
Stratigraphic record, producer assignment and phylogeny of chondrichthyan egg capsule morphotypes

Jan Fischer^{1,2}, Martin Licht³, Jörg W. Schneider¹ & Jürgen Kriwet⁴



JÖRG W. SCHNEIDER - schneidj@geo.tu-freiberg.de

JÜRGEN KRIWET - juergen.kriwet@univie.ac.at

Overview about the chondrichthyan egg capsule morphotypes

P. Pruvost 1930

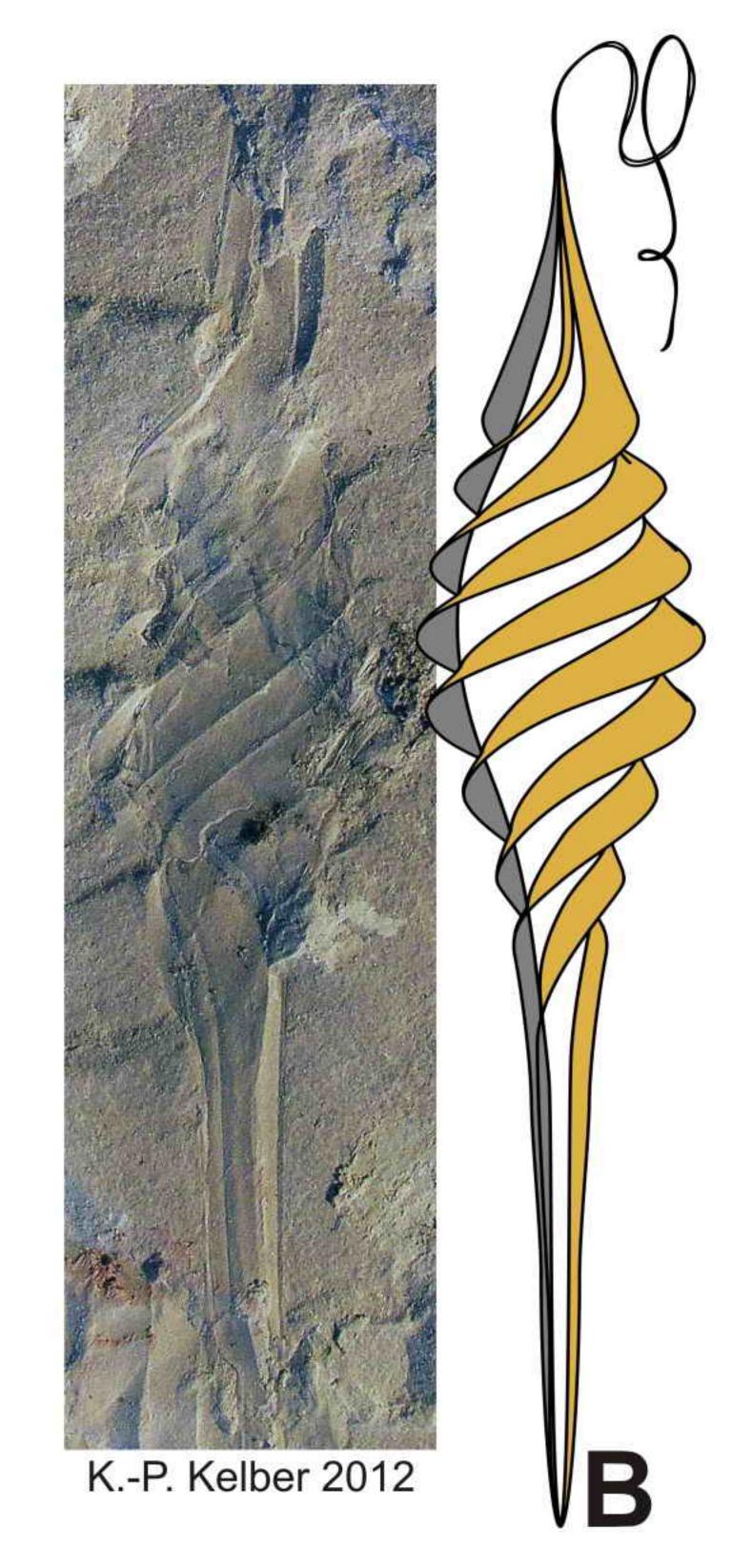
Jan Fischer^{1,2}, Martin Licht³, Jörg W. Schneider¹, Jürgen Kriwet⁴ & Ilja Kogan¹

