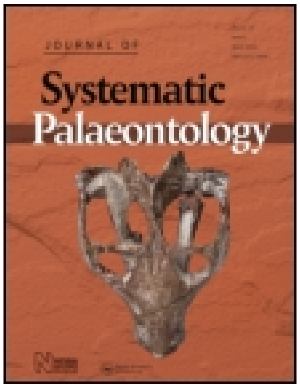

Journal of Systematic Palaeontology
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/tjsp20

A large predatory lizard (Platynota, Squamata) from the Late Cretaceous of South China

Jin-you Mo [a] [b] , Xing Xu [c] & Susan E. Evans [d]

[a] Faculty of Earth Sciences, China University of Geosciences, 388 Lumo Road, Wuhan, Hubei, 430074, PR China

[b] Natural History Museum of Guangxi, 1-1 East Renmin Road, Nanning, Guangxi, 530012, PR China

[c] Key Laboratory of Evolutionary Systematics of Vertebrates, Institute of Vertebrate Paleontology & Paleoanthropology, Chinese Academy of Sciences, 142 Xiwai Street, Beijing, 100044, PR China

[d] Research Department of Cell and Developmental Biology, Anatomy Building, UCL, University College London, Gower Street, London, WC1E 6BT, UK

To cite this article: Jin-you Mo, Xing Xu & Susan E. Evans (2012): A large predatory lizard (Platynota, Squamata) from the Late Cretaceous of South China, Journal of Systematic Palaeontology, 10:2, 333-339

To link to this article: http://dx.doi.org/10.1080/14772019.2011.588254

Journal of Systematic Palaeontology, Vol. 10, Issue 2, June 2012, 333–339

A large predatory lizard (Platynota, Squamata) from the Late Cretaceous of South China

Jin-you Mo[a,b], Xing Xu[c] and Susan E. Evans[d]*

[a]*Faculty of Earth Sciences, China University of Geosciences, 388 Lumo Road, Wuhan, Hubei, 430074, PR China;* [b]*Natural History Museum of Guangxi, 1-1 East Renmin Road, Nanning, Guangxi, 530012, PR China;* [c]*Key Laboratory of Evolutionary Systematics of Vertebrates, Institute of Vertebrate Paleontology & Paleoanthropology, Chinese Academy of Sciences, 142 Xiwai Street, Beijing 100044, PR China;* [d]*Research Department of Cell and Developmental Biology, Anatomy Building, UCL, University College London, Gower Street, London WC1E 6BT, UK*

(Received 2 August 2010; accepted 15 December 2010; printed 16 May 2012)

The Late Cretaceous deposits of the Nanxiong Formation, southern China, have yielded some dinosaur bones and many eggs, but there has been little record of the associated fauna. A new locality in Jiangxi Province has recently produced a fossil lizard assemblage including two genera of herbivores and the partial skull and lower jaws of a terrestrial predator. The latter combines large size, the possession of a small number of recurved, well-separated marginal teeth, a blunt rostrum, and rounded cranial osteoderms. It resembles *Estesia* from the Late Cretaceous of Mongolia, but is distinct in its jaw morphology and the possession of cranial osteoderms. It is therefore placed in a new genus and species, *Chianghsia nankangensis*. Phylogenetic analysis groups *Chianghsia* unequivocally with the Platynota, the group to which living monitor lizards and extinct mosasaurs belong. Within Platynota, there is support for the attribution of *Chianghsia* to Monstersauria, the group that includes the living venomous Gila monster, *Heloderma suspectum*, and its fossil relatives. This is the first record of a large terrestrial predatory platynotan lizard from the Mesozoic of southern China.

Keywords: China; Squamata; Platynota; Monstersauria; predatory lizard; new taxon

Introduction

Lizards are relatively well represented in the Late Cretaceous fossil record, but most records are either from North America (e.g. Gilmore 1928; Gao & Fox 1996) or Mongolia (e.g. Gilmore 1943; Borsuk-Białynicka 1984; Norell *et al*. 1992, 2008; Gao & Norell 2000). The fossil lizard assemblage of Mongolia (Djadochta Formation (Fm)) is remarkably diverse (Gao & Norell 2000) and is represented by a large number of well-preserved skulls. Much less is known of the contemporary Chinese record, and this mainly documents Inner Mongolian localities similar to those of Mongolia (e.g. Gao & Hou 1996; Li *et al.* 2008). The only exception was a partial dentary from the Ganzhou Basin, Jiangxi Province (*Conicodontosaurus kanhsiensis*, Young 1973), but this specimen is lost and its age uncertain (Li *et al*. 2008). Recently, however, an herbivorous lizard, *Tianyusaurus zhengi*, was described from the Late Cretaceous of Henan Province (Lü *et al*. 2008). Additional specimens of *Tianyusaurus* were recovered from a new locality in the Nanxiong Fm of southern Jiangxi, near the city of Nankang (Mo *et al*. 2009; Fig. 1). This same locality has yielded further undescribed lizard taxa, including the large predatory lizard described herein. The Nanxiong Fm, or its equivalents, outcrops across several provinces in south-eastern China as an extensive sequence of red bed mudstones, sandstones and conglomerates that have yielded a rich Maastrichtian age bone and egg assemblage (Zhao *et al*. 1991; Lucas 2001; Sato *et al*. 2005), including an oviraptorid dinosaur (Xu & Han 2010) and a turtle (Tong & Mo, unpubl. data).

