

## *Scomberomorus chichibu*, a New Miocene Scombrid Fish from Japan (Pisces, Perciformes)

By

Teruya UYENO<sup>1</sup>, Kazuo SAKAMOTO<sup>2</sup> and Osamu SAKAMOTO<sup>3</sup>

<sup>1</sup>Department of Geology, National Science Museum, 3–23–1 Hyakunin-cho,  
Shinjuku-ku, Tokyo, 169

<sup>2</sup>Department of Zoology, University Museum, University of Tokyo,  
7–3–1 Hongo, Bunkyo-ku, Tokyo, 113

<sup>3</sup>Saitama Museum of Natural History, Nagatoro, Chichibu-gun,  
Saitama, 369–13

**Abstract** A fossil scombrid fish from the Middle Miocene Nagura Formation, Chichibumachi Group, Saitama Prefecture, Japan, previously reported as *Scomberomorus* sp. is now described as a new species *S. chichibu*. This was determined based on the following characters: the temporal ridge reaching to the level of the posterior end of the ethmoid; a wide, short fenestra between the frontals (the ratio of its width to length is about 1 : 3); and the moderately forked anterior portion of the ethmoid.

### Introduction

In 1983, a fossil fish was collected by Mr. Michio SAKAMOTO in a mudstone bed belonging to the Middle Miocene Nagura Formation, Chichibumachi Group, at Hannya, Ogano-machi, Chichibu-gun, Saitama Prefecture, central Japan, and it was described as an indeterminable species of the genus *Scomberomorus* in the family Scombridae (Perciformes) (UYENO & SAKAMOTO, 1985).

The purpose of the present study is to reexamine and give a full description of this fossil specimen. Based on comparison with living and fossil congeners, the authors have concluded that this is a new species of the genus *Scomberomorus*, being distinct in the anterior position of the temporal ridge, the fenestra between both frontals, and the shape of the ethmoid.

### Systematic Paleontology

Class Osteichthyes

Order Perciformes

Family Scombridae

Genus *Scomberomorus* LACEPÈDE, 1801

*Scomberomorus chichibu* sp. nov.

(New Japanese name: Chichibu-sawara)

*Holotype*: Saitama Museum of Natural History catalogue number SMNH-Ve-30 (Figs. 1–3).

*Etymology*: The species name is derived from the type locality.

*Diagnosis*: A species of *Scomberomorus* with the combination of the following characters: the temporal ridges reach to the level of the posterior end of the ethmoid, a fenestra between both frontals just before the supraoccipital crest is wide and short, and the ethmoid is moderately forked anteriorly.

*Description*: The specimen consists of the cranium, shoulder girdle, opercular bones, a part of the hyoid arch, a few vertebral elements, and some unidentified bones.

The fairly well-preserved dorsal part of the cranium is trapezoidal in shape. There are three parallel ridges on the cranium: median, temporal and pterotic. The median ridge extends forward on the frontals to the ethmoid, is connected posteriorly with the supraoccipital crest, and as it extends anteriorly, the less prominent it becomes. The temporal ridge on the frontal reaches anteriorly to the posterior third of the nasal and to the level of the posterior end of the ethmoid, and posteriorly through the parietal ending at the epiotic (Fig. 3). The pterotic ridge on the frontal and pterotic extends forward to the midlevel of the orbit, and develops small auxiliary ridges anteriorly (two on the right frontal, one on the left) that extend laterally and posteriorly toward the temporal ridge.

The ethmoid is moderately forked anteriorly in the dorsal view (Fig. 3). It is attached to the nasal anterolaterally, and bounded by the frontal posteriorly in the dorsal view. Only the right nasal is preserved, and it is laterally attached to the frontal, and anteriorly to the anterior branch of the forked ethmoid.

