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GOBEKKO CRETACICUS GEN. ET SP. N., A NEW GEKKONID LIZARD FROM THE CRETACEOUS OF THE GOBI DESERT

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Gobekko cretacicus gen. et sp. n., a new representative of the family Gekkonidae *sensu* Kluge (1987), has been described from the ?upper Santonian and/or ?lower Campanian Djadochta Formation of the Gobi Desert. The presence of this family in the Cretaceous of Central Asia, suggested by earlier finding of fragmentary remains of *Hoburogekko suchanovi* Alifanov 1989 in the Aptian-Albian of the Gobi Desert, is thus confirmed.

Key words: Reptilia, Sauria, Gekkota, Cretaceous, Mongolia.

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INTRODUCTION

The present paper concerns the remains of a gekkotan lizard collected by the Polish-Mongolian Paleontological Expeditions to the Gobi Desert (1963—1971), from the upper Cretaceous deposits of Mongolia.

The remains of the Gekkota are rather rare in the Cretaceous. Of twenty five lizard genera described hitherto from the Cretaceous of the Gobi Desert (Gilmore 1943, Sulimski 1972, 1975, 1978, 1984, Borsuk-Białynicka 1984, 1985, 1986, 1988, Alifanov 1988, 1989 see also Estes 1983*a*) only two belong to the Gekkota.

For the first time, the Gekkota have been recorded in the Cretaceous by Soviet paleontologists from the Mongolian locality Khobur, of the Albian-Aptian age (Alifanov 1989). Described from this locality, *Hoburogekko suchanovi* Alifanov, 1989 is the oldest representative of the Gekkota known hitherto, taking apart the late Jurassic families Ardeosauridae and Bavarisauridae, related to the gekkotans and provisionally included into the infraorder by some authors (Hoffstetter 1964, Estes 1983*a*, *b*), but considered as out-groups by others (Kluge 1987). *Hoburogekko* is, at the same time, the oldest representative of the Gekkonidae *sensu* Kluge

(1976), and most probably the oldest one of the subfamily Gekkoninae *sensu* Kluge (1976), i.e. of the family Gekkonidae *sensu* Kluge (1987: 38), to which *Gobekko* is assigned too.

The second Cretaceous gekkotan, *Gobekko cretacicus* gen. et sp. n., the one described herein, has been based on three specimens from the locality Bayn Dzak, Gobi Desert, from sediments of the Djadochta Formation of the ?upper Santonian and/or ?lower Campanian age (Gradziński *et al.* 1968, Gradziński and Jerzykiewicz 1972, Gradziński *et al* 1977). It is better preserved and more safely assigned to the family Gekkonidae *sensu* Kluge (1987) than *Hoburogekko*.

Apart from the Mongolian records, the gekkotans are poorly known in pre-Quaternary deposits. The presence of the group has been documented in Europe beginning with the upper Eocene (*Cadurcogekko* and *Rhodanogekko*, Hoffstetter 1946). Uncertain remains are known from upper Eocene deposits of North America and from the upper Paleocene of South America (Estes 1983*a*, *b*). These remains are hardly determinable below the infraordinal level.

The following recent lizards have been examined during this study: *Gehyra oceanica* (Lesson), MBS 6852; *Gekko gekko* (Linneus), ZPAL z.p.R I/14 and 17; *Gymnodactylus pelagicus* (Girard), MBS 11134; *Hemidactylus flaviviridis* Ruppell, MBS 16046 of the Gekkoninae *Teratoscinus scincus* (Schlegel), MBS 6852 of the Teratoscincinae; *Gonatodes vittatus* (Lichtenstein), MBS 13617; *Sphaerodactylus molei* Boettger, MBS 9562 of the Sphaerodactylinae; *Bavayia cyclura* (Gunther); MBS 2901; *Naultinus elegans* Gray, MBS 19649; *Rhacodactylus auriculatus* (Bavay), MBS 7052 of the Diplodactylinae.

Institutional acronyms:
MBS — Natural History Museum, Basel, Switzerland.
ZPAL — Institute of Paleobiology, Polish Academy of Sciences, Warsaw, Poland.
PIN — Institute of Paleontology, Academy of Sciences of USSR, Moscow, USSR.

Acknowledgements. — I am highly indebted to Professor. U. Rahm (Natural History Museum, Basel) for making the comparative lizard material available for studies, and to Professors R. Estes (San Diego State University, California) and A. G. Kluge (University of Michigan, Ann Arbor) for their critical comments on the manuscript of the present paper.

SYSTEMATIC PART

Infraorder **Gekkota** Cuvier, 1807
Family **Gekkonidae** Gray, 1825 *sensu* Kluge (1987)
Genus *Gobekko* nov.

Type species: *Gobekko cretacicus* sp. n.

Etymology: Combination of geographic denomination — Gobi with a trivial name — gekko used for all gekkotans.

