

NEW DATA ON THE TURTLES FROM THE EARLY EOCENE OF KIRGHIZIA

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Based on new material from the Andarak 2 locality in southern Kirghizia (early Eocene, late Ypresian), the testudinid *Ergilemys vialovi* Ckhikvadze, 1984, is assigned to the subgenus *Hadrianus* Cope, 1872, of the genus *Manouria* Gray, 1852. Part of the humerus of the oldest known cheloniine sea turtle is described from the same locality. The cheloniine sea turtles might have evolved during the Ypresian, an interval during which Cenozoic sea turtles were exceptionally diverse.

Key words: *Manouria*, *Hadrianus*, Cheloniinae, early Eocene, Kirghizia.

Early Eocene turtles are poorly known from Asia. Trionychids of this age were described by Yeh (1962) from the Niushan Formation and by Lei and Ye (1985) from the Zoumaling Formation, The People's Republic of China. Broin (1987) described a carettochelyid and a trionychid from the lower-middle Eocene Kuldana Formation, Pakistan. In Central Asia, sites in the Zayssan Depression (eastern Kazakhstan), the Zhylga 2 locality in southern Kazakhstan, and the Andarak 2 locality in the Fergana Depression of southern Kirghizia have yielded a moderately diverse assemblage of early Eocene turtles (Ckhikvadze, 1973, 1984, 1990; Nessov, 1987; Nessov and Ckhikvadze, 1984). Originally considered to be late Paleocene in age (Nessov, 1987), the Zhylga 2 locality is now known to be early Eocene in age based on the presence of artiodactyls that elsewhere are known only since lower Eocene deposits (Averianov and Erfurt, 1996). Averianov and Udovichenko (1993) have argued that the Andarak 2 locality is late early Eocene (late Ypresian) in age based on elasmobranchian fauna, rather than middle Eocene as suggested by previous workers (Reshetov et al., 1978; Ckhikvadze, 1990; Russell and Zhai, 1987).

The Andarak 2 locality has yielded fossils of the testudinid *Ergilemys vialovi* Ckhikvadze, 1984, and fragmentary, undescribed specimens identified by Ckhikvadze (1984) as Cheloniidae gen. indet. Additional turtle fossils have been collected from the Andarak 2 locality since 1988 by the second author, and we have also identified other turtle fossils in a collection made by A. K. Rozhdestvensky in 1964 and

1967 from the Andarak 1 locality (see Russell and Zhai, 1987). The new specimens of *Ergilemys vialovi* described herein document the morphology of this species in more detail than has previously been possible. We also describe herein a fragment of a probable cheloniine humerus. If correctly identified, this specimen is significant because it is the geologically oldest known example of this subfamily of sea turtles.

All materials described in our paper are housed in the collection of the Herpetological Department of the Zoological Institute of the Russian Academy of Sciences, St. Petersburg (ZISP).

Family Testudinidae Gray, 1825**Genus *Manouria* Gray, 1852****Subgenus *Hadrianus* Cope, 1872*****Manouria (Hadrianus) vialovi* (Ckhikvadze, 1984)**

(Figs. 1, 2)

Hadrianus sp., Reshetov et al., 1978:152.

Ergilemys vialovi Ckhikvadze, 1984:76, Fig. 1; Ckhikvadze, 1989:47; Ckhikvadze, 1990:43.

Holotype. Collection of the Institute of Paleobiology Georgian Academy of Sciences, Tbilisi; left xiphiplastron No. 8-2-1. Lower Eocene (late Ypresian in age) lower part of Alay Formation; Andarak 2 locality, southern Fergana, Kirghizia.

