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Nonmarine ostracods from the Paleocene Subeng mammal site, Inner Mongolia, P.R. China, taxonomy and biostratigraphy

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Abstract

Nine species, belonging to six genera, of nonmarine ostracods of the mammal-bearing horizons of the Subeng locality are described and figured. One species is new: *Timiriasevia subengensis* sp. nov. Seven species are in common with the Paleocene White Beds (Naran Member) of the Naran Bulak Formation, Nemegt Basin, Mongolia. The two other species are known from the Paleocene of China. Based on the ostracod fauna, the mammal- bearing horizons of the Subeng site (Bayan Ulan Beds, Nomogen Formation) are late Paleocene in age and can be correlated with the Naran Member of the Naran Bulak Formation.

Key-words: nonmarine Ostracoda, Paleocene, Inner Mongolia, Nomogen Formation.

Résumé

Neuf espèces d'ostracodes d'eau douce, appartenant à six genres, sont décrites et illustrées des couches à mammifères de la localité de Subeng. Une espèce est nouvelle: *Timiriasevia subengensis* sp. nov. Sept espèces sont en commun avec les "White Beds" (Membre de Naran) de la Formation de Naran Bulak, d'age Paléocène du Basin de Nemegt, Mongolie. Les deux autres espèces sont connues du Paléocène chinois. La faune d'ostracodes permet de dater les couches à mammifères de la localité de Subeng (Couches de Bayan Ulan, Formation de Nomogen) comme Paléocène et de corréler ces couches avec le Membre de Naran de la Formation de Naran Bulak.

Mots-clefs: Ostracodes d'eau douce, Paléocène, Mongolie Intérieure, Formation de Nomogen.

Introduction

The Paleocene-Eocene transition represents a major turnover in mammal evolution. During this period modern mammalian orders replaced archaic taxa. A popular hypothesis takes Asia as the centre of early mammal origination with the dispersal of several mammal orders from Asia to North America and Europe (BOWEN *et al.*, 2002). A key-locality to confirm this hypothesis is the Late Paleocene mammal site, Bayan Ulan (Nomogen Formation). With the description of the Bayan Ulan fossil locality, RUSSELL & ZHAI (1987) mention the existence of three sites with a similar mammal fauna (and thus of a similar age) that remain to be described, among those Subeng (= Subon). The study of the poorly known mammal fauna of the Subeng site has already lead to new insights on the mammal migration during the Paleocene-Eocene interval (SMITH *et al.*, 2004).

In the present paper the assemblage of ostracods recovered from the mammal-bearing sediments at the Subeng site is described. The ostracod assemblage allows the positioning of the mammal-bearing sediments in the regional stratigraphical framework and it also gives an indication of the age of the sediments. Such an age estimation made independently of the vertebrate fossil group under study (in this case mammals) helps to avoid a circular reasoning for the age estimation of the sediments.

Geographical and geological setting

The outcrops of the Subeng mammal site are situated in an incline 20 km southwest of the city Erlianhot (Fig. 1). Here gulleys have eroded the Quaternary cover and the Tertiary sediments are exposed. The outcrops within recent gulleys are of a relative good quality but they are rapidly degrading in ancient gulleys. On the plains separated by the incline, outcrops are very rare to non-existent.

At the Subeng mammal site three different lithological units can be observed (Fig. 2), corresponding to the different formations that, according to the regional geological map, crop out at the Subeng site: the Upper Cretaceous Iren Dabasu Formation (unit 1) and the Tertiary Nomogen (unit 2) and Bayan Ulan (unit 3) formations. MENG *et al.* (1998) no longer consider the Bayan Ulan Beds as a separate formation but as the upper part of the Nomogen Formation. So, Unit 2 and 3 are here referred to the Nomogen Formation. The mammal fossils have only been recovered from the third unit and based on

