

SOFT-TISSUE ATTACHMENT STRUCTURES ON PYRITIZED INTERNAL MOULDS OF AMMONOIDS

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Specific dark coloured areas on pyritized internal moulds of ammonoids were described and interpreted as documents of soft tissue and muscle attachment. New material of Upper Devonian, Triassic, Jurassic and Lower Cretaceous ammonoids gave new insight into soft body attachment, its relation to the shell, and their changes in the course of ontogeny and evolution.

Paired and unpaired patterns can be recognized. Paired structures are observed along the umbilicus and on the flanks, and sometimes on the ventral side of the moulds. Unpaired ones appear on the dorsal and ventral sides. Paired double lines on the flanks of the phragmocone and of the body chamber, sometimes additionally connected with crescent shaped tracking bands, were left by lateral muscles. Small round or crescent shaped areas beneath each septum, sometimes connected with a tracking band were left by a ventral muscle. Small dark areas beneath each dorsal lobe were left by a dorsal muscle. Rounded black areas along the umbilicus, often connected with a dark tracking band are remains of a pair of dorsolateral muscles at the posterior end of the soft body. Black tracking bands connected to the incisions of the sutural lobes on the flanks of the phragmocone are interpreted as remains of muscles which fixed the posterior end of the soft body within the body chamber.

Marked differences occur in the attachment structures between Palaeozoic and Mesozoic ammonoids. Devonian ammonoids had only one pair of lateral muscles; the Mesozoic ones, in contrast, had two paired muscle systems, a lateral and dorsolateral. Attachment structures of a small unpaired ventral and dorsal muscle system can be observed especially in Lower Cretaceous heteromorph ammonites. Additionally in some Mesozoic genera a marked change of patterns was developed through ontogenesis (e.g. *Amaltheus*, *Quenstedtoceras*).

In the genus *Cheiloceras* the lateral attachment area appears as a distinct broad black double line running parallel to the ventral side and to the umbilicus on the flanks of the body chamber and phragmocone. In the space between the lines distinct crescent shaped tracking bands are developed. In contrast, the lateral attachment areas of the genus *Tornoceras* is developed as a faint bordering line only on the flanks of the body chamber. There are no tracking bands developed inside the bordering line, but the line is connected with a broad black area beneath the last septum.

The dark lateral and dorsolateral patterns can be interpreted as the attachment of paired retractor muscles. The dark tracking bands behind the incisions of the sutural lobes can be interpreted as remains of lines of tie points keeping the posterior part of the mantle in shape while constructing a new septum. The interpretation of the ventral and dorsal attachment structure is still unclear.

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Digitale Literatur/Digital Literature

Zeitschrift/Journal: [Berichte der Geologischen Bundesanstalt](#)

Jahr/Year: 1999

Band/Volume: [46](#)

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Artikel/Article: [Soft-tissue attachment structures on pyritized internal mould of ammonoids 95](#)