

¹ Department of Earth Sciences, The Natural History Museum, London, SW7 5BD, U.K. ² Lauer Foundation for Paleontology, Science and Education, Wheaton, Illinois, USA.

³ Institute of Geology and Petroleum Technology, Kazan Federal University, Kremlevskaya Str. 4/5, 420008 Kazan, Russia.

Introduction

Chimaeroid fishes are all oviparous; the females oviposit distinctive leathery, collagen-rich, multi-layered, proteinaceous egg capsules which enclose both the yolk and the developing embryo which feeds on it. The high organic, low inorganic composition of the egg capsule gives it low preservation potential, so that much taphonomic loss occurs through decomposition, bioerosion, deposition in unsuitable sedimentological facies etc. This means that chimaeroid egg cases are very rare components of marine ichnofaunas. Despite this, 11 ichnospecies have been recorded in deposits ranging from the late Triassic onwards.

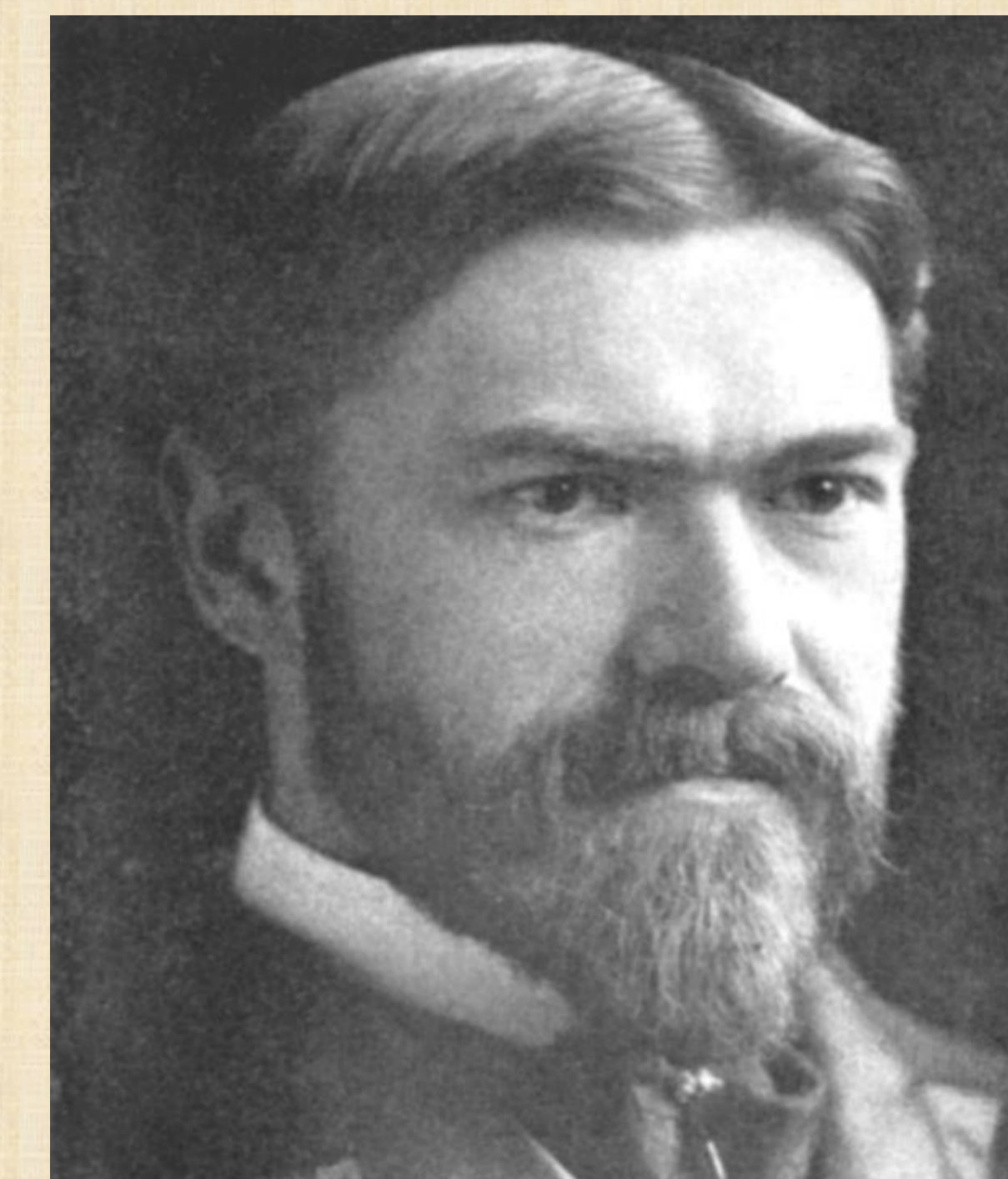
Early work

Much of our earliest understanding of chimaeroid egg capsules stems from the work of Bashford Dean (1867-1928), an expert both in ichthyology at the American Museum of Natural History, and medieval armour at the Metropolitan Museum of Art. He wrote several papers on the egg cases of extant and fossil chimaeroids and presented an especially useful summary in his *Chimaeroid Fishes and their Development* (1906).

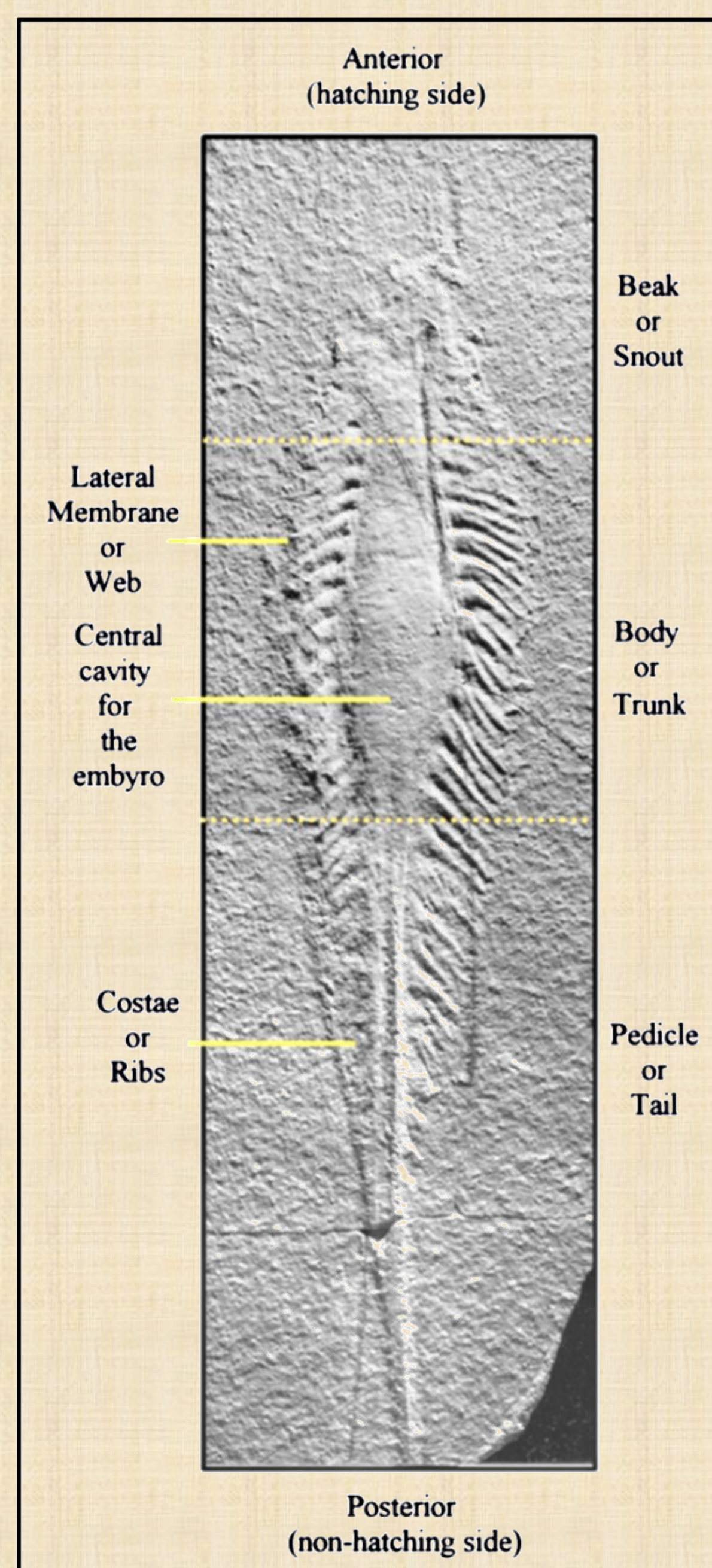
The lost specimen.

