving verified soft tissue specimen of Tasmanian emu in Australia. An emu leg of unknown provenance, beyond the fact that in the early 1920s it was part of William Ratcliffe's private museum at Port Arthur, is held by the Port Arthur Historic Site Authority. Two or more complete skins of Tasmanian emu are held in European collections (Dooley 2017).

Given the importance of this specimen, all details of its history are of interest and warrant scrutiny. Scott's entry in the old register states that the Museum acquired the specimen from Newstead House, former residence of Ronold [sic] Gunn, in February 1921. Whilst this sounds straightforward enough, Gunn died in 1881 and is not known to have referenced the leg since mentioning it in a letter to the Royal Society of Tasmania dated 17/11/1851, an extract of which was published by the Society in 1852. Scott himself noted that the leg had disappeared into obscurity for many years, stating that 'after resting in the cellar of Newstead House for some 70 years, this Emu's leg has now come to light again, and is upon the table before me as I write' (Scott 1931).

It is entirely possible, and indeed likely, that the emu leg referred to in Gunn's letter and that given to the Museum by the trustees of his estate in 1921 are one and the same. On the other hand, no original label by Gunn has survived and the specimen's chain of custody over 70 years is assumed rather than demonstrated. Gunn's interest in emus was no secret and it is plausible that he collected and stored other emu material at Newstead House. He is known to have sent a pair of emus to Joseph Hooker in London in 1837 and at one time kept live emus on his property, including one of Victorian stock which died by drowning in a river (Gunn 1852). On balance, however, Scott's conclusion is reasonable: this is probably the leg which Gunn wrote about in 1851. No evidence to the contrary has come to the author's attention.

Other details which deserve scrutiny include Scott's assertion that Gunn obtained the leg from St Pauls Plains, where it had been hatched

from an egg placed under a turkey hen. Scott recorded this information in the old register and later published it in the *Papers and Proceedings of the Royal Society of Tasmania* (Scott 1923). Scott's source appears to be J Milligan, Secretary of the Royal Society. Milligan inserted the following footnote in the Papers and Proceedings on the page where the extract of Gunn's 1851 letter was published:

> Captain Hepburn, of St. Paul's Plains, possesses a breed of Tasmanian emus, which he succeeded in rearing from eggs found many years since upon the high heathy land in his vicinity. Mr. J. Hepburn informs me that the booming noise is not peculiar to the female, and that the male bird does, though not frequently, make the same sound. The Tasmanian emus share the toils of incubation between the sexes, but upon the mother devolves the care of bringing up the young brood, to which the male parent, for the most part, displays an unnatural and most bitter antipathy.

Milligan's footnote does not state that Gunn's emu leg came from Hepburn's flock, although this would be an obvious thing to record if it was known to him. Gunn's extract does not state that his emu leg came from a bird raised by Hepburn. Therefore, we must consider the possibility that Scott jumped to the conclusion that Milligan's footnote—plausibly, an interesting aside on emus intended to complement Gunn's note, not an explanatory addition to it—provided critical data on the provenance of the Newstead House emu leg. Scott's close reading of Gunn and Milligan is confirmed by the fact that he quoted them in full in his own account of the Newstead House leg published in 1923. Scott's article references no other primary or secondary documentation. Further investigation of archival sources which could shed light on this issue is to be encouraged.

An interesting aside on the above is provided by Le Souef (1904), who corroborated Hepburn as a finder of emu eggs. According to Le Souef's source, Mr Ranson of Killymoon near Fingal, Hepburn raised two generations of captive Tasmanian birds from a clutch of eight or nine eggs found by him in an emu's nest. One of these birds reputedly survived until 1873 when it drowned trying to cross a flooded river. Le Souef recorded that Ranson believed the death of this bird signalled the extinction of Tasmania emu.

Finally, a further noteworthy aspect of the specimen is its poor condition. The skin and underlying tissue is shrunken and fissured by cracks exposing the underlying bone. Scott (1923) commented on this, observing that 'the outer cuticle has peeled off the scutes [scales]'. Scott alluded also to the partial loss of one of the toes. The present investigation observed that skin at the injury on the amputated toe has a ragged, torn aspect (Plate 20). A mechanism of injury involving significant force or torsion, as opposed to cutting with a sharp implement or gnawing by animals, is inferred. The injury shows no evidence of healing and seems to be post-mortem damage. Overall, the condition of the specimen is rather degraded, and it has clearly suffered serious neglect or rough handling. The fact that Gunn (1852) referred to it as 'a very imperfect specimen' implies that some or all of the damage occurred prior to it coming into his possession. Decades in the cellar at Newstead House may have compounded earlier deterioration.

In summary, the Newstead House emu leg is important as one of very few soft tissue specimens of Tasmanian emu in existence, albeit only a small portion of the total animal. More complete soft tissue specimens are available in Europe (e.g. skins at the Natural History Museum, Tring, UK); however, this is the only confirmed example in Australia.

3.12 Anomalous 'King Island' femur

Plate 21. Anomalous 'King Island' femur (centre) compared with femora of mainland emu (left: Melbourne Museum B12822) and King Island emu (right: QVM.1971.39.59).