Systematic palaeontology

Squamata Oppel 1811
Anguimorpha Fürbringer 1900
Platynota Camp 1923
Monstersauria Norell & Gao 2007
Chianghsia gen. nov.

Type species. *Chianghsia nankangensis* sp. nov.

Etymology. From Chiang-hsi, an alternative transliteration of Jiangxi.

Diagnosis. See type species.

---

*Corresponding author. Email: ucgasue@ucl.ac.uk

ISSN 1477-2019 print / 1478-0941 online

http://dx.doi.org/10.1080/14772019.2011.588254
http://www.tandfonline.com

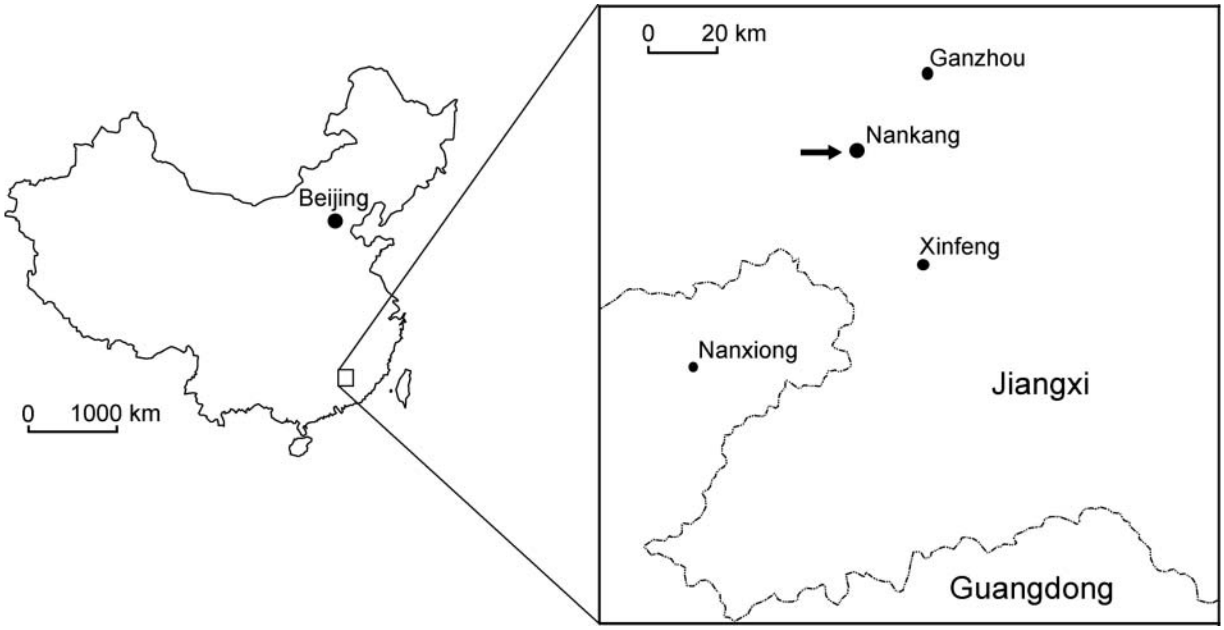

Figure 1. Map of PR China with enlargement of southern Jiangxi showing the location of Nankang close to the fossil site.

C. nankangensis sp. nov.
(Figs 1–4)

Etymology. From Nankang, the city closest to the locality

Type specimen. Guangxi Natural History Museum, Zoology Collection, NHMG 009318 (Nanning, Guangxi Province, China), a partial skull and lower jaws.

Diagnosis. Platynotan lizard (*sensu* Conrad 2008) uniquely combining large size (> 1 m snout–vent length (SVL)); blunt rostrum; substantial dentary–postdentary overlap; rounded and pitted cranial osteoderms attached, but not co-ossified, to lower jaws, and fused to some dorsal skull elements; four to five functional teeth on each maxilla and dentary; teeth large, high-crowned, laterally compressed and widely spaced with basal infolding. *Chianghsia* resembles other platynotans in the U-shaped palatine, septomaxilla partially flooring the narial opening, a narrow elongate vomer, anteroposteriorly directed ectopterygoid, size disparity between premaxillary and lateral teeth, shortened splenial, and widely spaced high-crowned teeth with broad bases and basal infolding; resembles *Lanthanotus* in having cranial osteoderms and a blunt rostrum, but differs from it and all varanids in the stronger dentary–postdentary overlap and the absence of a contact between the maxillae posterior to the premaxilla; resembles monstersaurs (*sensu* Norell & Gao 1997, Conrad 2008) in having thickened rounded cranial osteoderms, a low tooth count on the dentary and maxilla, a palatine expansion on the maxilla, a probable contact between the ectopterygoid and palatine anterior to the suborbital fenestra, and a broad rostrum; resembles the fragmentary Late Cretaceous Canadian *Labrodictes* (Gao & Fox 1996) in having a straight rather than convex ventral jaw margin and inferred absence of a venom groove, but it is larger, and has fewer, more elongated teeth; resembles the Late Cretaceous Mongolian monstersaur *Estesia* (Norell *et al*. 1992), and differs from *Gobiderma* (Gao & Norell 2000), in large size, rostral shape (parallel-sided, relatively elongate, blunt), tooth number (4–5 in dentary and maxilla), a straight rather than strongly convex ventral dentary profile, and general skull proportions, but differs in having cranial osteoderms and in lacking the edentulous posterior portion of the jaw ramus.