This is a plattenkalk specimen that was briefly described and figured in a 1986 paper by Reichenbach-Klinke and Frickhinger. It was offered for sale to the NHMUK but was turned down as there was already a specimen, NHMUK PX Z.183 in the collection. Its current whereabouts is unknown.

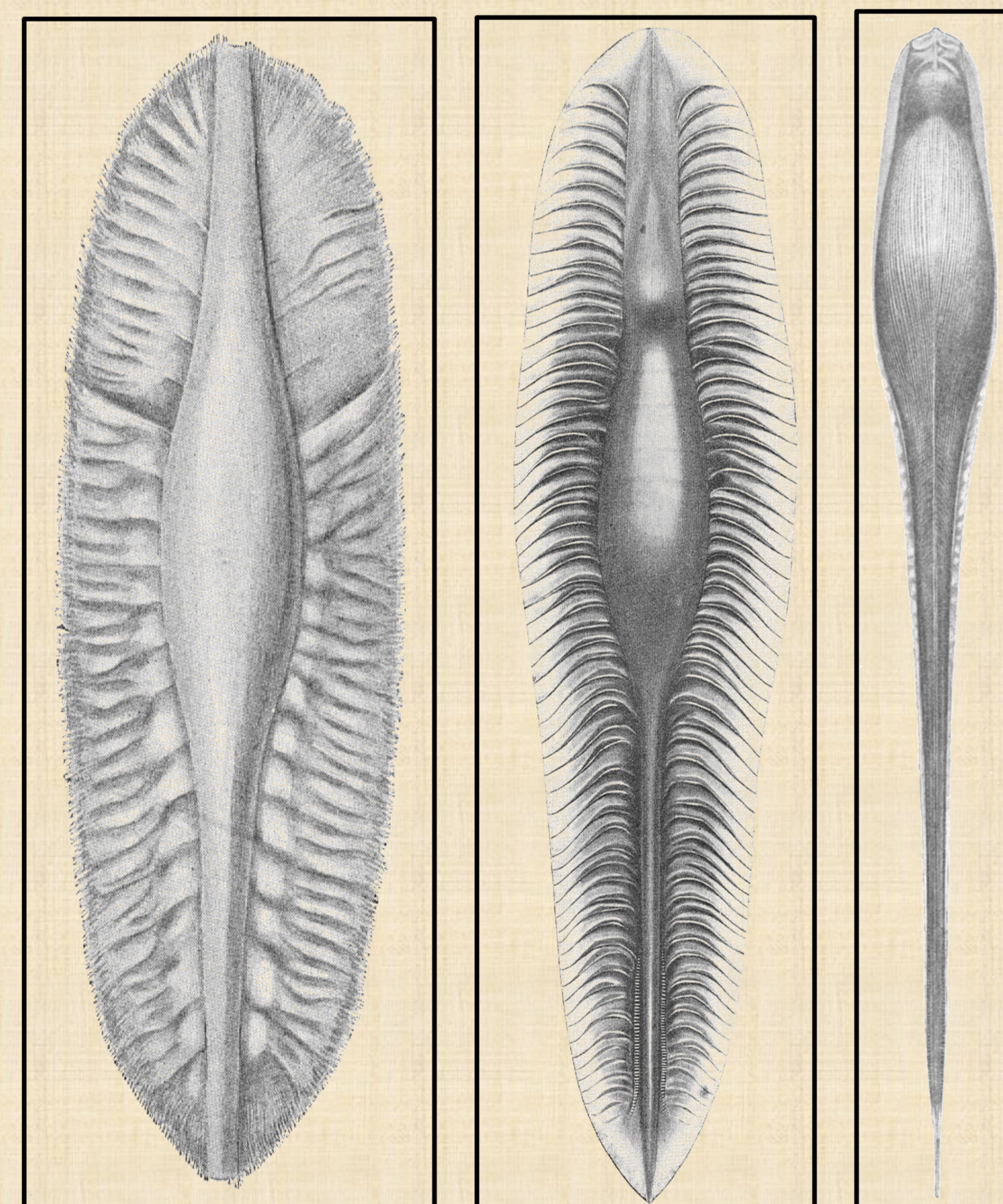
Reference: Reichenbach-Klinke, H. H. and Frickhinger, K. A., 1986, Neuer Fund einer Holocephalen-Eikapsel im Ob. Jura des Solnhofener Schiefers. *Fossilien*, 6: 86: 256-257.



