

PLEISTOCENE RECORDS OF *FALCO BERIGORA* FROM AUSTRALIA AND THE IDENTITY OF *ASTURÆTUS FURCILLATUS* DE VIS (AVES:FALCONIDAE)

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ABSTRACT

Restudy of the fossil falconiform material described by C.W. de Vis has shown that only *Asturaetus furcillatus* from the Pleistocene of Cooper Creek, northeastern South Australia, belongs to the Falconidae. It, and another fossil from the Pleistocene of Lake Menindee, western New South Wales, are here referred to the living species *Falco berigora*.

INTRODUCTION

During the late 19th and early 20th centuries, C.W. de Vis (1890, 1891, 1892, 1905) described several fossil raptors as members of the Falconidae including: *Uroaetus brachialis*, *Necraster alacer*, *Taphaetus lacertosus*, *Asturaetus furcillatus*, and *Baza gracilis*. At that time the Falconidae included the Accipitridae (Sharpe 1874), now a separate family. Within the present family Falconidae are four subfamilies: Herpethotherinae, Polyborinae, Falconinae, and Polihieracinae (Peters 1931). Most of the fossils de Vis originally assigned to the Falconidae were later referred to the Accipitridae. Only one, *Asturaetus furcillatus*, from Pleistocene sediments along Cooper Creek, South Australia, is now regarded as being a falcon (Brodkorb, 1964). Our examination of the type reveals that both this and a tibiotarsus discovered since the work of de Vis in Pleistocene sediments at Lake Menindee, New South Wales, are referable to the living species of *Falco berigora*.

Abbreviations: ANWC, Australian National Wildlife Collection, CSIRO, Division of Wildlife Research, Canberra; NMV, National Museum of Victoria, Melbourne; QM, Queensland Museum, Brisbane; UCMP, University of California, Museum of Paleontology, Berkeley; and USNM, United States National Museum of Natural History, Washington, D.C.

Falco berigora Vigors and Horsfield 1827

THE DE VIS MATERIAL: *Asturaetus furcillatus* de Vis, 1905.

Holotype, a nearly complete right tibiotarsus, lacking parts of proximal end, QM F5509 (see Pl. 1), from Pleistocene-aged deposits along the lower Cooper Creek, northeastern South Australia, Lake Eyre Basin.

COMMENT AND DIAGNOSIS

In recording the Pleistocene collections of J.W. Gregory from the Lake Eyre Basin, South Australia, de Vis (1905) described *Asturaetus furcillatus* as a hawk, intermediate between a goshawk (*Accipiter* = *Astur*) and the little eagle (*Hieraaetus* = *Nisaetus*). After consulting de Vis and using a name suggested by de Vis, Richmond (1909) substituted *Plioaetus* for *Asturaetus* de Vis which is preoccupied by *Asturaetus* Brehm 1855. Richmond, with a query, referred *P. furcillatus* to the Buteonidae, in which he included goshawks and eagles. Brodkorb (1964) and Condon (1968) placed *P. furcillatus* with the falcons in the Falconidae, but later Condon (1975) placed it with the goshawks in the Accipitrinae. We found that the type, which is the only published material of *Plioaetus furcillatus*, belongs within the extant genus *Falco*, and furthermore to the living species *F. berigora*.

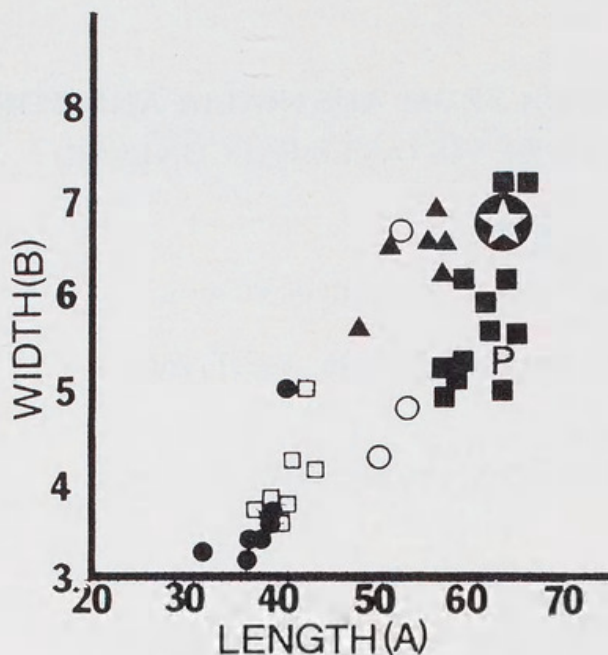


FIG 1. Plot of tibiotarsal proportions of fossil and recent falcons from Australia. Length (mm) = length of tibiotarsus from distal end of fibular crest to distal end of bone (A of Table 1), and width = width of shaft at base of fibular crest (B) • = *Falco cenchroides*; □ = *F. longipennis*; ○ = *F. subniger*; ■ = *F. berigora*; ▲ = *F. peregrinus*; * = the Menindee *F. cf. berigora*; and P = *Asturaetus* (*Pliotaetus*).

