

A basal eucryptodiran turtle “*Sinemys*” *efremovi* (= *Wuguia efremovi*) from the Early Cretaceous of China

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A reexamination of the type material (two specimens considered for a long time lost) of the poorly known turtle “*Sinemys*” *efremovi* Khosatzky, 1996 from the Early Cretaceous Tugulu Group of northwest China, allows us to present new observations, images, and taxonomic conclusions about these important specimens. We conclude that: (1) “*S.*” *efremovi* is referable to the basal eucryptodire genus *Wuguia* Matzke, Maisch, Pfretzschner, Sun, and Stöhr, 2004 based on a small size (up to 150 mm in shell length), absence of the nuchal emargination, presence of additional ossifications in the suprapygal region of the carapace and similar plastral proportions with relatively long bridges (35–45% of the plastron width), and a narrow and elongated posterior lobe; (2) “*S.*” *efremovi* is a senior subjective synonym of *Dracocheilus wimani* Maisch, Matzke, and Sun, 2003, another species recently described from the Tugulu Group. As construed here, *Wuguia* includes two species: *W. efremovi* (Khosatzky, 1996) and *W. hutubeiensis* Matzke, Maisch, Pfretzschner, Sun, and Stöhr, 2004. New diagnoses for these taxa are given.

Key words: Testudines, Eucryptodira, Macrobaenidae, *Sinemys*, *Wuguia*, Cretaceous, Tugulu Group, Junggar Basin, China.

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Introduction

Sinemys efremovi Khosatzky, 1996 was described based on three drawings and one photograph of what was originally thought to be three specimens (see Material section) in a posthumously published paper of Khosatzky (1996). The figured specimens, collected in 1941–1942 from the Early Cretaceous Tugulu Group near the Toutunhe (= Tukhun-Kho) River, southern Junggar Basin, Xinjiang-Uygur Autonomous Region, China, were considered lost by the time of the description. The species was questionably referred to the genus *Sinemys* Wieman, 1930 of the family Sinemydidae Yeh, 1963 based on “very long and sharply pointed posteromedial ends of the hypoplastra and strongly developed central plastral opening” (Khosatzky 1996: 91). The first of these characters is now known to be incorrect (see Description section) and the second one is plesiomorphic for the “macrobaenid” grade (*sensu* Parham and Hutchison 2003). Brinkman (2001) later removed *Sinemys efremovi* from *Sinemys* and left it as “*Sinemys*” *efremovi*, a view shared by other authors (Maisch et al. 2003).

During last five years, turtles of the Tugulu Group were intensively studied, resulting in the description of new material, and taxa and taxonomic revisions (Brinkman 2001; Maisch and Matzke 2003; Matzke et al. 2004). Despite these advances, “*Sinemys*” *efremovi* remains poorly known and its taxonomic status needs clarification. The type material of “*Sinemys*” *efremovi* was recently found by the authors and

appears to consist of only two, instead of three specimens as reported by Khosatzky (1996) (see Material section). A description of these specimens and taxonomic conclusions are given below.

Institutional abbreviations.—PIN, Paleontological Institute, Russian Academy of Sciences, Moscow, Russia; SGP, Sino-German Project, the material is currently housed at the Paläontologische Sammlung, Eberhard-Karls-Universität, Tübingen, Germany.

Description

Material.—According to Khosatzky (1996), the type material of “*Sinemys*” *efremovi* consists of three individuals: 1) a partial shell exposed in ventral aspect (the holotype), 2) a partial carapace exposed in dorsal aspect and 3) an anterior part of a carapace exposed in ventral aspect. In fact, there are only two specimens in the type series. The first one (the holotype, PIN 5114-1) consists of three pieces (Figs. 1, 2): the imprint of the ventral surface of the shell (PIN 5114-1/c, Fig. 2A), corresponding to the first specimen of Khosatzky (1996), the imprint of the dorsal surface of the shell (PIN 5114-1/a, Fig. 1B), corresponding to the second specimen of Khosatzky (1996) and the internal core of the shell (PIN 5114-1/b, Figs. 1A, 2B). The second specimen corresponds to the third specimen of Khosatzky (1996) (PIN 5114-2, Fig. 2C).