Occurrence. The type and only specimen is from the Upper Cretaceous (Maastrichtian) Nanxiong Fm near the city of Nankang, southern Jiangxi Province, China (Fig. 1).

Morphology

NHMG 009318 preserves the tooth-bearing margins of the maxillae and premaxilla, the septomaxillae, parts of the dorsal surface of the palate, and the lower jaws (Figs 2, 3). As preserved, the skull is 113 mm along the midline, but roughly one third is missing from the posterior end (by comparison with other platynotans), and the skull would originally have been *c*.175–180 mm long. Based on living relatives, this would suggest a snout–vent length (SVL) of 1–1.25 m. The skull has been prepared as fully as possible,

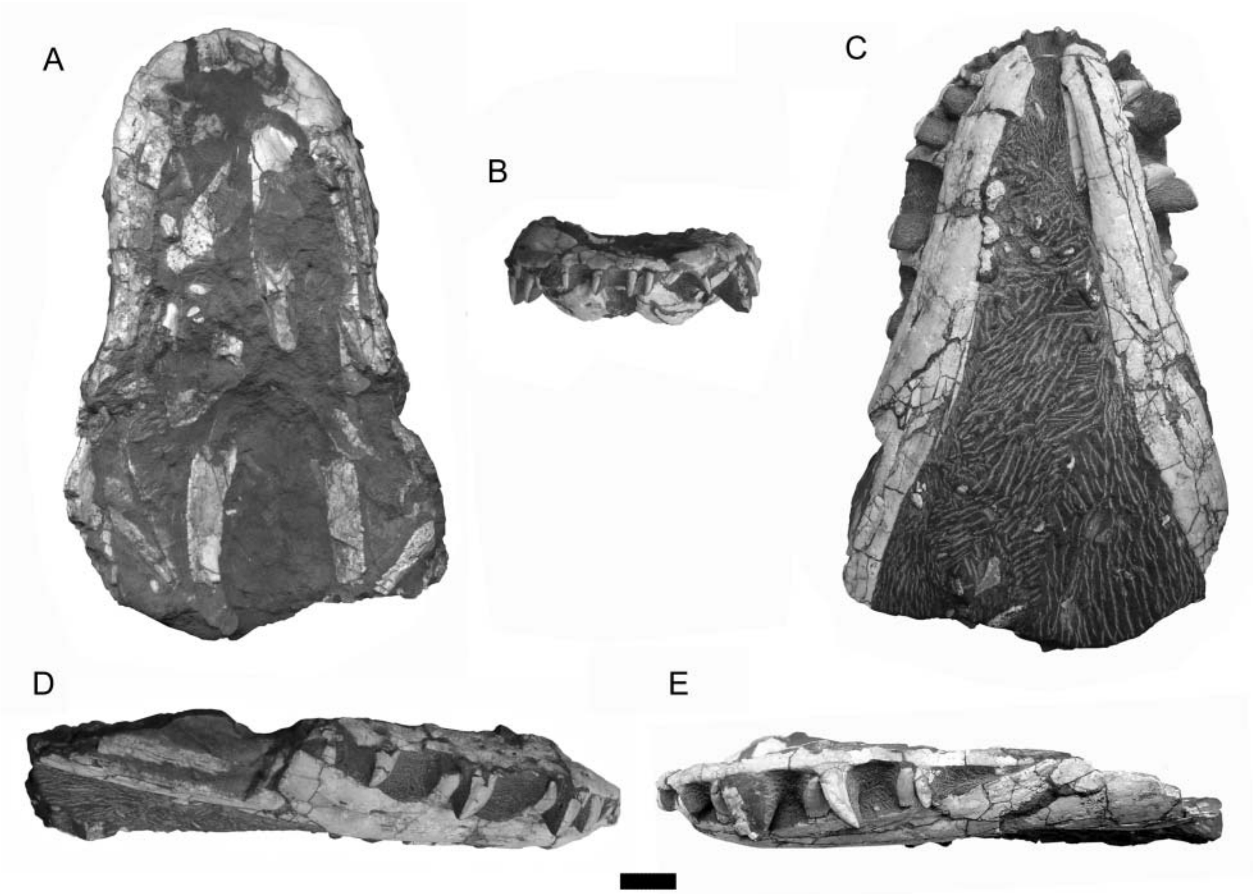

Figure 2. *Chianghsia nankangensis* gen. et sp. nov. type specimen NHMG 009318 in: **A,** dorsal; **B,** anterior; **C,** ventral; **D,** right lateral; and **E,** left lateral views. Scale bar: 10 mm, applies to all.

but attempts to CT scan material from this locality proved disappointing.