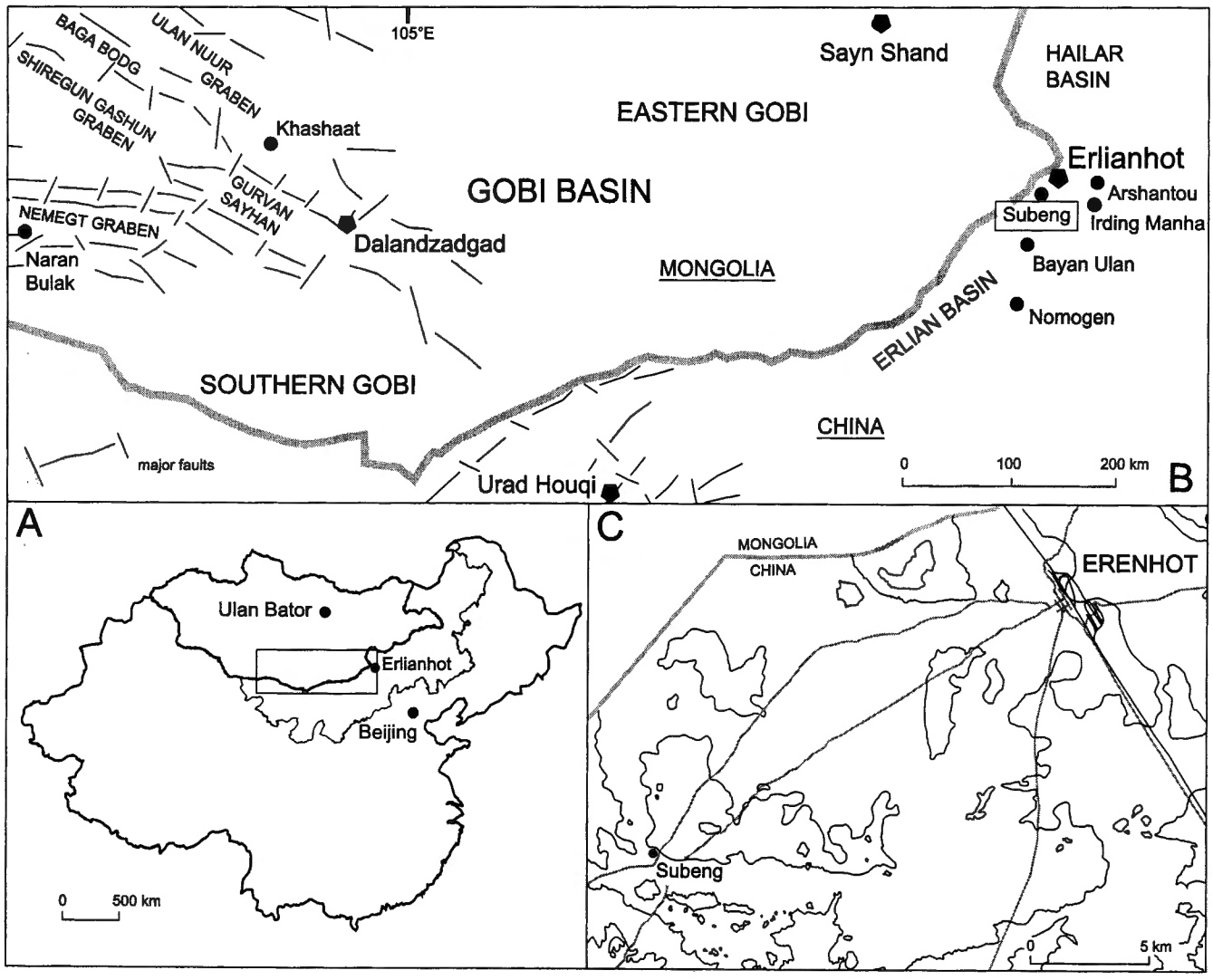

Fig. 1 — Map of the Gobi Basin (B), inset map showing the location of the town Erlianhot in Inner Mongolia, China (A) and map with the Subeng mammal site 20 km southwest from Erlianhot (C).

the mammal fauna the sediments of unit 3 are equivalent to the Bayan Ulan Beds (or to the Bayan Ulan Formation as indicated on the geological map). In the present paper the ostracods of this formation are described for the first time.

Systematic Palaeontology

The ostracods described in the following section have all been observed in the mammal-bearing horizons at the Subeng site (black arrow on Fig. 2, all specimens from 2 samples). All the figured specimens and the type specimens of the newly described species are deposited in the collections of the Royal Belgian Institute of Natural Sciences (RBINS), n° 4390-4422.

Subclass Ostracoda LATREILLE, 1806
Order Podocopida G.W. MÜLLER, 1894
Suborder Cytherocopina GRÜNDEL, 1967
Superfamily Cytheroidea BAIRD, 1850
Family Limnocytheridae KLIE, 1938
Subfamily Limnocytherinae KLIE, 1938
Genus *Limnocythere* BRADY, 1868

Limnocythere nemegtensis SZCZECHURA, 1971
Pl. 1, Figs. 15-23

1971 *Limnocythere nemegtensis* n. sp., SZCZECHURA, p. 92-93, pl. 15, fig. 1-4.

MATERIAL: more than 100 specimens.

Measurements: length = 438-538 μm, height = 220-253 μm, width = 108-146 μm.

