

## A New Platynotan Lizard (Parasaniwidae, Anguimorpha) from the Late Paleocene of Southern Mongolia

V. R. Alifanov\*

Borissiak Paleontological Institute, Russian Academy of Sciences, Moscow, 117647 Russia

\*e-mail: valifan@paleo.ru

Received March 12, 2018

**Abstract**—A new lizard, *Tsagansaurus nemegetensis* gen. et sp. nov., from the Late Paleocene of southern Mongolia is described. It is assigned to the extinct family Parasaniwidae (Platynota, Anguimorpha). The new taxon is the latest representative of this group in the fossil record.

**Keywords:** Lizards, Parasaniwidae, Platynota, Anguimorpha, Late Paleocene, Mongolia, southern Gobi

**DOI:** 10.1134/S0031030118120067

### INTRODUCTION

Estes (1964) established the family Parasaniwidae for a number of Late Cretaceous taxa from North America, but later (Estes, 1983) synonymized it under Necrosauridae Hoffstetter, 1943 (the type genus of Europe) in the superfamily Varanoidea. Representatives of Parasaniwidae and Necrosauridae are characterized by platynotan-like structure of the lower jaw and dentition. Distinctions concern primarily the structure of osteoderms known in them; in Parasaniwidae, they are polygonal or circular, while in Necrosauridae, they are carinate and overlap each other. The two families are also distinguished by the geological and geographical ranges, which contradict synonymization.

The skull structure of Parasaniwidae has become known from three taxa from the Barun Goyot Formation (Middle–Late Campanian) of southern Mongolia: *Proplatynotia longirostrata*, *Parviderma inexactum*, and *Gobiderma pulchrum*. In the original descriptions, all of them were assigned to the “necrosaurian grade,” but only *Proplatynotia* was placed in the family Necrosauridae sensu Estes, 1983 (Borsuk-Białynicka, 1984). Later, *Gobiderma* and *Parviderma* (Lee, 1997) were combined in the family Gobidermatidae. However, it is hardly probable that this is a separate family.

The Parasaniwidae from Mongolia lack certain characters of modern Platynota, such as the shortened occipital process of the maxillae, the frontals participating in the border of the nares, the closed olfactory canal, and streptognathly. The fossil group is characterized by fusion of osteoderms with membrane bones of the skull roof, multiseriate palatal teeth, and complete postorbital and upper temporal arches.

In cladistic studies, the Parasaniwidae are treated as basal members of the clade Monstersauria (Norell and Gao, 1997; Conrad, 2008), in which the Helodermatidae are regarded as the terminal group, or, based on the example of *Gobiderma*, taken for basal Platynota (Gauthier et al., 2012). Based on the presence of osteoderms, we admit that the families Parasaniwidae and Necrosauridae are monophyletic kins (Alifanov, 2012) related to Helodermatidae and all of them can be classified in the composition of the superfamily Helodermatoidea and microorder Platynota (Anguimorpha). Judging from the osteoderms in the area of the head (Maisano et al., 2002), this lineage is close to modern *Lanthanotus* (Lanthanotidae). The group of nonosteodermal Platynota includes modern Varanidae (Varanoidea; Varaniformes: Conrad, 2008).

In the composition of Parasaniwidae, *Proplatynotia* Borsuk-Białynicka, 1984 represents the most archaic lineage. Its frontals and maxillae are connected, the nasals are large, and maxillary teeth are numerous. *Proplatynotia* is probably close to *Colpodontosaurus* Estes, 1964 from the Maastrichtian of North America. In other Parasaniwidae, the number of maxillary teeth is reduced. *Parviderma* Borsuk-Białynicka, 1984 is distinguished by the unpaired frontal and large supraorbitals. Probably, *Parasaniwa* Gilmore, 1928 and *Paraderma* Estes, 1964 from the Maastrichtian of North America and also *Chianghsia* Mo et al., 2012 from the Early Campanian of China are close to *Gobiderma* Borsuk-Białynicka, 1984, which is known from the skull. Judging from *Gobiderma*, these taxa lack a connection between the maxilla and frontal and their osteoderms are often fused with the maxillae.

