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Article VIII.— THE RELATIONSHIP OF THE GENUS *PRISCACARA.*

By J. D. Haseman.

The genus *Priscacara* has usually been considered a member of the family of Cichlid fishes. However, its relationship has been questioned in recent years, partly at least because the Cichlidæ are now almost exclusively found in South America and Africa. Hence the exact relationship of *Priscacara* is important from the standpoint of zoögeography. If it is a member of the Cichlidæ, then the point of *family origin* may have been in the northern hemisphere, and not on an ancient southern continent (Gondwana).

Thanks to Professor Bashford Dean, who has placed in my hands the abundant material of the Newbury and Cope Collections in the American Museum, I was enabled to make a study of the relationship of *Priscacara.* I am also indebted to Doctor L. Hussakof for his suggestions in regard to some of the fossil characters.

The genus *Priscacara* was described by Cope in 1877 from Green River, Wyoming (Middle Eocene according to Osborn's 'Age of Mammals'). Cope states that it might be included in the Pomacentridæ but that it differs from the genera now known in the possession of vomerine teeth and in having apparently eight branchiostegal rays. I have been unable to verify the presence of eight branchiostegal rays in the excellent material (which includes Cope's specimens) at the American Museum of Natural History; but to the contrary am certain that the correct number is six. In regard to the vomerine teeth, I think that only two large specimens of *Priscacara serrata* (Nos. 2442 and 2443, American Museum) actually show small sockets which indicate the existence of very small vomerine teeth in this species. The vomer is well preserved in several specimens of other species of *Priscacara,* but no vomerine teeth or sockets were found.

Cope (p. 92) also states that the jaws of *Priscacara* are toothless but Woodward says that the specimens of *Priscacara* have small conical teeth in both jaws. I have verified Woodward's conclusion. Woodward also states that the Cichlidæ have a single narial opening on each side of the snout and that the scales are ctenoid but otherwise they are like the Labridæ. The data given in the following table indicates that this is the correct view: *i. e., Priscacara* is more like the Labridæ than the Pomacentridæ. However both Woodward and Pellegrin have considered *Priscacara* as a member of the Cichlidæ, and I believe that the following data lend strong support to their view.

POMACENTRIDÆ	LABRIDÆ	CICHLIDÆ	PRISCACARA
Single nostril on each side	Double nostril on each side	Single nostril on each side	Not certain
A subocular shelf	No subocular shelf	No subocular shelf	No subocular shelf
Lower pharyngeal bones completely united and T or Y shaped	Lower pharyngeal bones completely united and T or Y shaped	Lower pharyngeal bones united but retaining a suture and triangular shaped	Lower pharyngeal bones united but retaining a suture and triangular shaped
Small conical teeth in jaws	Long conical teeth in jaws	Usually short conical teeth in jaws	Small conical teeth in the jaws
Gills 3½ and pseudobranchiae	Gills 3½ and pseudobranchiæ	4 gills and slit behind 4th and no pseudobranchiæ	Not certain
Branchiostegals 5–7	Branchiostegals 5 or 6	Branchiostegals 5 or 6	Branchiostegals 6
No vomerine teeth	No vomerine teeth	No vomerine teeth	Small vomerine teeth in at least 1 species
Preoperculum serrate or entire	Preoperculum serrate or entire	Preoperculum serrate or entire	Preoperculum serrate or faintly so
Vertebræ with transverse processes from 4th to 5th	Vertebræ with transverse processes from the 3rd	Vertebræ with transverse processes from the 3rd	Vertebræ with transverse processes from the 3rd
Ribs attached to the transverse processes when they are present	Ribs attached to the transverse processes when they are present	Ribs sessile or subsessile	Ribs sessile
2 anal spines	3 or more anal spines	3 or more anal spines	3 anal spines
Numerous strong dorsal spines	Numerous slender dorsal spines	Numerous strong dorsal spines (8–23)	10 or 11 strong dorsal spines
Ctenoid scales	Cycloid (or weakly ctenoid) scales	Ctenoid scales	Ctenoid scales
Back part of lateral line wanting	Lateral line continuous or in 2 parts	Lateral line usually in 2 parts rarely continuous	Lateral lines perhaps in 2 parts
Marine	Marine	Freshwater	Very probably freshwater

The Green River Lake Formation is considered an estuarine or landlocked bay deposit (*cf.* page 136, 'Age of Mammals'). This view is apparently derived from the presence of *Dasyatis* and *Notogoneus* whose nearest

living relatives are marine forms. On page 572, 'Cambridge Natural History,' Boulenger states that *Notogoneus*, found in fresh water Eocene of France and North America, is related to the marine Gonorhynchidæ which is represented by only one living marine species, *G. greyi*. *Dasyatis*, a member of the order of sharks, is allied to existing forms which frequent the streams and estuaries of Florida as well as adjacent coasts (*cf.* Boulenger, p. 464). Both skates and sharks are known to enter mouths of rivers In fact *Potamotrygon* has many species which are found in rivers of South America. *Diplomystus* also offers no decisive support for a marine origin of the Green River Lake Formation, because some of its surviving relatives are said to exist in rivers and along the coast of Chile and eastern Australia (*cf.* Woodward).