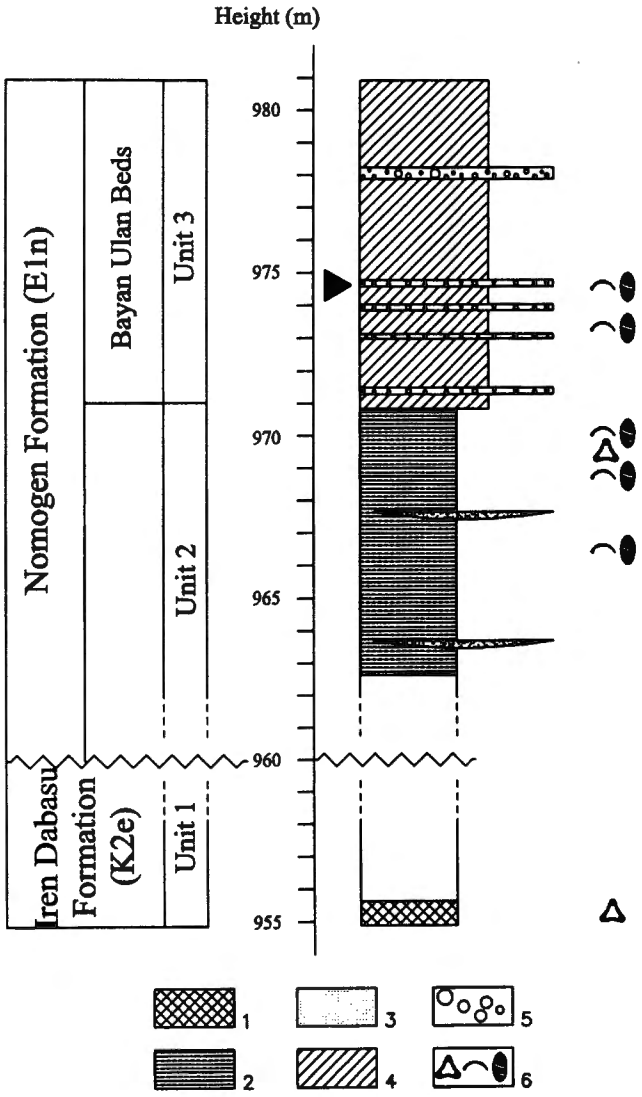

Fig. 2 — Subeng stratigraphic section with three lithological units. Unit 1: white siltstone with black organic rich intercalations (lithology 1); Unit 2: finely laminated green marls with white limestone intercalations (lithology 2), and lens-shaped bodies of coarse pebbly red sands (lithology 3); Unit 3: fine sands and marls (lithology 4), and conglomerates of calcareous pebbles (lithology 5); Palynomorphs, ostracods and charophytes (6) are present at different levels. The black triangle indicates the position of the mammal-bearing horizons.

DISCUSSION: The angular-ovate outline, the deep subvertical sulcus which is nodose anteriorly, the rib-like inflation and the hinge structure (Pl. 1, Fig. 23) clearly place the studied specimens within *Limnocythere nemegtensis* SZCZECHURA, 1971. In the original description, SZCZECHURA (1971) mentioned large infraspecific variability: the ornamentation varies from well (Pl. 1, Fig. 21) to poorly expressed (Pl. 1, Fig. 20). Male carapaces (Pl. 1, Figs. 16, 20, 21) are longer and less inflated laterally than female carapaces (Pl. 1, Figs. 17, 22). With the original description, SZCZECHURA (1971) described juvenile specimens of *L. nemegtensis* with a size only slightly smaller than the adult carapaces. Some specimens (Pl. 1, Figs. 15, 18, 19) correspond well to the juveniles described by SZCZECHURA (1971), as they have a longer rib-like inflation and are slightly smaller (length 438-500 μm).

L. hubeiensis YE in HOU *et al.*, 1978 does not show the rib-like inflation, *L. spinisalata* YE in HOU *et al.*, 1978 has a different outline.

OCCURRENCE: *Limnocythere nemegtensis* has been described from the Naran Bulak Formation, Nemegt Basin, Mongolia (SZCZECHURA, 1971; KHAND, 1987). In China this species has been observed in the upper member of the Shashi Formation (Late Paleocene), Yangtze-Han River Basin, Hubei (LI & YE, 1993) and in the Xinzhuang Formation (Paleocene), Longgui Basin, Guangdong (GUAN, 1988).

STRATIGRAPHIC RANGE: Paleocene.

Subfamily Timiriaseviinae MANDELSTAM, 1947 emend. COLIN & DANIELPOL, 1980
Genus *Timiriasevia* MANDELSTAM, 1947

Timiriasevia naranbulakensis SZCZECHURA, 1971
Pl. 1, Figs. 26-27

1970 *Timiriasevia* sp., SZCZECHURA & BLASZYK, p. 116-117, pl. 29, fig. 1a-c.
1971 *Timiriasevia naranbulakensis* n. sp., SZCZECHURA, p. 94-95, pl. 17, fig. 5-7.
1978 *Timiriasevia naranbulakensis* SZCZECHURA, 1971, SZCZECHURA, p. 80, pl. 35, fig. 1.

MATERIAL: a few complete detached valves, numerous fragments.

Measurements: length = 510 μm, height = 296 μm.

DISCUSSION: The strongly arched dorsal margin, the specific ornamentation and the general outline place the studied specimens within *T. naranbulakensis* SZCZECHURA, 1971. This species is larger than *T. ulanbulakensis* SZCZECHURA, 1971 and *T.* cf. *opinabilis* as described by SZCZECHURA, 1971.

The generic nature of the *Timiriasevia*-species mentioned in this work, is debatable. The extant timiriaseviine genus *Metacypris* is very similar to *Timiriasevia*. The difference between both genera is blurred; CHEN (1965) even considers *Timiriasevia* as a junior synonym of *Metacypris*, an opinion not followed by everybody. In the present work, the designation of SZCZECHURA (1971) is followed and all observed timiriaseviine species are referred to the genus *Timiriasevia*.

OCCURRENCE: *Timiriasevia naranbulakensis* has only been observed in the Nemegt and Naran Bulak formations, Nemegt Basin, Mongolia (SZCZECHURA, 1971; 1978).

STRATIGRAPHIC RANGE: Maastrichtian-Paleocene.

Timiriasevia ulanbulakensis SZCZECHURA, 1971
Pl. 1, Fig. 25

1971 *Timiriasevia ulanbulakensis* n. sp., SZCZECHURA, p. 95, pl. 17, fig. 3-4.

MATERIAL: more than 20 complete carapaces and detached valves.
Measurements: length = 385 µm, height = 210 µm.