Description. A right nearly complete epiplastron (Fig. 1*a, b*) belongs to a large individual with an estimated shell length of at least 40 cm. The epiplastron is long and thick, with a well-developed, broad epiplastral prominence. Ventrally, the gular scute covered the anterior one-half or so of the epiplastron. The gulo-humeral sulcus, which does not extend onto

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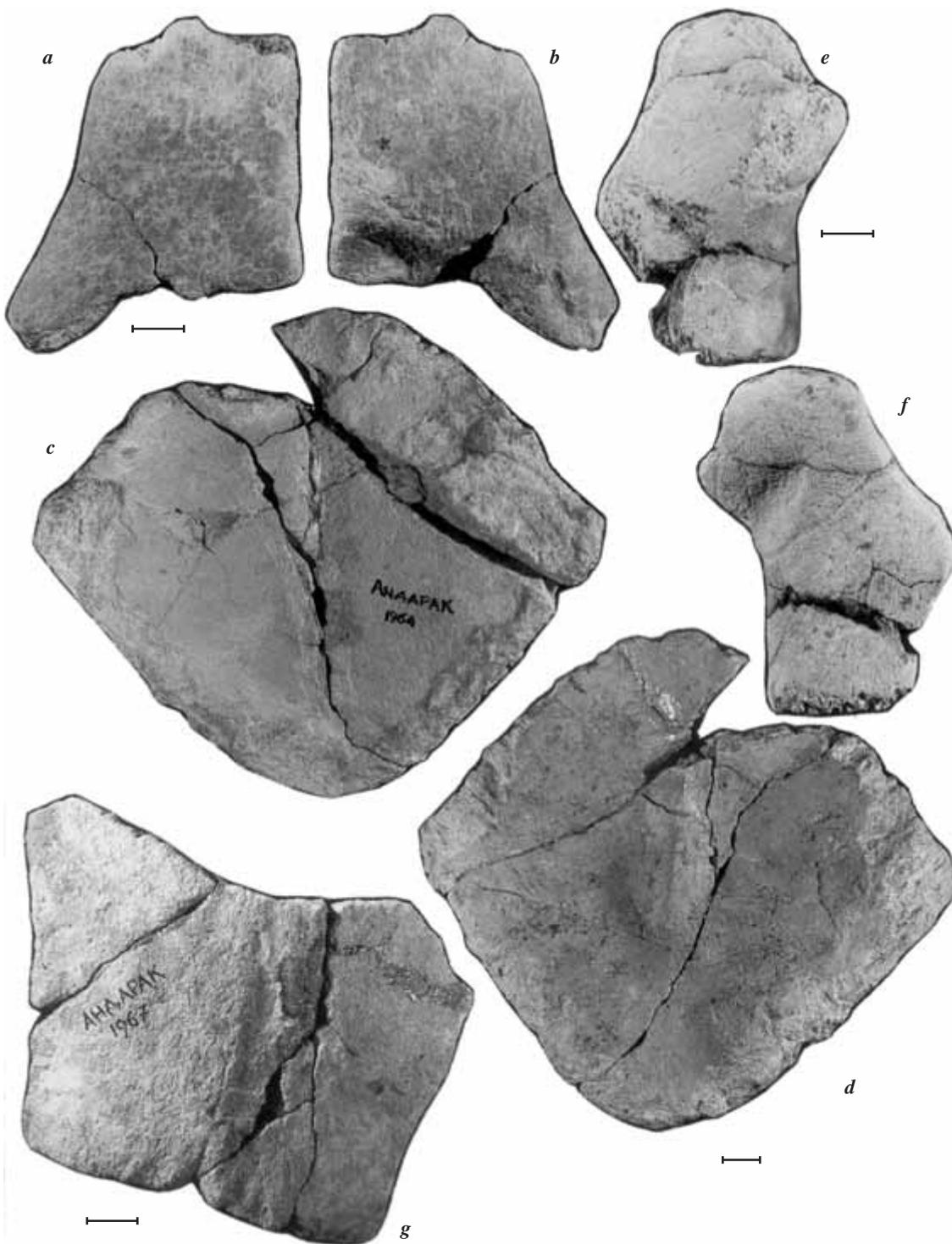