As the bones of the cranium are not completely discernable, the description was made mainly in connection with the ridges. The lateral ethmoids located just at the posterior corner of the nasal in the dorsal view are incompletely preserved by the anterior portion of the frontals. The frontals are attached to the ethmoid and nasal anteriorly, and mesially join to each other along the median line on the cranium, forming a median ridge together with the supraoccipital crest. A fenestra between both frontals is wide and short (the ratio of its width to length is about 1:3), surrounded by a slightly expanded area, and located just before the supraoccipital crest (Figs. 2–3). A temporal ridge runs the length of the frontal, parietal and epiotic, terminating at the posterior end of the epiotic. A supraoccipital crest forms the posterior portion of the median ridge. The pterotic ridge terminates at the posterior corner of the pterotic laterally attached to the sphenotic. The exoccipitals lie below the supraoccipital and epiotics in the back of the cranium.

Of the shoulder girdle, the cleithrum, scapula and coracoid are preserved, and connected to each other, but divided by sutures. In the opercular bones, the opercle, preopercle, subopercle and interopercle are all incompletely preserved. The ceratohyal is poorly preserved. Only fragments of several pectoral fin rays are observable. Three centra including an abdominal vertebra with a neural spine and a parapophysis, two pairs of incomplete neural spines, an epipleural and two ribs, and fragments of some