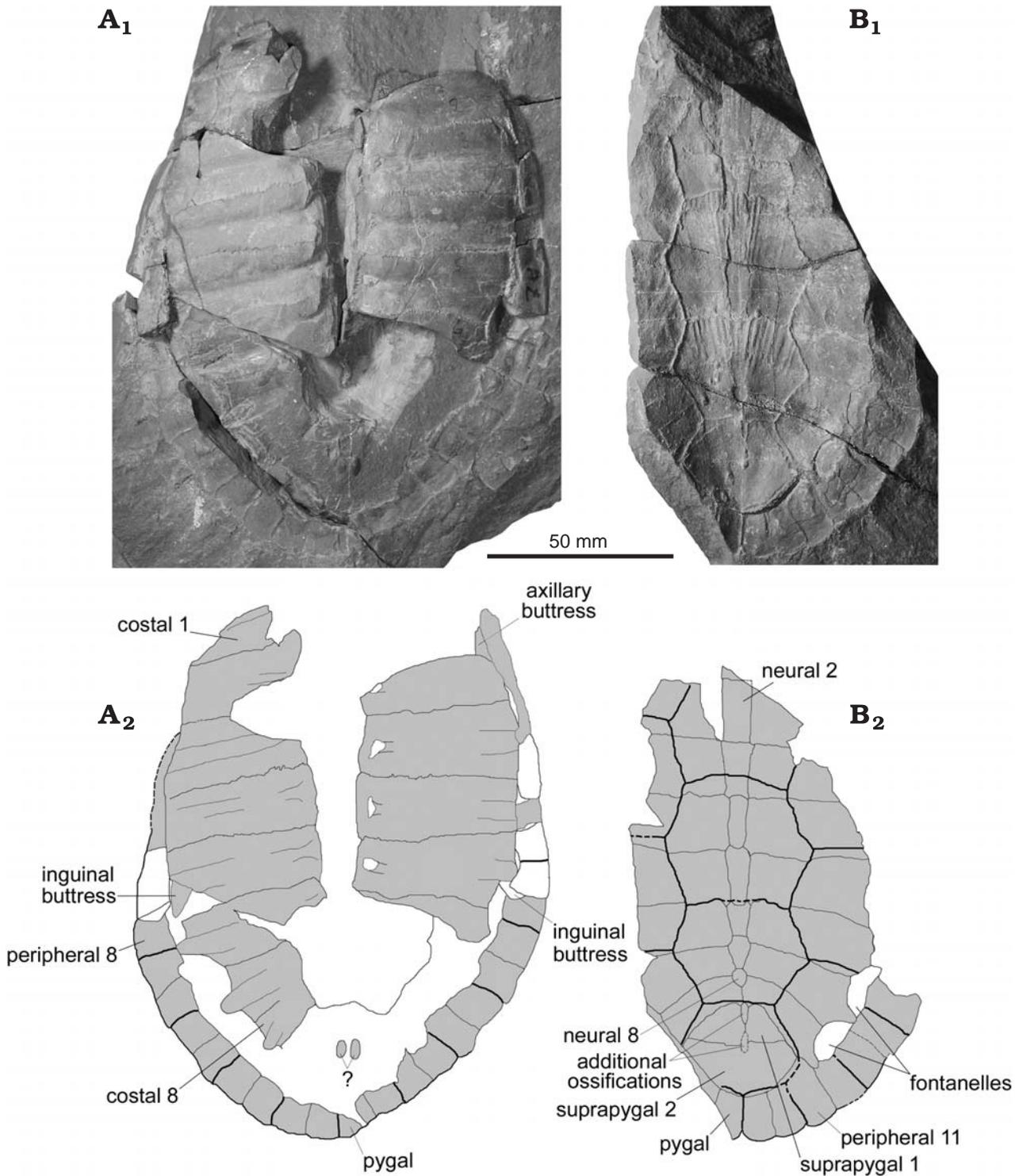


Fig. 1. “*Sinemys*” *efremovi* Khosatzky, 1996, PIN 5114-1 (holotype), Toutunhe River area, southern Junggar Basin, Xinjiang-Uygur Autonomous Region, China; Hutubei Formation, Tugulu Group, Hauterivian–Barremian. **A.** Internal core (PIN 5114-1/b) plus imprint of the ventral surface of the shell (PIN 5114-1/c), photograph (**A₁**) and explanatory drawing of the same (**A₂**). **B.** Imprint of the dorsal surface of the shell (PIN 5114-1/a); photograph (**B₁**) and explanatory drawing of the same (**B₂**). Imprints of plates are filled with grey. Unknown structures in the suprapygal region indicated by question mark.

Description of the holotype PIN 5114-1 (Figs. 1, 2).—The shell has a shape of a relatively elongate oval. Its estimated length is about 150 mm, the width is about 114 mm. The nuchal is not preserved. Among the neurals only 2–8 are present (Fig. 1B). Neural 2 is rectangular. Neural 3 is asymmetri-

cally hexagonal with short sides anteriorly on the left side and posteriorly on the right side. Neural 4 is subrectangular. Neurals 5–7 are hexagonal and short-sided anteriorly. Neural 8 is pentagonal, drop-shaped, and reduced in size, allowing contact of the eighth costals along the midline. Measurements of

Table 1. Comparison of selected “macrobaenid/sinemid” taxa in some shell characters. The information about characters are taken from the following papers: *Dracochelys* (Gaffney and Ye 1992), *Judithemys* (Parham and Hutchison 2003), *Kirgizemys* (Danilov et al. in press), *Ordosemys* (Brinkman and Peng 1993a; Tong et al. 2004), *Sinemys* (Brinkman and Peng 1993b), *Wuguia* (Maisch et al. 2003; Matzke et al. 2004; Matzke and Maisch 2004; this paper).

Character	<i>Dracochelys</i>	<i>Judithemys</i>	<i>Kirgizemys</i> (incl. <i>Hangaemys</i>)	<i>Ordosemys</i>	<i>Sinemys</i>	<i>Wuguia</i>
