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Inabaperca taniurai, a New Genus and Species of Miocene Percoid Fish from Tottori Prefecture, Japan

Yoshitaka Yabumoto[1] and Teruya Uyeno[2]

[1]Kitakyushu Museum and Institute of Natural History, 3–6–1 Nishihonmachi, Yahatahigashi-ku, Kitakyushu, Fukuoka, 805–0061 Japan
[2]Department of Geology and Paleontology, National Science Museum, 3–23–1 Hyakunin-cho, Shinjuku-ku, Tokyo, 169–0073 Japan

Abstract A percoid fish, *Inabaperca taniurai* gen. et sp. nov. is proposed on the basis of three specimens from the Middle Miocene Iwami Formation, Tottori Prefecture, Japan. The new genus is assigned to the family Sinipercidae, and distinguished from other genera by the presence of a distinct notch between the crest and anterior portion of the supraoccipital bone, a strong posteriorly extended opercular spine with dorsal lobe, and an emarginate caudal fin. This species has 12 abdominal and 15 caudal vertebrae, 136 to 150 minute scales in a longitudinal row. These fossils were found with marine life known to inhabit a shallow marine environment. All other species of the Sinipercidae live or lived in freshwater.

Key words: Middle Miocene, percoid fish, family Sinipercidae, Order Perciformes, Tottori Prefecture

Introduction

The Iwami Formation of the Tottori Group (Uemura *et al.*, 1979; Matsumoto, 1991) at Miyanoshita, Kokufu-cho, Tottori Prefecture, Japan has yielded numerous fossil specimens (Uyeno & Suda, 1991; Sakamoto & Uyeno, 1993; Yabumoto & Uyeno, 1994; Sato & Uyeno, 1999; Uyeno & Sakamoto, 1999). As the sixth account in a series describing the fossil fishes from this locality, we describe a new genus and species of the percoid fish family Sinipercidae. In the process of describing this new genus and species, extant and fossil members of the genera *Siniperca* and *Coreoperca*, family Sinipercidae were compared and listed in Table 1.

Institutional abbreviations: IOZ (CAS) (Institute of Zoology, Chinese Academy of Sciences); IVPP (Institute of Vertebrate Paleontology and Paleoanthropology, Chinese Academy of Sciences); KMNH (Kitakyushu Museum and Institute of Natural History); TRPM (Tottori Prefectural Museum).

Table 1. List of specimens compared.

Species	Catalogue number (no. of specimens)	Standard length (in mm)	Locality
Extant species			
Siniperca undulata	IOZ (CAS) 62536 (1)	93.3	Guangxi in China
S. kneri	IOZ (CAS) 61180 (1)	161.0	Guangxi in China
S. scherzeri	IOZ (CAS) 63863 (1)	80.1	Guangxi in China
	KMNH VR 000,102-000,107 (6)	114.1–223.0	Muju in Korea
S. obscura	IOZ (CAS) 65174 (1)	102.6	Guizhou in China
S. chuatsi	KMNH VR 000,100 (1)	214.9	Beijing in China
	KMNH VR 000,101 (1)	265.0	Beijing in China
	Skeletal specimen in IVPP (1)	273	Tianjin near Beijing
	Skeletal specimen in IVPP (1)	256	Wuhan in China
Coreoperca herzi	KMNH VR 000,102-000,109 (8)	58.1–100.0	Muju in Korea
C. whiteheadi	KMNH VR 000,117 (1)	79.2	Guangxi in China
C. kawamebari	KMNH VR 000,110 - 000116 (7)	39.4–76.1	Kitakyushu in Japan
Fossil species			
S. wuxiangensis	IVPP V 2457, Holotype (1)	—	Shanxi in China
C. shandongensis	IVPP V 11523. 1, Holotype (1)	104.4	Shanwang in China
	IVPP V 11523. 2–18, Paratypes (17)	—	Shanwang in China

Systematic Paleontology

Class Osteichthyes Huxley, 1880
Order Perciformes Bleeker, 1859
Family Sinipercidae Roberts, 1993
Genus *Inabaperca* nov.

Diagnosis: This genus differs from other members of the family Sinipercidae in having a distinct notch between the crest and anterior portion of the supraoccipital bone, a strong opercular spine which is posteriorly extended with dorsal lobe, and an emarginate caudal fin.