*Primaderma* Nydam, 2000 is the earliest Parasaniwidae, which comes from the Albian–Cenomanian of

North America. In Asia, the earliest record of this family comes from the Turonian of Uzbekistan (*Ekshmer bissektaensis* Nesson, 1981, nomen dubium; Parasaniwidae gen. indet.). The latest Asian Parasaniwidae have been recorded in the Late Campanian (Nemegt Formation) of Mongolia (Necrosauridae gen. indet.: Alifanov, 2000, text-fig. 30d; Parasaniwidae gen. et sp. nov.: Alifanov, 2012, p. 42).

During the Dzhadokhta–Barun Goyot stage of the historical development of tetrapods, the Parasaniwidae of Central Asia competed with representatives of the extinct varanoid family Cherminotidae Alifanov, 2000 (*Cherminotus* Borsuk-Bialynicka, 1984; *Estesia* Norell et al., 1992; *Aiolosaurus* Gao et Norell, 2000; *Ovoo* Norell et al., 2007; Late Cretaceous of southern Mongolia; *Asprosaurus* Park et al., 2015; Late Cretaceous of southern Korea). The possible co-existence in time and space of Parasaniwidae and Varanidae remains an open question. The last family appears in the fossil record of Central Asia only in the Early Eocene.

*Tsagansaurus nemegetensis* gen. et sp. nov., an Early Cenozoic representative of Parasaniwidae is described below. It is the second Paleocene Platynota of Central Asia, if the material from the Dou-Mu Series (Late Paleocene) in China (Anhui), identified as Varaniformes gen. et sp. indet. (Dong et al., 2016), is taken into account. The material of the new taxon was collected in 1987 by a party of the Joint Soviet–Mongolian Paleontological Expedition headed by V.Yu. Reshetov in the Tsagan Sair locality (southern Mongolia), at the top of the Zhigden Member (Naran Bulak Formation). This member contains abundant remains of small mammals, including Multituberculata (Badamgarav and Reshetov, 1985; Lopatin, 2006). Lizards, along with Parasaniwidae, are represented by the families Agamidae and Changjiangosauridae.

## SYSTEMATIC PALEONTOLOGY

Infraorder Anguimorpha

Microorder Platynota

Superfamily Helodermatoidea Gray, 1837

Family Parasaniwidae Estes, 1964

Genus *Tsagansaurus* Alifanov, gen. nov.

*Necrosaurus* sp.: Alifanov, 2000, p. 71, text-figs. 31c–31e; Alifanov, 2012, p. 44, text-fig. 16.

**E t y m o l o g y.** From Tsagan Hushu.

**T y p e s p e c i e s.** *Tsagansaurus nemegetensis* sp. nov.; Late Paleocene of southern Mongolia.

**D i a g n o s i s.** Large osteodermal scutes not fused with maxilla surface. Apex of dorsal process of maxilla falling on third quarter of bone extent. Its pointed frontal process well developed and positioned in line with fourth functional tooth. Tooth apices narrow and curved posteriorly. Enamel folds at tooth base numer-

ous. At least seven teeth present. Centra of dorsal vertebra relatively short. Neural spine high and extended craniocaudally. Articular surface of prezygapophyses positioned at angle of 45° to horizontal. Vertical axis of synapophyses almost perpendicular to long axis of vertebral centrum. Opening of neural canal relatively large and subtriangular in shape.

**S p e c i e s c o m p o s i t i o n.** Type species.

**C o m p a r i s o n.** The new genus differs from the majority of genera of the family in the absence of fusion between large osteoderms and maxillae, the greater number of teeth (except for *Proplatynotia* and *Colpodontosaurus*), the presence of a pointed frontal process of maxillae (except for *Proplatynotia* and *Parvidema*), the larger angle between the horizontal and articular plane of the prezygapophyses, the vertically positioned synapophyses and wide opening of the neural canal. In addition, it differs from *Gobiderma* in the presence and pointed shape of the frontal process of the maxillae.