Stratigraphic and geographic range. — Late Cretaceous Djadochta Formation (?late Santonian and/or ?early Companian), Gobi Desert, Mongolia.

Diagnosis. — Medium sized gekkonid lizard with flat skull, unpaired premaxilla, paired parietals and frontals. Minimum frontal width making up about 28% of the posterior width. Maxillary processes of frontals spreading lateral and far anterior. Frontomaxillary suture laterally convex. Nasals evenly oval with no abrupt narrowing of the posterior part. Parietals parallel-sided with almost no constriction. Slim supratemporal processes only slightly divergent. Triangular medial projection of the posterior parietal border reaching almost as far posterior as the supratemporal processes. Palatine ossified medial to the main triangular vomerine process but without producing interpalatine contact. Jugal entirely medial to the maxilla.

Gobekko cretacicus sp. n.

(pl. 17, 18; fig. 1—3)

Holotype: ZPAL MgR-II/4; pl. 17: 1.

Type horizon: Djadochta Formation (?late Santionian and/or ?early Campanian).

Type locality: Bayn Dzak, Gobi Desert, Mongolia.

Etymology: cretacicus (Lat.) — of the Cretaceous stratigraphic age.

Diagnosis. — Skull length about 15 mm. Number of tooth positions approximately 10 in premaxilla and 27 in maxilla.

Material. — ZPAL MgR-II/4. Skull with mandibles. Posterior part of the left mandible missing, pterygods and quadrates strongly damaged.

ZPAL MgR-II/43. Fragmentary skull with mandibles. Parietals, braincase and all parts of skull and mandible adjacent to them missing.

ZPAL MgR-II/47. Damaged snout with frontals and fragmentary mandible.

Measurements. — see Table 1.

Description. — Skull as a whole: The snout is low, sloping gently towards the top. Its length amounts to about 0.34 of the skull length. The external nares face dorsally. The parietals are subquadrangular with no constriction perpendicular to the long axis. Both the postorbital and supratemporal arcade are lacking from the specimens.

Dermocranial roofing elements: The premixilla is unpaired. Its dorsal process is roughly one-third the diameter of the single external nare. The outline of the nasals has been reconstructed from the preserved fragments as demonstrated in fig. 1B. There is no nasal prefrontal contact, but, instead, the anterolateral processes of the frontals, semilunar in shape, broadly contact the maxillae. The frontals are paired. The minimum frontal width makes up 0.6 of the anterior and about 0.3 of the posterior width. The subolfactory processes join each other below the olfactory tract. The frontoparietal suture is disarticulated and obscured by sediment closely adhering to the bones. Parietals are paired and almost unconstricted bones with short and narrow supratemporal processes directed almost posteriad. Between them, the posterior margin of the bones is produced into a triangular projection.

The posterior border of the maxilla raises up steeply dorsomedially. It broadly overlaps the prefrontal leaving only a thin semilunar surface uncovered. The posterior process of the maxilla is separated from the nasal process by a slight incision into which the prefrontal fits. The posterior process underlies the anterior 1/4 of

the orbit. Its posterior extremity is truncated. The jugal is reduced to a flat and short bone blade fused with the mediodorsal face of the maxilla and not exceeding its posterior reach. The anterior extremity of the jugal contacts the prefrontal and the palatine. The lacrimal is missing. The medioventral extent of the prefrontal is delimited by the subolfactory process of the frontal and the palatine. The prefrontals are, thus, separated from the boundary of the orbitonasal fenestra.

Palate: The vomers are fused with each other. Their surface is ventrally concave and bordered with lateral crests. Lateral walls of the bones ascend into the choanae. The main vomeropalatine contact is between the lateral crests and thin anterior processes of the palatines. Medial to these processes palatine blades ascend steeply mediodorsally and are separated from the vomers by a concavity having a poorly preserved surface suggestive of incomplete ossification. The left and right palatines almost touch each other but the actual contact is not preserved. The maxillary process of the palatine is directed ventrolaterally. As demonstrated by ZPAL MgR-II/43 (pl. 18: 1), the ectopterygoid is a semilunar bone extending parallel to a broad blade of the palatine part of the pterygoid and almost touching its lateral margin. The suborbital fenestra left between them is just a slit.