Type species: *Inabaperca taniurai* sp. nov.

Etymology: The generic name is derived from Inaba, which is an ancient name of the eastern part of Tottori Prefecture, and perca referring to perch.

Inabaperca taniurai sp. nov.
(New Japanese name: Inabaketsugyo)

Pls. 1–7

Holotype: Holotype, TRPM 664-0185 (Pls. 1, 2) is an almost complete specimen, but the posterior part of the caudal fin and the lower part of the shoulder girdle are missing. The counterpart is not preserved. Standard length is 65.6 mm.

Paratypes: TRPM 664-061 is an almost complete specimen (Pls. 3, 4) collected by Iwao Yamana. The anterior half of the body is better preserved in the counterpart. Standard length is 53.3 mm. KMNH VP 100, 245. (Pl. 5). Bones of the head and anterior part are disarticulated and scattered. The skeleton of the posterior portion beginning with the fourth abdominal vertebra is articulated and complete. This specimen was collected and donated by Toshiteru Maruo.

Etymology: The specific name honors Mr. Minoru Taniura, who provided with the holotype.

Horizon: All specimens were discovered from rock belonging to the Middle Miocene Iwami Formation of the Tottori Group at Miyanoshita, Kokufu-cho, Tottori Prefecture, Japan. The locality is discussed in Uyeno *et al.* (1999).

Diagnosis: As for the genus, monotypic species.

Description of the holotype: Body depth is moderate, and the head large (Pl. 1). Standard length is about 3 times body depth and about 2.7 times head length. The dorsal and ventral profiles of body are moderately convex. Except for the absence of the posterior part of the supraoccipital crest, the neurocranium is well preserved.

Length of the cranium is about 3.3 times the depth at the posterior margin of the orbit. Length of the ethmoid region is about half of the otic and occipital regions.

Eye is large and occupies the orbital cavity. The anterior margin of the mesethmoid is steep. There is a notch between the frontal and mesethmoid. The anterior end of the prevomer is pointed antero-ventrally. The prevomer has small conical teeth. There are no teeth on the parasphenoid. The frontal is long. The neurocranial lateral line on the frontal is branched above the posterior margin of the orbit.

The supraoccipital crest is well developed. There is a notch between the crest and anterior portion of the supraoccipital. The crest has lateral ridges along the dorsal margin. The premaxilla has small conical teeth, a long ascending process, and a large articulating process for the maxilla. The ascending process is longer than the articulating process. The anterior end of the maxilla has two condyles and the posterior part is thin and broad. The dentary is long, with conical teeth on the oral margin, extending below the anterior margin of the orbit.

The preopercle has four spines, two at the postero-ventral corner, the others at the lower margin. Seven branchiostegal rays are preserved along the anterior margin of the shoulder girdle. The insertion of the pelvic fin is high. The lower postcleithrum extends postero-ventrally. The pelvic girdle is oblique and inserts in the shoulder girdle. The ten ribs are short and curved, extending to midway between the abdominal vertebrae and the ventral margin of the abdomen.

The total number of vertebrae is 27, 12 abdominal and 15 caudal. Each centrum is longer than its depth. The first to seventh anterior neural spines are broad. Of the three supraneurals, the last one and the first proximal pterygiophore of the dorsal fin are inserted between the second and third neural spines. The second and third proximal pterygiophores are inserted between the third and fourth neural spines.

The dorsal fin consists of 11 spines and 11 soft rays, the origin being above the anterior end of the fifth abdominal vertebra. The first and second dorsal spines are short, the fourth and fifth longest. The dorsal fin base is long with the base of the spines being longer (1.7 times) than that of the soft rays. The origin of the soft rays is slightly forward of the origin of the anal fin. The number of distal pterygiophores is 21. The proximal pterygiophores of the dorsal fin have bony plates developed anteriorly and posteriorly from the lateral wings.