Fig. 1. Shell bones of *Manouria (Hadrianus) vialovi* (Ckhikvadze, 1984); Andarak 2 (*a, b, e, f*) and Andarak 1 (*c, d, g*), southern Fergana, Kirghizia; lower Eocene (late Ypresian in age), lower part of Alay Formation: *a, b*, right epiplastron (ZISP PH 1/3) in external (*a*) and internal (*b*) views; *c, d* endoplastron (ZISP PH 1/4) in external (*c*) and internal (*d*) views; *e, f*, fragmentary right hypoplastron (ZISP PH 2/3) in external (*e*) and internal (*f*) views; *g*, pygal (ZISP PH 2/4) in external view. Scale bar is 1 cm.

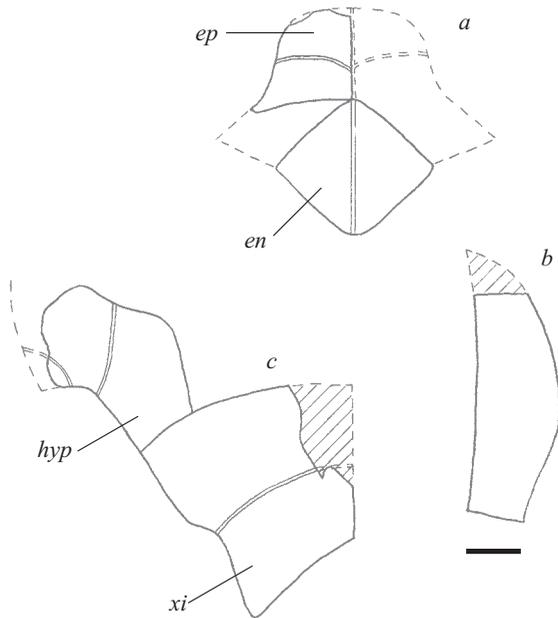


Fig. 2. Partial reconstruction of plastron of *Manouria (Hadrianus) vialovi* (Ckhikvadze, 1984); Andarak 1 and 2, southern Fergana, Kirghizia; lower Eocene (late Ypresian in age), lower part of Alay Formation: *a*, anterior part; *b*, epiplastral symphysis; *c*, posterior part (shape of xiphiplastron after Ckhikvadze, 1984, Fig. 1*a*). *a*, *c*, Without scale; scale bar for *b* is 1 cm. *ep*, Epiplastron; *en*, entoplastron; *hyp*, hypoplastron; *xi*, xiphiplastron.

the entoplastron, is almost perpendicular to the long axis of the plastron. The epiplastral lip is comparatively low, elongate, and becomes thinner towards the entoplastron (Fig. 2*b*). The dorsal surface of the epiplastral prominence is rather flat in transverse view and a weak intergular sulcus is visible on the dorsal surface.

A nearly complete entoplastron (Fig. 1*c*, *d*) is from a large individual with a shell length of about 60 cm. This plate is almost rhomboidal in ventral outline. Ventrally, neither the gulo-humeral nor humero-pectoral sulci extend onto the entoplastron. A well-developed medial crest is present on the internal surface of the entoplastron. Anterior to this crest, near the anterolateral edge of the entoplastron, is a pair of rough eminences that probably served for attachment of ligaments from the acromial process of the scapula. The entoplastron becomes thinner posteriorly.

A fragment consisting of the lateral part of a right hypoplastron (Fig. 1*e*, *f*) ventrally bears the lateral part of the antero-medially directed abdomino-femo-

ral sulcus. More laterally there is the sulcus for the inguinal scute. These two sulci do not contact one another, indicating that in life the abdominal scute separated the femoral and inguinal scutes.

On the ventral surface of the holotype xiphiplastron (Ckhikvadze, 1984, Fig. 1), the femoro-anal sulcus is straight (rather than sinuous) and directed postero-laterally. The xiphiplastral processes are acute or rounded, and the anal notch is deep.