Quadrate: On the basis of the preserved extremities the quadrate seems to be fairly long, approximately the length of the parietals. The shaft is strongly concave

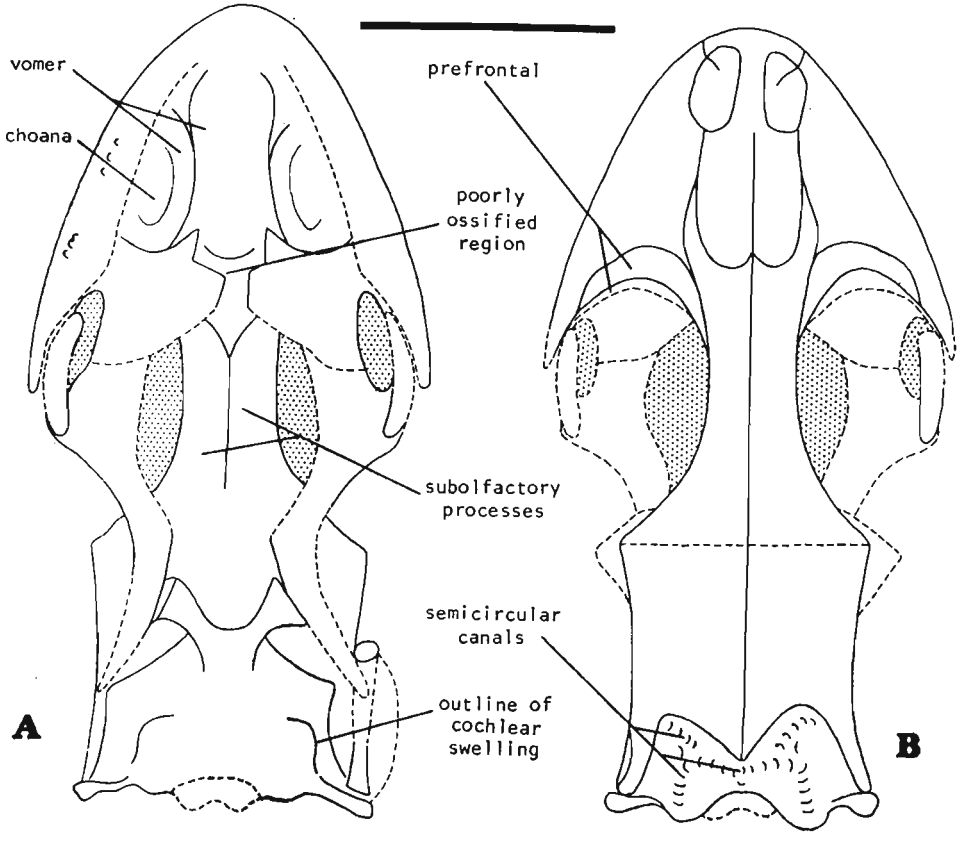


Fig. 1. Reconstruction of skull of *Gobekko cretacicus* gen. et sp. n. *A ventral* view, *B* dorsal view. Scale bar 5 mm.

posteriorly. The tympanic crest is missing from the specimen. The position of the quadrate shaft as well as that of the epipterygoid is very oblique, suggestive of a protractive phase of the jaw apparatus, as judged from the retracted position of the basipterygoid processes with respect to the pterygoids. The epipterygoid reaches to the alary process of the prootic.

Braincase: The base of the braincase is perforated by an oval hole corresponding to the embryological basicranial fenestra. The edges of the fenestra may be artificially enlarged by erosion. The course of the sphenoccipital suture is unknown. The basioccipital and exoccipitals are crushed together with the anterior cervical vertebrae in such a way as to make individual bone identification impossible. The sphenoccipital tubercles and the margins of the occipital recesses, posterior to the tubercles, are both, poorly developed. The ventrolateral crests occur at the bases of the basipterygoid proceses, and disappear posteriorly. The long basipterygoid processes with much broadened articular condyles extend anterolaterally and slightly ventrally. Their dorsal aspect is obscured by sediment.

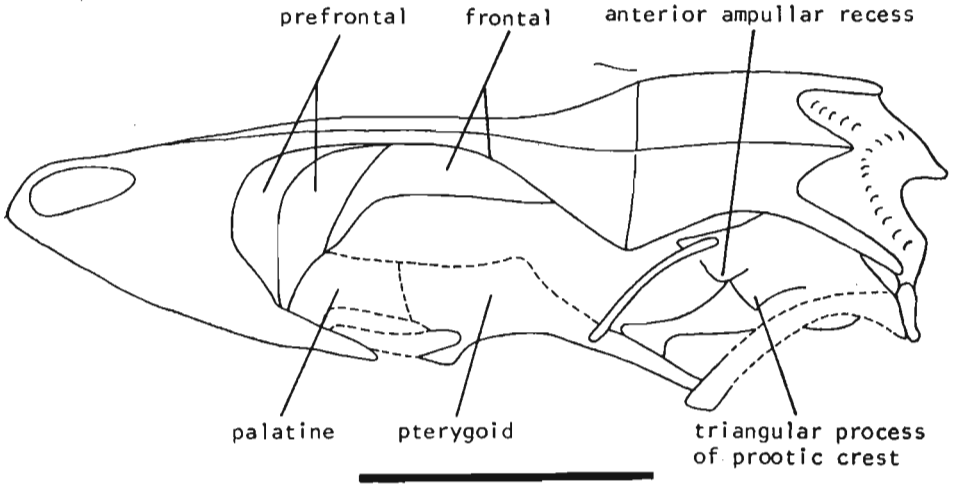


Fig. 2. Reconstruction of skull of *Gobekko cretacicus* gen. et sp. n. Left side view. Scale bar 5 mm.