The premaxilla is single, dorsoventrally shallow and anteroposteriorly broad (Fig. 2B). Behind it, the maxillary margins run in parallel so that, with the premaxilla, they give the snout a blunt profile. Broad maxillary shelves curve anteromedially and meet the edges of the premaxilla but do not appear to make contact posterior to it (Fig. 3A). Although the anteromedial margins are partly embayed, the morphology is not suggestive of premaxillary–maxillary fontanelles. Posteromedially the maxillary shelf (left side) expands to meet the palatine. The facial processes are broken, but the anterior edge is somewhat set back suggesting elongation of the narial margin. Pitted sculpture on the base of the right facial process may indicate the presence of fused osteoderms. There is similar pitting on a bony sheet that extends from the left maxilla toward the midline. This is probably the left nasal. It is relatively wide and its dorsal surface seems to be covered with fused, interdigitating osteoderms (Fig. 4A).

The palatal elements are preserved as bone fragments and impressions. A smooth septomaxilla forms the anteroventral floor of the nasal cavity on the right side and there is a similar, more fragmentary element on the left. The right vomer is a relatively thick, narrow bone that runs parallel to the maxilla, but is broken at both ends. Posterior to it on both sides are fragments and impressions of paired U-shaped palatines, roughly equal in width and length. Each bears a lateral process that meets the maxillary shelf expansion, and a short posterior stem. The left palatine approaches the anterior end of the ectopterygoid, and probably contacted it to exclude the maxilla from the suborbital foramen. The pterygoids are represented by parts of their palatal and ectopterygoid rami (pterygoid flanges), with an impression of the palatal plate between them. There is no trace of pterygoid teeth in the areas of impression but as the medial edge of the bone is preserved in dorsal view, small teeth may have been present on the palatal surface. Large ectopterygoids lie posterior to the maxillae and are oriented anteroposteriorly. NHMG 009318 is broken just posterior to the pterygoid flanges, so the quadrate rami of the pterygoids, the quadrates and the braincase are missing.

In the lower jaws, the dentaries are relatively shallow, with little ventral curvature. Five neurovascular foramina