The anal fin has 3 spines and 8 soft rays. The first spine is short and about half the length of the second. The third spine is slightly shorter than the second. The anterior soft rays of the anal fin are longer than the spines. There are 11 proximal pterygiophores of the anal fin, the first being long and extending to near the caudal vertebra. Of the five hypurals, the second is slender with a space between it and the third, and the fifth hypural is short. The urostyle and the first uroneural appear to be fused. The second uroneural is slender. There are three short epurals, the length being about half that of the neural spine of the third preural centra. The neural arch and spine of the second preural centra is not complete. The number of branched caudal fin is 15, with 7 in the lower lobe and 8 in the upper lobe.

Scales on head and body are small and cycloid having several v-shaped ridges on the exposed portion. The estimated number of scales in a longitudinal row ranges from 136 to 150. The basal parts of the caudal, dorsal and anal fins are covered by scales.

Description of the paratypes: Proportions of body (TRPM 664-061) are similar with those of the holotype. The supraoccipital crest is well preserved and the posterior end is slightly apart from the first supraneural. The posterior margin of the crest is slightly inclined. The anterior end of the maxilla is well preserved, the dorsal margin thickened. The neurocranial condyle and the premaxillary wing for the maxilla are large, the latter being larger. The quadrate is thick. The symplectic is stout and long (Pl. 4). The pelvic girdle well inserts between the ventral end of the pectoral fin insertion and the ventral end of the shoulder girdle. The estimated number of scales in a longitudinal row ranges from 136 to 148. The basal parts of the caudal, dorsal and anal fins are covered by scales. The caudal fin is emarginate.

The meristics of the dorsal and anal fins and the abdominal vertebrae (KMNH VP 100, 245) are the same as the holotype. The opercle has a strong spine extending backward and a wing above the process. The anguloarticular is long and low. The urohyal is deep.

Remarks and Discussion

The combination of the following characters indicates that this new genus *Inabaperca* is a member of the family Sinipercidae (the family diagnosis is compiled in this paper): 1) 27 vertebrae consisting of 12 abdominal and 15 caudal vertebrae, 2)

11 dorsal fin spines and 11 soft rays, 3) 3 anal fin spines and 8 soft rays, 4) 2 spines on the opercle, 5) 4 spines on the preopercle, 6) 136–150 minute cycloid scales in a longitudinal row, 7) the dorsal, anal, and caudal fin bases covered with scales. Two genera, *Siniperca* and *Coreoperca*, both fossil and extant have been known in the family from eastern Asia. *Inabaperca* differs from *Coreoperca* in having spines on the preopercle, minute scales on body and longer dorsal spines, without serrated posterior and ventral margins of the preopercle, and more numerous (more than 130) lateral line scales. *Inabaperca* is closer to the genus *Siniperca* than to *Coreoperca* by having the following characters: four preopercular spines, a strong opercular spine, minute scales on body, and long dorsal fin spines. The scales are morphologically similar to those of the *Siniperca* having several arc-like ridges on the exposed portion. *Inabaperca*, however, is distinguished from *Siniperca* in having an emarginate caudal fin and a supraoccipital notch (round caudal fin, and no supraoccipital notch in the latter).

To date, the following fossil sinipercids have been reported from Japan and China: *Coreoperca fushimiensis* Ohe and Ono, 1975 (Miocene Nakamura Formation in Kani City, Gifu Pref., Japan); *C. kaniensis* Ohe and Hayata, 1984 (Miocene Hiramaki Formation in Kani City, Gifu Pref., Japan); *C. shandongensis* Chen, Liu and Yan, 1999 (Shanwang Formation of the late Early Miocene in Linqu County, Shandong Prov, China); and *Siniperca wusiangensis* Liu and Su, 1962 (Pliocene sediments in Yushe, Shansi Prov., China). Fossil species of the both *Siniperca* and *Coreoperca* have also been found in Miocene beds in Iki Island Nagasaki Pref., Japan, showing that the two genera already occurred during Middle Miocene. All members, fossil and extant, of the other two genera are known solely from freshwater. On the other hand *Inabaperca taniurai* was found in the Fuganji Mudstone Member of the Iwami Formation, a marine deposit yielding many fossils of marine organisms including fish. *Inabaperca* is thus the first sinipercid species from a marine environment.

The genera *Siniperca* and *Coreoperca* were considered to be members of the family Percichthyidae, placed in centropomid lineage (Johnson, 1984; Nelson, 1994). Roberts (1993) placed these genera in the family Sinipercidae on the basis of scale morphology. We support Roberts (1993), because not only do they have cycloid scales, but also a restricted geographical distribution and an origin now believed to be the shallow sea of eastern Asia.