The poorly preserved prootic reveals: (1) a much swollen cochlear wall, to which the exoccipital contributes a posterior part without leaving any trace of suture; (2) semicircular canals, the anterior and the horizontal one, the former with a prominent ampulla; (3) a roughly triangular alary process extending anterolateral of the anterior semicircular canal and articulating with the top of the epipterygoid; (4) a triangular bone blade (if not an artifact) extending lateral of the braincase wall and just ventral to the ampulla of the horizontal semicircular canal. It seems to be a projection of the prootic crest, which itself is not preserved in the specimen.

Both the tuberal and the interfenestral crests extend onto the occiput and join the swellings of the posterior semicircular canal rather than extending onto the ventral margins of the paroccipital processes. The occiput is a flat plate, rounded in outline, bordered by the posterior semicricular canals and facing posterodorsally. A sagittal crest divides its surface into two parts. Its dorsal extremity contacts the

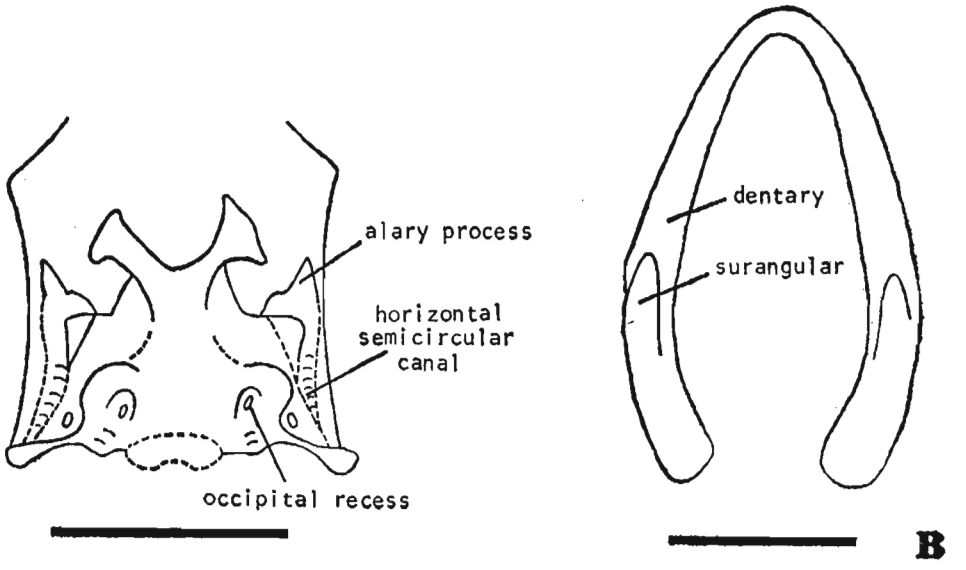


Fig. 3. *Gobekko cretacicus* gen. et sp. n. *A* braincase in ventral view. Scale bar 5 mm. *B* outline of mandible in ventral view. Scale bar 5 mm.

posterior projection of the parietals. The braincase of ZPAL MgR-II/4 has no bony extensions dorsal to the semicircular canals. Composed of the prootic and the supraoccipital, the dorsolateral braincase wall is concave with respect to the swellings covering the semicircular canals. Embraced by the dorsal extremities of the perpendicular canals, a small triangular part of the wall faces dorsally. There is no gap *ascendens tecti synotici* is absent.

Dentition: There are about 10 tooth positions in the premaxilla and about

Dentitioin. — There are about 10 tooth positions in the premaxilla and about 27 tooth positions in the maxilla. The tooth crowns are broken off at the level of the ventral margin of the maxilla, and obscured by sediment.

Mandible: The symphysis is U-shaped. The mandibular rami are medially concave. In medial aspect, the subdental part of the mandibular ramus is very low and rounded in transverse section with no traces of Meckelian groove. There is no suture on this surface up to the level of the 24 maxillary tooth position, which suggests that the dorsal and ventral edges of the Meckelian groove are completely fused. Posterior to this level there is a slight suggestion of an oblique, anteromedially sloping suture, probably between the splenial and the dentary, with a single foramen at its anterior end. The anterolateral process of the coronoid projects far anterior of the anteriormost extent of the supraangular.