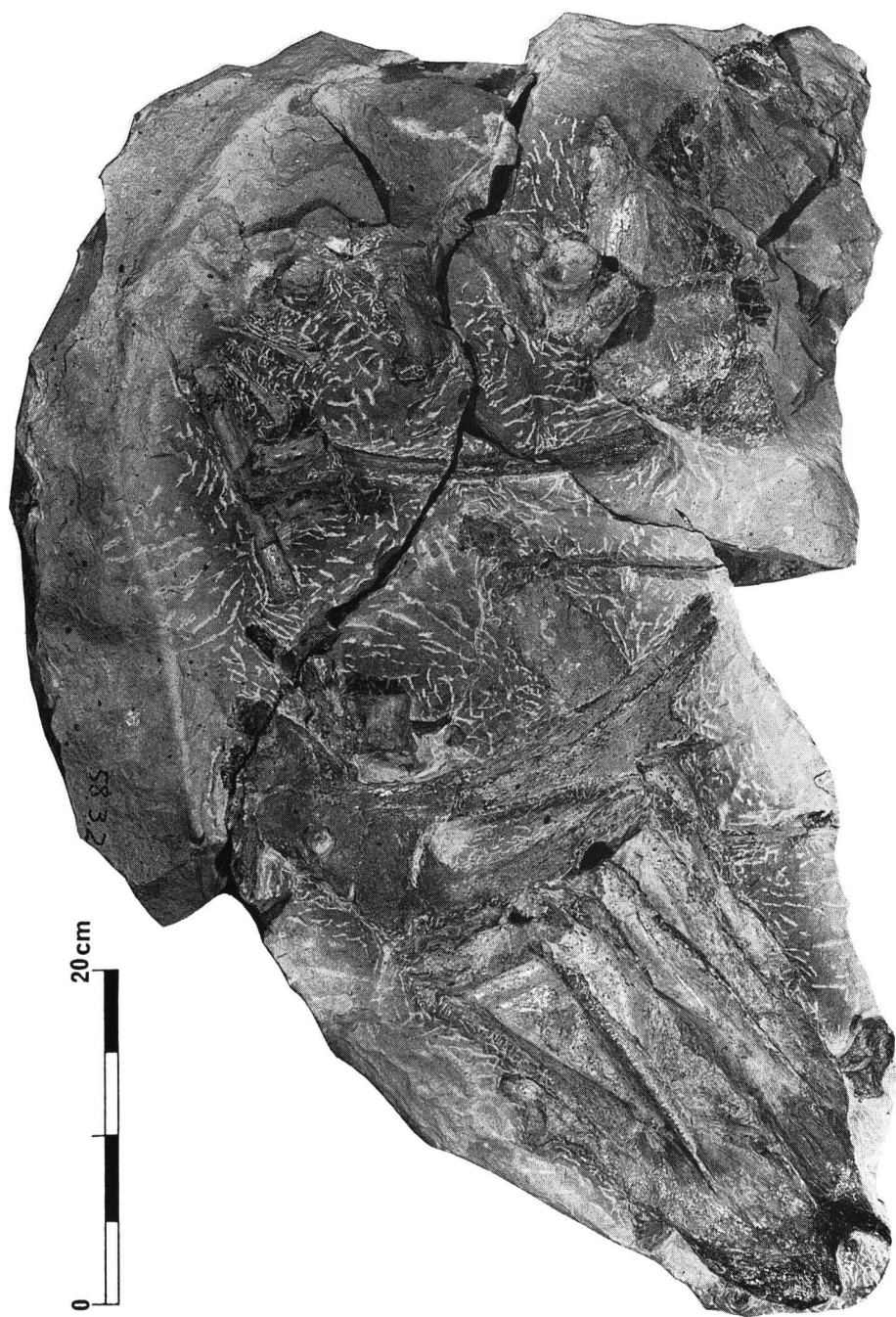


Fig. 1. *Scomberomorus chichibu* sp. nov., holotype, SMNH-Ve-30, from the Middle Miocene Nagura Formation, Saitama Prefecture, Japan. From UYENO and SAKAMOTO (1985).