Item(s)

1 x right femur

Provenance data

This specimen was found stored with King Island emu femora, most or all of which are marked with folio or accession numbers or collection details directly on the bone. In contrast, the femur is not marked in any way and is not obviously associated with any particular card label, although a number of unattached handwritten labels from the early 19th century were noted as stored in the same drawer.

Description

This femur is in excellent condition with the exception of minor abrasion at the extremities (Plate 21). A small hole has been drilled transversely across the bone at the distal end. The colour is pale yellow with a slight waxy sheen. There is no evidence of mineralisation or staining. Close inspection reveals traces of fine whitish powder adhering to the surface.

Dating

This specimen was not selected for dating because of its uncertain provenance.

Discussion

The femur came to attention because of its anomalous size compared to the smaller King Island femora with which it is stored, raising the possibility that the bone may be from Tasmanian emu. Certainly, the robust size of the specimen, which is 229 mm long, cannot be reconciled with King Island 'dwarf emu', which were very much smaller than mainland or Tasmanian emu. Spencer and Kershaw (1910) measured 64 King Island emu femora, none of which exceeded 186 mm in length and the majority did not exceed 170 mm.

It has been suggested that Tasmanian emu were close in size to mainland emu or possibly slightly smaller, although this remains to be verified. The largest emu femur confirmed as Tasmanian in the QVMAG collection measures 229.5 mm (Caveside Emu A: QVM.1974.2.9).

This exceeds femora length in all mainland emus sampled by Patterson and Rich (1987), who recorded a maximum length of 218 mm (n=22). Thus, based on size, the femur in question could be a very large Tasmanian or mainland emu. Its presence amongst the King Island material suggests that it was left there after being used for comparative purposes (see also QVM.1993. GFV.18). Furthermore, the condition of the bone corroborates the possibility of it being a professionally prepared osteological specimen rather than a found object.

3.13 Anomalous 'King Island' tibiotarsus (QVM.1993.GFV.18)

Plate 22. Anomalous 'King Island' tibiotarsus (centre. QVM.1993.GFV.18) with tibiotarsi of mainland emu (top: Melbourne Museum B12822) and King Island emu (below: QVM unregistered).

Item(s)

1 x left tibiotarsus
1 x left fibula (attached)

Provenance data

The provenance of this specimen is highly confused. Two card labels associated with the bone refer to '*Dromaius minor* from King Island' while a third, a scrap of paper, states '*LEG BONE – TASMANIAN EMU?*'. A further tag printed '1502' seems to link the specimen with a line entry in the old Museum register, which refers to eight King Island tibiotarsi received from James Mackie Bowling in 1905-07. That entry notes that the King Island bones range in length from 245 to 356 mm, whereas the tibiotarsus in question is 446 mm long, much larger than any King Island emu on record and larger than average for mainland emu (*cf.* Patterson & Rich 1987).

Compounding the uncertainty, the following are written directly on the bone: '?1487', '?1502' and 'QVM:1993:GFV:18'. From the old register, Scott allocated 1487 to the Irishtown tibiotarsus (QVM.1990.GFV.144) and 1502 to the aforementioned eight King Island femora. The current database entry for QVM.1993.GFV.18 repeats the suggestion that the tibiotarsus is from King Island, while also cross referencing the old register and footnoting 'Marawah Swamp' as a locality, probably meaning Mowbray Swamp.

Description

The specimen is large (length: 446 mm) with no indications of weathering. Traces of dried soft tissue remain attached to the shaft and hold the fibula in life position (Plate 22). The colour is mostly yellow but darker in places due to traces of fat and dried tissue.

Dating

This specimen was not selected for dating because of its uncertain provenance.

Discussion

As noted above, the labelling of this specimen is confused and contradictory. The two old register folio numbers associated with the bone are impossible to reconcile with the specimen itself, which is neither King Island emu nor Smithton

swamp fossil. It is inferred that the bone is probably mainland emu or, less likely, Tasmanian emu, which has become mixed in with King Island emu material and labelled incorrectly. This situation has parallels with a large emu femur stored with King Island emu femora (see Anomalous 'King Island' femur).

3.14 Pre-1897 femur (QVM.1490)

Plate 23. Pre-1897 femur (QVM.1490).

Item(s)

1 x left femur

Provenance data

HH Scott's entry against 1490 in the old register identifies the specimen as Tasmanian emu followed by a question mark (Appendix). It also states:

> No very exact history – I found [this femur] in 1897 in the old museum, listed as a "Deers' bone" to contrast with some New Zealand Moa remains. It may or may not be Tasmanian - it is sightly immature in the sense of being devoid of all super ossification. I presumed that Alex Morton gave the bone or acquired it prior to 1897

A more recent note on card held with the specimen records an examination of the bone by a visiting expert in 1971, who evidently considered it likely to be mainland emu and unlikely to be King Island emu. Reference on the card to 'No. 1480' appears to be a transcription error; other specimens are listed against this number in the old register.