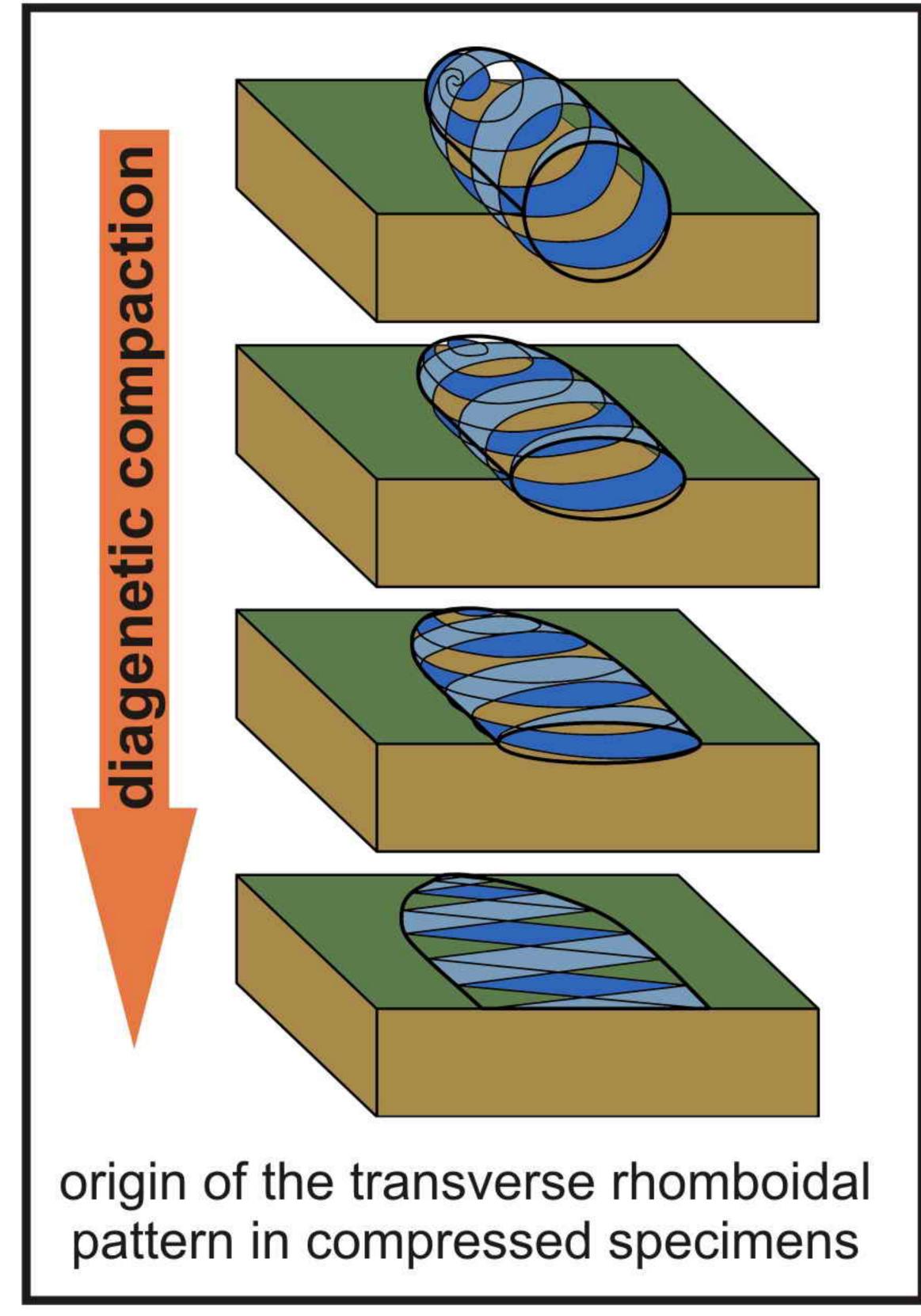


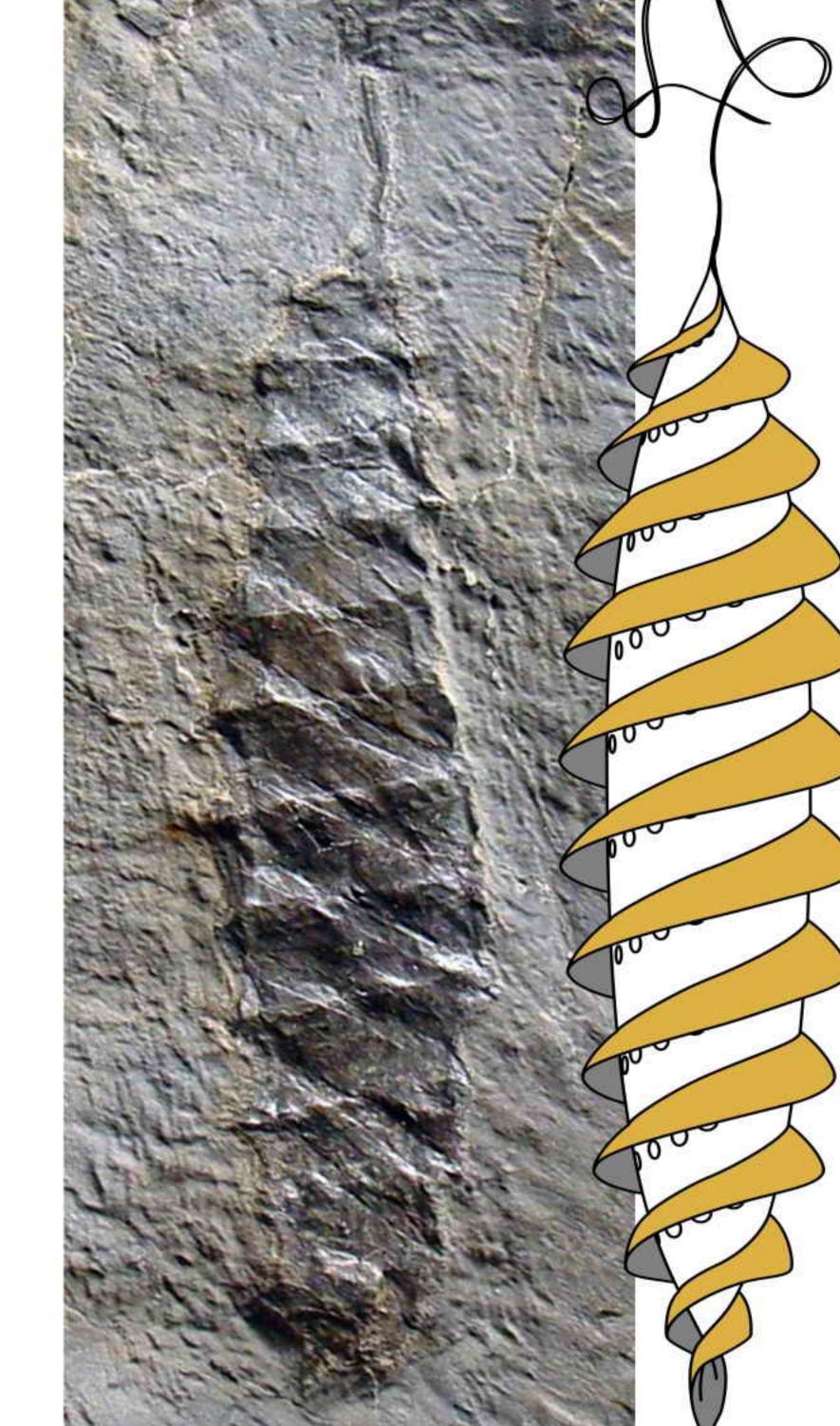
Palaeoxyris

BRONGNIART, 1828

(also known by its synonym Spirangium) has a three-fold division consisting of a fusiform body tapering gradually at one end into a pointed beak and at the other into a long and slender pedicle (with spiral ribbing structures in pre-Permian specimens [A], and parallel arrangement in Mesozoic ones [B]) accompanied by spirally twisted membranous collarettes. Capsules are 60-275 mm in length. 26 valid species of Early Carboniferous to Late Cretaceous age have been described from predominantly freshwater to brackish deposits of Europe, Asia, Australia, and the USA. Hybodontiform sharks are considered to be the most probable producers.