DISCUSSION: The small size and the typical ornamentation allow the identification of *Timiriasevia ulanbulakensis* SZCZECHURA, 1971. *T.* cf. *opinabilis* as described by SZCZECHURA, 1971 is very similar but is slightly larger and more inflated laterally in dorsal view. Although similar in size, *T. ulanbulakensis* is distinctly different from the juveniles of *T. naranbulakensis* as described by SZCZECHURA (1971).

OCCURRENCE: *Timiriasevia ulanbulakensis* has only been observed in the Naran Bulak Formation, Nemegt Basin, Mongolia (SZCZECHURA, 1971).

STRATIGRAPHIC RANGE: Paleocene.

Timiriasevia subengensis sp. nov.
Pl. 1, Figs. 28-33

1971 *Timiriasevia* sp. 2, SZCZECHURA, p. 96, pl. 17, fig. 2.

ETYMOLOGY: named after the locality Subeng, Inner Mongolia, P.R. China.

HOLOTYPE: male left valve (Plate 1, Fig. 32), RBINS n° b4421, length 517 µm, height 282 µm.

TYPE LOCALITY AND HORIZON: Bayan Ulan Beds, Nomogen Formation, section at Subeng (GPS N43°31'48.6'', E111°43'58.0''), Inner Mongolia, P.R. China.

MATERIAL: more than 20 complete carapaces and detached valves.

DIAGNOSIS: Carapace elongate-elliptical in lateral view, greatest height medially, moderately inflated laterally, widest just behind the centre, dorsal margin slightly arched, ventral margin straight to slightly concave. Valve surface subconcentrically reticulated laterally, ribbed ventrally. Sexual dimorphism well pronounced.

DESCRIPTION: Carapace solid, elongate-elliptical in lateral view with greatest height in the centre or just behind, dorsal margin slightly arched, ventral margin straight to slightly concave, anterior end acutely rounded, posterior end more broadly rounded. In dorsal view laterally inflated with greatest width just behind the centre, tapering towards the anterior, rounded posterior end. Right valve overlaps the left valve. Surface of the valve reticulated with ribs at the ventral margin. A few wartlike tubercules, more concentrated toward the posterior end, can be observed.

Sexual dimorphism distinct: male carapaces more elongate with a nearly straight dorsal margin and are less inflated laterally, female carapaces more elliptical with a slightly arched dorsal margin and are more swollen laterally.

Measurements: length = 455-524 µm, height = 255-297 µm, width = 262-345 µm.

DISCUSSION: *Timiriasevia naranbulakensis* SZCZECHURA, 1971 is slightly larger in size and has a more strongly arched dorsal margin. *Timiriasevia ulanbulakensis* SZCZECHURA, 1971 is smaller in size and has a different general outline, especially in dorsal view.

OCCURRENCE: *Timiriasevia subengensis* sp. nov. has been observed, as *Timiriasevia* sp. 2, in the Naran Bulak Formation, Nemegt Basin, Mongolia (SZCZECHURA, 1971).

STRATIGRAPHIC RANGE: Paleocene.

Timiriasevia sp.
Pl. 1, Fig. 24

MATERIAL: 10 detached valves, mostly broken.
Measurements: length = 634 µm, height = 330 µm.

DISCUSSION: *Timiriasevia* sp. is larger than *T. naranbulakensis* SZCZECHURA, 1971, *T. ulanbulakensis* SZCZECHURA, 1971 and *T.* cf. *opinabilis* as described by SZCZECHURA (1971). These three species are also elliptical in dorsal view while *Timiriasevia* sp. is hartshaped. *Timiriasevia* sp. 1 as described by SZCZECHURA (1971) is very similar but is slightly larger and higher than *Timiriasevia* sp. Maybe they represent different forms of the same species but more material is needed to clarify this.

Suborder Cypridocopina JONES, 1901
Superfamily Cypridoidea BAIRD, 1945
Family Ilyocyprididae KAUFMANN, 1900
Genus *Ilyocypris* BRADY & NORMAN, 1889

Ilyocypris multinoda YANG in HOU *et al.*, 1982
Pl. 1, Fig. 9

1982 *Ilyocypris multinoda* YANG, HOU *et al.*, p. 110-111, pl. 27, fig. 1,2.

MATERIAL: 1 well preserved specimen and numerous broken fragments.
Measurements: length = 547 µm, height = 287 µm.

DISCUSSION: The studied specimens match perfectly the description of *Ilyocypris multinoda*. The series of spines at the anterior and posterior margin and the short-ridged

dorsal and ventral nodes clearly differentiate this species from *Ilyocypris spinosa* YANG in HOU *et al.*, 1982 and *Ilyocypris huangqiaoensis* YANG in HOU *et al.*, 1982.

OCCURRENCE: *Ilyocypris multinoda* has only been observed in its type level, the fourth member of the Funing Group (Paleocene), Jiangsu, China (HOU *et al.*, 1982).

STRATIGRAPHIC RANGE: Paleocene.