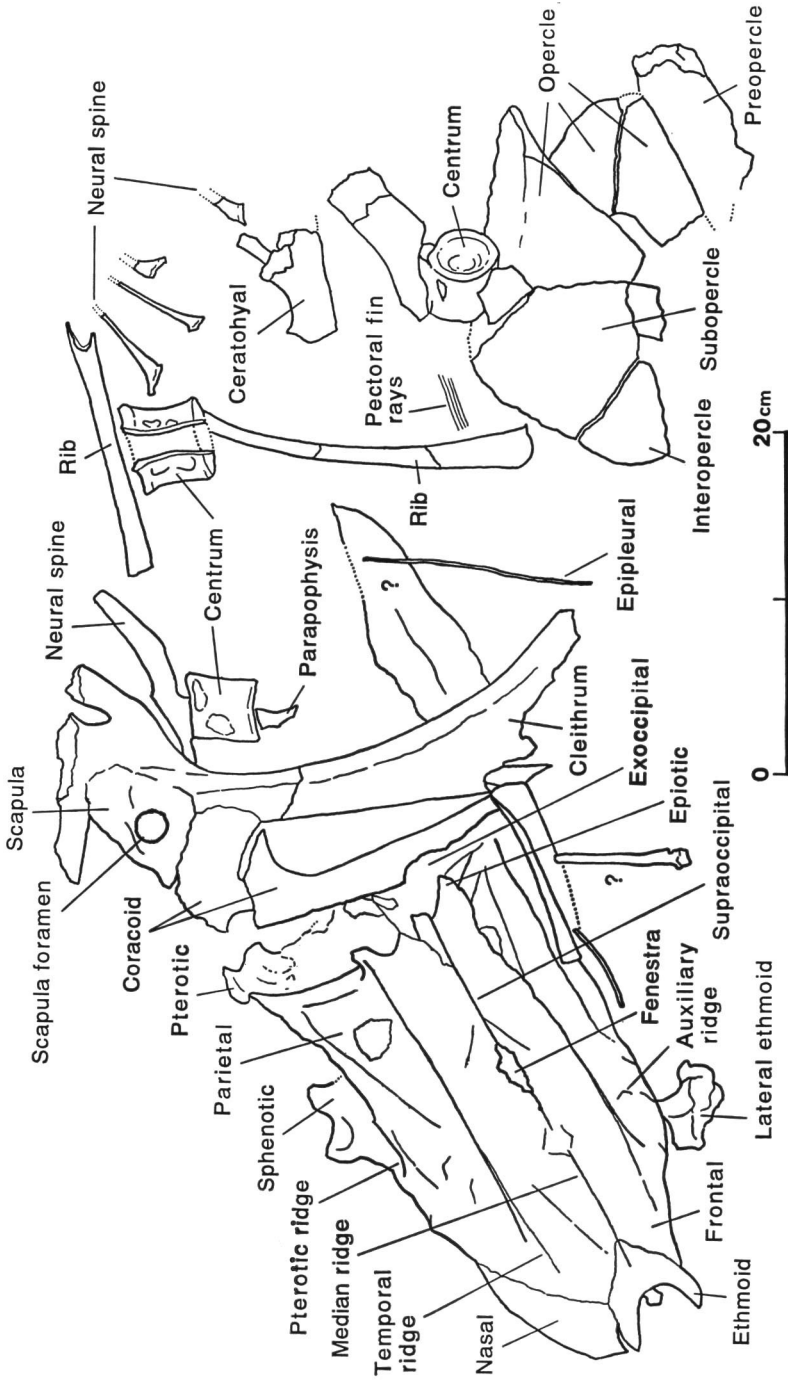


Fig. 2. *Scomberomorus chichibu* sp. nov., holotype, SMNH-Ve-30. Modified from UYENO and SAKAMOTO (1985).

