

## *Miobarbourisia aomori* gen. et sp. nov. (order Stephanoberyciformes), Miocene Whalefish from Aomori, Japan

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**Abstract** A fossil barbourisiid whalefish collected beside the Arakawa River, Aomori City, and believed to be from the Middle Miocene Wadagawa Formation, is described as a new genus and species, *Miobarbourisia aomori* in the family Barbourisiidae. The genus *Miobarbourisia* is more primitive to other whalefishes (including *Barbourisia*) in having large, long pelvic fins, a more anterior dorsal fin and an anal fin far behind the origin of the dorsal fin. This specimen is the first whalefish fossil discovered worldwide.

**Key words:** Fish fossil, Barbourisiidae, Middle Miocene, Aomori City, *Miobarbourisia aomori* gen. et sp. nov.

### Introduction

In October 1970, during construction of the Shimoyu Dam in 1970–1973, a fossil fish encased in pale greenish, unlayered sandstone tuff was discovered along a forest road near the Arakawa River, Aomori City. The collection site was about two kilometers upstream of the Shimoyu Hot Spring area (Fig. 1). Shimaguchi *in* Uyeno *et al.* (2002) reinvestigated the collection area in May 2001, and found that a site about 1.6km upstream of the hot spring was composed of material close to the composition of the stone in which the fossil is embedded. Nemoto (2001) concluded that grey to blackish mudstone and greenish tuff sandwiched between layers of sandstone and basalt of the collection site was part of the Middle Miocene Wadagawa Formation.

Although, the Barbourisiidae was included previously in the order Cetomimiformes (see Paxton and Bray, 1986; Paxton, 1989), the authors prefer the present nomenclature of the superfamily Cetomimoidea in the order Stephanoberyciformes adopted by Nelson (1994; 2006).

### Systematic Description

Class Osteichthys Huxley, 1880

Order Stephanoberyciformes Bauchot, 1970

Superfamily Cetomimoidea Nelson, 1994

Family Barbourisiidae Parr, 1945

*Revised diagnosis of the family:* Mouth large and terminal, jaw extending far behind small eyes. Head contains a network of broad tubes with pores composing the sensory canal system that joins the single broad lateral line tube, covered by large scales with small pores running parallel and above the vertebral column (Paxton, 1989). Minute embedded scales cover the head and body. Dorsal, anal and pelvic fins without spines. Pelvic fins located abdominally with 6 rays. Well-separated procurrent caudal rays prominent. Pleural ribs and predorsal bones present. Opercle triangular with radiating ridges. Gill rakers elongated and slightly flattened.

Two monotypic genera *Barbourisia* and *Miobarbourisia* gen. nov. (Figs. 2, 3).

### *Miobarbourisia* gen. nov.

*Type species:* *Miobarbourisia aomori* gen. et sp.

