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Triassic coleoid beaks and other structures from the Calcareous Alps revisited

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We performed comprehensive study of seven Carnian, Late Triassic specimens of a coleoid cephalopod *Phragmoteuthis bisinuata*, on which Suess based his hypothesis on "beaks of *P. bisinuata*". Using SEM/EDS, we found that "beaks of *P. bisinuata*" consist of a micro-granular carbonized matrix containing ~4–30 μm diameter and ~50–200 μm visible length, dense calcified bone-like micro-structures. This strongly suggests that these objects are vertebrate bone-inducing cartilages in which the matrix was post-mortem reworked by carbon-accumulating bacteria and substituted by nano-particles of carbon accumulated in micro-granules. Hence, the presumed "beaks of *P. bisinuata*" are cartilaginous remains of a prey, presumably juvenile fish. This data dismissed the entire hypothesis of Seuss. A small spatula-shape plate with a rachis-like process in an association with 10 or so imprints around (arm crown), found in front of a proostracum of *P. bisinuata* evidences an unknown Late Triassic juvenile teuthid which possessed a gladius resembling that of the early Permian *Glochinomorpha stifeli*. It inhabited the open sea area of the northwestern Tethys Ocean, and was, along with juvenile fishes, in the diet of *P. bisinuata*. The first identified Anisian (Middle Triassic) coleoid beak is represented by an isolated specimen from the Gardena Valley, NE Italy. It has a typical composition and morphology of coleoid upper beak: chitinous, wide-oval lateral walls, short wings, and pointed hook-like rostrum. This suggests similar upper beak structure in the Carnian *P. bisinuata* in which the lower beaks were apparently similar to that of the co-occurring *Lunzoteuthis schindelbergensis* and had a widely open outer lamella with posteriorly elongated paired wings joined into a pointed rostrum in the anterior portion.

Key words: Cephalopoda, Coleoidea, *Phragmoteuthis* , beaks, vertebrate and invertebrate prey, Triassic, Alps.

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