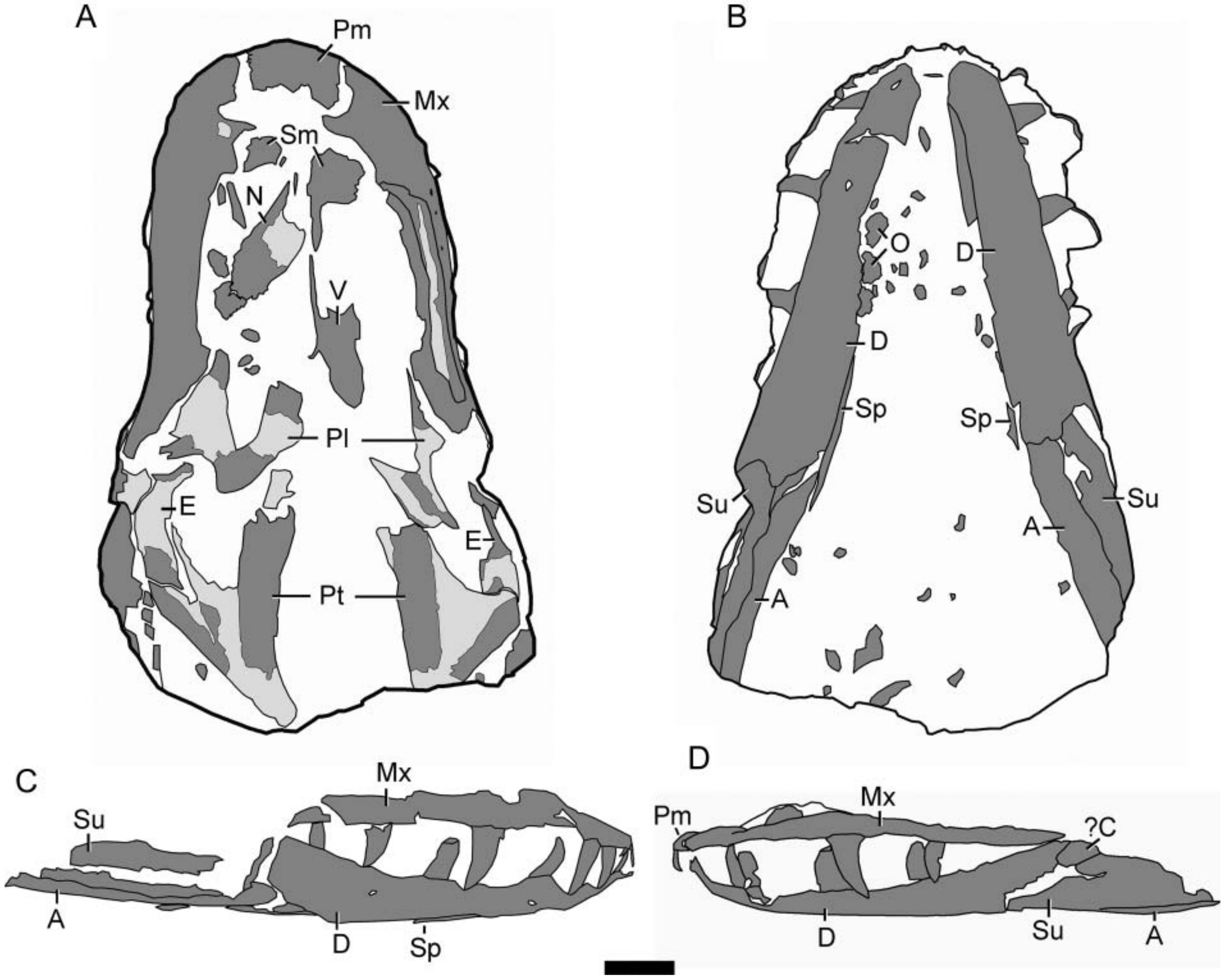

Figure 3. *Chianghsia nankangensis*. Line drawings of NHMG 009318 in: **A,** dorsal; **B,** ventral; **C,** right lateral; and **D,** left lateral views. Dark grey, bone; light grey, impression. Scale bar: 10 mm. Abbreviations: A, angular; ?C, possible coronoid fragment; D, dentary; E, ectopterygoid; Mx, maxilla; N, nasal; O, osteoderms; Pl, palatine; Pm, premaxilla; Pt, pterygoid; Sm, septomaxilla; Sp, splenial; Su, surangular; V, vomer.

open along the lateral surface. Posteriorly, the dentary overlapped the surangular and angular, although part of the overlapping surface has broken away. There is a clear, but small, surangular notch on each side (Fig. 2B). Both surangular and angular are exposed laterally (Fig. 3B). A slender strip of splenial is visible along each ventromedial jaw margin, spanning the dentary–postdentary contact but not obviously extending anterior to the mid-length of the dentary. Posterodorsally, on the left side (Figs 2E, 3D), the dentary contacts a fragment of a possible coronoid.

The marginal teeth are few, widely spaced, and very high-crowned (more than 50% of the tooth extending beyond the tooth-bearing elements; Bhullar & Smith 2008), with mesiodistally expanded bases that show basal ridging/infolding reminiscent of teeth with internal plicidentine (Fig. 4C, but see Kearney & Rieppel 2006). The degree of any lingual expansion of the base cannot be determined. There are four functional teeth on the premaxilla, four (left) or five (right) on the maxilla, and three (left) or four (right) on the dentary. The premaxillary teeth are straight and much smaller (3–4.4 mm long) than the largest maxillary (9.8 mm) or dentary (10.8 mm) teeth (Figs 2B, 4C), which are strongly recurved, labiolingually compressed (a narrow ovoid in mid-section) and have sharp anterior and posterior carinae. None of the teeth can be viewed in lingual aspect, but the preserved cross-sections show no obvious trace of venom grooves. The last dentary tooth (right side, Fig. 3C) lies close to the posterior end of the bone.

Before preparation, the block surface reportedly bore a scatter of small bone fragments (probably osteoderms). A small number of osteoderms remain on the ventral surface of the skull between the jaws. They vary in size but are rounded, thick, and have a ridged and pitted surface. Three lie against the edge of the right dentary (Figs. 2C, 4B) and osteoderms probably covered all or part of the skull in life. As described above, the pitted surface of the left

