

Euhelopus zdanskyi (Wiman, 1929) Romer, 1956: holotype (PMU 24705; formerly PMU R 233) elements held in the Museum of Evolution, Uppsala, Sweden

<i>Euhelopus zdanskyi</i> holotype ("exemplar a")	PMU R 233	PMU 24705	Wiman, 1929		Mateer & McIntosh, 1985		Wilson & Upchurch, 2009	
Element	Old number	New number	Description	Figure(s)	Description	Figure(s)	Description	Figure(s)
Premaxilla and maxilla (Left)	PMU R 233 a	PMU 24705/1a	Pages 7-8: interpreted four teeth in premaxilla, one at premaxilla-maxilla suture, nine in maxilla.	Plate 1, fig. 2 (lateral*), 3 (anterior*) and 4 (dorsal*); Plate 2, fig. 1 (lateral) and 2 (medial)	-	Figure 5, a (lateral) and b (medial); Figure 6 (lateral*)	Page 207 (premaxilla): fully described - step-like offset of snout and lateral plate supporting teeth noted; Pages 207-208 (maxilla): fully described, preantorbital fenestra, lack of antorbital fossa and jugal articulation noted.	Figure 6 (reversed; medial)
Premaxilla and maxilla (Right)	PMU R 233 a	PMU 24705/1b	Pages 7-8: interpreted four teeth in premaxilla, one at premaxilla-maxilla suture, nine in maxilla.	Plate 1, fig. 1 (lateral*), 3 (anterior*) and 4 (dorsal*); Plate 2, fig. 3 (medial) and 4 (lateral)	-	Figure 5, c (medial) and d (lateral)	Page 207 (premaxilla): fully described - step-like offset of snout and lateral plate supporting teeth noted; Pages 207-208: fully described, preantorbital fenestra, lack of antorbital fossa and jugal articulation noted.	-
Postorbital (Right)	PMU R 233 a	PMU 24705/1g	Page 9: interpreted to be attached to part of postfrontal.	Plate 1, fig. 1 (lateral), 4 (dorsal), 9 (medial) and 10 (lateral)	-	Figure 6 (reversed; lateral*)	Page 208: fully described, incorrectly listed as the left element on page 207 but description only makes sense if it is the right.	-
Squamosal (Left)	PMU R 233 a	PMU 24705/1h	Page 9: interpreted as the right squamosal, depicted upside down.	Plate 1, fig. 1 (lateral; upside down*), 4 ("dorsal"; actually ventrolateral and upside down*); 7 (lateral; upside down) and 8 (medial; upside down)	Page 125-126: corrected Wiman's interpretation of this element - showed it was from the left side, not the right, and figured and mounted upside down by Wiman.	Figure 1, a (medial) and b (lateral); Figure 6 (lateral*)	Pages 208-209: fully described, noted as being incorrectly mounted (upside down as the right squamosal), interpreted the ventral process as broken	-
Quadrate and pterygoid (Right)	PMU R 233 a	PMU 24705/1k	Page 8-9: vomer not recognised; part of quadratojugal thought to be present.	Plate 1, fig. 1 (lateral*); Plate 2, fig. 5 (medial), 6 (lateral) and 7 (posterior)	Page 127: showed that the lateral flange of the quadrate was not the quadratojugal as had been interpreted by Wiman. Page 128: noted that the pterygoid was broken immediately posterior of the ectopterygoid process.	Figure 2, a (lateral; upside down) and b (medial; upside down); Figure 6 (reversed; lateral*)	Page 209 (quadrate): fully described, interpreted to have been vertically oriented and to have had a deep posterior fossa, but also that the lateral margin of the posterior fossa and the articular end are damaged. Page 209 (pterygoid): fully described, but description was limited by the preservation and reconstruction of this element	-