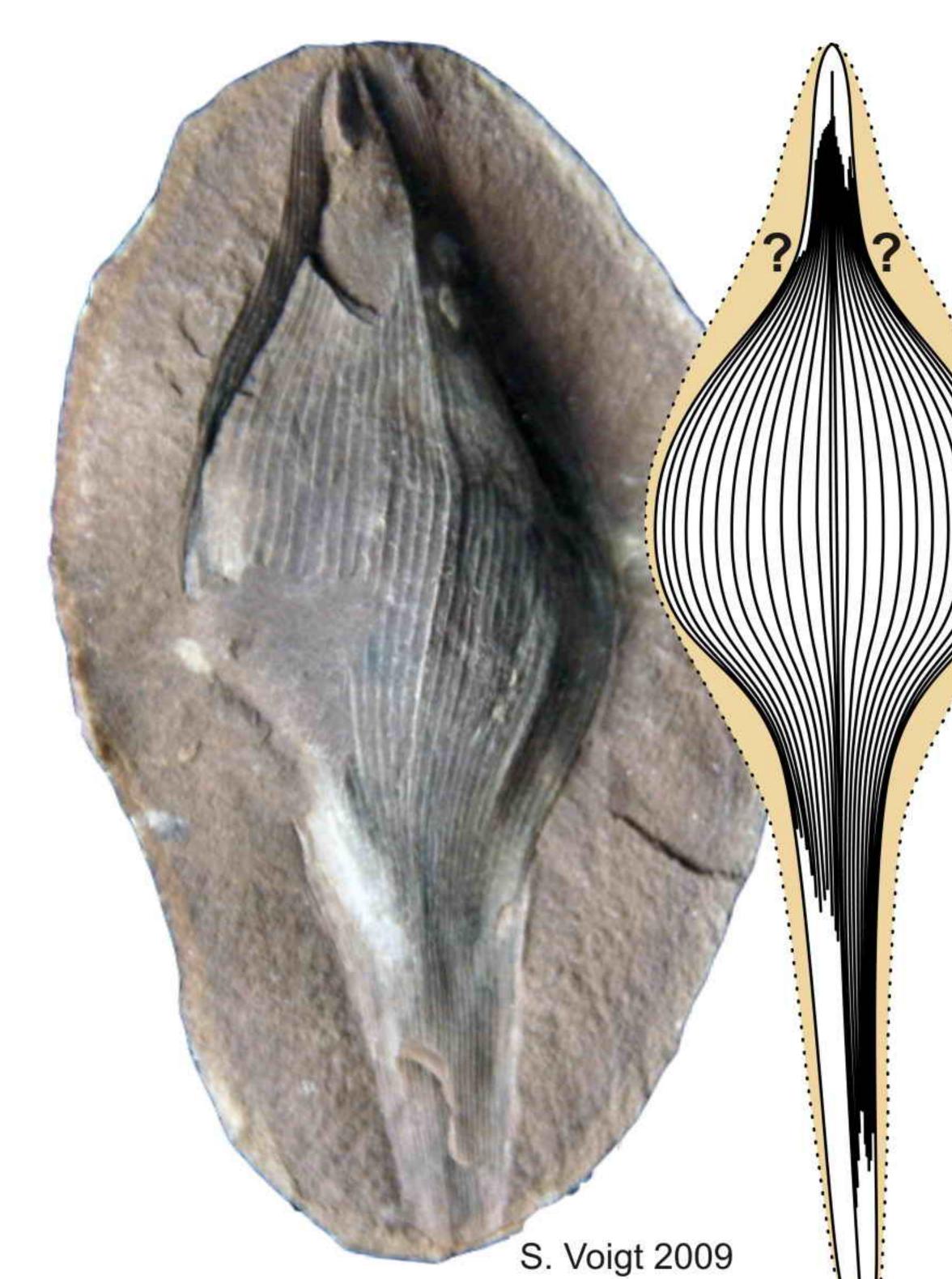
Fayolia

RENAULT & ZEILLER, 1884 is spirally twisted like Palaeoxyris, but differs due to a cylindrical 'screw-like' shape, the reduced shaping of pedicle and beak, and a flange-parallel scar-line. Size ranges between 45 and 400 mm in length. The fossil record contains 16 species of Late Devonian to Middle Triassic (Ladinian) age from predominantly freshwater successions of Europe, Asia, and the USA. Xenacanthiform sharks are regarded as the most likely producers.