Discussion. — *Gobekko* shares at least six of the 19 skull synapomorphies listed by Estes *et al.* (1988) for the *Gekkota*. They are as follows: descending processes of frontals in contact below olfactory tract; absence of postorbital and supratemporal arch; parietal foramen lost; lacrimal lost; Meckel's canal in closed and fused dentary tube. Other characters from Estes's *et al.* (1988) list are poorly preserved or lacking in the material being described except for frontals, which bear a sagittal suture. Their ontogenetic fusion in *Gobekko* is thus uncertain, while being considered synapomorphic for the *Gekkota* by Estes *et al.* (1988).

This difference does not falsify the assignment of the genus to the *Gekkota*, but rather corresponds with Kluge's (1987) view that the variation of the frontal states is "uninformative with respect to characterising major sister group relationships".

Two character states: the weakening of the contact between palatines and vomers (except for its part produced by the triangular vomerine process of the palatine just medial to the choana) and the presence of a triangular projection of the prootic crest, provide a basis for assignment of *Gobekko* to a less inclusive group. According to Estes *et al.* (1988) these character states are synapomorphic for the Gekkonidae *sensu* the same authors, thus, for the gekkotan group not including pygopodids, bavarisaurids and ardeosaurids. Although the Jurassic groups have these characters not adequately known, they are clearly set off from the remaining gekkotans, and from Gobekko as well, by their retention of the supratemporal arcade.

The combination of the azygous premaxillae with paired parietals tends to exclude *Gobekko* not only from the Pygopodidae, Bavarisauridae and Ardeosauridae, but also from the Eublepharidae and Diplodactylidae. Given the high reversibility of states of the parietals and premaxillae (Noble 1921, Hoffstetter 1946, Kluge 1967, 1987 and others) and difficulties in precising the actual state of premaxillae, which is more apparent early in ontogeny (Kluge 1987), the combination of these character states may not be safely based on in taxonomic determination of the remains. The exclusion of *Gobekko* from the eublepharids is endorsed by the lack of contact between the *pares frontales* of the prefrontals in this genus, since the presence of the contact is considered synapomorphic for the Eublepharidae (Grismer 1988).

Uncertain as it is, the above evidence suggests the assignment of *Gobekko* to the family Gekkonidae *sensu* Kluge (1987: 39) the extent of which has been limited to the Gekkoninae (including sphaerodactylines) and Teratoscincinae.

Of the forty skull characters discussed by Grismer (1988) only five may be studied in *Gobekko*. All of them display states considered plesiomorphic for the Gekkota by this author. They are as follows: dorsal process of premaxilla narrow; *pares frontales* separated from each other; dorsoposterior part of prefrontal recessed into the lateral frontal margin; palatine, most probably, overlapping the maxilla dorsally at the maxillopalatine suture, and anterolateral process of the coronoid extending far anterior of the anteriormost part of surangular.

Hoburogekko is the only Cretaceous gekkotan available for comparison. The parietals and premaxillae being unknown, its possible affinity with the Gekkoninae is based (Alifanov 1989), on the presence of the incision in the posterior border of the vomer. However, the equally deep incision may occur in both the Diplodactylinae (e.g. *Bavaya* and *Rhacodactylus*; pers. observ,) and the Eublepharinae (*Coleonyx*; according to Rippel's 1984: fig. 4A). This character state is not known in *Gobekko*. The paired frontals, the less vaulted snout and the lower maxilla of *Gobekko* support its generic distinctness from *Hoburogekko*. The attribution of the mandible PIN 3334/503 (Alifanow 1989), with its open Meckelian canal, to the genus *Hoburogekko* seems dubious, since the closure and fusion of the Meckelian canal is considered synapomorphic for the *Gekkota* (Estes *et al.* 1988).

The presence of the most ancient gekkonids, *Hoburogekko* and *Gobekko*, in the Cretaceous of the Gobi Desert is suggestive of an Asiatic origin of the Gekkonidae *sensu* Kluge (1987). This suggestion corresponds with Estes' (1983b) view about the originally Laurasian deployment of the *Gekkota*.

Table 1

Dimensions of skull and mandible of the Cretaceous gekkotans from the Gobi Desert (in mm)

	Gobekko cretacicus gen. et sp. n. ZPAL MgR-II/4	*Hoburogekko suchanovi* Alifanov, 1989 PIN 3334/500
Maximum skull length	15.5	—
Preorbital length	5.0	—
Orbital length	4.5	—
Length of vomer, approx.	3.1	2.9
Length of maxilla	6.0	6.1
Length of maxillary tooth row	5.5	—
Lenght of frontal, approx.	7.0	6.1
Length of parietal in sagittal plane	4.2	—
Lateral length of parietal	4.4	—
Maximum skull width	8.0	8.0
Anterior frontal width	2.4	2.4
Posterior frontal width, approx.	5.0	—
Minimum frontal width	1.4	1.4
Minimum parietal width	4.8	4.8
Maximum spread of supratemporal processses	5.0	—
Maximum length of right ramus of mandible up to articulation, approx.	12.2	—
Height of maxilla	3.1	3.6

REFERENCES

[ALIFANOV, W. R.] АЛИФАНОВ, В. Р. 1988. Новые ящерицы (Lacertilia, Teiidae) из верхнего мела Монголии. *In*: Е. Н. Курочкин (род.), Труды Совм. Сов.-Монг., Палеоат. Эксп., **34**, 90—100.