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Element	Old number	New number	Description	Figure(s)	Description	Figure(s)	Description	Figure(s)
Dentary and surangular (Left)	PMU R 233 a	PMU 24705/1o	Page 10: Brief mention.	Plate 1, fig. 2 (lateral*), 3 (anterodorsal*) and 6 (medial)	Yes (surangular)	Figure 6 (lateral*)	Page 210 (dentary): fully described, U-shaped nature of the jaw highlighted; left surangular mentioned in specimen list on page 207	-
Dentary and surangular (Right)	PMU R 233 a	PMU 24705/1p	Page 10: Brief mention.	Plate 1, fig. 1 (lateral*), 3 (anterodorsal*), 5 (medial)	Yes (surangular, angular)	-	Page 210 (dentary): fully described; Page 210 (surangular): brief mention; right angular listed on page 207	-
Axis	PMU R 233 b	PMU 24705/2a	Page 12: Brief description.	Plate 3, fig. 1 (dorsal*), 2 (ventral*), 3 (left lateral*) and 5 (anterior)	-	-	Pages 211-212: fully described	Figure 7, a (left lateral) and b (right posterolateral)
Cervical III	PMU R 233 c	PMU 24705/3a	Pages 12-18: presacral vertebrae described in dedicated section	Plate 3, fig. 1 (dorsal*), 2 (ventral*), 3 (left lateral*), 6 (anterior) and 7 (posterior)	-	-	Pages 212-217 (postaxial cervical vertebrae): fully described	Figure 8 (right lateral)
Cervical IV	PMU R 233 d	PMU 24705/4	Pages 12-18: presacral vertebrae described in dedicated section	Plate 3, fig. 1 (dorsal*), 2 (ventral*), 3 (left lateral*) and 8 (anterior)	-	-	Pages 212-217 (postaxial cervical vertebrae): fully described; Pages 217-218 (ribs): fully described	
Cervical V	PMU R 233 e	PMU 24705/5	Pages 12-18: presacral vertebrae described in dedicated section	Plate 3, fig. 1 (dorsal*), 2 (ventral*) and 3 (left lateral*)	-	-	Pages 212-217 (postaxial cervical vertebrae): fully described; Pages 217-218 (ribs): fully described	
Cervical VI	PMU R 233 f	PMU 24705/6	Pages 12-18: presacral vertebrae described in dedicated section	Plate 3, fig. 1 (dorsal*), 2 (ventral*) and 3 (left lateral*)	-	-	Pages 212-217 (postaxial cervical vertebrae): fully described; Pages 217-218 (ribs): fully described	
Cervical VII-VIII	PMU R 233 g	PMU 24705/7a, 8	Pages 12-18: presacral vertebrae described in dedicated section	Plate 3, fig. 1 (dorsal*), 2 (ventral*), 3 (left lateral*) and 9 (VIII, posterior)	-	-	Pages 212-217 (postaxial cervical vertebrae): fully described; Pages 217-218 (ribs): fully described	Figure 9 (VIII, right lateral)
Cervical rib VII (Left)	PMU R 233 h	PMU 24705/7b	Pages 12-18: presacral vertebrae described in dedicated section	Plate 3, fig. 1 (dorsal*), 2 (ventral*) and 3 (left lateral*)	-	-	Pages 217-218 (cervical ribs): fully described	
Cervicals IX-X	PMU R 233 i	PMU 24705/9a, 10	Pages 12-18: presacral vertebrae described in dedicated section	Plate 3, fig. 1 (dorsal*), 2 (ventral*), 3 (left lateral*), 10 (IX, anterior) and 11 (X, posterior)	-	-	Pages 212-217 (postaxial cervical vertebrae): fully described; Pages 217-218 (ribs): fully described	Figure 10 (X, right lateral)
Cervical XI	PMU R 233 j	PMU 24705/11	Pages 12-18: presacral vertebrae described in dedicated section	Plate 3, fig. 1 (dorsal*), 2 (ventral*), 3 (left lateral*), 12 (anterior) and 13 (posterior)	-	-	Pages 212-217 (postaxial cervical vertebrae): fully described; Pages 217-218 (cervical ribs): fully described	