PRUVOST, 1922

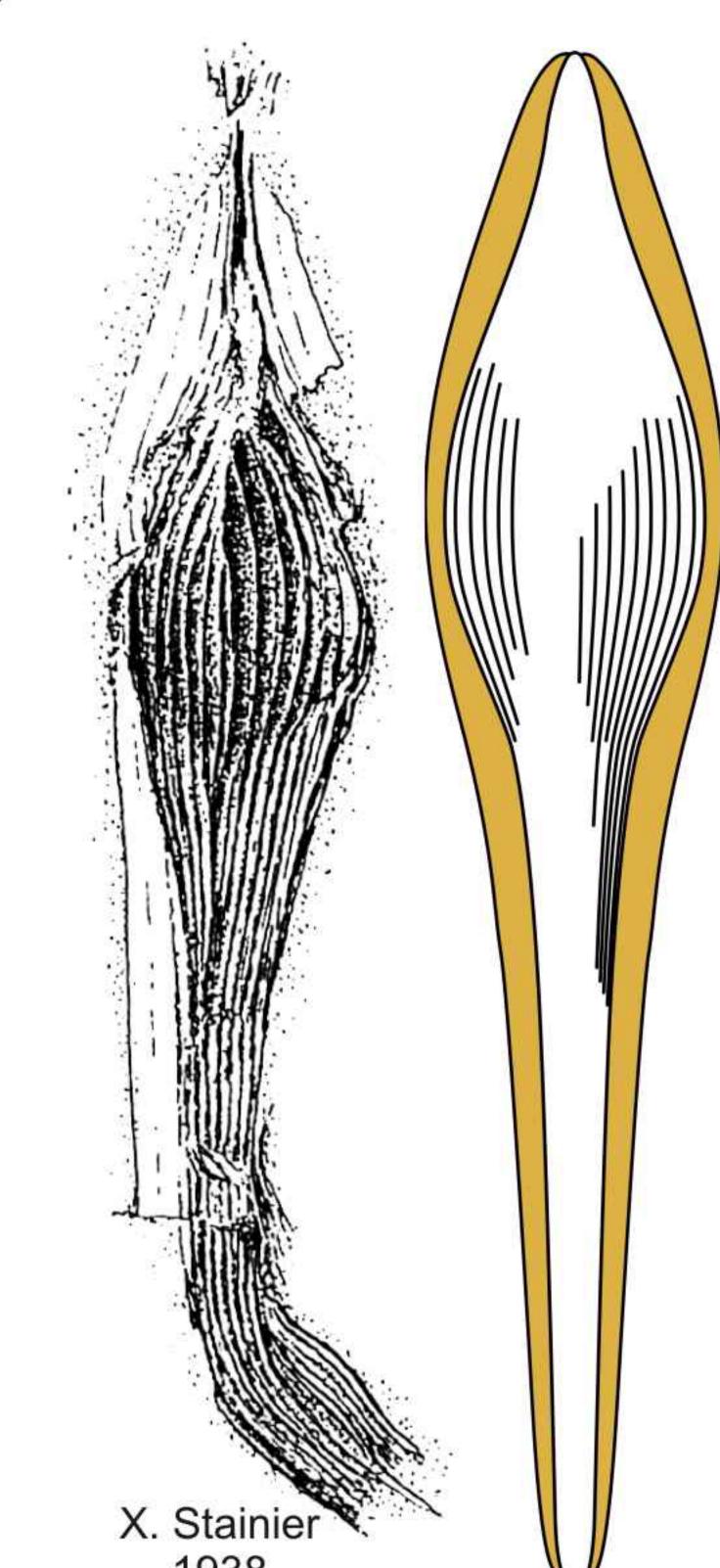
consists of a spindle-shaped form with a roughly textured surface like a ball of wool. Remains are 8-16 mm in length. Two species are described from probable marine deposits of the Westphalian A–B in Belgium and Germany. Although its producer remains uncertain the distinct rhomboidal patterns preserved on fossil remains probably point to an elasmobranchian origin.



