An associated dentition of *Agassizodus* (Eugeneodontiformes, Chondrichthyes) from the Late Carboniferous of Missouri

Christopher J. Duffin [1], David J. Ward [1], Bruce Lauer[2] and René Lauer [2]

[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.

Introduction

The Lauer Foundation has recently acquired an associated but largely disarticulated dentition of the edestoid eugeneodontiform fish, *Agassizodus*. The specimen was discovered by Robert Beaver, an amateur palaeontologist, collecting with permission in a privately owned limestone quarry and was prepared by Mark Palatas.

The dentition (LF3199), comprising over 220 teeth scattered over several blocks, comes from the Pennsylvanian (Late Carboniferous) Hushpuckney Shale Member (Swope Limestone Formation, Bronson Sub-Group, Kansas City Group) of Rockridge Quarry, Kansas City, Missouri. The specimen is significant for preserving teeth from many positions in the jaw and exposed in a variety of views, making it possible to characterise the heterodonty of this taxon for the first time and to resolve some of the nomenclatural problems surrounding it.

What are Eugeneodontiforms?

The Eugeneodontiformes is an Order raised by Rainer Zangerl in 1981 to embrace those sharks that possess a prominent, enlarged planispiral tooth whorl at the symphysis of the two lower jaws. The skeleton is often only weakly calcified, the palatoquadrates are characteristically reduced, and the body (where known) is fusiform. The Order embraces two Superfamilies: **Caseodontoids** and **Edestoids.**

Caseodontoids – Symphyseal teeth usually have a transverse crest and are relatively low-crowned.

Edestoids – Symphyseal teeth are generally high-crowned and laterally compressed with sagittal cutting edges. This group includes *Agassizodus*.

Erikodus groenlandicus Nielsen, 1932 (Permian, East Greenland).

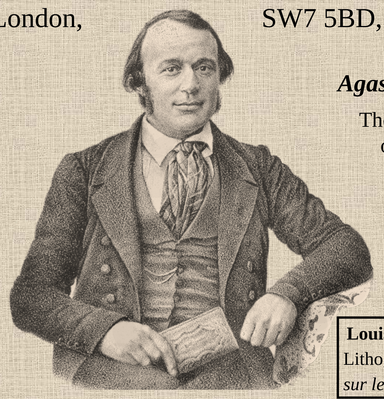
Helicoprion bessonowi Karpinsky, 1899 (Permian, Russia).

Chris Duffin
cduffin@blueyonder.co.uk

David J. Ward
david@fossil.ws

René Lauer
Rene@lauerfoundationpse.org

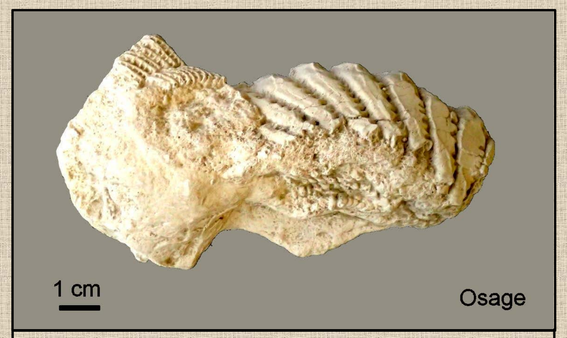
Bruce Lauer
Bruce@lauerfoundationpse.org



Louis Agassiz (1807-1873). Lithograph portrait from *Recherches sur les Poissons Fossiles*