Length of the shell (mm)	~300	~400	~350	~250	~200	~150
Carapace	longer than wide	longer than wide	longer than wide	as wide as long	longer than wide or wider than long	longer than wide
Nuchal emargination	large	small	small	small	small	very small or absent
Central fontanelle in the plastron	present	absent	absent	present	present	present or absent
Bridge length (% of plastron width)	~25	~30	30-35	~35	~70	35-45
Lobes of the plastron	moderate	moderate	moderate	moderate	narrow	narrow
Nuchal	narrower than vertebral 1	narrower than vertebral 1	narrower than vertebral 1	wider than vertebral 1	narrower than vertebral 1	wider than vertebral 1
Preneural	absent	absent	absent	present	absent	absent
Number of neurals	9	8	9 (8)	8	9	8
Peripheral 1 contacts costal 1	no	yes	yes	yes	yes	yes
Gutter on peripherals	absent	absent	present	present	absent	present
Cervical scale	indet	wide	wide	wide	absent	wide
Vertebral 3	wider than long	wider than long	as long as or longer than wide	wider than long	longer than wide	longer than wide or wider than long

the neurals are (length/width, in mm): 2, 16.0/8.0; 3, 15.5/~9.0; 4, 14.5/ 8.5; 5, 15.5/6.3; 6, 12.5/6.5; 7, 8.5/5.5; 8, 6.0/4.0.

Suprapygals 1 is trapezoid, 13.5 mm long and 30.5 mm wide posteriorly. It seems to be divided into two parts along the midline by what appears to be two small additional ossifications along the midline on the contacts of suprapygals 1 with costals 8 and suprapygals 2. Similar ossifications are reported for *Wuguia hutubeiensis* (Matzke and Maisch 2004: fig. 4G). Suprapygals 2 is also somewhat trapezoid-shaped but the broad side faces anteriorly. It is 15.0 mm long and 31.5 mm wide. Internal surfaces of the suprapygals region bears two closely placed oval concavities. The pygal is 10.0 mm long and 15.0 mm wide posteriorly. The caudal margin of the pygal is slightly notched.

