JOURNAL OF PALEONTOLOGY, VOL. 19, NO. 3, PP. 315–318, 2 TEXT FIGS., MAY 1945

# A NEOGENE STICKLEBACK FROM THE RIDGE FORMATION OF CALIFORNIA

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ABSTRACT—*Pungitius haynesi*, a Neogene stickleback from the Ridge formation of southern California is described.

A SPECIMEN of the piscine genus *Pungitius* Costa was found in dark-gray shale of the Ridge formation near Piru Creek, Ventura County, California. This little fish is the first identifiable macrofossil from the Ridge formation, which may be Pliocene or upper Miocene in age. Thus, far, the sparsity or absence of fossil material in these deposits has prevented an age assignment on the basis of direct paleontological evidence.

The fossil fish was collected by E. B. Haynes of Fillmore, California, and generously given to the California Institute of Technology, Pasadena. There are indications that more material of the same species is available at the fossil locality. However, because of present restrictions due to the war, it is not possible to obtain additional specimens, and the type is therefore the only fish now available for description.

Thanks are due Dr. Chester Stock for his interest and assistance in the present paleoichthyological study.

## LOCATION AND AGE OF SPECIMEN

The fossil was collected in a dark-gray silty shale exposed in an embankment at the south approach to the first bridge across Piru Creek, going north on the new Ridge Route (U. S. Highway 99) in Los Angeles County. The fish locality (Calif. Inst. Tech. Vert. Pale. Loc. 389) is situated in NW corner, sec. 13, T. 6 N., R. 18 W., U.S.G.S. Tejon quadrangle, California. The strata containing the specimen form part of the Ridge formation. These deposits were briefly mentioned by Clements (1937, p. 218). A more detailed account of the Ridge basin and its sediments was given by Eaton (1939). These shales fall into Eaton's Division II, a thick series of deposits probably of brackish-water and lacustrine origin, and tentatively referred by him to the Pliocene. The comparatively thin unit of a few hundred feet of dark-gray shale in which the fish was found is conspicuous but has been observed only locally, where it crosses the Ridge Route near the base of the Piru Creek bridge. When the new road was constructed in this region, several fossil palm fronds were uncovered. One of these specimens is now in the collections of the California Institution of Technology, but it has not been identified.

## DESCRIPTION OF MATERIAL

### PUNGITIUS HAYNESI David, n. sp.

Figure 1

*Type specimen.*—No. 10347, Calif. Inst. Tech. Coll. Vert. Pale. The specimen measures 50.5 mm. in length, including the urostyle, which is broken off; the caudal fin is missing.

*Type locality.*—No. 389 California Institute of Technology Vert. Pale. Loc.

*Description.*—An elongate species with slender head, small eye; body behind insertion of second dorsal and anal fins narrows rapidly to caudal peduncle with almost straight margins; caudal peduncle narrow, constricted as in genus. Urostyle broken off, as well as last vertebra. Caudal fin missing.

Outline of body as a whole well preserved, showing typical and evidently undisturbed proportions of body. Only middle of body seems to be slightly distorted in its upper part by intrusion of coarser material into an otherwise fine matrix; this caused loss of middle part of first dorsal and may have slightly lengthened body in this region.

The structures of skull and mouth, opercular region, pectoral and pelvic arches are as in the genus, in so far as they can be observed. Mouth comparatively long for genus, almost closed, turned diagonally forward and upward, teeth faintly preserved

only on premaxilla, ascending process of premaxilla of moderate length, reaching anterior end of orbit. Outlines of fairly large lacrimal and suborbitals visible, the latter partly covering angular preopercular. Triangular opercular ornamented with numerous transverse radii as in genus. Pectoral girdle (see Starks, 1903) with high slender clavicle, hypocoracoid with large ovoid foramen and broad hypocoracoid, extending into slender vertically projected "interclavicle." Interclavicle is met and superimposed posteriorly by pelvic plates. Pelvic girdle strongly forked, the robust upper fork extending near vertebral spine.