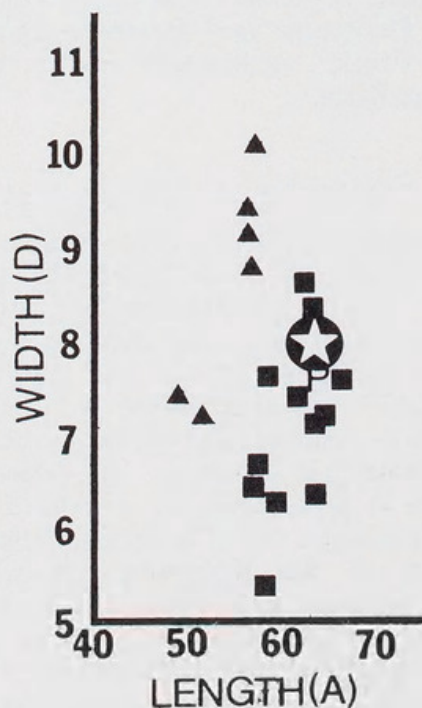


FIG 2. Plot of tibiotarsal proportions of fossil and recent falcons from Australia. For length see Fig. 1; Width = width of shaft at proximal end of supratendinal bridge. See Fig. 1 for legend.

In our sample of ten modern *F. berigora* (see Pl. 1, Tab. 1, and Figs. 1 & 2), we found sufficient variability in the tibiotarsi to encompass the character-states de Vis believed diagnostic for *P. furcillatus*: (1) the presence of a distinct, shallow groove between the outer edge of the shaft and the supratendinal bridge (= 'bridge for the extensor tendon') and (2) the greater dilation of the internal border of the shaft distally. A third character that de Vis believed to be 'the most peculiar feature of this tibia' is the Y-shaped nature of the supratendinal bridge producing three distal openings which, however, is actually a diagnostic feature of *Falco* and most of the rest of the Falconidae.

P. furcillatus can, furthermore, be distinguished from members of subfamilies of Falconidae other than the Falconinae in the same manner as the falcon from Lake Menindee discussed later in this paper. Thus on the basis of similarity of size and morphology to the extant *Falco berigora*, we consider *Pliotaetus* Richmond 1909 to be a junior synonym of *Falco* Linnaeus 1758 and *Asturaetus furcillatus* de Vis 1905 to be a junior synonym of *Falco berigora* Vigors and Horsfield 1827.

THE MENINDEE MATERIAL

A partial right tibiotarsus, UCMP 79276, (Pl. 1 and Figs. 1 & 2, Tab. 1), was recovered from UCMP Loc. V-67185, (= UCMP V5371, Lake Menindee 2), a blowout in the sand hills along the northwestern shore of Lake Menindee, south of Broken Hill, western New South Wales. This and several other sites in near proximity have yielded a rich collection of vertebrates (Tedford 1967), including birds. One specimen was the tibiotarsus of a large falcon. The Menindee falconid was recovered from the basal part of the exposed lunette sequence from which *Diprotodon* was also obtained. In an adjacent site, Site 1, 1600 yards (1.5 km) west of Site 2 (University of California, Museum of Paleontology localities) on the south-western horn of the lunette, the mammal fauna from the basal part of the exposed section included *Thylacinus*, *Sarcophilus*, *Procoptodon*, *Sthenurus*, and *Macropus* (presumably contemporaneous with the fossil falconid). This fauna roughly correlates (R.H. Tedford, pers. comm., 1976) with that from the older lunette of Lake Menindee (see Tedford 1967) and indicates a late Pleistocene age.

DIAGNOSIS

Although every genus in the family Falconidae was not available for comparison, tibiotarsi of *Herpetotheres* (*H. cachinnans*, USNM 491335), *Polyborus* (*P. plancus*, USNM 428041), and *Polihierax* (*P. semitorquatus*, USNM 322394), as well as those of several species of *Falco* (including all Recent Australian species) were compared with the fossil. Such a collection represents each of the four subfamilies of the Falconidae recognized in Peters (1931) (Herpetotherinae, Polyborinae, Falconinae, and Polihieracinae), and even though the latest revision of the Falconidae (Brown and Amadon 1968) does not recognize formal subfamilial groupings, the above genera clearly represent the breadth of variation within the family. The Menindee falconiform tibiotarsus is assigned to the Falconidae because the tendinal canal on the distal end of the bone has three openings, characteristic of this family alone. The tibiotarsus most closely resembles those of the genus *Falco* (Falconinae) and differs from those of other subgroups within the Falconidae as follows:

HERPETOTHERES (HERPETOTHERINAE)

The Menindee specimen differs in that it lacks a tendinal groove demarked by a distinct ridge on either side of lateral shaft surface near distal end; has the distolateral opening of tendinal canal as large or nearly as large as other two openings in same area; the long axes of medial and lateral flanges of the supratendinal bridge form small acute angles with long axis of the shaft; in posterior view, the lateral surface of the shaft near the distal end is 'dished out', concave posterolaterally.