Costals are visible on the imprint of the external surface of the carapace and on the internal core of the shell (Fig. 1). All costals, except 4, are wider laterally than medially. Costals 8 contact one another along the midline. The ribheads and rib thickenings of the costals are distinct and rather wide. The ridge on the ventral surface of the first costal seems particularly well developed, which may imply a long first thoracic rib. The free ribs of costal 7 contact the posterior part of peripheral 9, whereas the free rib of costal 8 inserts between peripherals 10 and 11.

There are imprints of peripherals 7–11 on both sides. In addition, the left peripheral 7 and the right peripherals 7 and 5 or 6 are represented by complete plates. The posterolateral peripherals are not strongly expanded, similar to *Wuguia hutubeiensis*, but unlike other primitive eucryptodires. The free margins of the posterior peripherals are slightly notched where the marginal sulci meet the rim. Costal-peripheral fontanelles are clearly visible in the posterior part of the carapace.

The plastron is only loosely connected to the carapace. The axillary and inguinal buttresses seem to have normal “macrobaenid” contacts, i.e., with peripherals 2 and 8 respectively. The estimated width of the plastron is about 75 mm, the minimal length of the bridge is about 26 mm (about 35% of the plastral width). The anterior lobe is not preserved. The posterior lobe is wedge-shaped and strongly narrowed distally. The hypoplastra are neither particularly long nor sharply pointed along their posteromedial ends as reported by Khosatzky (1996). Instead, the hypoplastra and xiphoplastra (considered absent by Khosatzky 1996) have a morphology similar to those observed in most basal eucryptodires. The lateral and central plastral fontanelles are well developed. The central fontanelle is 16.6 mm long and 18.6 mm wide.

Vertebral scales are represented by vertebrae 2–5. Vertebral 3 is wider than long and wider than vertebrae 4 and 5. Measurements of the vertebrae are (length/width maximal/width anteriorly, in mm): 3, 32.0/41.0/26.5; 4, 26.5/38.0/29.0; 5, 27.5/32.0/ 19.0. The interpleural sulci are located close to the posterior borders of the respective costals. The pleural-marginal sulcus corresponds to the costal-peripheral fontanelles in the posterior part of the carapace. The twelfth marginals extend slightly on to suprapygals 2 *contra* previous interpretation (Khosatzky 1996).

The pectoral-abdominal sulcus is straight and located just anterior to the hyo-hyoplastron suture. Medially this sulcus enters the central fontanelle. The abdominal-femoral sulcus stretches from the femoral notch to the central fontanelle. Other plastral sulci are not discernible.

Description of the paratype PIN 5114-2 (Fig. 2C).—The specimen is represented by the anterior part of the carapace in ventral aspect on the slab, including the nuchal region, which

