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Functional morphology and taphonomy of nautiloid beaks from the Middle Triassic of southern Germany

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New records of nautiloid beak elements conventionally classified as "*Rhyncholithes hirundo* (Biguet, 1819)" and "*Conchorhynchus avirostris* (von Schlotheim, 1820)" with carbonised (originally chitinous) three-dimensionally preserved appendages from the Upper Muschelkalk (Middle Triassic) of northern Württemberg (Southwest Germany) enable restoration of the complete beak of *Germanonautilus*. In three specimens, the lower mandible is embedded within the living chamber of *Germanonautilus* conchs. Beak elements of *Germanonautilus* differ from those of Recent Nautilus in the more elongate appendages of the fossil lower mandibles and the weaker sculpture on the originally chitinous parts. Furthermore, the dorsal sculpture of the fossil conchorhynchs consists of ridges rather than denticles and the ventral sculpture of the fossil rhyncholiths displays ridges in places where the Recent rhyncholiths have a smooth surface. Additionally, the fossil beak elements attained a larger size than their Recent counterparts. During transport of "*Rhyncholithes hirundo*", the light chitinous parts served as a sail and the heavier conchorhynch anchored in the sediment causing alignment. In contrast to the irregularly embedded isolated rhyncholiths, the conchorhynchs usually settled with their ventral side up. From the study of 407 fossil nautiloid beak-elements, a significant variability of the hard parts is evident. Consequently, the assignment of specific morphologies to the species of Germanonautilus is impossible.

Key words: Conchorhynch, rhyncholith, functional morphology, taphonomy, Muschelkalk, Triassic, Germany.

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