[ALIFANOV, W. R.] АЛИФАНОВ, В. Р. 1989. Древнейший геккон (Lacertilia Gekkonidae) из нижнего мела Монголии. — *Палеонт. Жур.* **1**, 124—126.

BORSUK-BIAŁYNICKA, M. 1984. Anguimorphans and related lizards. *In*: Kielan-Jaworowska (ed.), Results of the Pol.-Mong. Palaeont. Expeds., Part X. — *Palaeont. Polonica*, **46**, 5—105.

BORSUK-BIAŁYNICKA, M. 1985. Carolinidae, a new family Xenosaurid-like lizards from the Upper Cretaceous of Mongolia. — *Acta Palaeont. Polonica*, **30**, 3—4, 151—176.

BORSUK-BIAŁYNICKA, M. 1987. *Carusia*, a new name for the Late Cretaceous lizard *Carolina* Borsuk-Białynicka, 1985. — *Acta Palaeont. Polonica*, **32**, 1—2, 153.

BORSUK-BIAŁYNICKA, M. 1988, *Globaura venusta* gen. et sp. n. and *Eoxanta lacertifrons* gen. et sp. n. — non-teiid lacertoids from the Late Cretaceous of Mongolia. — *Acta Palaeont. Polonica*, **33**, 3 211—248.

ESTES, R. 1983a. Sauria terrestria, Amphisbaenia. Handbuch der Palaeoherpetologie. 10A: 1—249. Gustav Fisher Verlag, Stuttgart.

ESTES, R. 1983b. The fossil record and early distribution of lizards. *In*: A. G. J. Rhodin and K. Miyata (eds.), Advances in herpetology and evolutionary biology. Mus. Comp. Zool. Harvard, Cambridge, Mass. 365—398.

ESTES, R., de QUEIROZ, K. and GAUTHIER, J. 1988. Phylogenetic relationships within Squamata. *In*: R. Estes and G. Pregill (eds.), Phylogenetic relationships within lizard families. Herpetologist's League Spec. Publ. 2, 119—270.

GILMORE, C. W. 1943. Fossil lizards of Mongolia. — *Bull. Amer. Mus. Nat. Hist.*, **81**, 361—384.

GRADZIŃSKI, R. and JERZYKIEWICZ, T. 1972. Additional geographical and geological data from the Polish-Mongolian Palaeontological Expeditions. *In*: Z. Kielan-Jaworowska (ed.), Results of the Pol.-Mong. Palaeont. Expeds. Part. IV. — *Palaeont. Polonica*, **27**, 17—30.

GRADZIŃSKI, R., KAŹMIERCZAK, J. and LEFELD, J. 1968. Geographical and geological data from the Polish-Mongolian Palaeontological Expeditions. *In*: Z. Kielan-Jaworowska (ed.), Results of the Pol.-Mong. Palaeont. Expeds. Part I. — *Palaeont. Polonica*, **19**, 33—82.

GRADZIŃSKI, R., KIELAN-JAWOROWSKA, Z. and MARYAŃSKA, T. 1977. Upper Cretaceous Djadochta, Barun Goyot and Nemegt Formations of Mongolia. Including remarks on previous subdivisions. — *Acta Geol. Polonica*, **27**, 281—318.

GRISMER, L. L. 1988. Phylogeny, Taxonomy, Classification, and Biogeography of eublepharid Geckos. *In*: R. Estes and G. Pregill (eds.), Phylogenetic Relationships within Lizard Families. Herpetologist's League Spec. Publ. 2, 369—464.

HOFFSTETTER, R. 1946. Sur les Gekkonidae fossiles. — *Bull. Mus. Nat. Hist. Nat.*, **18**, 2, 2195—2203.

HOFFSTETTER, R. 1964. Les Sauria du Jurassique supépieur et spécialement les Gekkota de Baviere et de Mandchourie. — *Senck. Biol.*, **45**, 281—324.

KLUGE, A. G. 1967. Higher taxonomic categories of gekkonid lizards and their evolution. — *Bull. Amer. Mus. Nat. Hist.*, **135**, 1, 1—50.

KLUGE, A. G. 1987. Cladistic relationships among the Gekkonoidea. — Misc. Publ. Mus. Zool. Univ. Michigan, 173.

NOBLE, K. K. 1921 The bony structure and phyletic relations of *Sphaerodactylus* and allied lacertilian genera, with description of the new genus. — *Amer. Mus. Novit.*, **4**, 1—16.