POLYBORUS (POLYBORINAE)

The Menindee specimen differs in that the lateral border of the proximal opening for the tendinal canal protrudes farther anteriorly than does the medial border; the proximal opening of the tendinal canal does not exceed half of the shaft width; the distolateral opening of the tendinal canal is nearly as large or as large as the other two openings; the external condyle does not extend beyond the lateral margin just proximal to this condyle.

TABLE 1: MEASUREMENTS IN MILLIMETRES OF THE TIBIOTARSI OF FOSSIL AND RECENT AUSTRALIAN FALCONIDAE

	<i>Falco</i> <i>hypoleucus</i> ANWC (x-ray photograph)	<i>Falco</i> <i>berigora</i> (UCMP 79276)	<i>Asturæetus</i> (= <i>Plioæetus</i>) <i>furcillatus</i> (QMF5509)	<i>Falco</i> <i>berigora</i> (n = 14)	<i>Falco</i> <i>peregrinus</i> (n = 6)	<i>Falco</i> <i>cenchroides</i> (n = 7)	<i>Falco</i> <i>longipennis</i> (n = 7)	<i>Falco</i> <i>subniger</i> (n = 3)
A. Length from distal end of fibular crest to distal end of tibiotarsus.	51.8	64.6	64.2	57.5-66.6	48.7-57.8	31.6-40.1	39.4-43.3	50.2-53.8
B. Width of shaft at distal end of fibular crest.	5.2	6.8	5.8	5.0-7.2	6.2-6.9	3.2-5.0	3.6-5.0	4.3-6.7
C. Maximum depth of shaft at distal end of fibular crest.	—	5.6	5.6	4.3-5.8	5.0-6.2	2.9-3.5	3.2-4.1	3.8-4.8
D. Width of shaft at proximal end of supratendinal bridge.	—	7.6	8.8	6.3-8.8	7.4-10.1	3.6-4.8	4.3-5.7	6.7-7.9
E. Depth of shaft at proximal end of supratendinal bridge.	—	5.6	4.7	4.0-5.6	5.1-5.6	2.4-3.3	2.9-3.8	3.8-5.0
F. Length of external condyle, viewed anteriorly.	6.2	6.2	6.6	5.4-6.6	5.8-7.4	3.1-3.9	3.4-4.0	5.9-6.1
G. Maximum width distal end	12.4	—	11.5	9.7-11.5	11.6-14.4	6.4-7.2	6.7-8.4	11.0-11.7
H. Depth internal condyle.	8.7	—	7.9	7.4-9.1	8.3-9.7	4.8-5.6	4.9-5.9	7.3-8.0
I. Depth external condyle.	—	—	8.1	7.3-8.9	7.7-9.9	4.8-5.4	5.0-5.7	7.6-7.9
J. Length of fibular crest.	15.0	—	@14.6	11.6-17.4	18.0-18.9	8.5-11.2	8.4-10.9	11.4-13.6

POLIHIERAX (POLIHIERACINAE)

The Menindee specimen differs in that the proximal opening for the tendinal canal tends to be situated near the midline of shaft or slightly medial to it rather than lateral; a broad shelf of bone lies lateral to the distolateral opening of the tendinal canal; in posterior view, the lateral surface near the distal end is 'dished out' rather than being convex posterolaterally.

Against this background of comparison, the Menindee tibiotarsus has been assigned to the genus *Falco*.

COMMENTS

Figs. 1 and 2 and Tab. 1 illustrate how the Menindee specimen is similar in size to specimens of *Falco peregrinus* and *F. berigora*, and larger than specimens of the other Australian falcons, *F. hypoleucos*, *F. cenchroides*, *F. longipennis*, and *F. subniger*.

Even though qualitative characters can be quite variable within any one species of living falcon, a few appear to show consistent differences between some of the Australian falcons and the Menindee specimen. In lateral view, the posterior margin of the shaft is very straight in the Menindee specimen, but distinctly concave in *F. subniger* and *F. longipennis*. In the Menindee specimen, the anterior surface of the shaft is only slightly convex, whereas in most specimens of other Australian falcons this area is more highly arched, but both flattened and arched conditions were observed in *F. berigora*.

Based on the above comparisons, the match of the Menindee specimen is close enough to the tibiotarsi of the living Brown Falcon, *F. berigora* to be assigned to it. Although the tibiotarsi of *F. peregrinus* is also quite similar to both the Menindee specimen and de Vis' *Asturaetus*, it differs in being more robust, while the two fossils and the tibiotarsi of *F. berigora* are more gracile.

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PLATE 1. Anterior views of tibiotarsi of:

- (A) *Falco berigora* (Modern, Australia),
- (B) *Asturaetus* (= *Plioaetus*) *furcillatus* (Pleistocene, Lower Cooper Creek, S.A. QM F5509), and (C) *Falco* cf. *berigora* (Pleistocene, Lake Tandou, N.S.W., UCMP 79276).





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