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Explanations of Plates

Abbreviations: BRA, branchiostegals; CHY, ceratohyals; CLE, cleithrum; DEN, dentary; ECP, ectopterygoid; ENP, endopterygoid; HYO, hyomandibular; MAX, maxilla; MET, metapterygoid; OPE, opercle; PARA, parasphenoid; PREM, premaxilla; PREO, preopercle; PT, posttemporal; QUA, quadrate; SUPM, supramaxilla; SUPO, supraoocipital; SYM, symplectic.

Plate 1.
Holotype (TRPM664-0185) of *Inabaperca taniurai* gen. et sp. nov.

Plate 2.
Head region of the holotype (TRPM664-0185) of *Inabaperca taniurai* gen. et sp. nov.

Plate 3.
Paratype (TRPM664-061) of *Inabaperca taniurai* gen. et sp. nov.

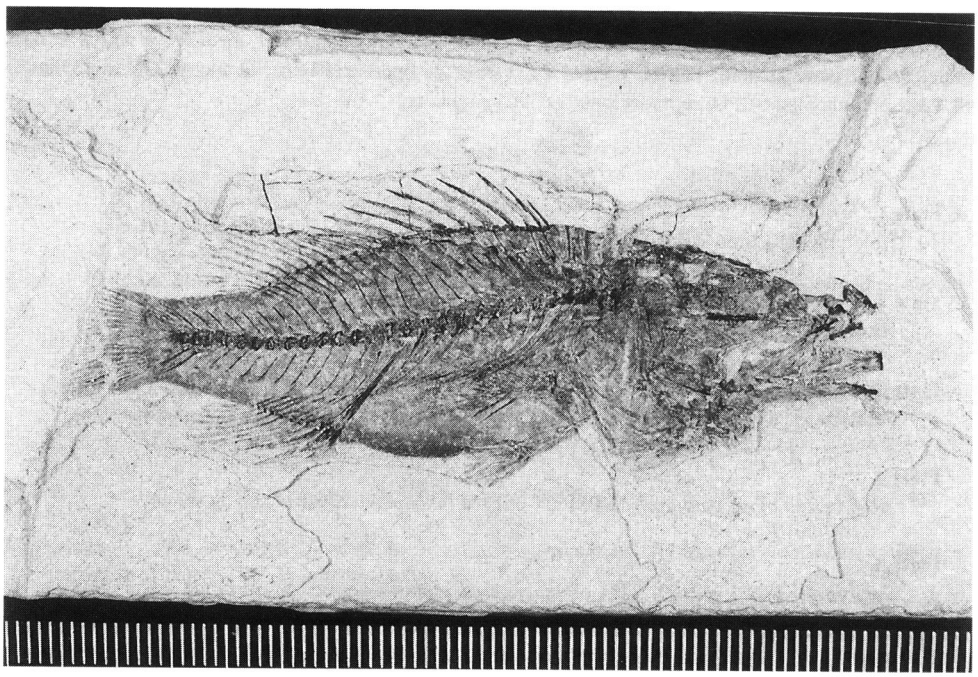
Plate 4.
Head region of the paratype (TRPM664-061) of *Inabaperca taniurai* gen. et sp. nov.

Plate 5.
Paratype (KMNH VP100, 245) of *Inabaperca taniurai* gen. et sp. nov. and detail showing squamation including ridges of the holotype (TRPM664-0185).

Plate 6.
Opercles of *Inabaperca taniurai* gen. et sp. nov. (top row) and four percoid fishes.

Plate 7.
Scales on body of *Inabaperca taniurai* gen. et sp. nov. (top) and *Siniperca scherzeri*.