Vetacapsula

MACKIE, 1867

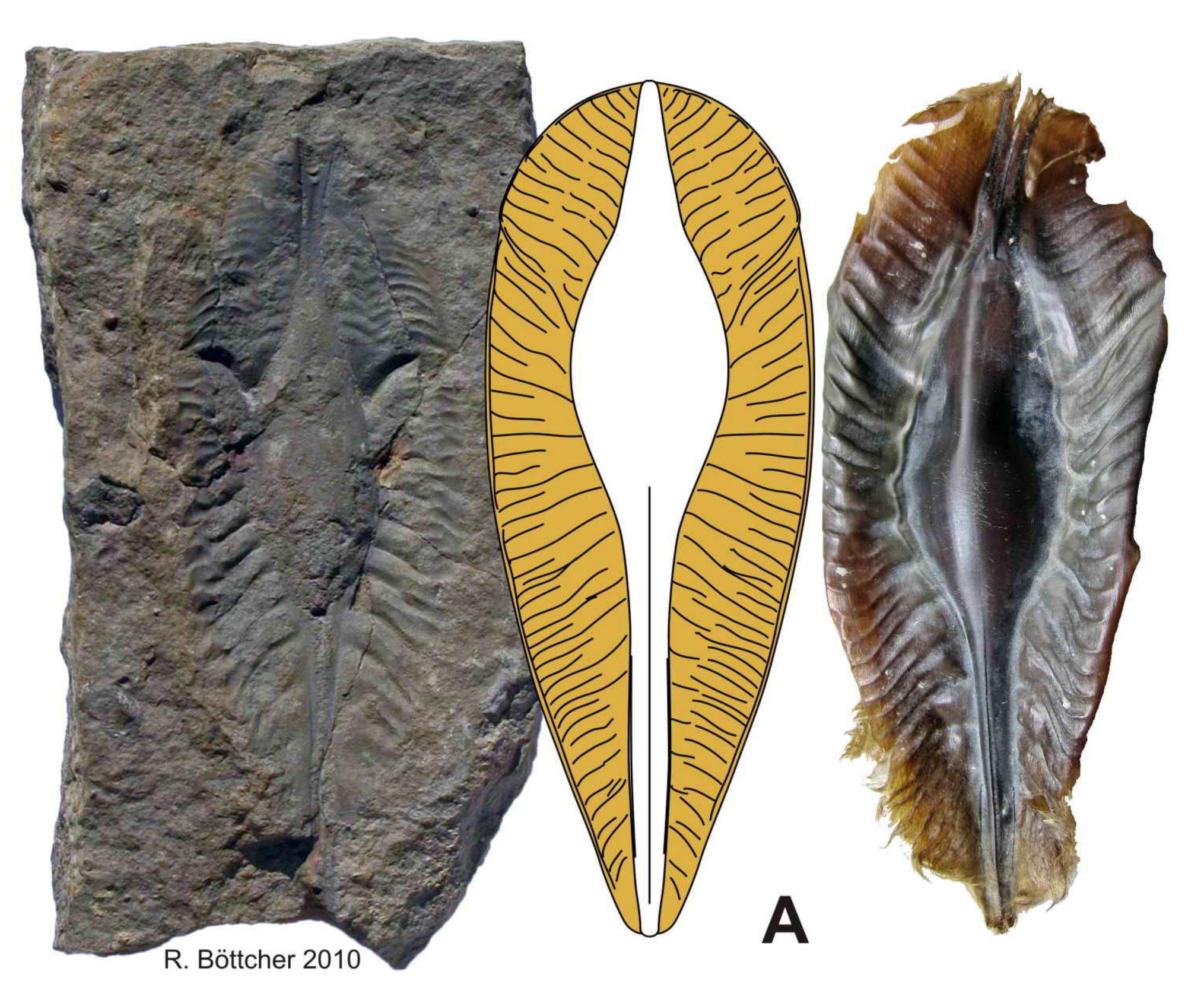
shows a three-fold division similar to *Palaeoxyris* but is more bulb-shaped with a large number of longitudinal ribs on the surface and a prominent middle ridge. Capsules are 80-110 mm in length. 12 species are described from Pennsylvanian (Bashkirian) paralic strata of Europe and USA. The producer most probably belongs to the Holocephali.