Family Cyprididae BAIRD, 1845
Subfamily Cypridinae BAIRD, 1845
Genus *Cypris* O.F. MÜLLER, 1776

Cypris dashzevegi (KHAND, 1976)
Pl. 1, Figs. 1-8

non 1933 *Cypris decaryi* nov. sp. , GAUTHIER, p. 209-215, fig. 1-4.
1976 *Eucypris*? *dashzevegi* KHAND, sp. nov., KHAND, p. 157, pl. 2, fig. 7.
1978 *Cypris henanensis* GUAN & SUN, GUAN *et al.*, p. 163, pl. 41, fig. 6-8.
1987 *Cypris dashzevegi* (KHAND 1976), KHAND, p. 17.
2002 *Cypris decaryi* GAUTHIER 1933, HOU *et al.*, p. 117-118, pl. 1, fig. 8-13.

MATERIAL: 20 well preserved specimens.
Measurements: length = 1250-1400 µm, width = 930-1000 µm, height = 775-830 µm.

DISCUSSION: The studied specimens show clearly an inwardly displaced anterior selvage in both valves, resulting in lip-like anterior marginal extensions, that of the right valve being larger. This character places them within the genus *Cypris* (KHAND, 2000). They perfectly match the description of *Cypris dashzevegi* (KHAND, 1976). *Cypris decaryi* GAUTHIER, 1933, a typical recent species from subtropical Africa, is also very similar (see also NEALE, 1976). The distinction between *C. decaryi* and *C. dashzevegi* is not easy to make. As *C. decaryi* is a recent species, less attention is paid to the shell morphology in favor of the morphology of the soft parts; contrary to fossil species like *C. dashzevegi* where shell morphology is the only way of determination.

Numerous Chinese authors have identified *C. decaryi* from Chinese sediments of Early Eocene age. The present specimens and the Chinese ostracods attributed to *C. decaryi* differ from *C. decaryi* as described by GAUTHIER (1933): they have a left valve that overlaps the right and they are distinctly smaller in size. Therefore the Chinese forms described as *C. decaryi* are assigned here to *C. dashzevegi*. As consequence, *C. henanensis* GUAN & SUN in GUAN *et al.*, 1978, a Chinese species considered a synonym of *C. decaryi*, is also assigned to *C. dashzevegi*.

OCCURRENCE: *C. dashzevegi* is known from the Naran Bulak Formation, Mongolia (KHAND, 1976; 1987). *C. henanensis* is known from the Gaoling member, Xialiushi Formation (Eocene), Henan, China (GUAN *et al.*, 1978). *C. decaryi* is typical for the Lower Eocene of China (HE *et al.*, 1988). The species has been observed in the Qijiachuan Formation, Xining and Minhe Basins (HAO, 1988), the Fangjiahe and Xingouzui formations (Lower Eocene), Yangtze-Han River Basin (LI & YE, 1993)

STRATIGRAPHIC RANGE: late Paleocene-early Eocene

Family Notodromadidae KAUFMANN, 1900
Genus *Cyprois* ZENKER, 1854

Cyprois xuyiensis ZHOU & CHEN in HOU *et al.*, 1982
Pl. 1, Fig. 14

1982 *Cyprois xuyiensis* ZHOU CHEN, HOU *et al.*, p. 153, pl. 62, fig. 8,23-31.

MATERIAL: 3 well preserved specimens.
Measurements: length = 1166 µm, height = 800 µm.

DISCUSSION: The studied specimens are fairly large in size and one of the specimens shows a broken thin marginal flange around the anterior margin, allowing the assignment of the specimens to *Cyprois*. The studied specimens perfectly match the description of *Cyprois xuyiensis* CHOU CHEN in HOU et al., 1982. *C. xiangxiangensis* GUAN in GUAN *et al.*, 1978 is more rounded in lateral view. *C. submarginata* GUAN in GUAN *et al.*, 1978 has a more slanted posterior margin.

OCCURRENCE: The species is known from the second to the fourth member of the Funing Group (Paleocene), Jiangsu (HOU *et al.*, 1982).

STRATIGRAPHIC RANGE: Paleocene.

Family uncertain
Genus *Caganella* SZCZECHURA, 1971

Caganella oblonga KHAND, 1976
Pl. 1, Figs. 10-13

1976 *Caganella*? *oblonga* KHAND sp. nov., KHAND, p. 156-157, pl. 2, fig. 6.

MATERIAL: more than 30 well preserved carapaces and detached valves.
Measurements: length = 1014-1066 µm, height = 529-557 µm, width = 500 µm.

DISCUSSION: The studied specimens can be attributed to *Caganella oblonga* KHAND, 1976 based on their general outline. This species differs from other known representatives of *Caganella* like *C. badamgaravae* KHAND, 1976, *C. mongolica* SZCZECHURA, 1971 and *C. trivialis* KHAND,

1976 described from the Naran Bulak Formation by its larger size and elongate outline with equally rounded ends.

OCCURRENCE: *Caganella oblonga* has only been observed within the Naran Bulak Formation, Nemegt Basin, Mongolia (KHAND, 1976).

STRATIGRAPHIC RANGE: Paleocene.

Discussion and conclusions

The ostracod assemblage of the Bayan Ulan Beds, Nomogen Formation at the Subeng mammal site consists of nine species belonging to six genera: *Cypris, Ilyocypris, Caganella, Timiriasevia, Limnocythere* and *Cyprois*.