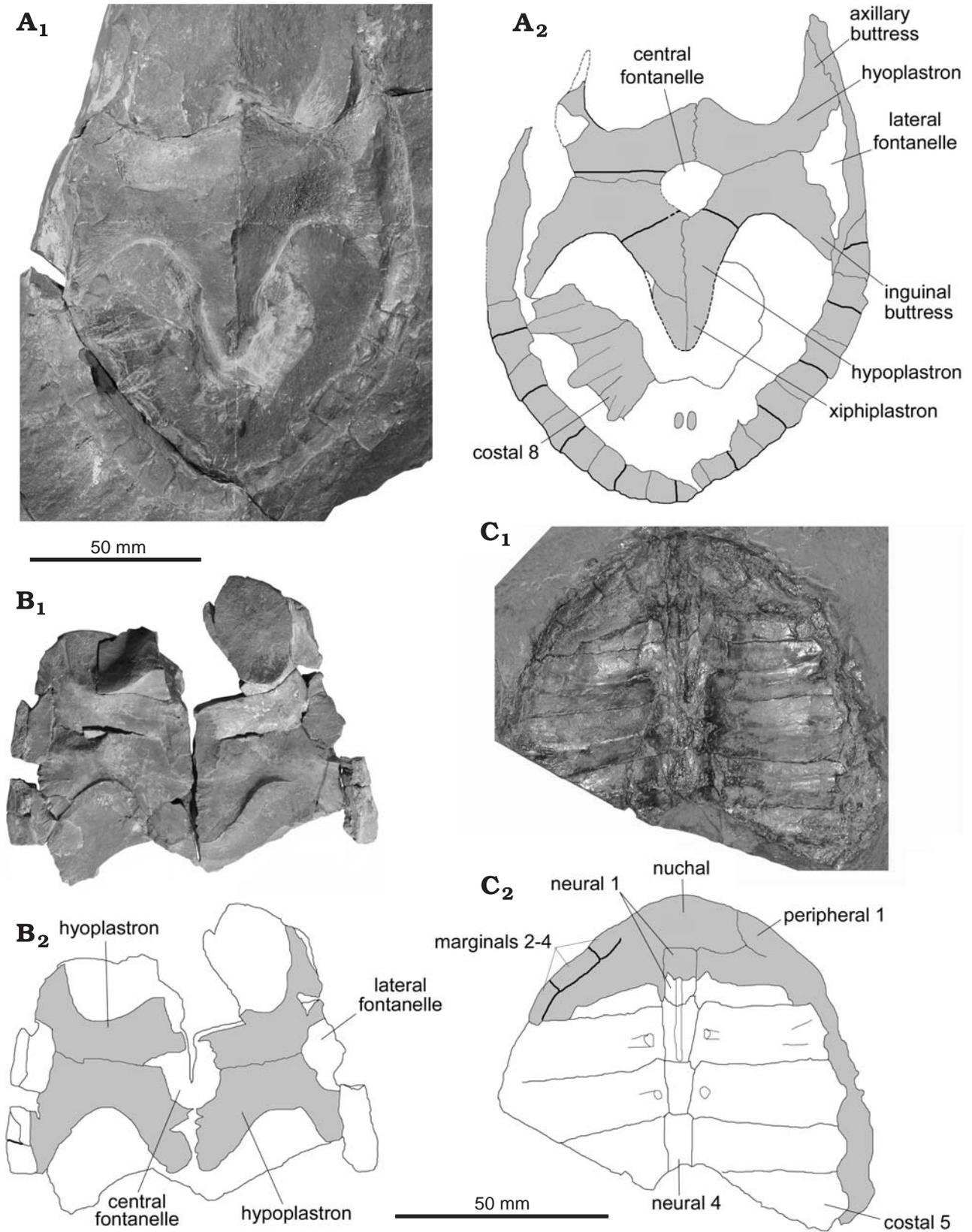


Fig. 2. “*Sinemys*” *efremovi* Khosatzky, 1996, Toutunhe River area, southern Junggar Basin, Xinjiang-Uygur Autonomous Region, China; Hutubei Formation, Tugulu Group, Hauterivian–Barremian. **A, B.** PIN 5114-1 (holotype). **A.** Imprint of the ventral surface of the shell (PIN 5114-1/c) (internal core piece removed), photograph (A₁) and explanatory drawing of the same (A₂). **B.** Internal core of the shell (PIN 5114-1/b) in ventral view, photograph (B₁) and explanatory drawing of the same (B₂). **C.** PIN 5114-2, anterior part of the carapace in ventral aspect, photograph (C₁) and explanatory drawing of the same (C₂). Imprints of plates are filled with grey.

is represented by a dorsal imprint, neurals 1–4, right costals 1–4, left costals 1–5, and an undetermined number of peripherals. The estimated length of the shell is about 120 mm. The nuchal is convex anteriorly and lacks any emargination. The nuchal/peripheral 1 suture is discernible on the right side of the specimen and reveals that the nuchal must have been slightly trapezoidal. Neural 1 is rectangular, whereas neurals 2–4 are hexagonal and short-sided anteriorly. Costal 4 is slightly narrowed distally as is seen in the holotype. Rib heads and rib thickenings of the costals are distinct and rather wide. The peripherals contacts are not clear. The left marginals 2–4 are the only discernible carapacial scales.

