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Precursory siphuncular membranes in the body chamber of *Phyllopachyceras* and comparisons with other ammonoids

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Organic membranes preserved in the rear part of the body chamber of the Late Cretaceous phylloceratid ammonite *Phyllopachyceras ezoense* were examined with scanning electron microscopy (SEM) on the basis of well-preserved specimens from Hokkaido, Japan. SEM observations revealed that the membranes are continuous with the siphuncular tube wall in the phragmocone and consist of two layers, both of which are made of a dark, primarily conchiolin material; namely, a thinner inner homogeneous layer and a thicker outer layer with gently inclined pillar-like units. Hence, they are interpreted as the precursory siphuncular membranes. The precursory siphuncular membranes are not associated with any other organic components such as the siphuncular sheets reported in some Paleozoic and Mesozoic ammonoids. Unlike the tube-like condition in the phragmocone, the precursory siphuncular membranes in the body chamber of the specimens examined do not form a tube shape; on the ventral side the membranes are truncated and directly contact the outer shell wall. These observations suggest that the inner and outer layers of the precursory siphuncular membranes in the body chamber were respectively formed by the siphuncular epithelium from the inner side and by the invaginated septal epithelium from the outer side. It is also postulated that at the initial stage of septal formation, the rear part of the body moved slowly forward, developing a circumsiphonal invagination of the septal epithelium. Because similar conchiolin membranes are occasionally preserved in the body chambers of other phylloceratids, the above morphogenetic process applies to all members of the Phylloceratina. The tube-shaped structure in the rear part of the body chamber of desmoceratid *Damesites* consists only of nacreous layer. We interpret it as a pathologically overgrown prochoanitic septal neck.

Key words: Ammonoidea, Phyllopachyceras, morphogenesis, conchiolin membranes, siphuncle, septal epithelium, chamber formation.

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