The pygal plate (Fig. 1*g*) is relatively wide. In dorsal view, the outline of the pygal is trapezoid, the anterior edge is broadly concave, and the posterior edge is almost straight and bears a shallow caudal notch. On the external surface of the plate is a weak sulcus between the supracaudal (= marginal 12) scutes.

Comparison. Among Eurasian taxa, *Manouria (Hadrianus) vialovi* most closely resembles the European species *M. (Hadrianus) eocaenica* (Hummel, 1935) from the German middle Eocene (Hummel, 1935), *M. (Hadrianus) cf. eocaenica* from the Austrian middle Eocene (Bachmayer and Mlynarski, 1985*b*), and *M. (Hadrianus) sp.* from the Austrian upper Miocene (Bachmayer and Mlynarski, 1985*a*) in having a well-developed, broad epiplastral prominence and a horizontal gulo-humeral sulcus that is restricted to the epiplastron, but it differs from the latter three taxa and *M. (Hadrianus) sp.* from the French lower Eocene (Broin, 1977) in having an epiplastral prominence with a flat dorsal surface. In the above-mentioned European taxa, the dorsal surface of the epiplastral prominence is concave in transverse view. *M. (Hadrianus) vialovi* further differs from *M. (Hadrianus) obailiensis* (Ckhikvadze, 1970) from the lower Eocene of the Zayssan Depression, eastern Kazakhstan, in having a deeper anal notch and comparably broader pygal.

Among taxa from North America, *Manouria (Hadrianus) vialovi* most closely resembles the upper Eocene species *M. (Hadrianus) utahensis* (Gilmore, 1915) in having the gulo-humeral sulcus restricted to the epiplastron, but it differs from the latter species and all other North American congeners in having a more well-developed epiplastral prominence. *M. (Hadrianus) vialovi* further differs from *M. (Hadrianus) majuscula* (Hay, 1904) from the lower Eocene and *M. (Hadrianus) corsoni* (Leidy, 1871) from the upper Eocene in having a deeper anal notch; from *M. (Hadrianus) majuscula* — in having a femoro-anal sulcus that is straight in ventral view; and

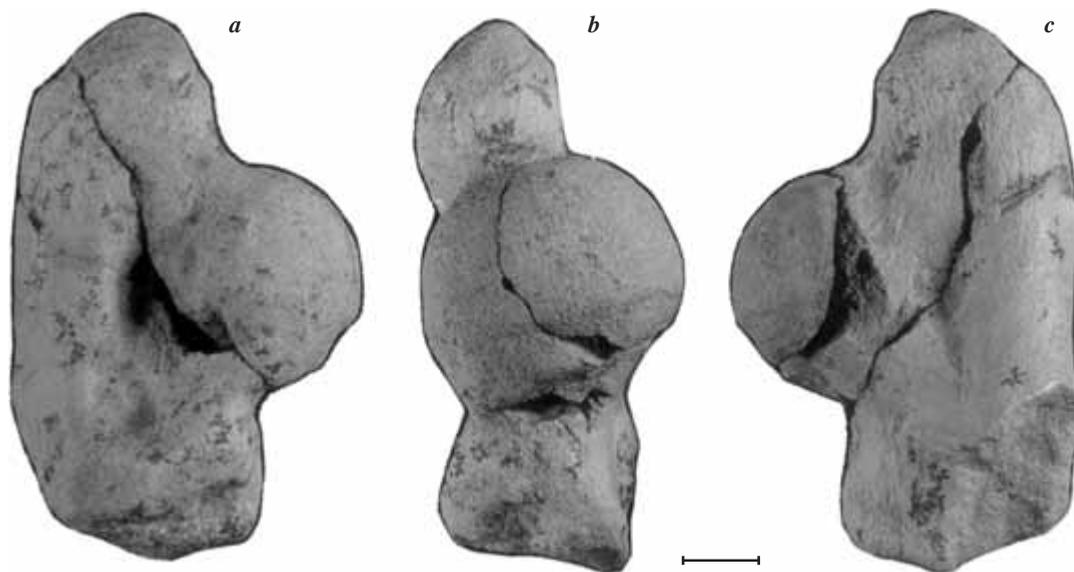


Fig. 3. Proximal part of left humerus, ZISP PH 3/3, of Cheloniinae gen. et sp. indet.; Andarak 2, southern Fergana, Kirghizia; lower Eocene (late Ypresian in age), lower part of Alay Formation: ventral (a), anterior (b), and dorsal (c) views. Scale bar is 1 cm.