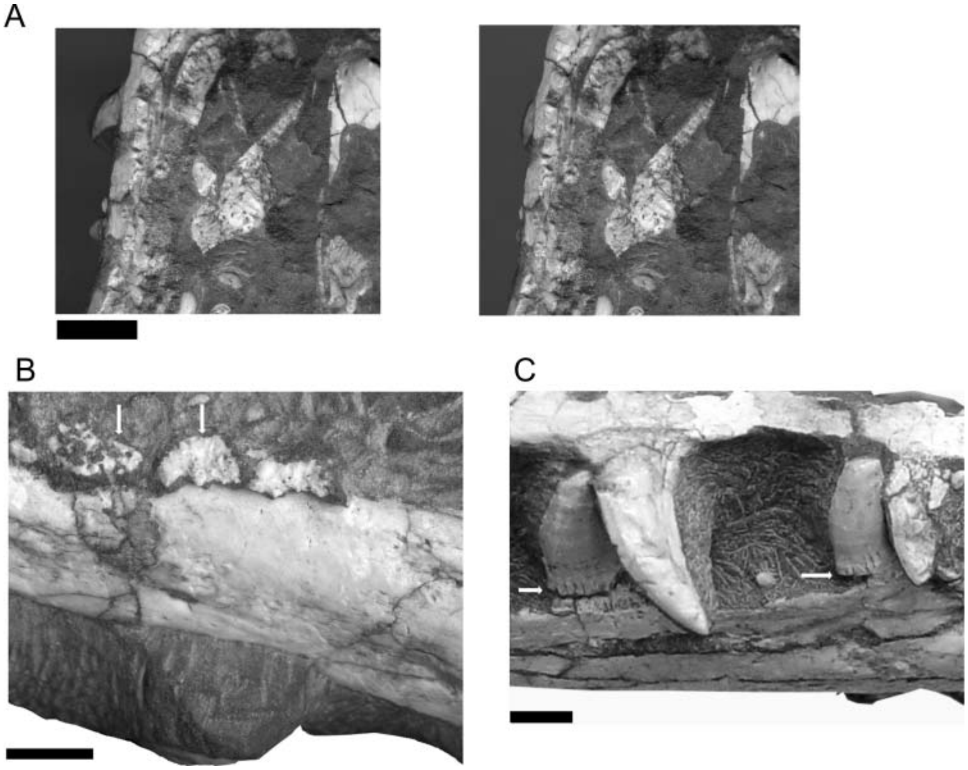

Figure 4. *Chianghsia nankangensis*, NHMG 009318: **A,** stereopair showing section of dorsal rostrum with osteodermal pitting; **B,** detail of osteoderms (arrowed) overlying edge of dentary; **C,** detail of teeth showing basal grooving/ridging suggestive of plicidentine (arrowed). Scale bars: 10 mm (A), 5 mm (B, C).

nasal seems to be due to fused, interdigitated osteoderms (Fig. 4A).

Phylogenetic analysis

We used the character matrix of Conrad (2008), with his character ordering, updated as in Norell *et al*. (2008) (372 characters; 254 active taxa including the new Jiangxi fossil, but excluding Tupinambinae, Teiinae, Iguanidae, Corytophanidae, Phrynosomatidae and Crotaphytidae from the Conrad 2008 matrix as these were replaced by representative genera in the updated matrix; see Online Supplementary Material, Chianghsiamatrix.nexus). Character ordering (addictive characters) followed Conrad (2008). The matrix is too large to run in PAUP (Swofford 2002) and we therefore used TNT (Goloboff *et al.* 2003). The analysis was performed using the New Technology (NT) search with Ratchet (100 or 1000 ratchet iterations; 1000 Random Addition [RAM] sequences) and Kuehneosauridae as the designated outgroup taxon. A Traditional Search (1000 repetitions, TBR branch swapping) was then run using the trees obtained from the ratchet search as starting trees. However, in the Traditional Search, the saved trees always exceeded the available computer memory (at 90 000+ and 100 000+ trees on two different computers). This prohibited the calculation of either Bootstrap or Bremer decay indices. To compensate, the analysis was repeated several times. In each case, the ratchet trees showed the same topographical relationships for *Chianghsia* whether 100 or 1000 ratchet iterations were run. The strict consensus of the trees recovered by the Traditional TBR search also recovered the same placement of *Chianghsia*. We are therefore confident that the relationships of the new taxon have been explored as fully as possible. The topology of the monstersaur clade was identical in each of these trees with *Chianghsia* placed as a sister taxon to the Mongolian *Estesia* (Fig. 5). The tree shown in Fig. 5 is that recovered by both the strict consensus of four Ratchet trees (Length, 3938; Consistency Index, 0.136; Retention Index, 0.705; Rescaled Consistency Index 0.096: as reported after importing into PAUP) and the strict consensus of 100 000 trees obtained from a Traditional TBR search using the ratchet trees as the starting point. These analyses also placed *Varanus* and its relatives (Varaniformes, Conrad 2008) closer to monstersaurs than to the aquatic mosasauroids (*contra* Conrad 2008).

Discussion

The phylogenetic analysis places *Chianghsia* within Platynota (*sensu* Conrad 2008), crownward of shinisaurs,

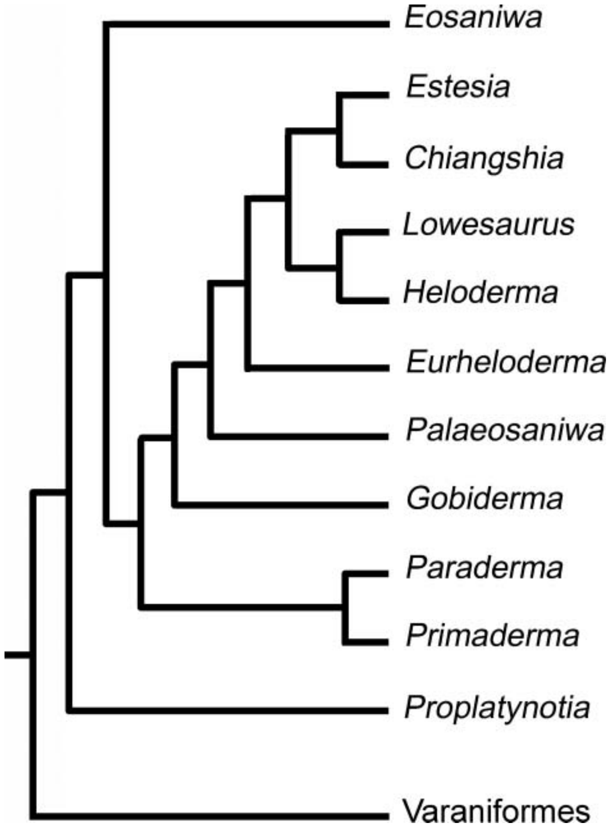

Figure 5. Monstersaur segment of a phylogenetic tree showing hypothesis of relationships for *Chianghsia*. See text for further discussion.

and this position is well supported by characters of the jaws and dentition (Conrad 2008: characters 33, 111, 112, 196, 211, 223), including some not included in the Conrad dataset, such as the possession of high-crowned, labiolingually compressed teeth (Bhullar & Smith 2008) with expanded bases (Conrad *et al.* 2010).

