FIRST RECORD OF A TAPINOCEPHALID (THERAPSIDA: DINOCEPHALIA) FROM THE RUHUHU FORMATION (SONGEA GROUP) OF SOUTHERN TANZANIA

RACHEL V. SIMON,1 CHRISTIAN A. SIDOR,*,1 KENNETH D. ANGIELCZYK,2 and ROGER M. H. SMITH3; 1Burke Museum and Department of Biology, University of Washington, Seattle, Washington 98195, U.S.A., rsimon777@gmail.com; casidor@u.washington.edu; 2Department of Geology, The Field Museum, 1400 South Lake Shore Drive, Chicago, Illinois 60605, U.S.A.; 3Karoo Palaeontology, Iziko: South African Museum, Cape Town 8000, South Africa

Middle Permian tetrapod faunas are known from only a handful of localities around the world, the most diverse of which hail from South Africa and Russia (Boonstra, 1963, 1969; Ivachnenko, 1995, 1996; Lucas, 2004, 2009). In the Karoo Basin of South Africa, dinocephalians form an important component of Middle Permian tetrapod biodiversity and are found exclusively in the Eodicynodon and Tapinocephalus assemblage zones (Rubidge, 1995, 2005). Dinocephalians have also been recovered from Brazil (Langer, 2000), China (Cheng and Li, 1996, 1997), and Zimbabwe (Lepper et al., 2000), although these records tend to be based on more fragmentary material.

In June, 2008, our team collected tetrapod fossils from the Ruhuhu Formation of southern Tanzania (Fig. 1). Among them, several large teeth with prominent ‘talon and heel’ anatomy show clear affinity with the tapinocephalid Dinoccephalia (Boonstra, 1962; King, 1988). The discovery of dinocephalians in the Ruhuhu Formation provides the first solid biostatigraphic data for the formation and extends the geographic range for this clade of early therapsids.


SYSTEMATIC PALEONTOLOGY

THERAPSIDA Broom, 1905
DINOCEPHALIA Seeley, 1894
TAPINOCEPHALOIDAE Owen, 1876
TAPINOCEPHALIDAE Owen, 1876
(Figs. 2, 3)

Material—NMT RB24, two incisors, partial rib, parabasisphenoid, and partial neural arch; NMT RB25, fragmentary incisor; NMT RB26, possible postorbital, four tooth fragments.

Locality and Horizon—All specimens were surface-collected from the green, lacustrine mudrocks of the upper part of the Ruhuhu Formation, approximately 2.3 km west of Usili Mountain, Songea District, Ruvuma Province, Tanzania. NMT RB24 was found at 10°21.685′S, 35°0.746′E; NMT RB25 was found at 10°21.758′S, 35°0.726′E; and NMT RB26 was found at 10°21.880′S, 35°0.755′E.

DESCRIPTION

Dentition—The following description focuses on NMT RB24, because it preserves the most complete and diagnostic anatomy. NMT RB24 includes two teeth that we interpret as tapinocephalid incisors. Based on comparisons with Moschops (AMNH 5555, 5602), we suspect that the teeth come from within the first four positions in the tooth row. For descriptive purposes, we will assume that the larger incisor is a lower right, and the smaller incisor is a lower left. As in all tapinocephaloids (sensu Hopson and Barghusen, 1986), both specimens have a tall labial talon that is continuous with a broad, elongate heel that stretches lingually. The lingual face of the talon and the occlusal surface of the heel are worn smooth and lack enamel.

As preserved, the larger incisor (Fig. 2A–C) measures 5.9 cm from base to tip, 1.8 cm mesio-distally, and 4.1 cm labio-lingually, giving the occlusal face an oblong outline. In mesial view (Fig. 2A), the heel slopes ventrally from its labial talon to lingual heel. In addition, the occlusal surface slopes steeply from its higher distal edge to its lower mesial edge. Although the apex of the talon is slightly eroded, it is not as prominent as in Moschops (AMNH 5555, 5602), Ulemosaurus (PIN 4337/4), or an unidentified tapinocephalid with complete incisor dentition (AM 4950; Rubidge and de Klerk, 2007). Moreover, in contrast to the condition in the aforementioned tapinocephalids, the talon is not as distinct from the heel. Instead, the talon and heel are smoothly continuous. Enamel is preserved on the labial, distal, and mesial surfaces of the crown. Small patches of enamel preserving a finely wrinkled texture are present on the labial face, near the crown-root margin.

Although incomplete, the root is very long in comparison to the crown. The lingual portion of the root is emarginated, such that the root is tallest below the talon and dramatically shorter below the heel (Fig. 2A, B). In his review of dinocephalian dentition, Boonstra (1962) did not figure similar anatomy, instead noting that the dinocephalian roots typically taper uniformly, without notable asymmetry. We suggest that the lingual emargination of the root may be due to tooth replacement, with the newly erupting tooth causing partial resorption before the tooth is shed. This scenario accords well with the degree of wear observed in NMT RB24, and similar morphology appears among other isolated tapinocephalid incisors (AMNH 5555, SAM-PK-3012).

As preserved, the smaller incisor (Fig. 2D–F) measures 3 cm from base to tip, 1.8 cm mesio-distally, and 3 cm labio-lingually. The lingual edge of the tooth is completely eroded, as is the majority of the root, and the apex of its talon. However, when compared to the larger incisor, what remains of the talon shows that it was more pronounced than that of the larger incisor and would have better matched the anatomy in Moschops (e.g., AMNH 5602). The occlusal surface is devoid of enamel and worn smooth, although its distal margin forms a well-defined edge. The enamel along the labial aspect of the crown shows four distinct facets near the crown-root junction that display wrinkled enamel, as in the larger tooth. Tiny crevices are present on the surface of the enamel where it makes contact with the flattened surface of the heel.

NMT RB25 and RB26 both contain fragmentary dental material that conforms to the general shape and preservation of RB24, but provide no additional anatomical detail.

Parabasisphenoid—Included in NMT RB24 is an element that we identify as a parabasisphenoid (Fig. 3A, B). It is