Head 3.4 in body, depth of body almost 5, snout a little longer than eye, 4 in head; mouth comparatively long, 3 in head. 15 +19 =34 vertebrae. D 1 =IX?, D 2 =I, 10; spine of second dorsal 3.3 in length of head. First dorsal uncertain as its middle portion is disturbed, however most of its interneurals well formed. Two strong interneurals connected with first two vertebrae, preceding dorsal spines. Following four vertebrae with strong triangular interneurals evidently supporting dorsal shields and spines, third spine partly preserved. Interneurals of following three vertebrae lost, but spine of third of these partly preserved (evidently seventh spine). Tenth vertebra without interneural and spine, same probably true for twelfth and fourteenth vertebrae; eleventh, thirteenth and fifteenth vertebrae support interneurals and evidently spines; strong spine supported by fifteenth vertebra partly preserved forming spine of second dorsal. Interneurals, supported by first 15 vertebrae, of more or less the same strength and not greatly increasing in length as in highly arched species of the genus. Second dorsal inserted at a distance 1.4 times farther from end of snout than from end of body. Anal fin I, 8, inserted slightly behind second dorsal. Pelvic spines missing. About 12 or more pectoral rays, their tips broken off. Except for shields connected with spines of first dorsal and with pectoral and pelvic girdles as described above, no dermal shields are present; if a dermal skeleton was present at all, it evidently was feeble.

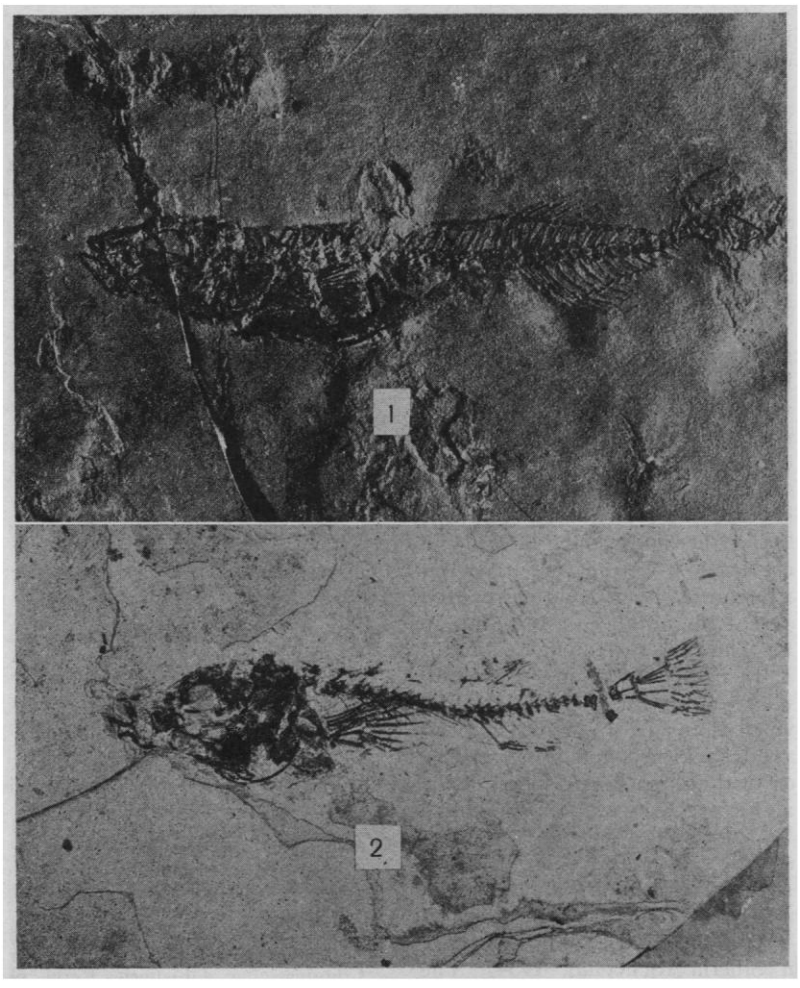
## RELATIONSHIPS AND GEOLOGICAL AGE OF FOSSIL

The fossil species seems to be related to the small or nine-spined stickleback. The structure of the head and body as well as the number of vertebrae agree. Although most of the dorsal spines are missing, the structure of the interneurals indicates that there were about 9 spines in the first dorsal, and the skeletal elements of this part of the body agree well with those found in *Pungitius pungitius*. Two specimens of *P. pungitius* from Lake Nipigon, Ontario were used for comparison. Dr. Carl L. Hubbs very kindly donated this Recent material.

These show 15 +19 or 20 =34 or 35 vertebrae, the first specimen thus agreeing with the fossil. The number of soft dorsal and anal rays also falls within the variation of the species. The fossil species evidently differs in possessing a body slightly longer than is normal for *P. pungitius*, and in the farther posterior insertion of the second dorsal fin. Otherwise, the fossil species appears to agree with the very variable living form.