Following Norell & Gao (1997), Conrad (2008) and Conrad *et al.* (2010), those platynotans closer to *Heloderma* than to *Varanus* form the clade Monstersauria. From recent analyses (e.g. Conrad 2008, Conrad *et al.* 2010), fossil monstersaurs include *Eurheloderma* (Palaeogene, France, Hoffstetter 1957), *Lowesaurus* (Oligocene, North America, Yatkola 1976), *Primaderma* (mid-Cretaceous, North America, Nydam 2000), *Paraderma* (Late Cretaceous, North America, Pregill *et al.* 1986), *Estesia* (Late Cretaceous, Mongolia, Norell & Gao 1997) and *Gobiderma* (Late Cretaceous, Mongolia, Borsuk-Białynicka 1984). The fragmentary *Labrodictes* (Late Cretaceous, Canada, Gao & Fox 1996) has also been attributed to this group but with a single partial jaw (and uncertainly associated cranial material) further comparison is difficult.

The TNT analyses consistently support the attribution of *Chianghsia* to Monstersauria, based on the blunt snout, rounded cranial osteoderms, and strongly reduced tooth count. The first two of these characters are also found in *Lanthanotus* (Maisano *et al.* 2002), and a blunt rostrum is present in some large varanids (e.g. *Varanus komodoensis*), but there is no trace of the varanid jaw hinge in *Chianghsia* and the inclusion of blunt-snouted varanids in the analysis did not affect the position of *Chianghsia*. *Estesia* is a near contemporary of *Chianghsia* and is most similar to it in terms of size, rostral shape (blunt but proportionally longer and narrower than that of *Heloderma*), the shallow premaxilla, the shape and position of the palatal and septomaxillary bones, and the low number (4–5) of functional teeth in each jaw quadrant, and this is reflected in the results of the TNT analysis. However, as described (Norell *et al.* 1992), *Estesia* differs from *Chianghsia* in lacking cranial osteoderms and having a long, edentulous, posterior dentary margin. Given the similarity in size of these two fossil taxa, it seems unlikely that the differences are ontogenetic. Generic separation therefore seems justified for *Chianghsia*.

Chianghsia thus provides the first record of a large platynotan lizard from the Late Cretaceous of southern China. Its cranial and dental characters support attribution to Monstersauria, as a relative of *Estesia*, but this needs to be confirmed with more complete cranial material. Nonetheless, *Chianghsia* is likely to have had a lifestyle similar to that of living large monitor lizards, as a predator of lizards and other small tetrapods, as well as of dinosaur eggs and hatchlings.

Acknowledgements

Our thanks are due to the authorities of the Guangxi Natural History Museum for funding J.-Y. Mo's visit to London in 2008 and giving permission for the specimen to be loaned; to L.-D. Cen for preparation of the specimen; and to Marc E. H. Jones for preparing the stereopair in Fig. 4A. We benefited from comments and suggestions from Jack Conrad, an anonymous reviewer and the journal editors. Dr Susie Maidment (NHM) provided valuable help and advice with TNT. This project was supported by grants from the National Natural Science Foundation of China (to J.-Y. Mo), the Chinese Academy of Sciences (to X.X.), and the Palaeontological Association, UK (to S.E.).

Supplementary material

Supplementary material is available online DOI: 10.1080/14772019.2011.588254

References

Bhullar, B. S. & **Smith, K. T.** 2008. Helodermatid lizard from the Miocene of Florida, the evolution of the dentary in

Helodermatidae, and comments on dentary morphology in Varanoidea. *Journal of Herpetology*, **42**, 286–302.

Borsuk-Białynicka, M. 1984. Anguimorphans and related lizards from the Late Cretaceous of the Gobi Desert, Mongolia. *Palaeontologia Polonica*, **46**, 5–105.

Camp, C. L. 1923. Classification of the lizards. *Bulletin of the American Museum of Natural History*, **48**, 289–481.

Conrad, J. L. 2008. Phylogeny and systematics of Squamata (Reptilia) based on morphology. *Bulletin of the American Museum of Natural History*, **310**, 1–182.

Conrad, J. L., **Ast, J. C.**, **Montanari, S.** & **Norell, M. A.** 2010. A combined evidence phylogenetic analysis of Anguimorpha (Reptilia: Squamata). *Cladistics*, **26**, 1–48.

Fürbringer, M. 1900. Beitrag zur Systematik und Geneologie der Reptilien. *Jenaische Zeitschrift für Naturwissenschaften Gesellschaft*, **34**, 596–682.

Gao, K. & **Fox, R. C.** 1996. Taxonomy and evolution of Late Cretaceous lizards (Reptilia: Squamata) from Western Canada. *Bulletin of the Carnegie Museum of Natural History*, **33**, 1–107.