RIEPPEL, O. 1984. The structure and the skull and jaw adductor musculature in the Gekkota, with comments on the phylogenetic relationships of the Xantusiidae (Reptilia: Lacertilia). — *Zool. Journ. Linn. Soc.*, **82**, 3, 291—318.

MAGDALENA BORSUK-BIAŁYNICKA

GOBEKKO CRETACICUS GEN. et SP. N., NOWY GEKKON Z KREDY PUSTYNI GOBI

Streszczenie

W pracy opisano nowy rodzaj i gatunek gekkona *Gobekko cretacicus* gen. et sp. n. (fig. 1—3) z górnej kredy Mongolii, z formacji Dżadochta (?g. santon i/lub ?d. kampan) stanowiska Bajn Dzak. Nowy rodzaj zaliczono do rodziny Gekkonidae *sensu* Kluge (1987). Opisane znalezisko potwierdza obecność tej ścisłej grupy gekkonów w kredzie centralnej Azji zasugerowane przez opisany wcześniej, lecz gorzej zachowany i gorzej oznaczalny gatunek *Hoburogekko suchanovi* Alifanov, 1989 z dolnej kredy Mongolii.

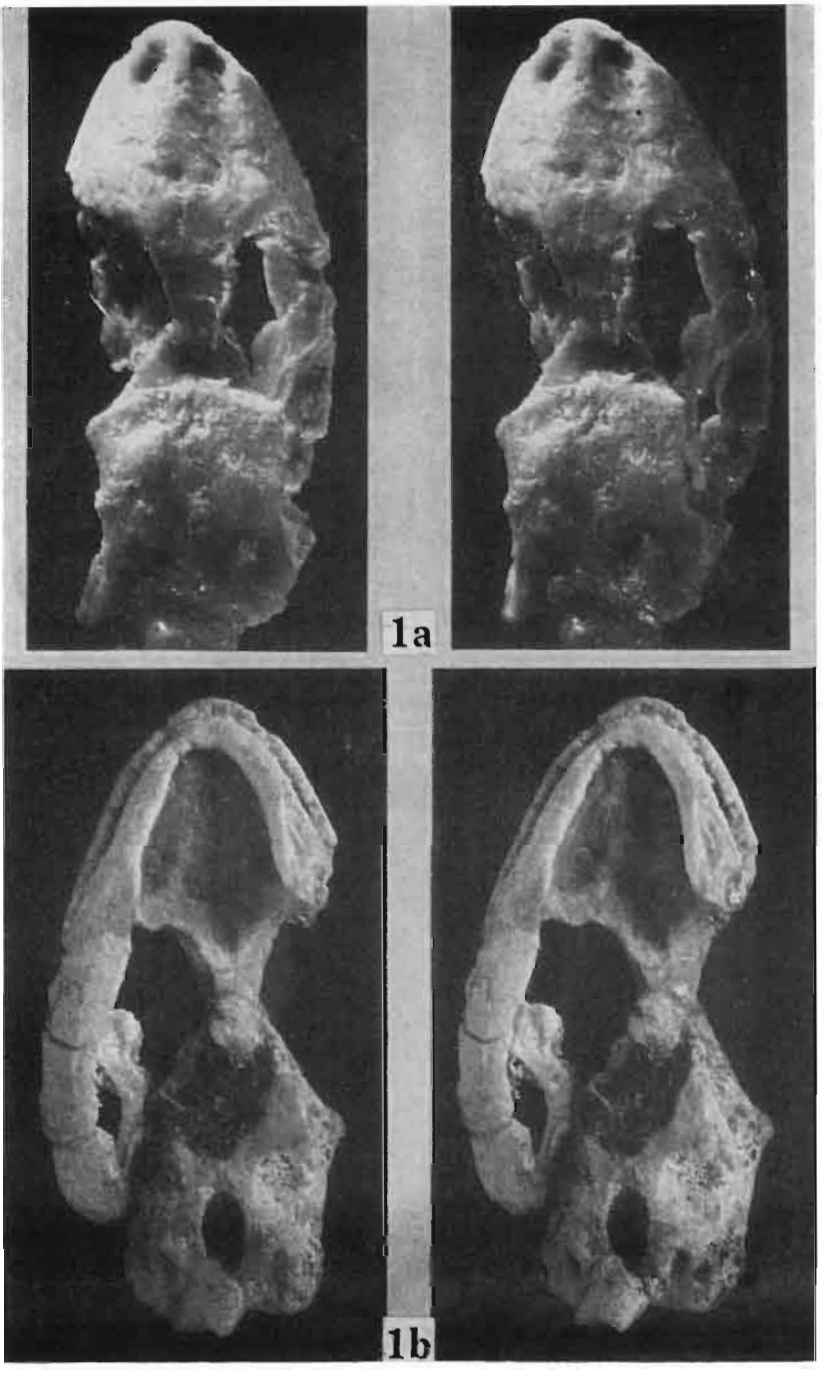
EXPLANATION OF PLATES 17 AND 18

Plate 17

1. Skull of *Gobekko cretacicus* gen. et sp. n.: ZPAL MgR-II/4, holotype, stereophotograph, ×5; 1*a* dorsal view, 1*b* ventral view.