Discussion

We follow Khosatzky (1996) in considering both specimens described herein as belonging to “*Sinemys*” *efremovi*. New observations for this taxon include absence of the nuchal emargination and presence of the additional ossifications in the suprapygal region. More importantly, and in contrast to Khosatzky (1996), we observe the xiphiplastron typical for basal eucryptodires, and 12th marginals extending onto suprapygal 2. All of these characters are present in *Wuguia hutubeiensis* Matzke, Maisch, Pfretzschner, Sun, and Stöhr, 2004, a basal eucryptodire recently described from the same area and horizon, the Hutubei Formation of the Tugulu Group, near Toutunhe River, Junggar Basin, Xinjiang, China (Matzke et al. 2004; Matzke and Maisch 2004). In addition, these two taxa are both rather small (up to 150 mm in shell length) and possess similar plastral proportions with relatively long bridges (35–45% of the plastron width) and a narrow and elongated posterior lobe. Based on these similarities, we assign “*Sinemys*” *efremovi* to the genus *Wuguia* (see Systematic paleontology section). “*Sinemys*” *efremovi* differs from *Wuguia hutubeiensis* by the presence of fontanelles in the carapace and plastron, by possessing a nuchal that is not fused with the peripherals, the presence of a narrower pygal, a midline contact of costals 8, a shorter bridge, and by possessing vertebral 3 that is wider than long and wider than vertebrals 4 and 5. These differences are sufficient to consider “*S.*” *efremovi* as a separate species of *Wuguia*. We consider the presence of fontanelles as a specific character of *Wuguia efremovi*, rather than age dependent, because the holotype (PIN 5114-1) demonstrating this character is an adult similar in size to *W. hutubeiensis*. On the other hand, it is possible that some characters, like absence of the nuchal/peripheral fusion, are subjected to individual variation as is known in *W. hutubeiensis* (see Matzke and Maisch 2004) and not good for distinguishing the species under discussion. Anyway study of new materials is needed to support or reject the taxonomic construction accepted herein.

Dracochelys wimani Maisch, Matzke, and Sun, 2003 recently described from the Lianmuxin Formation of the Tugulu Group, Lihonggou, west of Toutunhe River, Junggar Basin, Xinjiang, China was referred to the genus *Dracochelys* Gaff-

ney and Yeh, 1992 based on the fenestration of the carapace and plastron and the presence of vertebrals that are widened along their central part (Maisch et al. 2003). However, both of these characters are widely distributed among basal eucryptodires (Table 1) and so are not sufficient to diagnose lower level taxa. In addition, *Dracochelys wimani* differs from *Dracochelys bicuspis* Gaffney and Yeh, 1992 (type species of *Dracochelys*) in its smaller size, very weak nuchal emargination, the presence of eight neurals and longer bridges. On the other hand, all these characters argue in favor of assignment of *D. wimani* to the genus *Wuguia*. Within *Wuguia*, *Dracochelys wimani* is most similar to *Wuguia efremovi* in the presence of fontanelles, the nuchal is not fused with the peripherals, vertebral 3 is wider than long and wider than vertebrals 4 and 5. We found no significant differences between these taxa and we conclude that *Wuguia efremovi* is a senior subjective synonym of *Dracochelys wimani*. Thus as construed here, *Wuguia* includes two species: *W. efremovi* (= *Dracochelys wimani*) and *W. hutubeiensis*. A revised diagnoses of *Wuguia* and species included are given in the Systematic paleontology section (below).

Matzke et al. (2004) reported five turtle taxa from the Tugulu Group: (1) “*Sinemys*” *efremovi* Khosatzky, 1996; (2) *Wuguia hutubeiensis* Matzke, Maisch, Pfretzschner, Sun, and Stöhr, 2004; (3) *Dracochelys bicuspis* Gaffney and Ye, 1992; (4) *Dracochelys wimani* Maisch, Matzke, and Sun, 2003; (5) “*Sinemys*” *wuerhoensis* Yeh, 1973. Our study removes *Dracochelys wimani* from this list and replaces “*Sinemys*” *efremovi* with *Wuguia efremovi*. Besides that, according to our unpublished data, type series of “*Sinemys*” *wuerhoensis* include three taxa. Considering these changes, the Tugulu Group is now thought to contain up to six species and five genera of turtles and remains one of the most diverse Early Cretaceous turtle faunas from Asia.