Bashford Dean (1867-1928)



The lost specimen



Callorhynchus

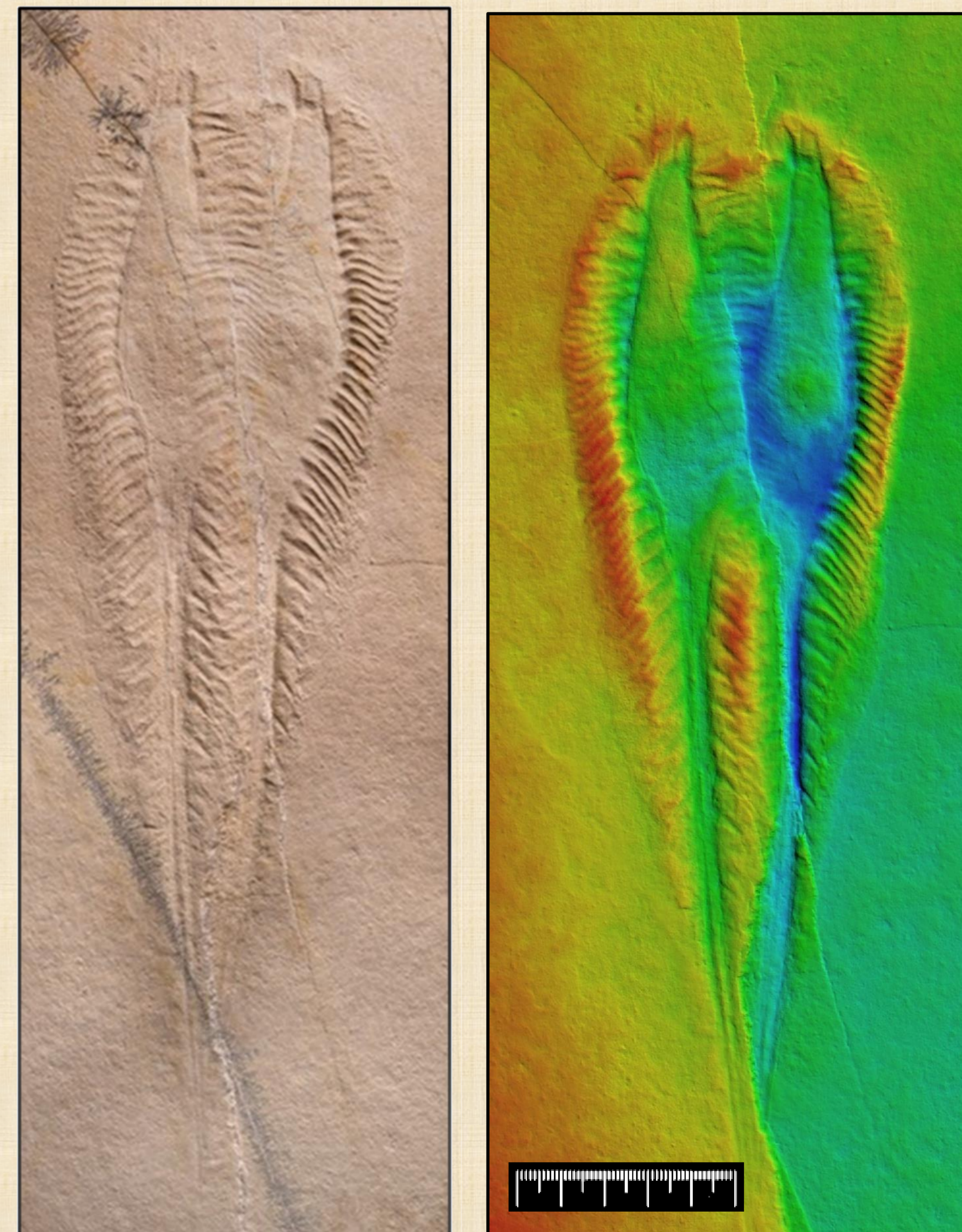
Rhinochimaera

Chimaera

Egg cases from the lithographic limestones of southern Germany

The late Jurassic (late Kimmeridgian to Tithonian) lithographic limestones (Plattenkalk) of the Solnhofen and Nusplingen areas in southern Germany have yielded occasional spectacular holomorphic specimens of myriacanthoid (*Chimaeropsis paradoxa*), rhinochimaerid (*Elasmodectes avitus*) and callorhynchid (*Ischyodus quenstedti*) holocephalians. Very rare, single morphotype egg cases also form part of the holocephalian fauna in the Schernfeld area (c. 8km east of Solnhofen) and are reviewed here.