**R e m a r k s.** Parasaniwidae vertebrae are poorly known. They are investigated by us based on specimen PIN, no. 4216/204 (Parasaniwidae gen. indet.) from the Nemegt Formation in Mongolia. They have a low neural spine, an inclined synapophysis, and a small foramen of the neural canal. The new taxon is assigned to Parasaniwidae based on the presence of the osteodermal sculptures on the external surface of the maxilla, the small condyle, and the development of a superficial interprezygapophyseal notch, which are characteristic of representatives of the family.

The new taxon is phylogenetically close to the parasaniwid group *Proplatynotia* Borsuk-Bialynicka, 1984. It is also similar to the platynotan lizard (“Varaniformes” gen. indet.) from the Dou-Mu Series (Late Paleocene of China, Anhui) in numerous teeth (not more than ten) and vertical articular planes of pre- and postzygapophyses (Dong et al., 2016). The Mongolian taxon differs from the last in the relatively short centra of the dorsal vertebra and the vertical synapophyses.

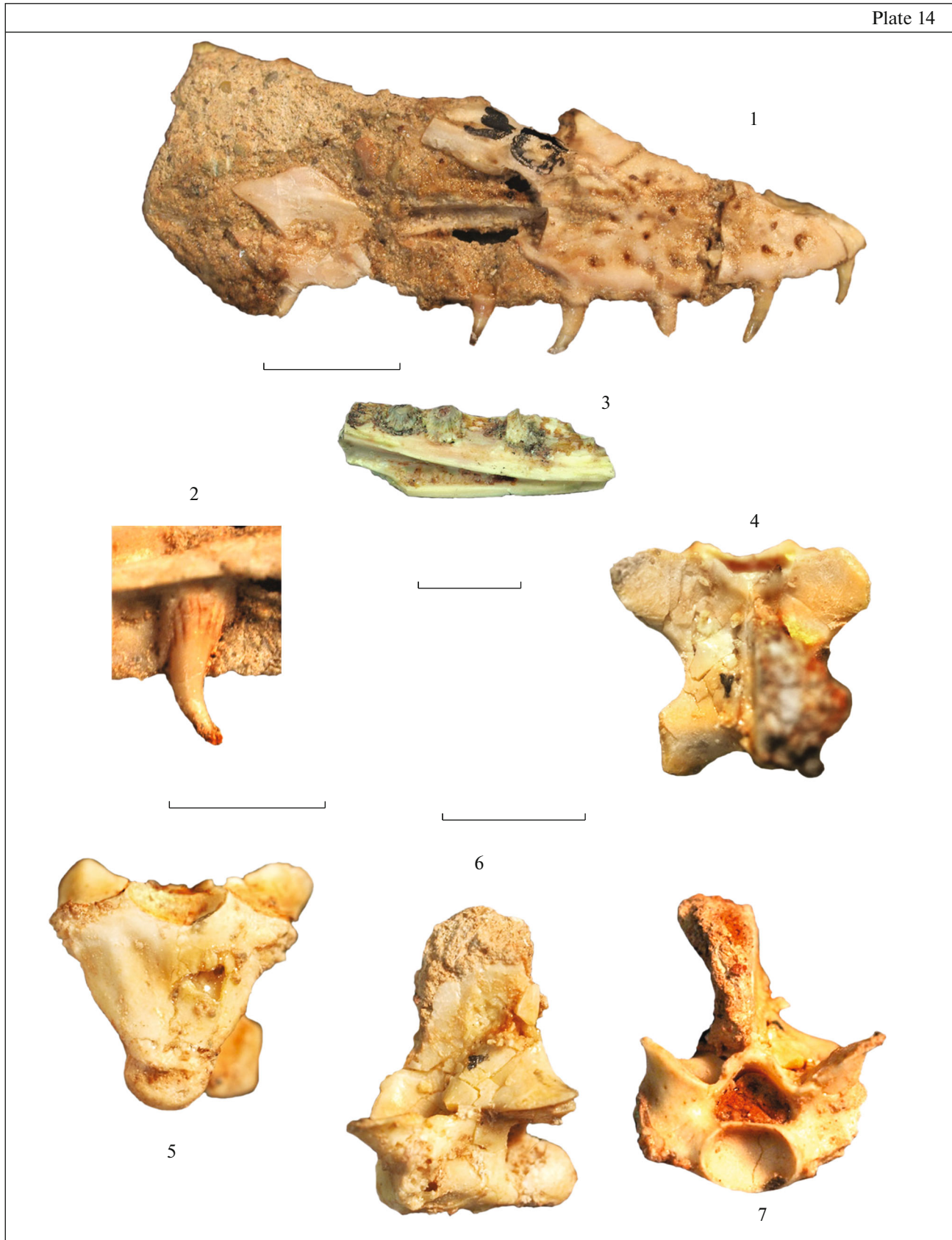
*Tsagansaurus nemegetensis* Alifanov, sp. nov.