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Element	Old number	New number	Description	Figure(s)	Description	Figure(s)	Description	Figure(s)
Cervicals XII-XIV	PMU R 233 k	PMU 24705/12-14	Pages 12-18: presacral vertebrae described in dedicated section	Plate 3, fig. 1 (dorsal*), 2 (ventral*), 3 (left lateral*), 14 (XII, anterior), 15 (XIV, posterior) and 16 (XIV, anterior)	-	-	Pages 212-217 (all postaxial cervical vertebrae): fully described; Pages 217-218 (ribs): fully described	Figure 11 (XIV, right lateral)
Cervicals XV-XVII and dorsal I	PMU R 233 l	PMU 24705/15-18	Pages 12-18: presacral vertebrae described in dedicated section	Plate 3, fig. 1 (dorsal*), 2 (ventral*), 3 (left lateral*) and 17 (dorsal I, posterior)	-	-	Pages 212-217 (postaxial cervical vertebrae): fully described; Pages 217-218 (ribs): fully described; Pages 218-219 (anterior dorsal vertebrae): fully described	Figure 11 (XV, right lateral); Figure 12 (XVI-XVII, right lateral)
Dorsals II-VIII	PMU R 233 m	PMU 24705/19-25	Pages 12-18: presacral vertebrae described in dedicated section	Plate 3, fig. 1 (dorsal*), 2 (ventral*), 3 (left lateral*), 4 (right lateral*) and 18 (II, anterior)	-	-	Pages 218-221: fully described	Figure 14 (VII, right lateral); Figure 15 (II-IV, dorsal); Figure 16 (II-V, right lateral); Figure 17 (VI, right lateral); Figure 18 (VII, right lateral)
Femur (Left)	PMU R 233 n	PMU 24705/28	Page 18: described as having a short well-developed fourth trochanter and spongy internal bone texture	Plate 3, fig. 20 (posterior), 21 (lateral), 22 (anterior) and 23 (proximal)	-	-	Pages 223-224: fully described	
Dorsal rib III (Left)	PMU R 233 o	PMU 24705/27a	Page 18: brief mention; pages 22-23: brief description	Plate 3, fig. 18 (anterior) and 19 (posterior)	-	-	Page 221: fully described	Figure 21 (posterior; proximal end only)
?Splenic (?Right)	PMU R 233 p	PMU 24705/1t	-	-	-	-	-	-
Rock associated with skull block	PMU R 233 q	PMU 24705/1x	-	-	-	-	-	-
Prearticular (Left)	PMU R 233 r	PMU 24705/1r	-	-	Page 128: described as a left and as being similar to the prearticular of <i>Camarasaurus</i>	Figure 4, a (lateral) and b (medial)	Page 207: mentioned in specimen list	-
Angular (Right)	PMU R 233 s	PMU 24705/1q	-	-	Page 128: described as the right angular, said to closely resemble the angular of <i>Camarasaurus</i>	Figure 4, c ("upper" = medial) and d ("lower" = lateral)	Page 210: described as the left angular, absence of evidence for mandibular fenestra noted	-
Nasal and Prefrontal (Right; caudal portion)	PMU R 233 t	PMU 24705/1d	-	-	Page 125: described as the right frontal	Figure 1, c (dorsal) and d (ventral)	Page 208: fully described as left nasal, interpreted as having anteromedial and anterolateral processes	-
Jugal (Right)	PMU R 233 u	PMU 24705/1u	-	-	-	-	-	-
Nasal (Right; rostral portion)	PMU R 233 v	PMU 24705/1c	-	-	-	-	-	-

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Element	Old number	New number	Description	Figure(s)	Description	Figure(s)	Description	Figure(s)
Quadratojugal (Right; dorsal process)	PMU R 233 w							
	PMU R 233 x	PMU 24705/1s	-	-	-	-	-	-
Postorbital (Right; jugal process)	PMU R 233 y	PMU 24705/1v	-	-	-	-	-	-
Quadratojugal (Left)	PMU R 233 z	PMU 24705/1i	-	-	Page 127: identified and likened to the quadratojugal of <i>Camarasaurus</i> and <i>Giraffatitan</i> (<i>Brachiosaurus</i>).	Figure 3, e (medial)	Page 209: fully described, both quadratojugals interpreted as having the tops of their anterodorsal processes (which may have contacted the squamosal) missing	-
Quadratojugal (Right)	PMU R 233 å	PMU 24705/1j	-	-	Page 127: identified and likened to the quadratojugal of <i>Camarasaurus</i> and <i>Giraffatitan</i> (<i>Brachiosaurus</i>).	Figure 3, f (medial); Figure 6 (reversed; lateral*)	Page 209: fully described, both quadratojugals interpreted as having the tops of their anterodorsal processes (which may have contacted the squamosal) missing	-
Pterygoid (Left; partial)	PMU R 233 ä	PMU 24705/1l	-	-	-	-	-	-
Pterygoid (Left; partial)	PMU R 233 ö	PMU 24705/1w	-	-	-	-	-	-
Lacrimal (Left)	PMU R 233 α	PMU 24705/1e	-	-	Page 127: identified and briefly described; right is incorrectly stated to be the more complete	Figure 3, c (medial) and d (lateral); Figure 6 (upside down; lateral*)	Page 207: mentioned in specimen list	-
Lacrimal (Right)	PMU R 233 β	PMU 24705/1f	-	-	Page 127: identified and briefly described; right is incorrectly stated to be the more complete	Figure 3, a (anterolateral; upside down) and b (posterolateral, upside down)	Page 207: mentioned in specimen list	-
Palatine (Right)	PMU R 233 γ	PMU 24705/1n	Page 8: described as a vomer.	Plate 2, fig. 8 (medial), 9 (ventral) and 10 (lateral).	Page 127: identified as vomer, briefly described.	Figure 2, c (lateral) and d (medial)	Page 209: fully described.	-
Palatine (Left)	PMU R 233 δ	PMU 24705/1m	Page 8: described as a vomer.	Plate 2, fig. 11 (medial)	Page 127: identified as vomer, briefly described.	-	Page 209: fully described.	-
Dorsal rib V (Left; proximal)	PMU R 233 ε	PMU 24705/27b	-	-	-	-	Page 221: incorrectly stated as absent	-
Dorsal rib (Left; proximal)	PMU R 233 ζ	PMU 24705/27c	-	-	-	-	Page 221: incorrectly stated as absent	-
Cervical rib II (proximal)	PMU R 233 η	PMU 24705/2b	-	-	-	-	Page 217: incorrectly stated as absent	-
Cervical rib III (Right)	PMU R 233 θ	PMU 24705/3c	-	-	-	-	Page 217: incorrectly stated not to be present	-
Cervical ribs (distal) in matrix	PMU R 233 ι	PMU 24705/26h	-	-	-	-	-	-
Cervical rib (distal)	PMU R 233 κ	PMU 24705/26a	-	-	-	-	Pages 217-218 (cervical ribs): fully described	-
Cervical rib (distal)	PMU R 233 λ	PMU 24705/26b	-	-	-	-	Pages 217-218 (cervical ribs): fully described	-