The genus *Caganella* is endemic to Mongolia and is only known from the Paleocene (KHAND, 2000, fig. 1).The presence of the genus *Cypris* indicates that the age of the sediments can be no older than the Paleocene (GUAN, 1988, fig. 1) or even the late Paleocene (KHAND, 2000, fig. 1). According to GUAN (1988), the genus *Ilyocypris* ranges from the Paleocene to the Holocene. However KHAND (2000, fig. 1) already mentioned this genus from the Upper Cretaceous of Mongolia. The exact range of this genus is debatable as there is discussion how to distinguish *Ilyocypris* from other Mesozoic ilyocypridid genera like *Rhinocypris* and *Neuquenocypris*.

Although the generic composition of the studied assemblage already gives some clues about the age, the specific composition offers more conclusive evidence. The studied ostracod fauna has seven species in common with the Naran Member of the Naran Bulak Formation (SZCZECHURA, 1971; KHAND, 1976; 1987): *Caganella oblonga, Timiriasevia subengensis, T. naranbulakensis, T. ulanbulakensis, Timiriasevia* sp., *Cypris dashzevegi, Limnocythere nemegtensis*. Only the latter two species have been reported from other strata than the Naran Member. In China *C. dashzevegi* (under the name of *C. decaryi*) is typical for the Lower Eocene (HE *et al.*, 1988). The other species (*Ilyocypris multinoda, Cyprois xuyiensis*) have been reported from the Funing Group, Jiangsu (HOU *et al.*, 1982). Both the Naran Member of the Naran Bulak Formation and the Funing Group are considered to be Paleocene in age, although sometimes an early Eocene age has been proposed for the upper part of the Funing Group (HE *et al.* 1988).

The ostracod assemblage of the Bayan Ulan Beds at the Subeng site clearly indicates a Paleocene age for these strata. It also confirms the correlation of these beds with the Naran Member of the Naran Bulak Formation as already postulated on the basis of fossil mammal data (MENG *et al.*, 1998, fig. 2).

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References

BOWEN, G. J., CLYDE, W. C., KOCH, P. L., SUYIN, T., ALROY, J., TSUBAMOTO, T., WANG, YUANQING & WANG, YUAN, 2002. Mammalian dispersal at Paleocene/Eocene boundary. *Science*, **295**: 2062-2065.

BRADY, G.S., 1868. A monograph of the recent British Ostracoda. *Transactions of the Linnean Society*, **26**: 353-495.

BRADY, G.S. & NORMAN, A.M., 1889. A monograph of marine and fresh-water Ostracoda of the North Atlantic and of Northwestern Europe. Section I. Podocopa. *Royal Dublin Society, Science, Transactions, serie 2*, **4**: 63-270.

CHEN, T., 1965: The ostracode genus *Metacypris* and its allies. *Acta Palaeontologica Sinica*, **13**(1): 1-28.

GAUTHIER, H., 1933. Entomostracés de Madagascar 1re note: Description d'une nouvelle *Cypris* (Ostracodes). *Bulletin de la Société Zoologique de France*, **58**: 209-215.

GUAN, S., 1988. Palaeocene non-marine ostracods in China. *In*: HANAI, T., IKEYA, N. & ISHIZAKI, K. (Editors), *Evolutionary biology of Ostracoda, its fundamentals and applications*, Kodansha/Elsevier, Tokyo/Amsterdam, pp. 1147-1152.

GUAN, S., SUN, Q., JIANG, Y., LI, L., ZHAO, B., ZHANG, X., YANG, R. & FENG, B., 1978. Ostracoda. *In*: *Paleontological atlas of Central and South China*, Geological Publishing House, Beijing, 382 pp.

HAO, Y., 1988. Cretaceous and Palaeogene ostracod biostratigraphy in Xining and Minhe Basins of China. *In*: HANAI, T., IKEYA, N. & ISHIZAKI, K. (Editors), *Evolutionary biology of Ostracoda, its fundamentals and applications*, Kodansha/Elsevier, Tokyo/Amsterdam, pp. 1163-1171.

HE, J., VAN NIEUWENHUISE, D. S. & SWAIN, F. M., 1988. Biostratigraphy of Paleogene Ostracoda from East China. *In*: HANAI, T., IKEYA, N. & ISHIZAKI, K. (Editors), *Evolutionary biology of Ostracoda, its fundamentals and applications*, Kodansha/Elsevier, Tokyo/Amsterdam, pp. 1153-1161.

HOU, Y., HE, J. & YE, C., 1978. The Cretaceous-Tertiary ostracods from the marginal region by the Yangtze-Han River Plain in Central Hubei. *Memoirs of the Nanjing Institute of Geology and Palaeontology, Academia Sinica*, **9**: 129-206.

HOU, Y., CHEN, T., YANG, H., HO, J., ZHOU, Q. & TIAN, M., 1982. *Cretaceous-Quaternary ostracod fauna from Jiangsu.* Geological Publishing House, Beijing, 298 pp.

HOU, Y., GOU, Y. & CHEN, D., 2002. *Superfamilies Cypridacea*

and Darwinulidacea. Nanjing Institute of Geology and Palaeontology, Academia Sinica, 1090 pp.

KHAND, E., 1976. Some new ostracod species from the Upper Cretaceous and Paleogene deposits in the South of the Mongolian Republic. *The joint Soviet-Mongolian Paleontological Expedition, Transactions*, **3**: 151-159.

KHAND, Y., 1987. *Late Cretaceous and Early Paleogene ostracods of Mongolia and their stratigraphic significance*. Akademia Nauk SSSR, Paleontologicheskii Institut, Moscow, 22 pp.

