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LOCOMOTION AND ENDOCRANIAL MORPHOLOGY OF THE ANCIENT WHALE *GEORGIACETUS*: INSIGHTS INTO THE EVOLUTION OF PROTOCETIDS IN NORTH AMERICA

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Georgiacetus vogtlensis (Mammalia, Archaeoceti) is one of only five species of Protocetidae from North America. With characteristics of both semi- and fully-aquatic whales, it is an ideal subject for studying the land-to-sea transition in whale evolution. Here we highlight recent research on the locomotion and brain structure of *Georgiacetus* to provide insight into the evolution of North American protocetids.

During the land-to-sea transition, the lumbar vertebrae of early whales underwent drastic changes as they evolved from dorsostable artiodactyls and began to swim via vertebral undulation rather than paddling of hind limbs. Lumbar vertebrae of *Georgiacetus* and other archaeocetes were compared to those of 25 modern mammals using principal component analysis. The results demonstrate that the lumbar vertebrae of basal archaeocetes are most like those of dorsostable mammals, while those of more derived archaeocetes (like *Georgiacetus*) are most like those of dorsomobile mammals. This supports the hypothesis that archaeocetes increased lumbar mobility as they adapted to a fully-aquatic lifestyle. *Georgiacetus* plots among semi-aquatic mammals, suggesting that vertebral undulation is important to its locomotion but may not be the only driver.

The digital endocast of *Georgiacetus*, reconstructed using computed tomography, does not preserve subtleties of the external surface, but its overall shape strongly suggests the shape of adnexia. There is no trace of a falx cerebri, but a comparable position is marked by a narrow and tall cast of the dorsal sagittal sinus. Posterior to the sinus is a triangular depression (with the apex pointing posteriorly) for a median tentorial projection, the only clear demarcation between the middle and posterior cranial fossae. Posterior to this depression, the cast of the rete mirabile forms the highest point of the endocast, similar to the morphology seen in basilosaurids but unlike that of *Indocetus* and *Remingtonocetus*. A cross section through the anterior of the endocast is trefoil in shape, with a median dorsal portion corresponding to the olfactory tract and bilateral ventral portions to neurovascular structures. As in basilosaurids, this portion of the endocast is large and tubular, unlike the narrow morphology seen in *Remingtonocetus*.

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