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Element	Old number	New number	Description	Figure(s)	Description	Figure(s)	Description	Figure(s)
Cervical rib (distal)	PMU R 233 μ	PMU 24705/26c	-	-	-	-	Pages 217-218 (cervical ribs): fully described	-
Cervical rib (distal)	PMU R 233 ν	PMU 24705/26d	-	-	-	-	Pages 217-218 (cervical ribs): fully described	-
Cervical rib (distal)	PMU R 233 ξ	PMU 24705/26e	-	-	-	-	Pages 217-218 (cervical ribs): fully described	-
Cervical rib (distal)	PMU R 233 ο	PMU 24705/26f	-	-	-	-	Pages 217-218 (cervical ribs): fully described	-
Cervical rib III (Left)	PMU R 233 ϕ	PMU 24705/3b	-	-	-	-	Page 217: incorrectly stated as absent	-
Cervical rib IX (Left; distal)	-	PMU 24705/9b	-	-	-	-	Pages 217-218 (cervical ribs): fully described	-
Cervical rib (distal)	-	PMU 24705/26g	-	-	-	-	Pages 217-218 (cervical ribs): fully described	-
Cervical rib in matrix	-	PMU 24705/26i	-	-	-	-	-	-
Dorsal rib VII (mid-shaft)	-	PMU 24705/27d	-	-	-	-	Page 221: incorrectly stated as absent	-
Unidentified element (fragmentary)	-	PMU 24705/29	-	-	-	-	-	-
Unidentified large element (fragmentary)	-	PMU 24705/30	-	-	-	-	-	-
Eight loose teeth with buttress at bottom right when oriented with crown dorsally and root ventrally (i.e. left premaxillary or maxillary teeth, or right dentary teeth); likely to be mostly, if not exclusively, right dentary teeth since the left premaxilla and maxilla have few if any vacant alveoli	"PMU M 2983"	PMU 24705/1y	Page 10: brief mention	Plate 2, fig. 18; 19-20; 21-22; 23.	-	-	Pages 210: fully described, dental formula = premaxilla 4; maxilla 10; dentary 13; occlusal pattern, wear, enamel texture and lingual buttresses all noted	-
Seven teeth with buttress at bottom left when oriented with crown dorsally and root ventrally (i.e. right premaxillary or maxillary teeth, or left dentary teeth); likely to be mostly, if not exclusively, left dentary teeth since the right premaxilla and maxilla have few vacant alveoli	"PMU M 2983"	PMU 24705/1y	Page 10: brief mention	Plate 2, fig. 12-13, 24; 14; 15; 16; 17.	-	-	Pages 210: fully described, dental formula = premaxilla 4; maxilla 10; dentary 13; occlusal pattern, wear, enamel texture and lingual buttresses all noted	-

An asterisk (*) indicates that a bone is figured as part of a reconstruction. Elements described by Young (1935) are currently lost and not included in this list.

References

- Mateer, N.J., McIntosh, J.S., 1985. A new reconstruction of the skull of *Euhelopus zdanskyi* (Saurischia: Sauropoda). **Bulletin of the Geological Institution of the University of Uppsala (new series)** 11, 124-132.
- Wilson, J.A., Upchurch, P., 2009. Redescription and reassessment of *Euhelopus zdanskyi* (Dinosauria: Sauropoda) from the Early Cretaceous of China. **Journal of Systematic Palaeontology** 7, 199-239.
- Wiman, C., 1929. Die Kreide-Dinosaurier aus Shantung [The Cretaceous Dinosaur from Shantung]. **Palaeontologia Sinica (Series C)** 6, 1-67.

Poropat and Kear: Photographic atlas and three-dimensional reconstruction of the holotype skull of *Euhelopus zdanskyi* with description of additional cranial elements