Plate 14, figs. 1–7

**E t y m o l o g y.** From the Nemegetu Ridge in southern Mongolia.

**H o l o t y p e.** PIN, no. 4758/1, right maxilla; Mongolia, South Gobi Aimag, Nemegt Depression, Tsagan Hushu, dry river channel of the Tsagan Sair River; Upper Paleocene, Naran Bulak Formation, Zhigden Member.

**D e s c r i p t i o n.** Laterally, the maxillae have foramina scattered over the entire surface. The bone also has well-developed tubercles and grooves which are usual, as the osteodermal scutes are formed (Pl. 14, fig. 1). Transition from the premaxillary to dorsal processes of the maxilla is poorly pronounced. The medial part of the premaxillary process is large and



## Explanation of Plate 14

**Figs. 1–7.** *Tsagansaurus nemegetensis* sp. nov., Parasaniwidae (Platynota, Anguimorpha); Mongolia, South Gobi Aimag, Tsagan Sair locality; Upper Paleocene, Naran Bulak Formation, Zhigden Member: (1) holotype PIN, no. 4758/1, right maxilla, labial view; (2) holotype PIN, no. 4758/1, fourth maxillary tooth, lingual view; (3) specimen PIN, no. 4758/2, left dentary fragment, lingual view; (4–7) specimen PIN, no. 4758/8, dorsal vertebra: (4) dorsal, (5) ventral, (6) lateral, and (7) cranial views. Scale bar, 5 mm.

raised upwards. The notch between the medial and lateral parts of the last process is superficial. The dorsal process of the bones is relatively low. Their supraddental crest is narrow.

The maxillary teeth are narrow and curved at the end. The number of enamel folds at their bases reaches ten. The number of teeth preserved in the specimen is six. The total number of teeth was undoubtedly greater (eight or nine), since the maxilla has lost the middle and occipital parts (Pl. 14, figs. 1, 2). The largest teeth are located in the anterior part of the tooth row.

The dentary is very fragmentary. In the specimen in our collection, the margins of the Meckel's canal are distinctly narrowed and displaced vertically. Dentin deposits connected with the tooth bases are extensive (Pl. 14, fig. 3).

The centra of the dorsal vertebrae are relatively short and narrowed distinctly occipitally. In ventral view, it is gently widened in the middle part. The condyle is one-third as wide as the cranial part. The zygopophyses are large. The articular surfaces of the prezygopophyses are oval. The neural spine is high and wide. Its lateral axis coincides with the middle of the vertebra. The interprezygopophyseal notch is wide (Pl. 14, figs. 4–7).