Description

The femur is somewhat abraded at the extremities, exposing cancellous bone, but otherwise largely intact (Plate 23). The shaft is marked by several fine longitudinal fractures. The colour is pale grey with no obvious staining from sediment or organics. The bone is varnished. Patchy darker colouration, most obviously at the distal end, is suggestive of traces of fatty tissue or perhaps coagulated varnish.

Dating

This specimen was not selected for dating because of its uncertain provenance and potential for contamination from the varnish coating.

Discussion

Scott's entry in the old Museum register suggests that this specimen was displayed at QVM in 1897 as an example of a deer bone! Whilst it is clearly emu, not deer, very little can be said regarding provenance, other than that this specimen was part of an older collection and its origins are uncertain. At this stage it cannot be confirmed that the femur is either Tasmanian emu or mainland emu.

3.15 Sandy Cape putative emu vertebra (unregistered)

Plate 24. Sandy Cape putative emu vertebra (top), compared with cervical vertebrae of mainland emu (Melbourne Museum B12822).

Item(s)

1 x vertebra

Provenance data

The vertebra is part of a small collection of bones of various animals from a midden, possibly at Sandy Cape. A partly illegible note dated 5/2/1955 lists the bones with putative identifications. The vertebra is listed as 'emu ?'. A more recent card label states that the bones were 'found in a box' and 'transferred from Zoology 22/8/2005'. No other details appear to have been recorded.

Description

The vertebra is very weathered and porous. The spinous process is missing. The colour is greyish white with traces of red mineral or pigment (Plate 24).

Dating

This specimen is not emu and was not selected for dating.

Discussion

The identification of this specimen as emu was tested by comparing the bone with that of a mainland emu specimen on loan from Melbourne Museum (B12822). Based on this comparison, the Sandy Cape vertebra is not emu – the general morphology of the bone cannot be matched with the distinctive form of emu vertebrae (Plate 24).

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Appendix
QVMAG old register

Transcriptions of line entries referencing emu material (pages 100-101). Content presented as written:

Newstead House emu leg (QVM.2002.2.1)

Number	1486
Vernacular Name	*Leg of Tasmanian Emu, with the skin attached – minus the Femur,*
Scientific Name	*Dromeus*
Sex	[male symbol]
Locality and General History	*Obtained from the late Ronold Gunn [sic] from St Pauls Plains (bird hatched from egg by a Turkey hen)*
Donor or Seller including Amount Paid	
Remarks	*From Newstead house cellar Feb 9.1921. Gunn gave a paper to Royal Socty of Tas. H Scott also, years afterwards.*
Case Number	[blank]
Date Acquired	*9/2/21*
Date Exhibited	*1921*

Irishtown tibiotarsus (QVM.1990.GFV.144)

Number	1487
Vernacular Name	*Tibio Tarsus Tasmanian Emu*
Scientific Name	*Dromeus*
Sex	[blank]
Locality and General History	[blank]
Donor or Seller including Amount Paid	*Given Messers Fenton & Willis*
Remarks	[blank]
Case Number	[blank]
Date Acquired	[blank]
Date Exhibited	[blank]

Mowbray Swamp postcranial bones (QVM.1990.GFV.138-143)

Number	1488
Vernacular name	*Femur, Tibio Tarsus, 2, Tarso-metatarsi, cervical, + synsacrum of Tas emu.*
Scientific name	*Dromeus*
Sex	[female symbol]
Locality and general history	*Purchased from Mr T. Edwards, of Mowbray Swamp.*
Donor or seller including amount paid	[blank]
Remarks	*Fairly good order rubbed proximally.*
Date acquired	*Oct 1924*
Date exhibited	[blank]

Mole Creek tibiotarsus (QVM.1991.GFV.54)

Number	1489
Vernacular name	*Tibio-Tarsus* *Tas Emu*
Scientific name	*Dromeus*
Sex	[female symbol]
Locality and general history	*From Sassafras Farm, Mole Creek.*
Donor or seller including amount paid	*Given by Mr E.W. Clarke.*
Remarks	*Fairly good order rubbed proximally.*
Date acquired	*13/3/31*
Date exhibited	[blank]

Pre 1897 femur (QVM.1490)

Number	1490
Vernacular name	*Femur* *Tasmanian Emu (?)*
Scientific name	*Dromeus, Sp*
Sex	[female symbol]
Locality and general history	*No very exact history – I found in 1897 in the old museum, listed as a "Deers' bone" to contrast with some*
Donor or seller including amount paid	*New Zealand Moa remains. It may or may not be Tasmanian - it is sightly immature in the sense of being devoid*
Remarks	*of all super ossification. I presumed that Alex Morton gave the bone or acquired it*
Date acquired	*Prior to 1897*
Date exhibited	*1897, & earlier*

Jackson egg (QVM.1965.GFV.0006)

Number	1512
Vernacular name	*Two small scraps of egg shell of an Emu.*
Scientific name	[blank]
Sex	[blank]
Locality and general history	*From near Amita [sic] Found by Mr Frank Jackson 600 feet above sea level 4 miles inland*
Donor or seller including amount paid	
Remarks	
Date acquired	*ap. 10.1917*
Date exhibited	*ap. 11.1917*