Plate 18

1. Fragmentary skull of *Gobekko cretacicus* gen. et sp. n.: ZPAL MgR-II/43, stereophotographs, ×2.6; dorsal view.
2. Fragmentary skull of *Gobekko cretacicus* gen. et sp. n.; ZPAL MgR-II/47, stereophotographs, ×3; dorsal view.
3. Skull of *Gobekko cretacicus* gen. et sp. n.: ZPAL MgR-II/4, holotype, stereophotograph, ×5; right side view.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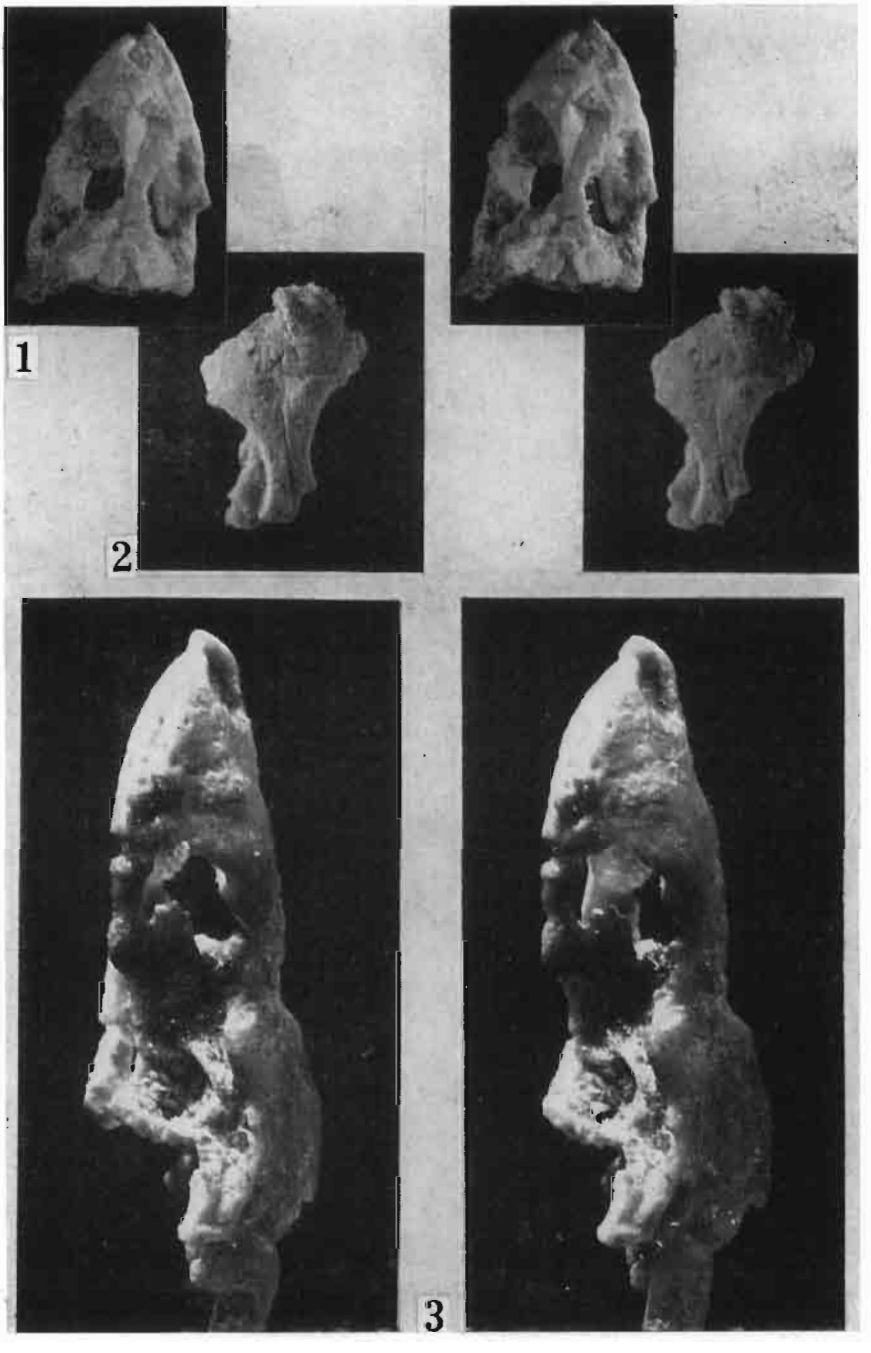
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