The presence of *Lepidosteus*, *Amia* and other teleosts indicate that the formation is of fresh water origin. The relationship of *Dapedoglossus* (*Phareodus*) and *Priscacara* with forms which live in tropical rivers, also indicates a fresh water origin. *Asineops* (*cf.* Cope, p. 85–87) is considered by Boulenger, p. 656, to be related to *Aphredoderus* which is now found in fresh water. These and other genera indicate that the bulk of the fishes of the Green River Formation were fresh water forms. The deposits also lack typical marine perciform fishes. Hence it appears more probable that the shark-like forms entered this basin from the sea, than that all of the freshwater forms floated down the streams to be deposited near the coast in an estuary or land-locked bay. As far as *Priscacara* is concerned, it makes little or no difference whether the Green River shales were or were not estuarian or land-locked bay in origin, because *Priscacara* is known from undoubted freshwater deposits. Pharyngeal teeth of *Priscacara* are known from the Washakie basin of the Bridger formation (*cf.* Cope, p. 93). Hence *Priscacara* was very probably a freshwater form.[1]

The differences in the sub-ocular shelf, number of anal spines, location of lateral processes on vertebræ, etc., separate the Labridæ and Cichlidæ from the Pomacentridæ. Ctenoid scales, sessile ribs, shape of fused pharyngeal bones with suture, short conical teeth, strong dorsal spines, and being fresh water forms, easily separate *Priscacara* from the Labridæ. The presence of vomerine teeth and a few other characters show a closer relationship between the ancestral Cichlidæ and Percidæ and Centrarchidæ,

[1] It might be maintained that *Priscacara* entered the freshwater from the sea. This view has some weight in view of the fact that I have shown that *Geophagus braziliensis*, a Cichlid, can live for some time in sea-water. But if such a view were proven, then the origin of the Cichlidæ would be in the sea. This being the case, no favorable evidence would exist from their distribution for a continuous Gondwana Land.

[2] Prof. Grabau also considers the Green River Formation as fresh water (*cf.* Index Fossils, Vol. II, p. 658).

than is generally accredited, but most of these similarities are apparently ancestral (paleotelic) perciform characters. *Priscacara* is easily separated from these families by its fused lower pharyngeal bones which retain a suture, etc.

The character of the nares of *Priscacara* cannot be definitely determined. This character is not, I believe, of any great importance because some of the living Cichlidæ (*Geophagus*) have several small pits on their snouts. I have passed bristles through some of these holes and in some cases they were found to be continuous with the cavity beneath the true naris. Besides there appears to be no objection to the view that the ancestral Cichlidæ might have had double nares—possessing, however, the tendency of narial coalescence or disappearance of one of the openings on each side of the head. So *Priscacara* may or may not have had double nares.

In all details, which can be definitely determined, excepting the presence of vomerine teeth in at least one species of *Priscacara*, this genus agrees with the Cichlidæ. The presence of degenerate or small vomerine teeth in any or all of the species of *Priscacara* is not, I believe, of sufficient importance to separate the genus from the Cichlidæ, because many of the primitive perciform fishes had vomerine and palatine teeth. It is, therefore, quite probable that the ancestral Cichlidæ also had degenerating vomerine teeth. In fact, the small size of the vomerine teeth in *Priscacara* may be evidence of the trend of their evolution. The teeth may be adolescent in the smaller species of *Priscacara*, where, in spite of favorable material, they could not be determined. On the other hand it is possible that the development of some of the living Cichlidæ would show traces of vomerine teeth if the different genera were studied. Therefore it appears that the data at our command are sufficient to show that *Priscacara* is an ancestral Cichlid.

Notes.

The serrate preoperclum of *Priscacara* vaguely indicates, along with other characters, that the American genus *Crenicara* is more primitive than the genus *Acquidens* which is usually considered to be the most primitive.

Priscacara sp.? Specimen No. 2583 in the American Museum has fused lower pharyngeal bones with a suture.

Priscacara oxyprion Cope, No. 2447 Amer. Mus., has a lateral line which apparently ends under the posterior base of the soft dorsal. The same specimen has two or three lateral line scales on the base of the caudal. This may indicate a two-part lateral line, if not, it being continuous, makes no difference, for some of the living Cichlidæ have continuous lateral lines (*cf. Cichla*).

Priscacara serrata Cope, Nos. 2442 and 2443 Amer. Mus., evidently have sockets of teeth on the end of the vomer.

The specimens all have twenty-four or more vertebræ (usually twenty-six), but this is a very variable character in perciform fishes. The serrate preoperculum is also found in living Cichlidæ (*cf. Crenicara*). The arrangement of scales on the cheeks, pre- and sub-operculum, also vary much in living Cichlidæ.

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