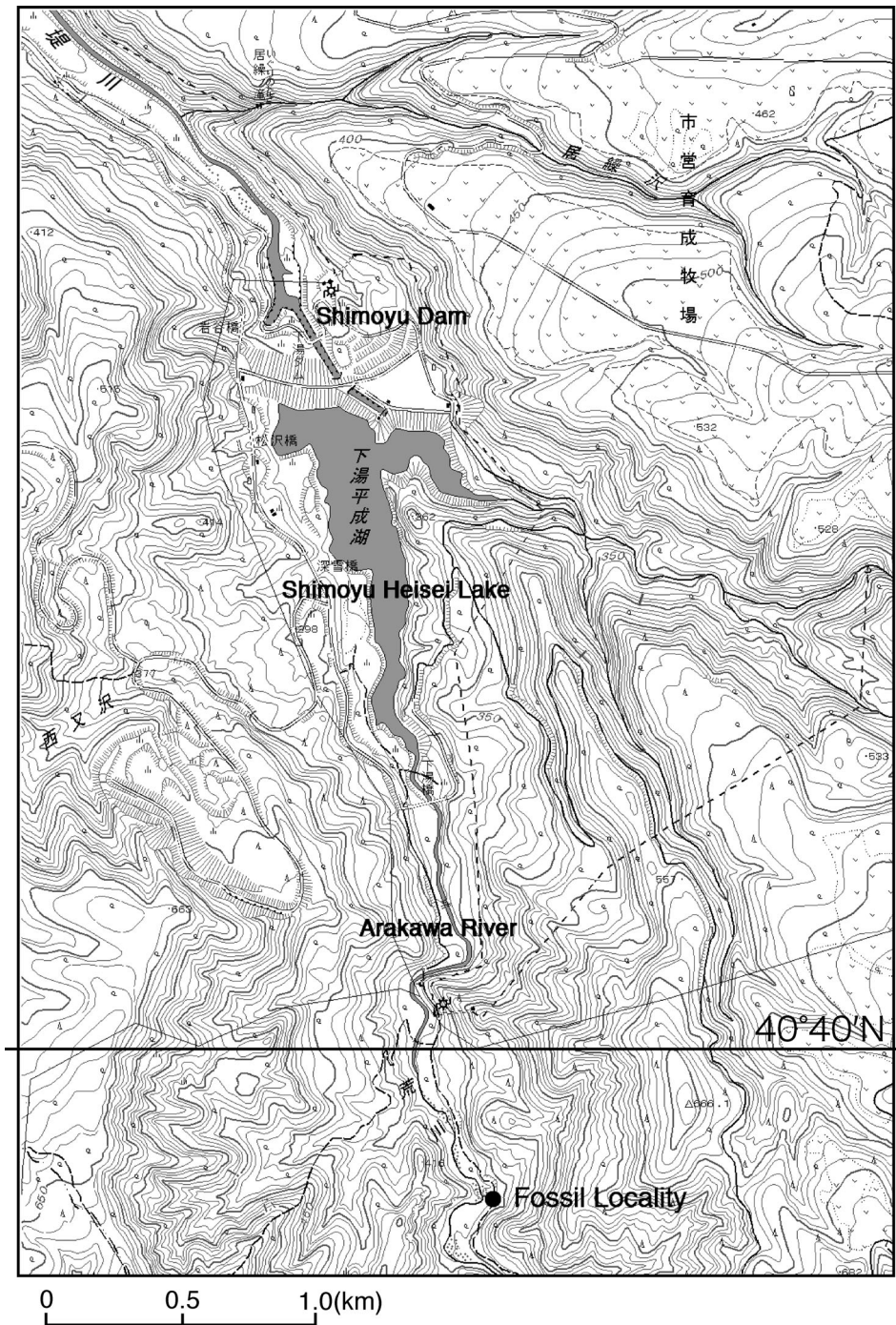


Fig. 1. Map of the fossil locality (40°39'50"N, 140°47'13"E) in Aomori City, Aomori Prefecture, northernmost Honshu, Japan. (from 1 : 25,000 map of "Kumotani" published by the Geographical Survey Institute of Japan).

nov.

*Diagnosis of the genus:* Pelvic fins large and long, reaching the anal fin, originating slightly behind the origin of the dorsal fin. Anal fin originates far behind that of the dorsal fin. Principal caudal rays 22 (19 in *Barbourisia*). Number of vertebrae about 50 (40–43 in *Barbourisia rufa*). Lateral line scales about 50 (26–32 in *B. rufa*). Numbers in parentheses are cited from Paxton (1989) and Fahay (2007).

***Miobarbourisia aomori* gen. et sp. nov.**

(New Japanese name: Aomori-mukashi-kujirauo)

*Holotype:* Aomori Prefectural Museum (AOPM) No. 491 (74 mm in standard length).

*Etymology:* The genus name is formed by combining the geological age with the name of the closest genus, whereas the species name is derived from the collection locality. The Japanese name means “ancient Aomori whalefish.”

*Diagnosis:* Same as the genus.

*Description:* Eye of the fossil is observable as a minute, round projection. The position of the posterior end of maxillary is observable and confirming that the mouth is large. The length of upper-jaw is more than a half of that of the head. Some gill arches with gill rakers observable. The shape of gill rakers is elongated and slightly flattened. Minute dots similar in size to scales of *Barbourisia* on head and body are observable. Spines absent on all fins. Pelvic fin located abnormally with 6 rays (Fig. 4). Broad lateral line tube runs parallel and above the vertebral column (Fig. 2). Lateral line scales about 50. Dorsal fin originates about mid-body. First four anterior dorsal fin rays present, gradually lengthening from 1st to 4th, about 22 fin ray bases and 3 predorsal bones are observable. Anal fin with 12 rays (Fig. 5) originates far behind the origin of the dorsal fin. Pectoral fin is missing in the fossil. Six dorsal and 3 ventral well-separated procurrent caudal spinous rays are observable. Principal caudal rays 22. Thread-like pleural ribs observable especially in the region behind head (Fig. 2).

Measurements: standard length 72.5 mm, upper jaw length 30.2 mm, head length 27 mm, snout length 7.0 mm, eye diameter 1.7 mm, depth of body 17.0 mm, predorsal length 42 mm, preanal length 45 mm.