Sticklebacks are restricted to the northern hemisphere and are distributed over Europe from the Arctic Ocean, including Iceland and Greenland, to the Black sea. In Asia they occur in northern Siberia to Transcaucasia, from the Amur to Behring Island to Japan. In America they range from Alaska to California and from Nova Scotia to Cape Cod. Except for a few local species, the sticklebacks are represented in almost their entire region of distribution by two species. *Gasterosteus aculeatus*, the common stickleback, and the nine-spined stickleback, *Pungitius pungitius*. The high-bodied larger, common stickleback with a restricted number of long and strong spines in the first dorsal is easily distinguished from the slender nine-spined *Pungitius*.

Both species occur in salt, brackish, and fresh water and show great variability as exemplified especially in their dermal skeleton. In the northern part of their range in the sea the dermal ossifications are strong, the series of body plates complete, the fin spines usually either long or strong. Toward the southern part of their range in the sea and everywhere in fresh water, the dermal




FIGS. *1*—***Pungitisius haynesi*** David, n. sp., Holotype, California Inst. Technology Vert. Paleontology Coll. No. 10347. Ridge formation, upper Miocene or Pliocene, Piru Creek, California. Approximately ×1.8.
*2*—***Gasterosteus doryssus*** (Jordan). Lahontan beds, Pleistocene, near Hazen, Nevada. Collected by D. T. Axelrod. Approximately ×2.

ossification is much weaker. It is interesting to note that the Californian fossil is related to *Pungitius pungitius*, a form not known today in the western portion of North America. The modern species does occur in Europe as well as Asia, and in eastern America from the Arctic south to Long Island. In contrast, *G. aculeatus* is represented by two varieties in California today. Regan (1909), for example, notes *G. aculeatus* (=*G. williamsoni*) in the Santa Clara River and *G. santa-annae* in the Santa Ana River.

*P. pungitius* is found in America (Schrenkeisen, 1938, Jordan, Evermann, Clark, 1930) in fresh and brackish waters and sometimes in mountain lakes. *Pungitius* is less common today than *Gasterosteus*, but may have had a wider distribution than the latter in late Tertiary times. It is desirable to obtain additional fossil specimens with better-preserved dorsal spines than in the described material in order to verify the rela-

tionship of the Californian form to the living nine-spined stickleback. The fossil fish has a weak dermal skeleton, if any. The occurrence warrants the assumption that the sediment accumulated in fresh water, a view previously accepted with reference to the origin of the strata. Sticklebacks migrate to shallower regions in the spawning season in early summer and retire to deeper pools in ponds toward fall, a habitat in which the fossil may have been preserved.

Only a few fossil sticklebacks are known. *Gasterosteus doryssus* (fig. 2) from the Pleistocene Lahontan beds of Nevada (Hay 1907, 1926; Jordan, 1907) is related to *Gasterosteus aculeatus*. Several specimens of the latter species from Truckee River, Nevada, are in the collection of the California Institute. These show the typical arched outline of *G. aculeatus*, the depth being 3.6 to 4 in body. There are 15+18=33 vertebrae. According to Regan (1909) 29, and more often 31–33 represent the number of vertebrae in *G. aculeatus*. The type specimen of *G. doryssus* (Hay 1907, p. 272) is extended by fossilization, as is well shown by the vertebral column, which is curved upward. The head also is turned backward and upward. One or the other of the three strong spines of the first dorsal fin are preserved in the fossil material. The Lahontan species, therefore, is not related to *P. haynesi*. The only other known fossil sticklebacks are a Pleistocene form from Canada, related to *Gasterosteus aculeatus* (Dawson, 1894), and a neogene type from Siberia (Schtylko, 1934). The wide distribution of the living species of sticklebacks over the northern hemisphere appears to indicate that they have been in existence for some time. The principal species of the Gasterosteidae may have been established by Miocene time. *Pungitius haynesi* is the only fossil stickleback known from California. It is not possible at present to determine definitely the geologic age of the specimen. However, since it is closely related to the living species, it is not likely to be older than middle Miocene; its presence in the Pliocene seems more likely. *P. haynesi* probably became extinct in California at a later time, perhaps as a result of climatic change.

## CONCLUSIONS

The small stickleback found in the Ridge formation, near Piru Creek, represents a near relative of living forms. It is probably related to *P. pungitius* (Linnaeus), an inhabitant of Eurasia and the coast of eastern America. The type is not likely to be as old as middle Miocene, and evidently represents a fresh-water variety.

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