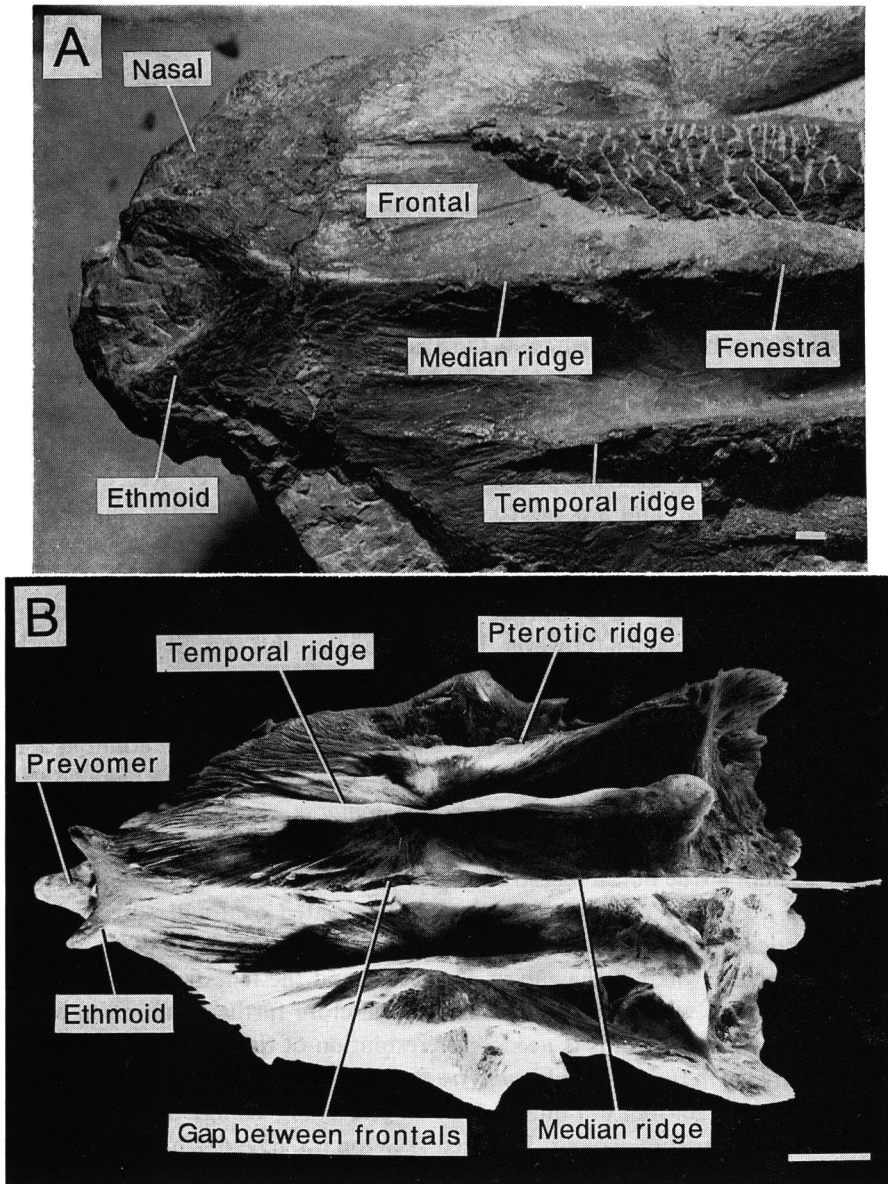


Fig. 3. Dorsal view of cranium. A, *Scomberomorus chichibu* sp. nov., holotype, SMNH-Ve-30; B, *S. sinensis*, USNM 269706. Scale bar indicates 10 mm.

unidentified bones are all disparately preserved.

### Discussion

Based on the five well-developed ridges, especially the temporal ones originating on the anterior part of the frontal bones in the dorsal part of the cranium, the present species was definitely assigned to the genus *Scomberomorus* in the family Scombridae (see COLLETTE & RUSSO, 1984) by UYENO and SAKAMOTO (1985).

Of the 17 Recent species in *Scomberomorus*, five species are found around Japan (COLLETTE and RUSSO, 1984; RAO & LAKSHMI, 1993; NAKABO, 1993). More than 20 fossil species have been reported from the Paleocene to Miocene of North America, Europe, Africa and Japan (WOODWARD, 1901; JONET, 1967; BANNIKOV, 1985; OHE *et al.*, 1986; OHE & MATSUOKA, 1989). Since almost all fossil species were described mainly on the basis of jaw elements along with some other fragmental bones, they are not easily comparable with the present species. Within the 17 Recent species of *Scomberomorus*, UYENO and SAKAMOTO (1985) have suggested that the fossil specimen most closely resembles *S. sinensis* which is distributed from Japan to Southeast Asia (Fig. 3), as it possesses a "frontal fenestra" between the frontals at about the same location as a "wide gap" in *S. sinensis* (see COLLETTE & RUSSO, 1984). Reexamination of the Nagura specimen, however, has revealed that this species is distinguishable from *S. sinensis* in the following characters: the temporal ridges reach to the level of the posterior end of the ethmoid (they do not in *S. sinensis*) (Fig. 3), a fenestra or wide gap between the frontals is short (long in *S. sinensis*) (Fig. 3), and the ethmoid is moderately forked anteriorly (vs. widely forked) (Fig. 3). Therefore, we have concluded that this Miocene fish is a new species of *Scomberomorus*.

COLLETTE and RUSSO (1984) considered that a wide gap between the frontals in *S. sinensis* was not a true pineal fenestra. The fenestra in *S. chichibu* sp. nov., however, appears to be a pineal fenestra because it is an elongated oval and surrounded by a slightly expanded area as in the scombrid genus *Thunnus* (see IWAI *et al.*, 1965). It remains problematic whether the gap in *S. sinensis* and the fenestra in *S. chichibu* sp. nov. are homologous with each other or not. Therefore further anatomical comparison throughout the scombroids is needed for resolution of this question.

*Comparative material:* *Scomberomorus sinensis*, USNM (U.S. National Museum of Natural History) 269706, 677 mm in fork length, Hong Kong; *S. niphonius*, NSM (National Science Museum, Tokyo) PV dried skeleton no. 659, 682 mm in total length, off Odawara, Kanagawa Pref., Japan, 1982.9; *Acanthocybium solandri*, NSM PV dried skeleton no. 561, 1660 mm in total length, North Pacific, 1981; *Grammatorcynus bicarinatus*, NSM PV dried skeleton no. 211, Okinawa Is., Japan, 1977. 10. 5.

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