A NOVEL RECONSTRUCTION OF THE SKULL OF ARCHAEOPTERYX

by

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ABSTRACT

The new reconstructions of the Archaeopteryx skull in lateral view and its bony palate reflect the new data obtained from the Munich (7th) and Eichstätt (5th) specimens (ELŻANOWSKI & WELLNHOFER, 1996). The lateral view shows a unique conformation of the temporal region, which is intermediate between that of theropods and modern birds, and lacks any indication of the articulation between the postorbital and the jugal bar. The bony palate combines the theropod hooked ectopterygoid and the maniraptoran pterygopalatine fenestra with pronouncedly avian features of the palatine and pterygoid. The palate easily compares to that of Gobipteryx, fills the gap between the theropods and Hesperornis, and shows several palaeognathous similarities.

KEY WORDS: Archaeopteryx, birds, Aves, Maniraptora, Theropoda, skull, cranial anatomy, avian osteology.

INTRODUCTION

All usable information on the skull of Archaeopteryx comes from four specimens. In the Berlin (2nd) and Eichstätt (5th) specimens the skulls are exposed in lateral view and essentially complete. The Berlin skull is poorly preserved and/or damaged by early preparation attempts (HEILMANN, 1926). The Eichstätt skull shows most details of the cranial exterior and a few details of the palate (WELLNHOFER, 1974; ELŻANOWSKI & WELLNHOFER, 1996). In the London (1st) and Munich (7th) specimen the cranial bones are widely scattered and thus reveal many details of the braincase and palate (WHETSTONE, 1983; ELŻANOWSKI & WELLNHOFER, 1996). The poor cranial fragments of the Solnhofen (6th) specimen contribute very little information although a fragment that seems to be derived from the braincase (WELLNHOFER, 1988: fig. 4/2) has yet to be interpreted.

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The first and for half a century the only reconstruction of the skull of *Archaeopteryx* (in lateral and dorsal views) by HEILMANN (1926) was based exclusively on the Berlin specimen. A poor preservation of this skull does not match the detail of HEILMANN's reconstruction, which heavily relies on the assumption of the similarity of *Archaeopteryx* to the early archosaurs (MARTIN, 1983). KLEINSCHMIDT (1951) prepared a three-dimensional model of the skull, which in lateral view follows Heilmann's reconstruction, but also includes the palate and quadrate, which are heavily misrepresented as they could not be reconstructed from the Berlin specimen.

WELNHOFER (1974) developed the first factual reconstruction of the *Archaeopteryx* skull (in lateral and dorsal views) based on the Eichstätt specimen. MARTIN's (1983: fig. 9.7; 1991: figs. 10-11, 12-14) reconstructions added some details (especially of the braincase) but lost others (e.g. of the caudal end of the jugal). The great detail of WHETSTONE's (1983) reconstruction of the occipital aspect of the London skull cannot be supported by the specimen. BÜHLER (1985: fig. 1) published his reconstructions of lateral and dorsal views primarily to demonstrate that *Archaeopteryx* had an avian brain, which completely filled the braincase and thus left no room for any mobility within the braincase. WALKER (1985) reconstructed the otic region of the braincase by using the juveniles of modern neognathous birds as models for the interpretation of the London specimen, and identified an isolated cranial bone of this specimen as the right quadrate, an identification that remains questionable (WELMAN, 1995). PAUL'S (1988: 354) reconstruction is inspired by his belief in the closest relationships of *Archaeopteryx* and the Dromaeosauridae. CHATTERJEE'S (1991: fig. 31; 1997: fig. 5.3) reconstructions are remarkably imprecise and without reservations show never observed elements, such as a complete dorsal temporal arch and the postorbital process of the jugal. WITMER (1990: fig. 14) provided a detailed reconstruction of the upper jaw and antorbital region of the Eichstätt specimen. ELZANOWSKI & WELNHOFER (1996: fig. 5B) revised the reconstruction of the prootic.

Presented here are novel cranial reconstructions of *Archaeopteryx*, which incorporate the new information provided by the Munich specimen and a few additional observations from the Eichstätt specimen (ELZANOWSKI & WELNHOFER, 1996). Aside from the premature attempt by KLEINSCHMIDT (1951), the present paper contains the first factual (even if partly tentative) reconstruction of the *Archaeopteryx* palate.