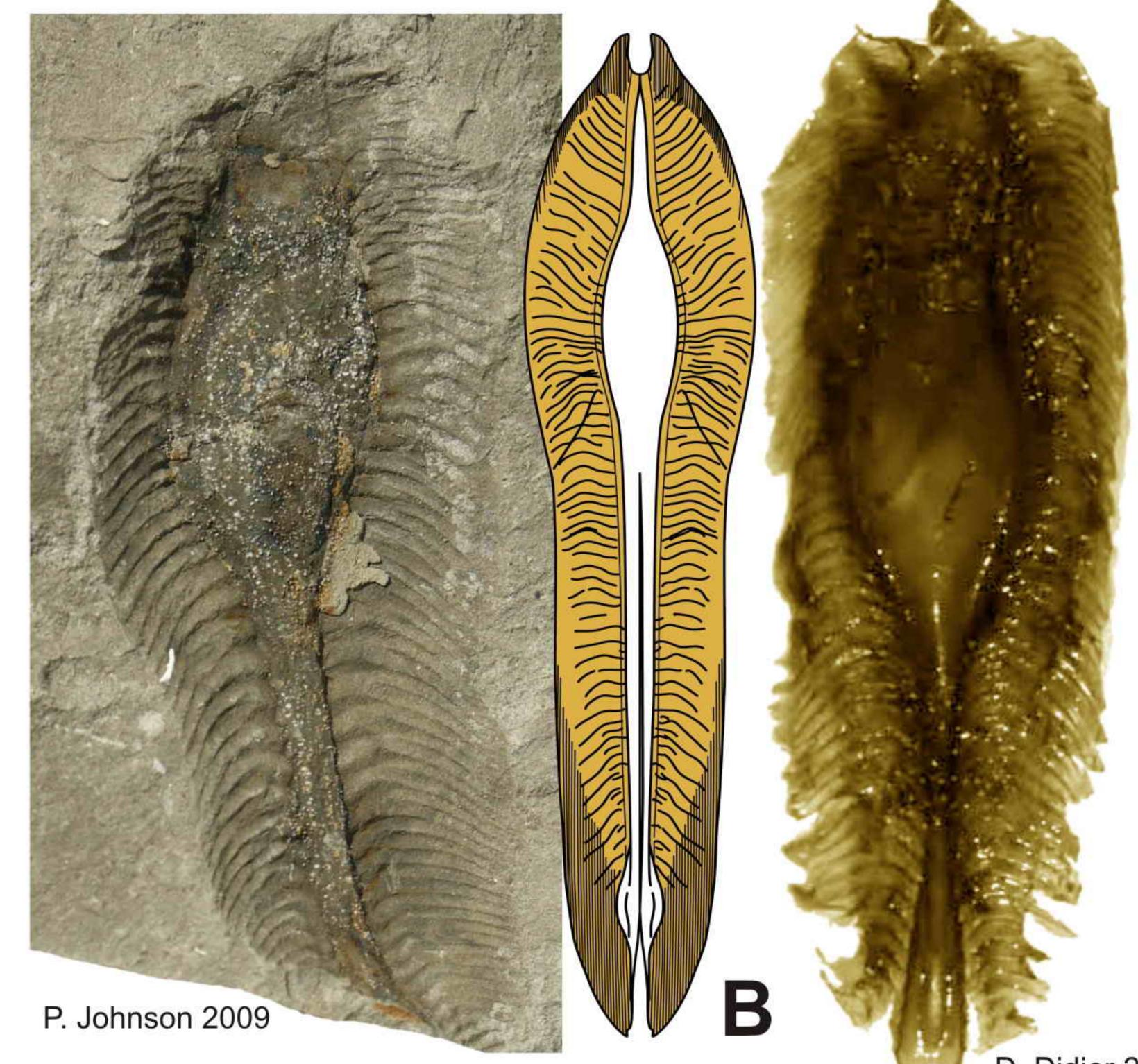


Crookallia

CHABAKOV, 1949

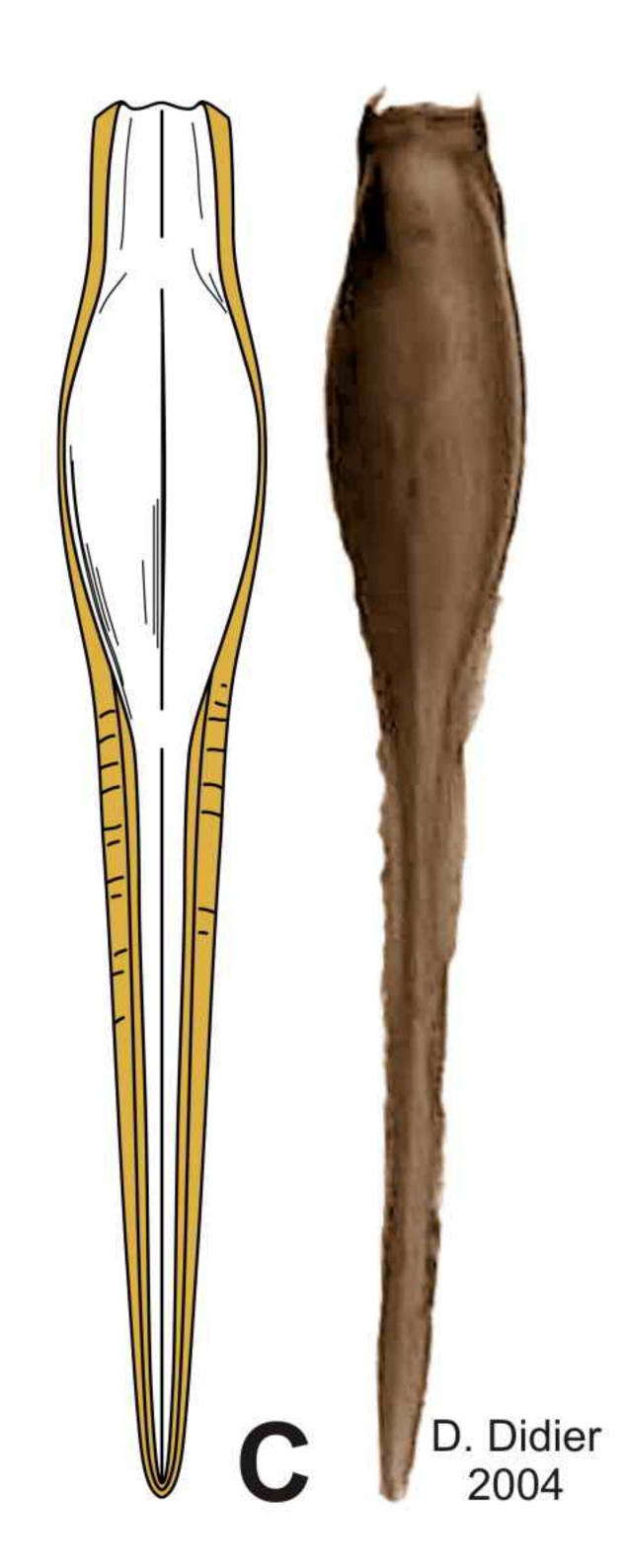
contains specimens formerly attributed to Vetacapsula but subsequently separated due to their lack of a median ridge, few longitudinal ribs, and less bulbshaped body. One specimen exhibits a broad lateral flange comparable to the flange in capsules of extant chimaeras. Size ranges between 20-35 mm in length. Five species are known from Pennsylvanian (Bashkirian) paralic strata of Belgium, the Netherlands, and the Ukraine. As for Vetacapsula the producer most probaly belongs to the Holocephali.





