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First fossil occurrence of a filefish (Tetraodontiformes; Monacanthidae) in Asia, from the Middle Miocene in Nagano Prefecture, central Japan

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Abstract

A new fossil filefish, *Aluterus shigensis* **sp. nov.**, with a close resemblance to the extant *Aluterus scriptus* (Osbeck), is described from the Middle Miocene Bessho Formation in Nagano Prefecture, central Japan. It is characterized by: 21 total vertebrae; very slender and long first dorsal spine with tiny anterior barbs; thin and lancet-shaped basal pterygiophore of the spiny dorsal fin, with its ventral margin separated from the skull; proximal tip of moderately slender first pterygiophore of the soft dorsal fin not reaching far ventrally; soft dorsal-fin base longer than anal-fin base; caudal peduncle having nearly equal depth and length; and tiny, fine scales with slender, straight spinules. The occurrence of this fossil filefish from the Bessho Formation is consistent with the influence of warm water currents suggested by other fossils, but it is inconsistent with the deep-water sedimentary environment of this Formation. This is the first fossil occurrence of a filefish in Asia; previously described fossil filefishes are known from the Pliocene and Pleistocene of Italy, the Pliocene of Greece, and the Miocene and Pliocene of North America. These fossil records suggest that the genus *Aluterus* had already been derived and was widely distributed during the Middle Miocene with taxa closely resembling Recent species.

Key words: *Aluterus*, Bessho Formation, filefish, Japan, Middle Miocene, new species

Introduction

Recent filefishes of the family Monacanthidae are widely distributed in tropic and temperate shallow waters of the Atlantic, Indian, and Pacific oceans (e. g., Hutchins, 1977; Nakabo, 2000; Matsuura, 2002; Nelson, 2006). The family consists of about 32 genera and about 102 species (Nelson, 2006), being one of the most speciose families of the order Tetraodontiformes (Sorbini and Tyler, 2004). However, fossil filefishes have been known only from the Pliocene and Pleistocene of Italy (Landini and Menesini, 1978; Sorbini, 1988; Landini and Sorbini, 1992; Landini and Sorbini, 1993; Sorbini and Tyler, 2004), the Pliocene of Greece (Gaudant, 2001), and the Miocene and Pliocene of North America (Purdy *et al*., 2001).

A fossil filefish was discovered by the first author from the Miocene Bessho Formation, Nagano Prefecture, central Japan on 9 September 2012. This is the first fossil occurrence of a filefish in Asia. Although this fossil specimen lacks the skull and pelvic girdle, it clearly belongs to the genus *Aluterus* and has a unique set of characters which very closely resembles those of the extant *Aluterus scriptus* (Osbeck, 1765), but the fossil also differs from all of the extant species of the genus and it is described herein as a new fossil species of that genus.

Geological setting

The fossil filefish reported herein was discovered in an outcrop of the Tazawa black mudstone Member (Tanaka and Seki, 1966) of the Bessho Formation (Honma, 1927) in the riverbed (36°19'37"N, 137°59'40"E) of the Hofukuji River at Sorimachi, Matsumoto City, Nagano Prefecture, central Japan (Figure 1). The Bessho Formation

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In addition to the numerous complete fossils of *Frigocanthus stroppanobili* and *F. margaritatus* from localities in Italy, both of these species are known from the Upper Pliocene (3.1-2.5 Ma) of Crete, Greece, although only from fragmentary remains (Gaudant, 2001; Sorbini and Tyler, 2004).

Fossils described as *Aluterus* sp., based only on vertebrae, are also known from the Middle Miocene (Langhian) and Lower Pliocene in North Carolina (Purdy *et al*., 2001). It is pointed out that these fossil vertebrae have a resemblance to those of extant *Aluterus schoepfii* (Purdy *et al*., 2001). This fossil record from the Middle Miocene in North Carolina is of about the same age as or older than the Bessho Formation.

Both Matsuura (1979) and Tyler (1980) pointed out that *Aluterus* is a relatively derived genus among the Monacanthidae based on osteological characters such as the decreased size and closeness of association of the basal pterygiophore of the spiny dorsal fin with the skull, increased number of vertebrae, and relatively simplified (without dorsal lobe and incasing scales) pelvic girdle. In addition, according to Sorbini and Tyler (2004), the slender first dorsal spine with small to moderate barbs and the soft dorsal-fin base being shorter than the anal-fin base are also derived characters of *Aluterus*. The fossil occurrences of *Aluterus* from the Middle Miocene and of *Frigocanthus*, which is closely related to *Aluterus* (Sorbini and Tyler, 2004), from the Pliocene and Pleistocene indicate that the derivation of the *Aluterus* + *Frigocanthus* clade of the family Monacanthidae was already relatively advanced by the Middle Miocene.

The fossil occurrence of filefish from the Bessho Formation in Nagano Prefecture, central Japan indicates that monacanthid fishes, especially the species belonging to the genus *Aluterus*, had already been derived and were distributed at least in the Northwest Atlantic and Northwest Pacific in the Middle Miocene. In addition, the close resemblance of the extant species of *Aluterus* to the Middle Miocene species *Aluterus shigensis* **sp. nov.** indicates that, about 13 Ma in the Middle Miocene, the species of this clade already had obtained the highly derived features that characterize the Recent species of this genus.

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