Plate 1



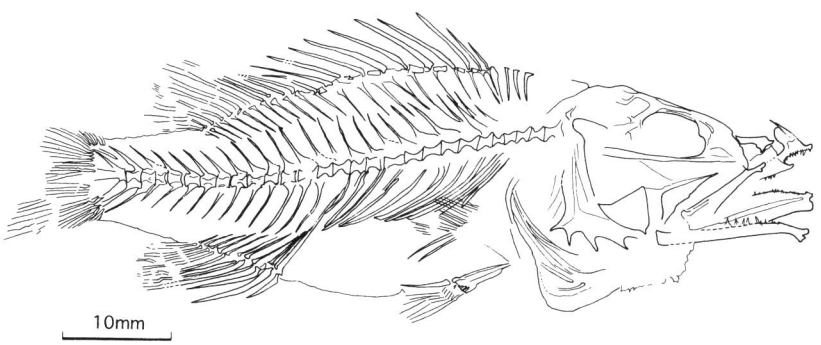
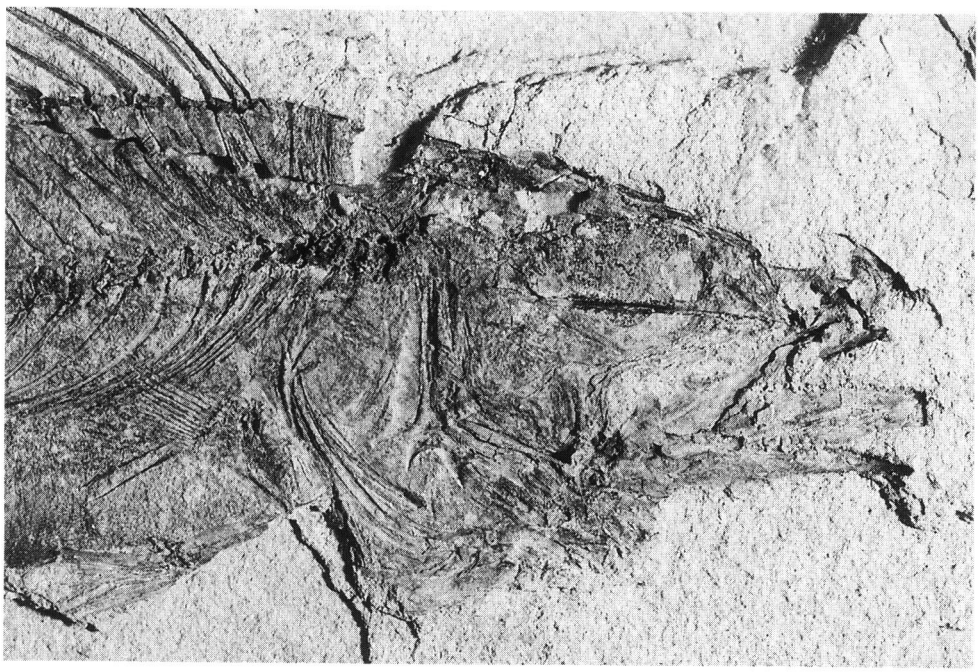
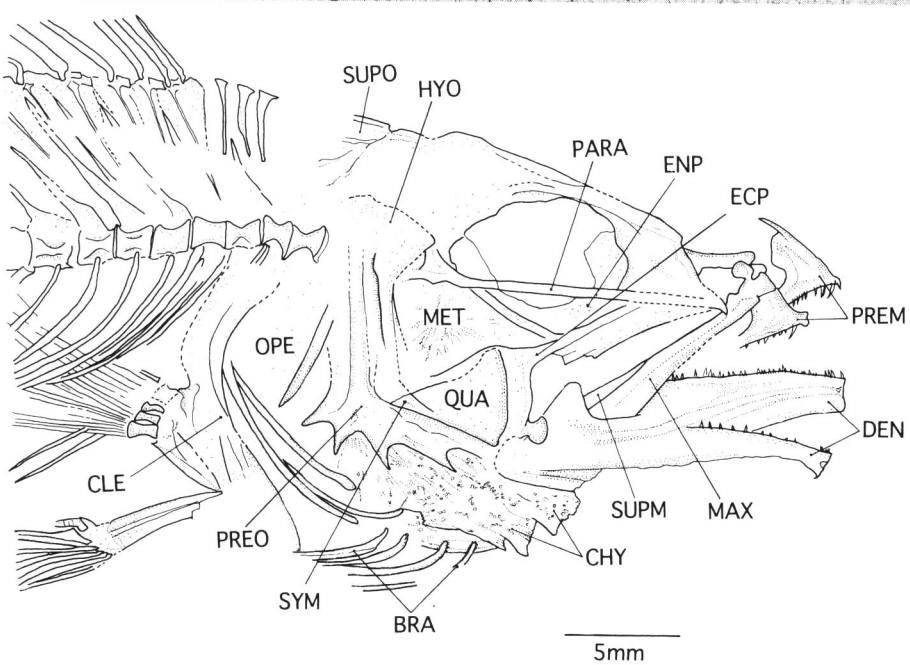


