

## **Application of Computed tomography in the Morphological Interpretation of Pachyrhachis problematicus, a Snake with Legs from the Cretaceous of Israel**

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The Cenomanian snake, Pachyrhachis problematicus, is represented by two specimens from limestone quarries near 'Ein Yabrud, Israel. Recent phylogenetic analyses of Pachyrhachis problematicus have yielded varied results, placing it as a basal member of Serpentes, or alternatively as a basal macrostomatan, more closely allied with boids and pythonids. This incongruence is due in large part to conflicting interpretation of partially obscured elements. A number of factors limit the viability of optical analysis techniques for examination of these elements. These include overlapping elements, displacement during preservation, matrix residue from mechanical preparation on the dorsal surface of the skull, and subsequent resin embedding of the dorsal surface for acid preparation of the ventral surface. To test conflicting interpretations of elements and characters, the specimen was scanned using high-resolution x-ray computed tomography techniques. Two and three-dimensional reconstructions were generated to isolate and optimize areas of interest. These reconstructions expose details that could not be viewed using optical techniques and support interpretations of Pachyrhachis problematicus as a relatively derived macrostomatan.