KHAND, Y., 2000. The origins of modern nonmarine ostracod faunas: evidence from the Late Cretaceous and Early Palaeogene of Mongolia. *Hydrobiologia*, **419**: 119-124.

LI, L. & YE, C., 1993. Paleocene nonmarine Ostracoda from the Yangtze-Han River Basin, Hubei. *Acta Micropalaeontologica Sinica*, **10**(1): 53-70.

MANDELSTAM, M.J., 1947. Ostracoda from the Middle Jurassic deposits of the Mangyshlak Peninsula. *In*: *Microfauna of the oil fields of the Caucasus, Emba, and Central Asia*. Leningrad, VNIGRI, pp. 239-259.

MENG, J., ZHAI, R. & WYSS, A. R., 1998. The late Paleocene Bayan Ulan fauna of Inner Mongolia, China. *Bulletin of the Carnegie Museum of Natural History*, **34**: 148-185.

MÜLLER, O.F., 1776. Zoologiae Danicae prodromus, seu animalium Daniae et Norvegiae indigenarum characters, nomina, et synonyma imprimis popularium. *Havniae*, **8**: 1-282.

NEALE, J.W., 1976: On *Cypris decaryi* Gauthier. *Stereo-atlas of ostracod shells*, **3**(2): 133-140.

RUSSELL, D. E. & ZHAI, R., 1987. Paleogene mammals of Asia. *Mémoires du Muséum National d'Histoire Naturelle, Paris (série C)*, **52**: 1-490.

SMITH, T., VAN ITTERBEECK, J. & MISSIAEN, P., 2004. Oldest Plesiadapiformes (Mammalia, Proprimates) of Asia and its paleobiogeographical implication with North America. *Comptes Rendus Palevol*, **3**: 43-52.

SZCZECHURA, J., 1971. Freshwater Ostracoda from the Paleocene of the Nemegt Basin, Gobi desert, Mongolia. *Palaeontologia Polonica*, **25**: 85-97.

SZCZECHURA, J., 1978. Freshwater ostracods from the Nemegt Formation (Upper Cretaceous) of Mongolia. *Palaeontologica Polonica*, **38**: 65-121.

SZCZECHURA, J. & BLASZYK, J., 1969. Freshwater Ostracoda from the Upper Cretaceous of the Nemegt Basin, Gobi desert. *Palaeontologia Polonica*, **21**: 107-118.

ZENKER, G.F.W., 1854. Monographie der Ostracoden. *Archiv fuer Naturgeschichte*, **20**(1): 1–87.

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PLATE 1

Fig. 1 — *Cypris dashzevegi* (KHAND, 1976) (n° 4390), adult, left valve, external view.
Fig. 2 — *Cypris dashzevegi* (KHAND, 1976) (n° 4391), adult, left valve internal view.
Fig. 3 — *Cypris dashzevegi* (KHAND, 1976) (n° 4392), juvenile, left valve, external view.
Fig. 4 — *Cypris dashzevegi* (KHAND, 1976) (n° 4393), juvenile, carapace, dorsal view.
Fig. 5 — *Cypris dashzevegi* (KHAND, 1976) (n° 4394), adult, right valve, external view.
Fig. 6 — *Cypris dashzevegi* (KHAND, 1976) (n° 4395), adult, right valve, internal view.
Fig. 7 — *Cypris dashzevegi* (KHAND, 1976) (n° 4396), adult, carapace, ventral view.
Fig. 8 — *Cypris dashzevegi* (KHAND, 1976) (n° 4397), adult, carapace, dorsal view.
Fig. 9 — *Ilyocypris multinoda* YANG, 1982 (n° 4398), right valve, external view.
Fig. 10 — *Caganella oblonga* KHAND, 1976 (n° 4399), carapace, dorsal view.
Fig. 11 — *Caganella oblonga* KHAND, 1976 (n° 4400), right valve, internal view.
Fig. 12 — *Caganella oblonga* KHAND, 1976 (n° 4401), left valve, external view.
Fig. 13 — *Caganella oblonga* KHAND, 1976 (n° 4402), carapce, right external view.
Fig. 14 — *Cyprois xuyiensis* ZHOU & CHEN, 1982 (n° 4403), carapace, left external view.
Fig. 15 — *Limnocythere nemegtensis* SZCZECHURA, 1971 (n° 4404), juvenile, carapace, dorsal view.
Fig. 16 — *Limnocythere nemegtensis* SZCZECHURA, 1971 (n° 4405), ♂, carapace, dorsal view.
Fig. 17 — *Limnocythere nemegtensis* SZCZECHURA, 1971 (n° 4406), ♀, carapace, dorsal view.
Fig. 18 — *Limnocythere nemegtensis* SZCZECHURA, 1971 (n° 4407), juvenile, left valve, external view.
Fig. 19 — *Limnocythere nemegtensis* SZCZECHURA, 1971 (n° 4408), juvenile, carapace, right external view.
Fig. 20 — *Limnocythere nemegtensis* SZCZECHURA, 1971 (n° 4409), ♂, left valve, external view.
Fig. 21 — *Limnocythere nemegtensis* SZCZECHURA, 1971 (n° 4410), ♂, carapace, left external view.
Fig. 22 — *Limnocythere nemegtensis* SZCZECHURA, 1971 (n° 4411), ♀, carapace, right external view.
Fig. 23 — *Limnocythere nemegtensis* SZCZECHURA, 1971 (n° 4412), left valve, internal view.
Fig. 24 — *Timiriasevia* sp. (n° 4413), left valve, external view.
Fig. 25 — *Timiriasevia ulanbulakensis* SZCZECHURA, 1971 (n° 4414), right valve, external view.
Fig. 26 — *Timiriasevia naranbulakensis* SZCZECHURA, 1971 (n° 4415), ♂, right valve, external view.
Fig. 27 — *Timiriasevia naranbulakensis* SZCZECHURA, 1971 (n° 4416), carapace, dorsal view.
Fig. 28 — *Timiriasevia subengensis* sp. nov. (n° 4417), ♀, left valve, external view.
Fig. 29 — *Timiriasevia subengensis* sp. nov. (n° 4418), ♂, carapace, right external view.
Fig. 30 — *Timiriasevia subengensis* sp. nov. (n° 4419), ♀, right valve, external view.
Fig. 31 — *Timiriasevia subengensis* sp. nov. (n° 4420), carapace, dorsal view.
Fig. 32 — *Timiriasevia subengensis* sp. nov. (n° 4421), holotype, ♂, right valve, external view.
Fig. 33 — *Timiriasevia subengensis* sp. nov. (n° 4422), ♀, right valve, external view.