The best example (LF 703) is a double egg case, with each measuring around 489mm long and 72mm across. The fusiform central cavity is elongate, extending into the long, slender pedicle. The beak is also quite slender. The relatively narrow lateral web is ornamented by a series of c. 50 costae. The overall form of the case suggests that it belongs to a callorhynchid, and the size makes *Ischyodus quenstedti* a likely producer.



LF 703 Double egg case under normal lighting and as a photogrammetric image. Picture credit: J. P. Brown, Regenstein Conservator at the Field Museum, Chicago, Illinois, USA. Scale in mm.

Egg cases from extant chimaeroids

Chimaeroid egg cases are all somewhat flattened, bilaterally symmetrical structures comprising an ovoid central trunk which tapers posteriorly to an elongate pedicle or tail, and more gradually anteriorly to form a somewhat blunt beak or snout. The spindle-shaped central cavity houses the embryo, whose shape it closely matches. The lateral margins of the case are extended to form a membrane or web which is commonly ornamented by rib-like corrugations or costae, which may be branched or unbranched.

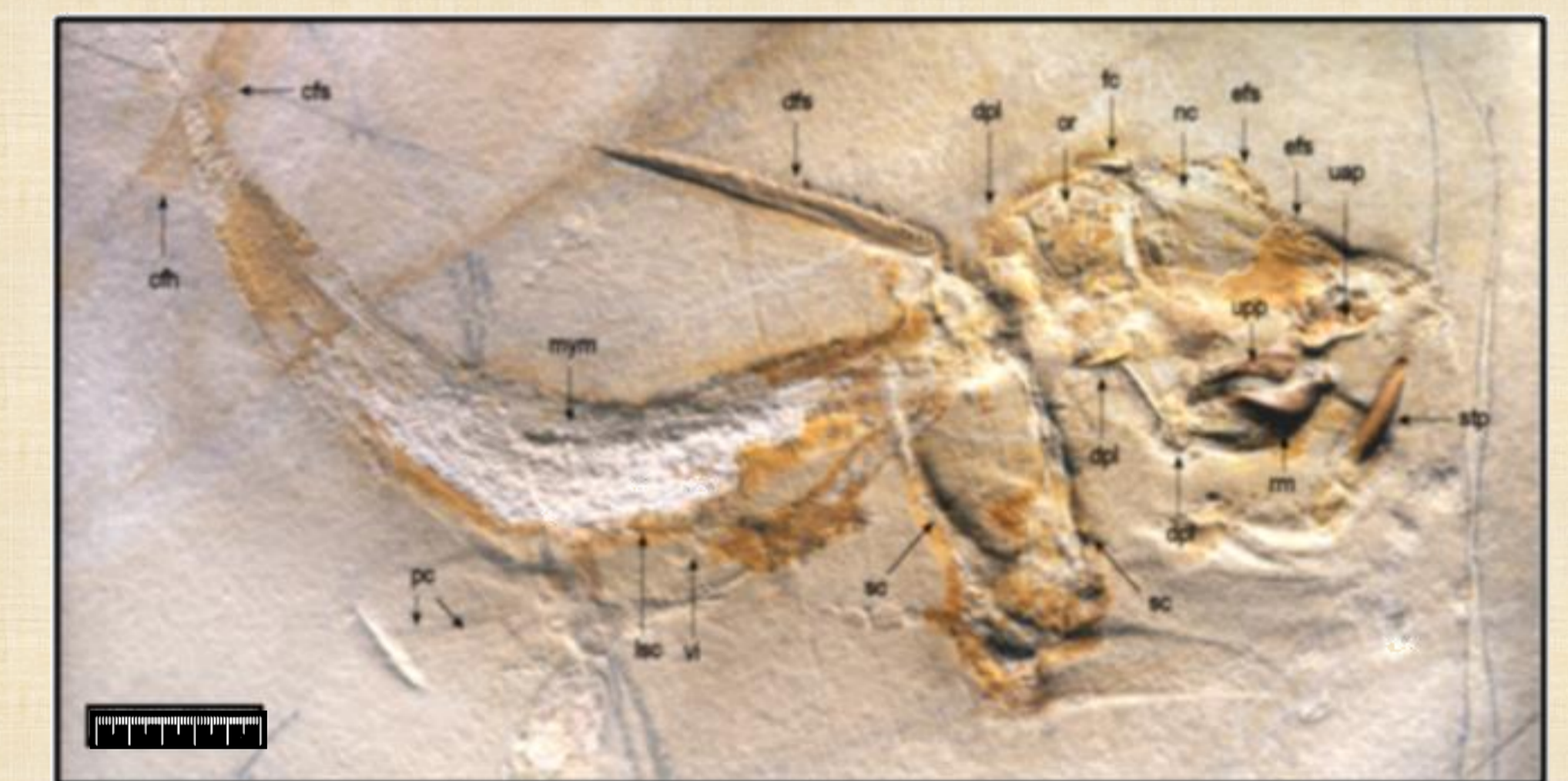
Since the case is relatively impermeable to oxygen, movements of the embryo stimulate water entry and through-flow via a system of fine pores enabling efficient exchange of dissolved O₂ and CO₂.