### Discussion

The holotype is the first fossil specimen of a whalefish and of the superfamily Cetomimoidea identified to date.

According to Paxton (1989), the following characters of the family Cetomimidae are considered to be derived states in the superfamily Cetomimoidea: no pelvic fins, no pleural ribs, gill rakers absent or modified (but not elongate and slightly flattened). He considered the Barbourisiidae to be an outgroup with the following to be primitive characters: pelvic fins and pleural ribs present, elongated gill rakers. This family also has tiny, embedded scales on the head and body which are absent in the Cetomimidae. Therefore, both Paxton and the present authors agree that the Barbourisiidae are more primitive than other members of the whalefish superfamily.

Further, the present authors propose that *Miobarbourisia* is more primitive to other whalefishes (including *Barbourisia*) in having large, long pelvic fins, a more anterior dorsal fin and an anal fin far behind the origin of the dorsal fin. In contrast, in *Barbourisia* and other whalefishes, the placement of the anal fin is just below the origin of the dorsal fin (Fig. 3). In the larvae, the Barbourisiidae (monotypic Recent species), Rondeletiidae, and Gibberichthyidae of the outgroup of the Cetomimidae have large and elongated pelvic fins, but they are small in adult (Paxton, 1989; Paxton *et al.*, 2001; Fahay, 2007). These characters of *Miobarbourisia* are significant to study the systematic relationships among stephanoberyciform fishes.

### Acknowledgements

We wish to thank Shikanai Gumi of Aomori, the company that built the Shimoyu Dam, for



Fig. 2. Fossil holotype (AOPM No. 491) of *Miobourisia amori* gen. et sp. nov. (SL 74 mm). Note placement of anal fin far posterior to origin of dorsal fin. E, eye; Op, opercle.



Fig. 3. *Barbourisia rufa* (NSMT-P78939, SL 330 mm; National Museum of Nature and Science, Tokyo) collected off Surinam. Note minute eye and placement of anal fin just below origin of dorsal fin.

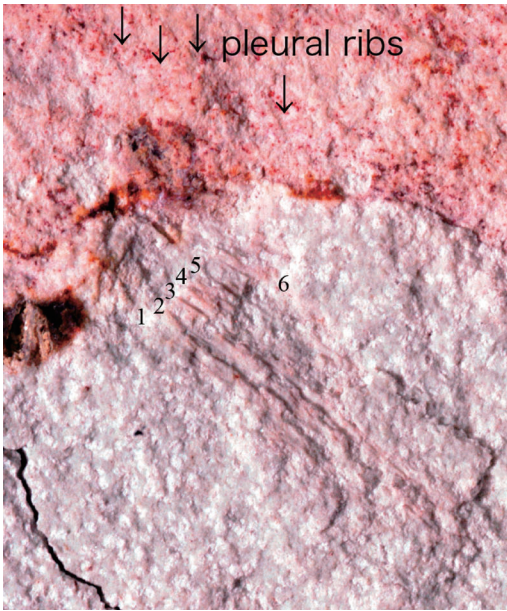


Fig. 4. Closeup of pelvic fin region of *Miobarbourisia aomori* gen. et sp. nov. (AOPM No. 491). Numbers indicate pelvic fin rays. Black arrows point to pleural ribs.

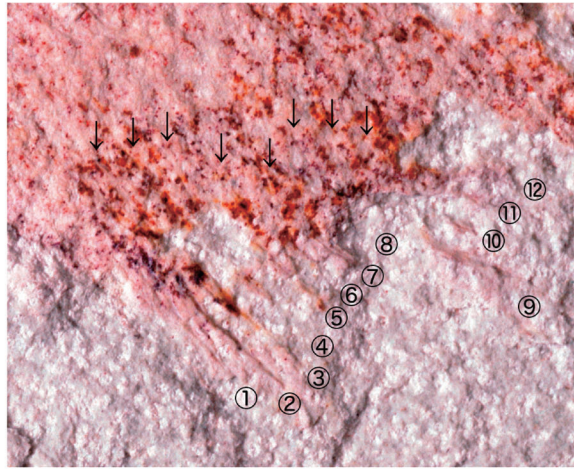


Fig. 5. Closeup of anal fin region of *Miobarbourisia aomori* gen. et sp. nov. (AOPM No. 491). Circled numbers indicate anal fin rays. Black arrows point to anal pterygiophores.

discovering a number of fossils during construction, and donating them to the Aomori Prefectural Museum. We also express our thanks to Naoki Nemoto of the Hirosaki University for geological information of the fossil site. Neal Teitler assisted us in reviewing the English manuscript.

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