from *M. (Hadrianus) tumida* (Hay, 1908) from the upper Eocene in having the abdominal scute separate the femoral and inguinal scutes.

Material. ZISP PH 1/3, right epiplastron, and ZISP PH 2/3, fragmentary right hypoplastron, from Andarak 2 locality; ZISP PH 1/4, entoplastron, and ZISP PH 2/4, pygal, from Andarak 1 locality. Both localities are in the lower Eocene (late Ypresian in age) lower part of the Alay Formation; southern Fergana, Kirghizia.

Remarks. In the type description of *Manouria (Hadrianus) vialovi*, Ckhikvadze (1984) assigned this species to the testudinid genus *Ergilemys* Ckhikvadze, 1972, because the elongate epiplastral prominence and thin epiplastral lip in the holotype of *M. (Hadrianus) vialovi* also occur in *E. saikanensis* Ckhikvadze, 1972 (see Ckhikvadze, 1972, Fig. 2b) from the lower Oligocene of Kazakhstan. Four lines of evidence suggest to us that *M. (Hadrianus) vialovi* belongs instead to the subgenus *Hadrianus*. First, the form of the epiplastron in *E. saikanensis* is not typical of other unequivocal members of this genus. For example, in the type species *E. insolitus* (Matthew and Granger, 1923) from the Mongolian lower Oligocene, the epiplastral prominence is short and the epiplastral lip is thick (Ckhikvadze, 1975, Figs. 5, 7). Instead, the epiplastron of *E. saikanensis* resembles that seen in *Hadrianus*, suggesting that this species

may in fact be referable to *Hadrianus*. Second, based on the holotype xiphoplastron and previously unknown, referred shell bones described above, *M. (Hadrianus) vialovi* clearly lacks the following additional features that Ckhikvadze (1972) considered diagnostic for *Ergilemys*: gular scute may extend onto entoplastron; intergular scute usually absent; femoro-anal sulcus sinuous in ventral outline; supracaudal scute unpaired; and inguinal scute absent. Third, instead the fossils from Andarak exhibit the following diagnostic features of the subgenus *Hadrianus* (Hay, 1908; Ckhikvadze, 1973; Crumly, 1984): 1) epiplastral prominence well-developed; 2) epiplastral lip relatively thin; 3) femoro-anal sulcus straight; 4) inguinal scute present; 5) rudimentary intergular sulcus present; and 6) supracaudal scute paired. Finally, all members of *Ergilemys* are geologically younger — i.e., early Oligocene to early Miocene — than *M. (Hadrianus) vialovi*.

Family Cheloniidae Gray, 1825
Subfamily Cheloniinae Gray, 1825
Cheloniinae gen. et sp. indet.
 (Figs. 3, 4)

Material. ZISP PH 3/3, proximal part of left humerus. Lower Eocene (late Ypresian in age) lower