Gao, K. & **Hou, L.** 1996. Systematics and taxonomic diversity of squamates from the Upper Cretaceous Djadochta Formation, Bayan Mandahu, Gobi Desert, People's Republic of China. *Canadian Journal of Earth Science*, **33**, 578–598.

Gao, K. & **Norell, M. A.** 2000. Taxonomic composition and systematics of Late Cretaceous lizard assemblages from Ukhaa Tolgod and adjacent localities, Mongolian Gobi Desert. *Bulletin of the American Museum of Natural History*, **249**, 1–118.

Gilmore, C. W. 1928. The fossil lizards of North America. *Memoirs of the US National Academy of Sciences*, **22**, 1–197.

Gilmore, C. W. 1943. Fossil lizards of Mongolia. *Bulletin of the American Museum of Natural History*, **81**, 361–384.

Goloboff, P. A., **Farris, J. S.** & **Nixon, K. C.** 2003. TNT: tree analysis using new technology. Updated at: www.zmuc.dk/public/phylogeny/tnt, accessed 15 October 2011.

Hoffstetter, R. 1957. Un saurien helodermatidé (*Eurheloderma gallicum* nov. gen. et sp.) dans la faune fossile des phosphorites du Quercy. *Bulletin de la Société Géologique de France*, **7**, 775–786.

Kearney, M. & **Rieppel, O.** 2006. An investigation into the occurrence of plicidentine in the teeth of squamate reptiles. *Copeia*, 2006, 337–350.

Li, J. L, **Wu, X. C.** & **Zhang, F. C.** 2008. *The Chinese fossil reptiles and their kin*. 2nd edition. Science Press, Beijing, 473 pp.

Lü, J., **Ji, S.**, **Dong, Z.** & **Wu, X.** 2008. An Upper Cretaceous lizard with a lower temporal arcade. *Naturewissenschaften*, **95**, 663–669.

Lucas, S. G. 2001. *Chinese fossil vertebrates*. Columbia University Press, New York, 375 pp.

Maisano, J. A., **Bell, C. J.**, **Gauthier, J.** & **Rowe, T.** 2002. The osteoderms and palpebral in *Lanthanotus borneensis* (Squamata: Anguimorpha). *Journal of Herpetology*, **36**, 678–682.

Mo, J., **Xu, X.** & **Evans, S. E.** 2009. The evolution of the lepidosaurian lower temporal bar: new perspectives from the Late Cretaceous of South China. *Proceedings of the Royal Society of London B*, **277**, 331–336.

Norell, M. A. & **Gao, K.** 1997. Braincase and phylogenetic relationships of *Estesia mongoliensis* from the Upper Cretaceous, Gobi Desert and the recognition of a new clade of lizards. *American Museum Novitates*, **3211**, 1–25.

Norell, M. A., **McKenna, M. C.** & **Novacek, M. J.** 1992. *Estesia mongolensis*, a new fossil varanoid from the Late Cretaceous Barun Goyot Formation of Mongolia. *American Museum Novitates*, **3045**, 1–24.

Norell, M. A., **Gao, K.** & **Conrad, J.** 2008. A new platynotan lizard (Diapsida: Squamata) from the Late Cretaceous Gobi Desert (Ömnögov), Mongolia. *American Museum Novitates*, **3605**, 1–22.

Nydam, R. L. 2000. A new taxon of helodermatid-like lizard from the Albian-Cenomanian of Utah. *Journal of Vertebrate Paleontology*, **20**, 285–294.

Oppel, M. 1811. *Die Ordnungen, Familien und Gattungen der Reptilien, als Prodrom einer Naturgeschichte derselben*. Joseph Lindauer, Munich, 87 pp.

Pregill, G. K., **Gauthier, J. A.** & **Greene, H. W.** 1986. The evolution of helodermatid squamates, with description of a new taxon and an overview of Varanoidea. *Transactions of the San Diego Society of Natural History*, **21**, 167–202.

Sato, T., **Cheng, Y.**, **Wu, X.**, **Zelenitsky, D. K.** & **Hsiao, Y.** 2005. A pair of shelled eggs inside a female dinosaur. *Science*, **308**, 375.

Swofford, D. L. 2002. *P.A.U.P. —Phylogenetic analysis using parsimony*. Smithsonian Institution, Washington, DC.

Xu, X. & **Han, F. L.** 2010. A new oviraptorid dinosaur (Theropoda, Oviraptorosauria) from the Upper Cretaceous of China. *Vertebrata PalAsiatica*, **48**, 11–18.

Yatkola, D. A. 1976. Fossil *Heloderma* (Reptilia, Helodermatidae). *University of Kansas Museum of Natural History, Occasional Papers*, No. **51**, 1–14.

Young, C. C. 1973. On a Mesozoic lizard from Kanhsien, Kiangsi. *Vertebrata PalAsiatica*, **11**, 44–45.

Zhao, Z., **Ye, J.**, **Li, H.**, **Zhao, Z.**, & **Van, Z.** 1991. Extinctions of the dinosaurs across the Cretaceous-Tertiary boundary in Nanxiong basin, Guangdong Province. *Vertebrata PalAsiatica*, **29**, 1–20.