Plate 2

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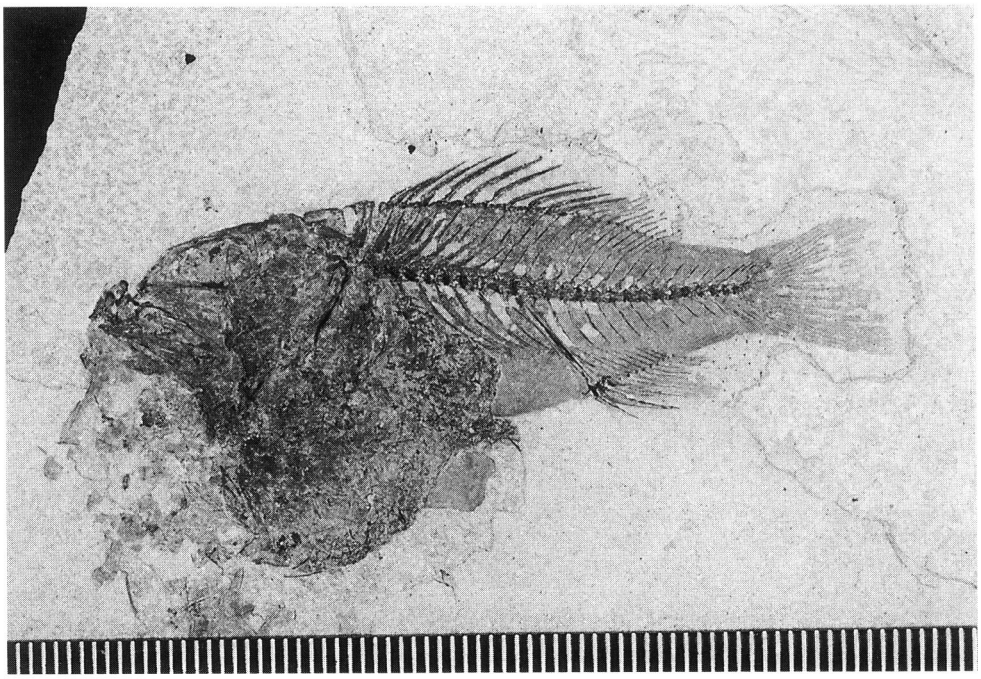