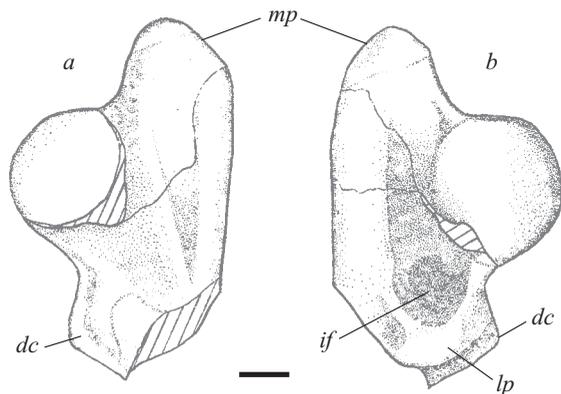


Fig. 4. Proximal part of left humerus, ZISP PH 3/3, of *Cheloninae* gen. et sp. indet.; Andarak 2, southern Fergana, Kirghizia; lower Eocene (late Ypresian in age), lower part of Alay Formation: dorsal (*a*), and ventral (*b*) views. *dc*, Deltopectoral crest; *if*, intertubercular fossa; *lp*, lateral process; *mp*, medial process. Scale bar is 1 cm.

part of Alay Formation; Andarak 2 locality, southern Fergana, Kirghizia.

Description (morphology of humerus after Romer, 1956 and Walker, 1973). The preserved part of the humerus bears a strongly-developed medial process. On the top of the medial process there is a tuberosity for attachment of the *m. coracobrachialis magnus*. A depression for attachment of the *m. subscapularis* is present on the dorsal surface of the humerus shaft. The head is well-isolated from the diaphysis, the angle (α) between the head axis and the longitudinal axis of the shaft is approximately $130 - 140^\circ$. The angle (β) between the axis of the articular surface of the head and the longitudinal axis of the shaft is about 20° . The lateral process arises off the ventral surface of the diaphysis, just distal to the humeral head. This process together with deltopectoral crest form an V-shaped surface in anterior view for attachment of the *mm. pectoralis* and *supratoracoideus*. The intertubercular fossa is deep. On the dorsal surface of the diaphysis, just distal to the head, is an elongate tuberosity for attachment of the *mm. latissimus dorsi* and *teres major*.

Comparison. The humerus fragment shows most similarity with humeri of extant sea turtles *Caretta*, that could be seen in the degree of development of medial process and in the location of lateral process relatively to the head of the bone. It differs from the humerus in *Caretta* by the structure of the tuberosity from aponeuroses *mm. latissimus dorsi* and *teres ma-*

ior on the dorsal surface of diaphysis, which is stronger developed and more proximally located. The *Caretta* has this tuberosity set in the elongated pit. Moreover, the anterior apex of the deltopectoral crest in the described fragment placed more proximally relatively to the head than in *Caretta*.

Remarks. Prior to this report, the geologically oldest cheloniine was the North American late Eocene – Miocene genus *Procolpochelys* Hay, 1908, (Weems, 1974), which has been assigned by Zangerl and Turnbull (1955) to the tribe Carettini. Previously the oldest, unequivocal record of an Asian cheloniine were fossils of *Glarichelys* Zangerl, 1958, from the middle Oligocene Trans-Caspian Sea area (Aslanova et al., 1979). But recently *Glarichelys* is considered to be an eochelyine (Weems, 1988). The humerus from the Andarak 2 locality is thus significant because it documents the geologically oldest occurrence of the Cheloniinae. This record also demonstrates that the humeral morphology typical of geologically younger cheloniines was established by at least the early Eocene. Previously, Zangerl (1980) suggested that this characteristic humeral morphology had arisen later, during the late Oligocene – early Miocene.

Cenozoic sea turtles achieved their peak diversity in the early Eocene (Weems, 1988). The early Eocene was also a time of warm temperatures and the maximum marine transgression for the Cenozoic, factors which may have contributed to the radiation of marine turtles during this interval. The presence of a cheloniine in the early Eocene of Kirghizia suggests that the evolution of this highly successful group of marine turtles may have been part of this early Eocene radiation event.

Acknowledgments. The authors are very grateful to Drs. N. I. Udovichenko and M. Godinot for assistance in the field, to Dr. V. B. Sukhanov (Paleontological Institute, Moscow, Russia) and Dr. J. Gardner (University of Alberta, Edmonton, AL, Canada) for corrections and useful comments on the manuscript.

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