**M a t e r i a l.** In addition to the holotype, specimen PIN, no. 4758/6, left maxilla; specimen PIN, no. 4758/2, fragmentary left dentary; specimen PIN, no. 4758/8, dorsal vertebra; type locality.

**M e a s u r e m e n t s.** Maxilla (holotype PIN, no. 4758/1): preserved (and reconstructed) length, 15 (20–22); depth, 7; height of the largest teeth, 4.5; vertebra (specimen PIN, no. 4758/8): length, 7; height, 9; width, 10.

## ACKNOWLEDGMENTS

This study was supported by the Russian Foundation for Basic Research, project no. 16-05-00408.

## REFERENCES

Alifanov, V.R., Macrocephalosaurs and early stages of the evolution of lizards of Mongolia, *Tr. Paleontol. Inst. Ross. Akad. Nauk*, 2000, vol. 272, pp. 1–126.

Alifanov, V.R., Order Lacertilia, in *Iskopaemye pozvochnochnye Rossii i sopredel'nykh stran. Iskopaemye reptilii i ptitsy. Chast' 2* (Fossil Vertebrates of Russia and Adjacent Countries: Fossil Reptiles and Birds: Part 2), Kurochkin, E.N. and Lopatin, A.V., Eds., Moscow: Geos, 2012, pp. 7–136.

Badamgarav, D. and Reshetov, V.Yu., Paleontology and stratigraphy of Paleogene of Transaltai Gobi, *Tr. Sovm. Sovet.-Mongol. Paleontol. Eksped.*, 1985, vol. 25, pp. 1–104.

Borsuk-Białynicka, M., *Anguimorphans* and related lizards, *Palaeontol. Polon.*, 1984, no. 46, pp. 5–105.

Conrad, J.L., Phylogeny and systematics of Squamata (Reptilia) based on morphology, *Bull. Am. Mus. Natur. Hist.*, 2008, no. 310, pp. 1–182.

Dong, L., Evans, S.E., and Wang, Y., Taxonomic revision of lizards from the Paleocene deposits of the Qianshan Basin, Anhui, China, *Vertebr. Palasiat.*, 2016, vol. 54, no. 3, pp. 243–268.

Estes, R., *Fossil vertebrates from the Late Cretaceous Lance Formation of Eastern Wyoming*, *Publ. Geol. Sci. Univ. California*, 1964, vol. 49, pp. 1–180.

Estes, R., *Handbuch der Paläoherpetologie: Encyclopedia of Paleoherpetology, vol. 10A: Sauria terrestria, Amphisbaenia*, Stuttgart–New York: G. Fisher, 1983.

Gauthier, J.A., Kearney, M., Maisano, J.A., et al., Assembling the Squamate tree of life: Perspectives from the phenotype and the fossil record, *Bull. Peabody Mus. Natur. Hist.*, 2012, vol. 53, no. 1, pp. 3–308.

Lee, M.S.Y., The phylogeny of varanoid lizards and affinities of snakes, *Philos. Transact. R. Soc. B Biol. Sci.*, 1997, vol. 352, no. 1349, pp. 53–91.

Lopatin, A.V., Early Paleogene insectivore mammals of Asia and establishment of the major groups of Insectivora, *Paleontol. J.*, 2006, vol. 40, suppl. no. 3, pp. 205–405.

Maisano, J.A., Bell, C.J., Gauthier, J.A., and Rowe, T., The osteoderms and palpebral in *Lanthanotus borneensis* (Squamata: Anguimorpha), *J. Herpetol.*, 2002, vol. 36, no. 4, pp. 679–682.

Norell, M.A. and Gao, K., Braincase and phylogenetic relationships of *Estesia mongoliensis* from the Late Cretaceous of the Gobi Desert and the recognition of a new clade of lizards, *Am. Mus. Novit.*, 1997, no. 3211, pp. 1–25.

Translated by G. Rautian