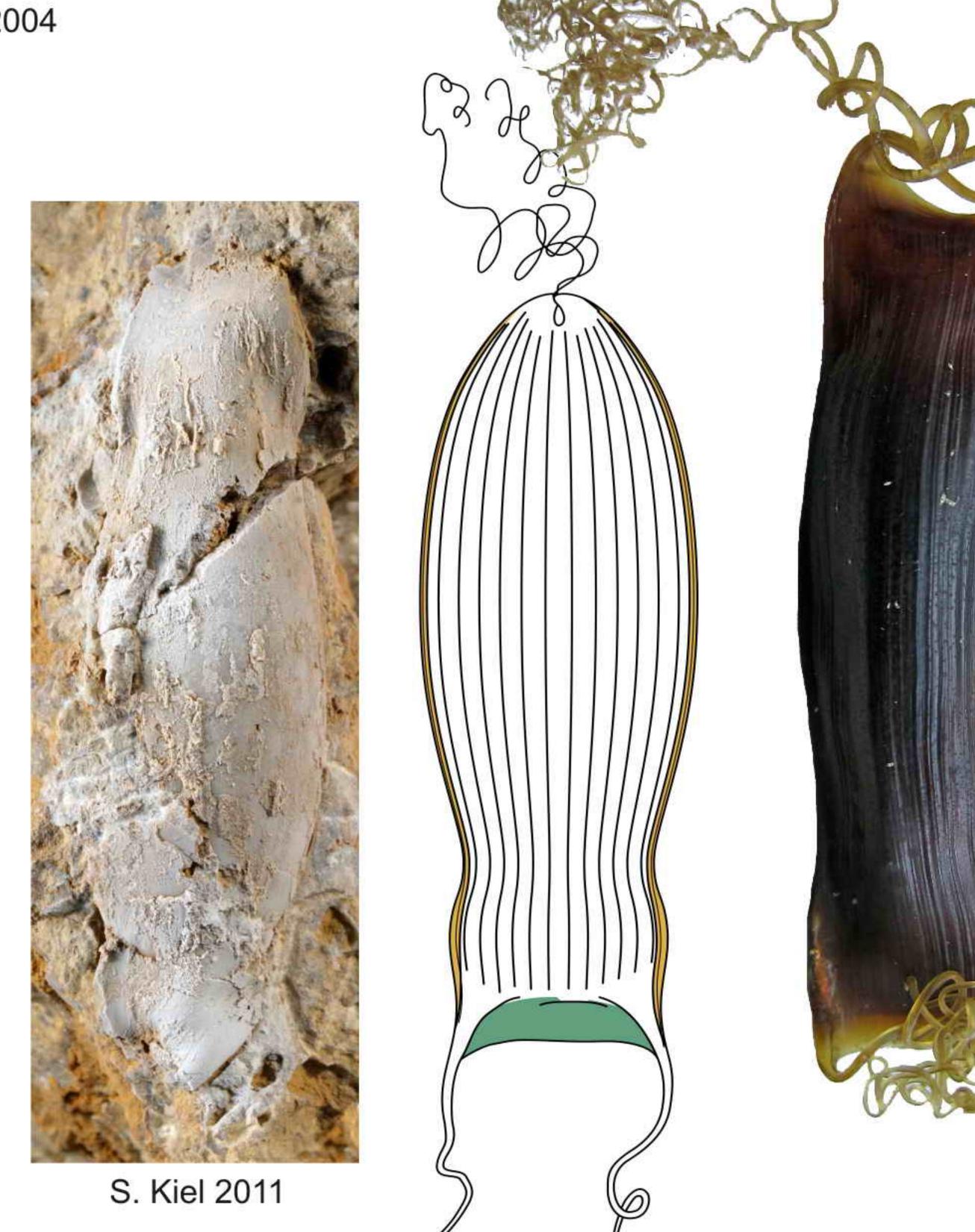
Extant holocephalan egg capsules of callorhinchids [A], rhinochimaerids [B], and chimaerids [C] show a bulbous central fusiform body accompanied by a ribbed lateral flange of different size that tapers to a point at each end where one end forms an elongate tail. Capsules are between 10-270 mm in length. 14 fossil species, summarised as Chimaerotheca Brown, 1964 but clearly assignable to the callorhinchid and rhinochimaerid extant types, are recorded from shallow marine strata of Germany, Russia, USA, and Canada dated back to the late Triassic. A holocephalan affinity for early Triassic small butterflylike remains has been repeatedly questioned; such specimens may belong to pteropods.

A chimaeroid capsule-like fossil from the Late Devonian of South Africa, that has been referred to placoderms, bringing into question a phylogenetic relationship of the Holocephali to this group.





Extant batoid capsules are characterised by a dorsoventrally flattened, rectangular body in lateral outline, small lateral flanges, and inwardly-oriented pairs of horns at the anterior and posterior end with tendrillike tips and aprons between them. Attachment tendrils exist in a few forms. Capsules (with horns) are 20-210 mm in length. Fossil capsules of three wellknown and one unnamed species, summarised as Rajitheca Steininger, 1966 morphotype, are known from Late Jurassic to Miocene shallow marine deposits of Central Europe.



Scyliorhinid (catshark) capsules are dorsoventrally flattened, vaseshaped fusiform bodies with a slightly constricted waist, lateral flanges, possible aprons at both ends, and anterior and posterior pairs of partly inward curved and crossed horns merging into coiled tendrils. Several forms show straight longitudinal striations. The size ranges between 50-110 mm in length. Fossil remains of the type **Scyliorhinotheca** KIEL et al., 2013 are reported from late Eocene marine deep-water sediments of the USA.



Capsules of Orectolobiformes (carpetsharks) exhibit a bulbous body with small lateral flanges along the edges, aprons at both ends, and two curved and twisted horns at each of its ends extended to form tendrils, where one horn is elongated and the other one shorter or rudimentary. In several species the attachment tendrils form a mass extending from the lateral edges. Capsule size is 50-70 mm in length. Although orectolobid sharks are dated back to the Early Jurassic no fossil remains are known to date.

S. P. Iglésias 2011



Heterodontid egg capsules are characterised by a bulky body with sometimes slightly constricted waist and narrow and broad ends, surrounded by two spirally twisted large flanges that may merge at the narrow end into coiled tendrils, and in one species even into horn-like structures. Capsules are 100-150 mm in length. Heterodontiform sharks are known to have existed since the early Jurassic whereas the characteristic 'screw-like' eggs have not yet been found in the fossil record.