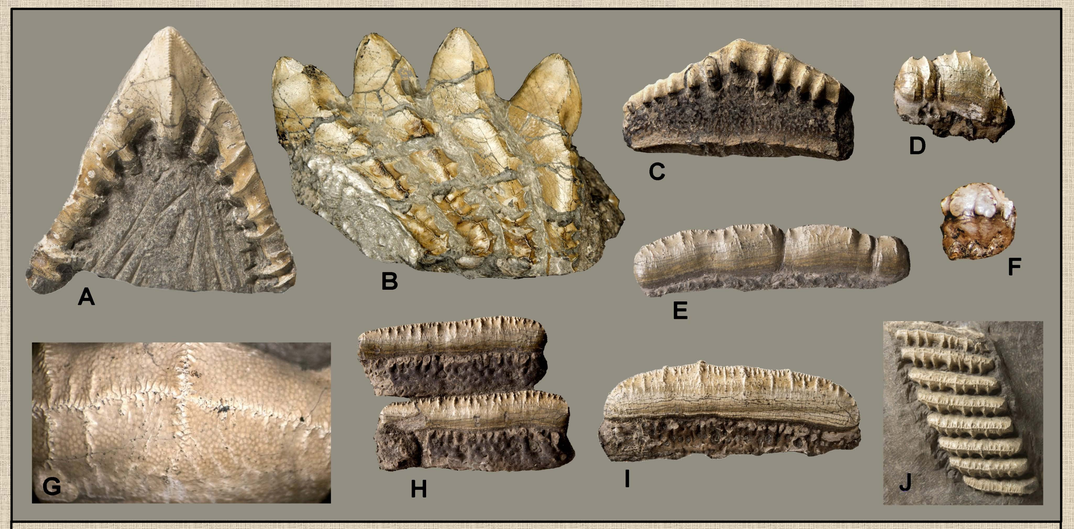
Agassizodus

The name *Agassizodus* was erected by St John and Worthen in 1875 in honour of Louis Agassiz (1807-1873), the Swiss paleoichthyologist who had written his celebrated *Recherches sur les Poissons Fossiles*, in parts, during the 1830s and 1840s. Agassiz emigrated to the USA in 1846 and St John was one of his students at Harvard University.



Agassizodus variabilis (Newberry & Worthen, 1875) (Upper Coal Measures: Osage County, Kansas) ; Symphyseal tooth whorl and partial lateral dentition. NHMUK PV P.9674 (cast)

Agassizodus variabilis (Newberry & Worthen, 1875) (Upper Coal Measures: Cedar Creek, Nebraska); Symphyseal tooth whorl. NHMUK PV P.9673 (cast)



Agassizodus variabilis (Newberry & Worthen, 1875), LF3199, Late Carboniferous, Kansas City, Missouri, USA. A selection of tooth morphologies.
A, symphyseal tooth; B, stack of four symphyseal teeth; C, median lateral tooth; D, ? posterolateral tooth; E, lateral tooth showing ? pathological damage; F, parasymphyseal tooth; G, surface of lateral tooth showing ridges and dentine pillars; H, lateral teeth; I, lateral tooth; J, file of eight small lateral teeth. Scales vary.

New specimen LF3199 – *Agassizodus variabilis*.

An articulated revolver of 4 robust symmetrical symphyseal teeth, each with a high upright central cusp, is supplemented by two disarticulated specimens from the same tooth family. Prominent labial nodes, low down on the crown, are buttressed with root tissue and are a distinctive characteristic of the teeth. The post-symphyseal components of the dentition show linear gradient monognathic heterodonty, with tooth size increasing from small, stud-like parasymphyseals, through low-crowned, elongate and increasingly robust laterals, to smaller posterolaterals.

The taxonomic problem

Much confusion currently exists concerning the nomenclatural validity of the genus. The Belgian palaeontologist and chemist from Louvain, Laurent-Guillaume de Koninck (1809-1887), erected *Campodus agassizianus* in 1844, based upon isolated teeth from the Late Carboniferous of Liège. Further material was described by Maximin Marie Joseph Lohest (1857-1926), Professor of Geology at the University of Liège, in 1885.

During the intervening years Lt-Col Hennadius Romanowsky (dates unknown) of St Petersburg had defined the genus *Lophodus*, with several species, for teeth which he noted resembled those of *Helodus*, and which were collected from the Carboniferous of Tula in Central Russia. Romanowsky's generic name was used by Newberry and Worthen in 1870 to define *L. variabilis*, which species was then adopted by St John & Worthen as the type species of *Agassizodus*.

It is hoped that further work on LF3199 will help to unravel some of this taxonomic confusion. As Ginter *et al*. (2010:125) have indicated : "*Lophodus variabilis* is based on a very meagre specimen, consisting of a broken symphyseal tooth and two fragmentary lateral teeth. St. John & Worthen also had a large dentition on the ramus of a mandible from Osage, Kansas, USA that lacks the symphyseal teeth. They assumed, valid at the time it was made, that the large dentition belonged to *Agassizodus variabilis*. Other authors subsequently considered the genus *Agassizodus* as a valid taxon, while others, for example Eastman (1902, 1903) suggested *Agassizodus* to be a synonym of *Campodus*. When large symphyseal dentitions with associated lateral teeth were discovered, Eastman unhesitatingly placed these in the genus and species *Campodus variabilis*, since the lateral teeth conformed perfectly with those of the Kansas specimen figured by St. John & Worthen. This probably would not have happened, had Eastman compared his new specimens with the holotype of *Lophodus variabilis*, instead of the Osage, Kansas dentition."

SVP 2018