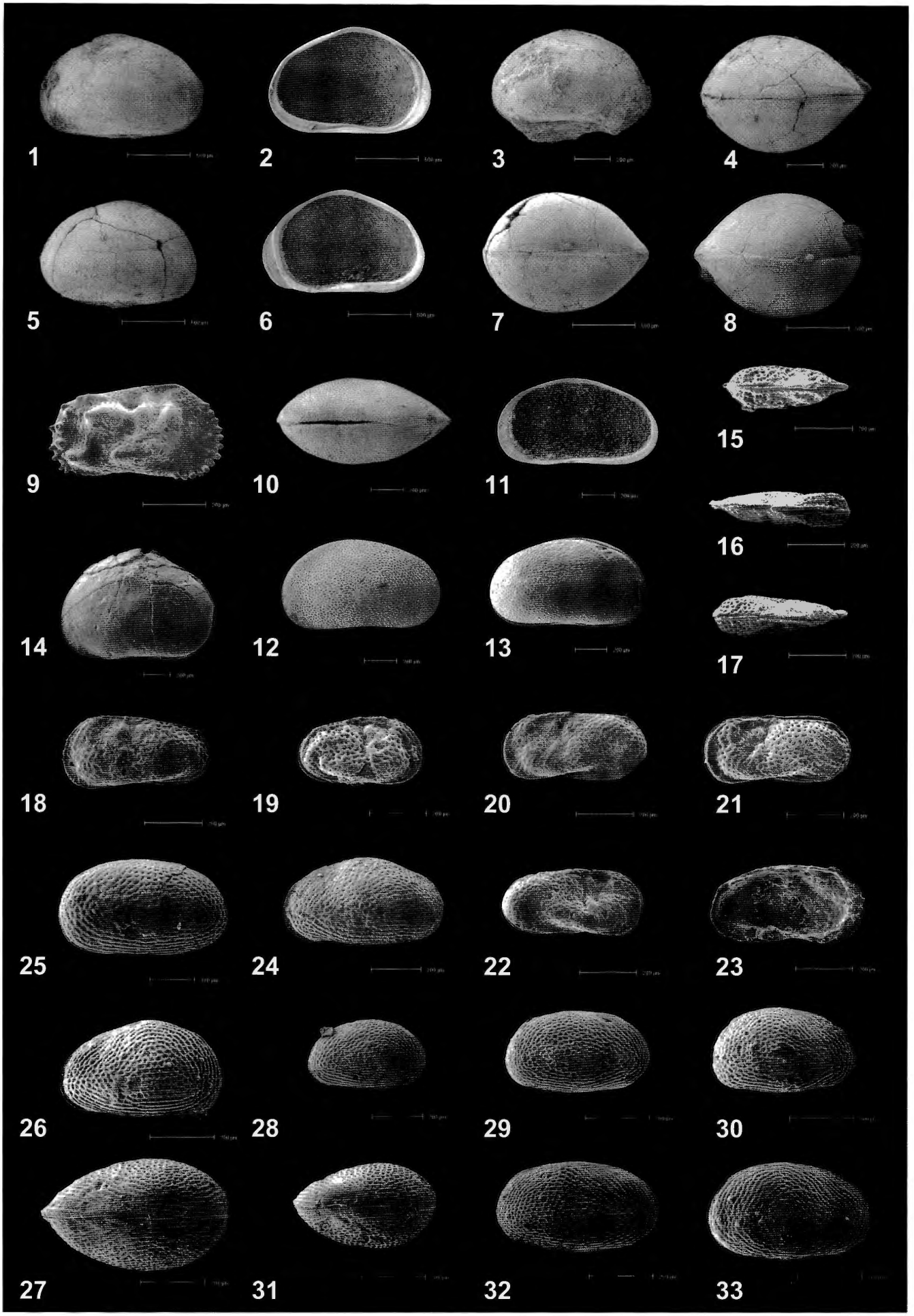
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PLATE 1