Chimaeroid egg cases are normally laid in pairs. Those of the extant families, (Chimaeridae, Rhinochimaeridae, and Callorhynchidae) can be distinguished on their external morphology.

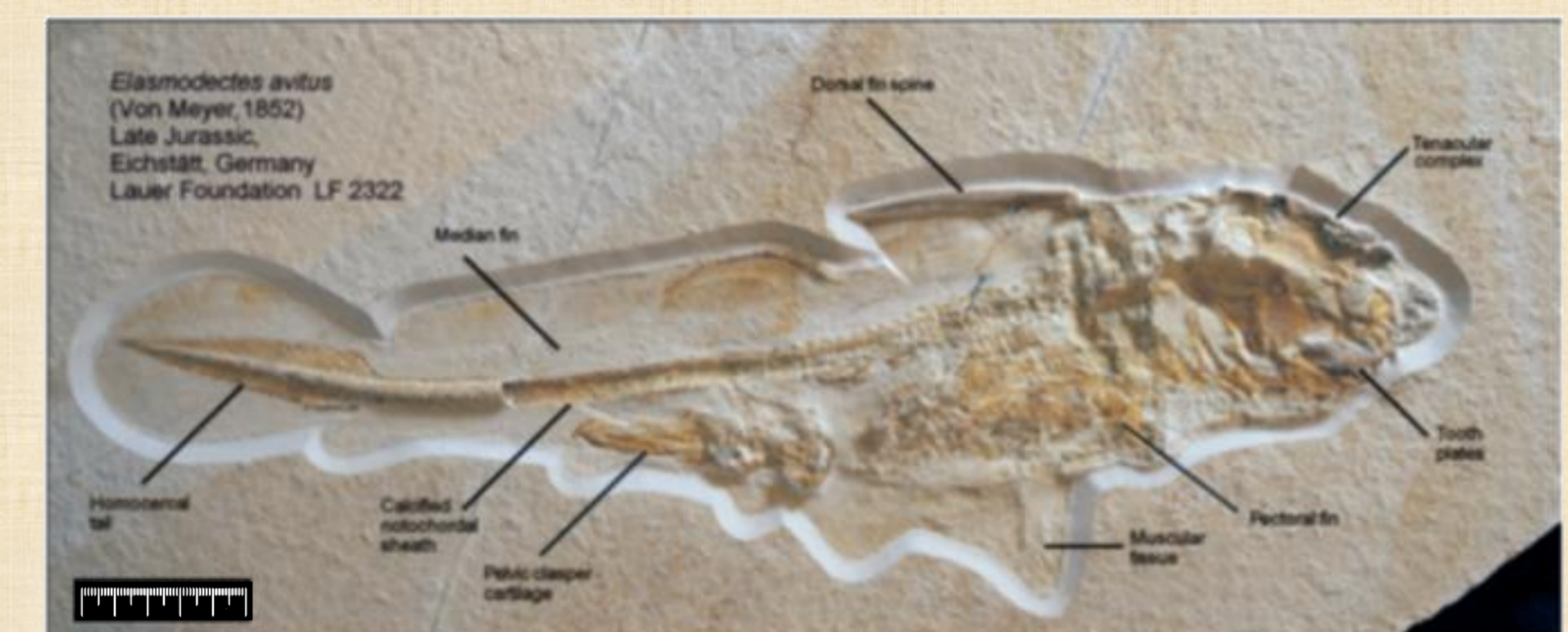
Possible egg case producers



LF1369 – *Ischyodus quenstedti*.



LF 2317 – *Chimaeropsis paradoxa*



LF 2322 – *Elasmodectes avitus*.



NHMUK PX Z.183 Egg case



Chris Duffin
cduffin@blueyonder.co.uk



David J. Ward
david@fossil.ws



Evgeny Popov
elasmodus74@gmail.com



René Lauer
Rene@lauerfoundationpse.org



Bruce Lauer
Bruce@lauerfoundationpse.org