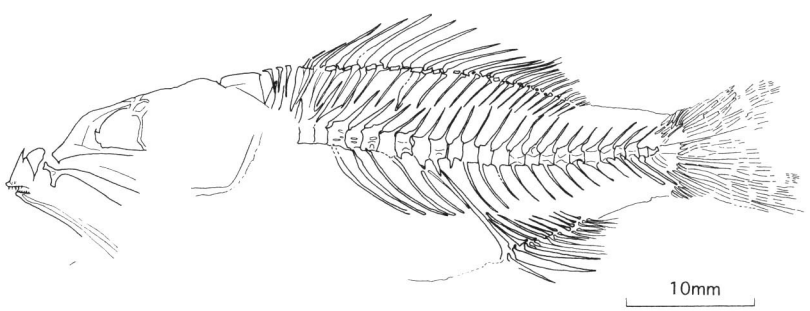
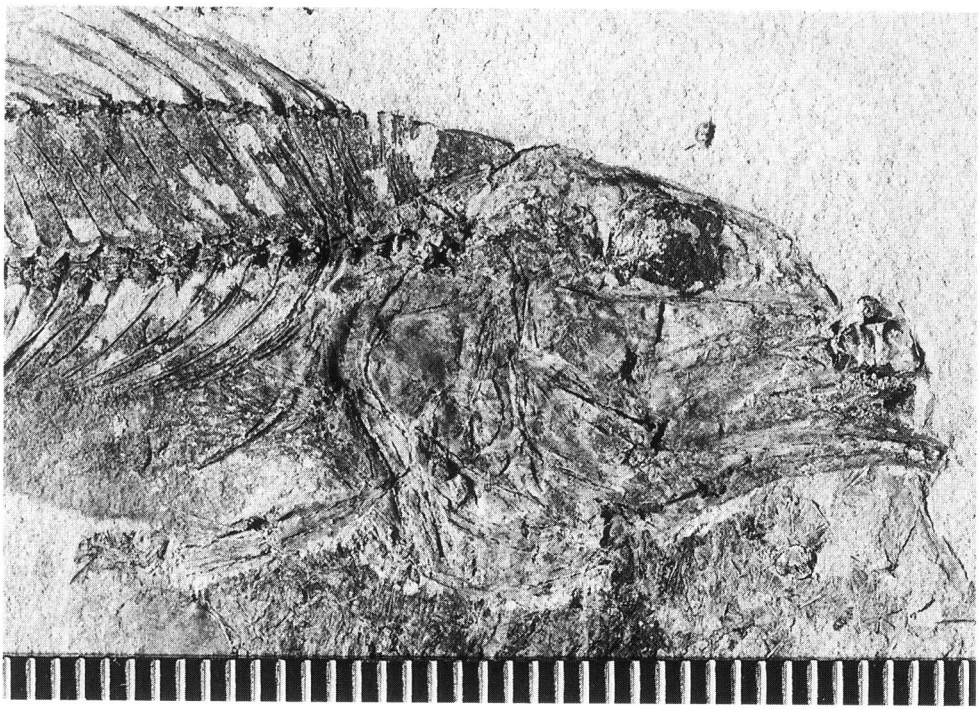