Systematic paleontology

Testudines Batsch, 1788

Pancryptodira Joyce, Parham, and Gauthier, 2004

Eucryptodira Gaffney, 1975 *sensu* Gaffney (1984)

grade “Macrobaenidae” Sukhanov, 1964 *sensu*

Parham and Hutchison (2003)

Wuguia Matzke, Maisch, Pfretzschner, Sun, and Stöhr, 2004

2004 *Wuguia*: Matzke et al. 2004: 153; Matzke and Maisch 2004: 474.

Type species: *Wuguia hutubeiensis* Matzke, Maisch, Pfretzschner, Sun, and Stöhr, 2004.

Included species: *Type species* and *Wuguia efremovi* (Khosatzky, 1996).

Diagnosis (emended after Matzke et al. 2004).—Small eucryptodiran turtle (up to 150 mm in shell length) with no or very small nuchal emargination. Nuchal probably wider than vertebral first scale. Preneural absent. Eight neurals present. Additional ossifications may be present in the nuchal and

suprapygial regions of the carapace. Peripherals gutter present. Plastral bridges relatively long (35–45% of the plastron width). Anterior and posterior lobes very narrow and elongated. Cervical scale wide.

Comparison.—For comparison with other “macrobaenid/sinemysid” turtles see Table 1.

Distribution.—Tugulu Group, Lower Cretaceous of China.

Wuguia hutubeiensis Matzke, Maisch, Pfretzschner, Sun, and Stöhr, 2004

2004 *Wuguia hutubeiensis*; Matzke et al. 2004: 153, figs. 1–4.

2004 *Wuguia hutubeiensis*; Matzke and Maisch 2004: 474, figs. 1–4.

Holotype: SGP 2001/006, a partial skeleton with carapace and plastron preserved as natural impressions on three slabs.

Locality and horizon: Haojiagou section east of the Toutunhe river, southern Junggar Basin, Xinjiang-Uygur Autonomous Region, China; Lowermost Hutubei Formation, Tugulu Group, Lower Cretaceous (Hauterivian–Barremian).

Diagnosis.—A species of *Wuguia* without fontanelles in the carapace and plastron. Nuchal fused with peripherals. Pygal wide. Costals 8 not in contact at midline. Plastral bridges make up about 45% of the plastron width. Vertebral 3 longer than wide and narrower than vertebrae 4 and 5.

Distribution.—Hutubei Formation, Lower Tugulu Group, Lower Cretaceous, Junggar Basin, northwest China.

Wuguia efremovi (Khosatzky, 1996) comb. nov.

1996 ?*Sinemys efremovi* Khosatzky, 1996: 92, figs. 1–4.

2000 ?*Sinemys efremovi* Khosatzky, 1996; Sukhanov 2000: 319.

2001 “*Sinemys*” *efremovi* Khosatzky, 1996; Brinkman 2001: 1650.

2003 “*Sinemys*” *efremovi* Khosatzky, 1996; Maisch et al. 2003: 706–707.

2003 *Dracochelys wimani* sp. nov.; Maisch et al. 2003: 707, figs. 1–5. [syn. nov.]

Holotype: PIN 5114-1, a partial shell consists of three pieces: imprint of the dorsal surface, internal core, and imprint of the ventral surface.

Locality and horizon: Toutunhe (= Tukhun-Kho) River area, southern Junggar Basin, Xinjiang-Uygur Autonomous Region, China; Hutubei Formation, Tugulu Group, Lower Cretaceous (Hauterivian–Barremian).

Diagnosis.—A species of *Wuguia* characterized by presence of fontanelles in the carapace and plastron. Nuchal not fused with peripherals. Pygal narrow. Costals 8 contact at midline. Plastral bridges make up 35–40% of plastral width. Vertebral 3 wider than long and wider than vertebrae 4 and 5.

Distribution.—Hutubei and Lianmuxin Formations, Tugulu Group, Lower Cretaceous, Junggar Basin, northwest China.

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