Plate 4



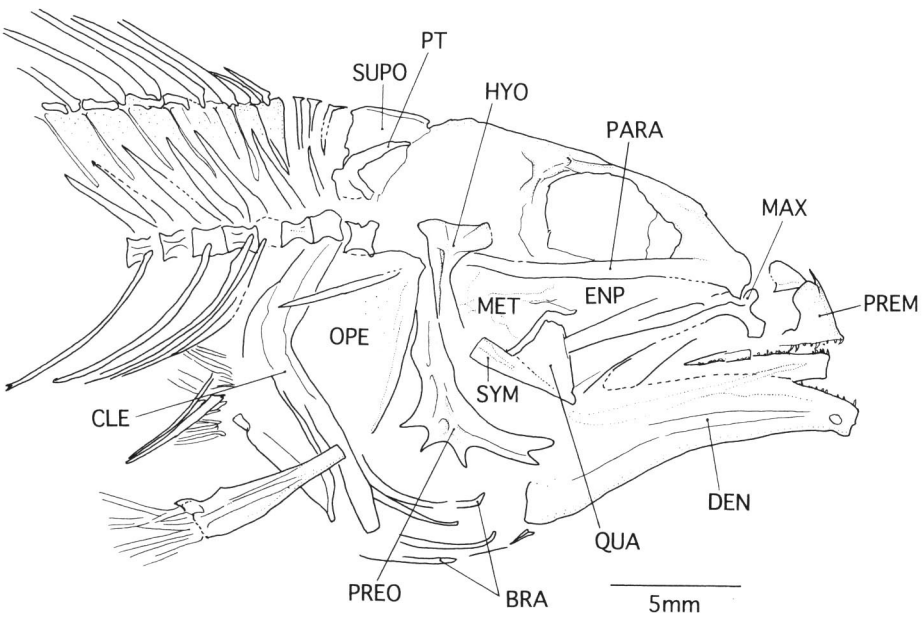

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Plate 5

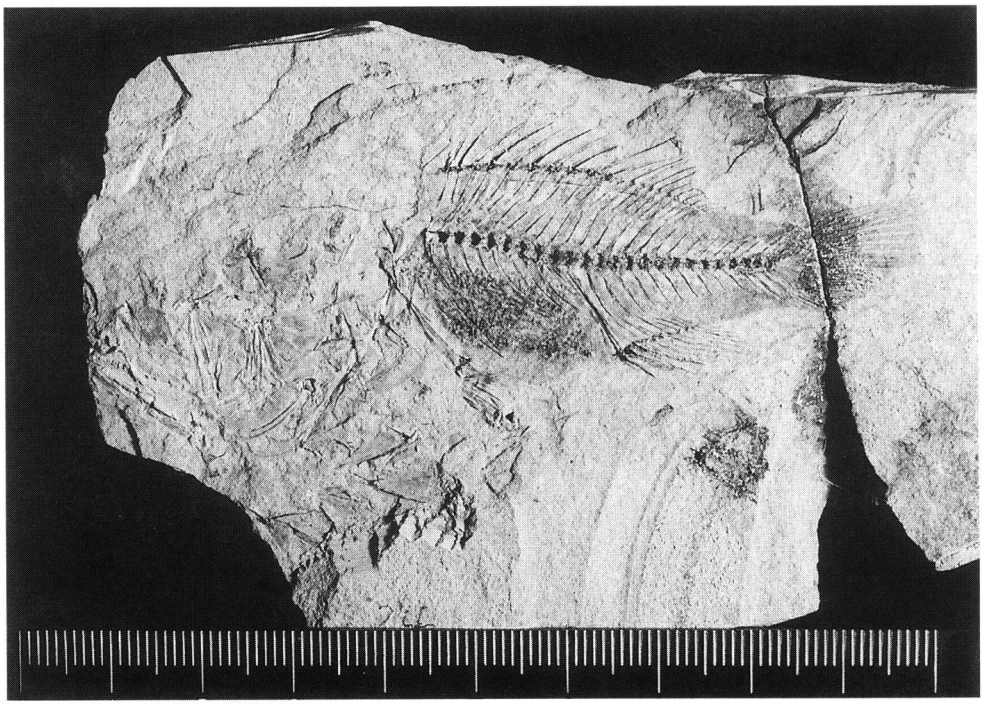
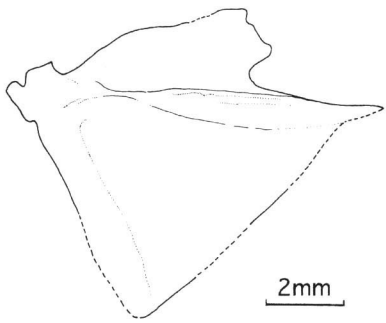
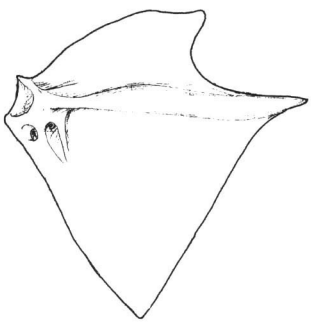


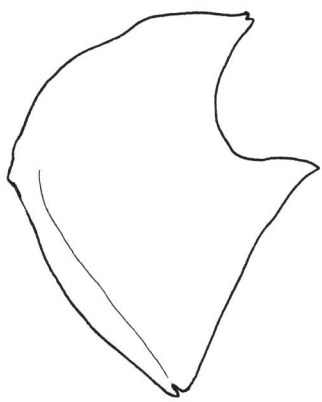
Plate 6



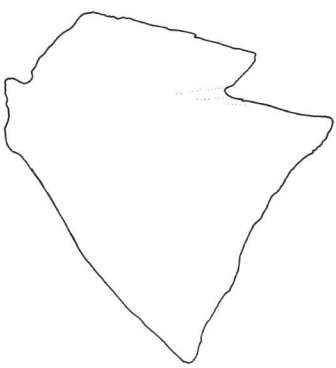
Inabaperca taniurai



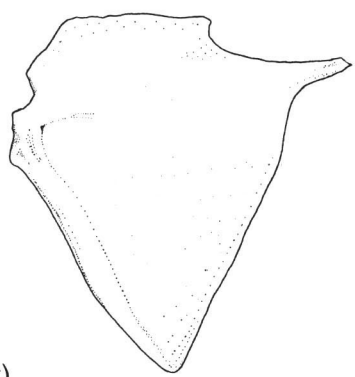
Siniperca scherzeri (extant)



Coreoperca kawamebari (extant)



Stereolepis gigas (extant)



Lateolabrax japonicus (extant)

Plate 7