A new fossil Carangid fish from the Miocene Toyooka formation, Okutango Peninsula, Kyoto Prefecture, Central Japan

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奥丹後半島中新統からのアジ科魚類化石

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（要　旨）

奥丹後半島の北東部，京都府与謝郡伊根町足谷地区の小谷に露出する豊岡累層福之内層灰岩・砂岩・泥岩層から産出したアジ科魚類化石の種属について検討した結果，アジ科イケガツオ属（***Chorinemus***）の新種であることが判明し，イネイケガツオ（***Chorinemus inensis*** OHE and FURUHASHI）と命名した．

現生イケガツオ属は暖海性中層遊泳型の魚類でアジ科魚類の中では祖先的な形質を多くもち，サバ科とも比較され，その進化系統樹中では基部に位置ずけられる．

本報告では主として新種の形態的記載をおこなった．外形的，骨格的特徴は次のように概括される．

（1）　総体長81 mmの紡錘型小魚で頭部が総体長に比べ異常に大きい．総体長は頭長の3.8倍である．（2）　主上顎骨は眼の中心下まで達する．（3）　下顎骨は細長く直線的でアジ科魚類一般にみられる歯骨と関節骨の接続によって形成される間隙（Interosseous space）はない．（4）　体表保存の鱗は細長く矢先形．この鱗形はイケガツオ亜科の特徴である．（5）　尻鰭を支えている第一中間血間棘は太く，その基部は血管棘に融合する．また，その末端部には強大な2つの尻鰭棘が附着する．（6）　第二背鰭，尻鰭は軟条．両鰭の後部はサバ科等にみる遊離鰭（fin-let）に変化する．（7）　眼下骨 SO_1, SO_2 の間に三角形状の眼下骨床（第2図）が存在する．（8）　尾椎骨数は16，腹椎骨は一部不完全であるがその数は10である．（9）　尾骨（第3図）の下尾軸骨 HY1—4 は融合して三角扇状に発達する．

このような特徴を備える種属は ***Chorinemus*** 属以外に ***Oligoplites*** 属がある．両者は外形的には区別がつかず，***Chorinemus*** 属（7種）は太平洋に，***Oligoplites*** 属（4種）は太西洋に生息する．しかし，頭蓋骨の形状の相違，尾椎骨数15，眼下骨床の欠除などの点で区別される．

現生種との比較では頭長の総体長に対する比の値が現生種のものに比較して小さいことや第二背鰭始部が尻鰭始部よりやや前方にあって異なる．しかし，基本的には日本近海に生息する ***Chorinemus orientalis*** TEM. et SCH. に似る．

日本近海では黒潮影響下の太平洋沿岸に2種生息する．イケガツオ属は熱帯から温帯まで世界的に分布するが前述したように大西洋，太平洋で生息する属が違うこと，種の数が少ないことなど生態的に興味深い．また，古生物地理的分布においては現在のところ，ソ連の北東コーカサス地方の中新統 Maikop deposit からの ***Oligoplites*** 属が1種記載されているのみで，今後，本種とより詳細な検討を試みねばならない状況である．また，Maikop deposit と福之内層灰岩・砂岩・泥岩層とは魚類フォーナが多量の暖海性ニシン科魚類（例えばサッパ属）を含むことで類似性が高く，今後，奥丹後半島中新統の堆積環境，地史を考察していく上で，魚類フォーナ解明が待たれるところである．

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Introduction

In May, 1976, Mr. Toshihiko OHE, who is a student of Mineyama Senior High School, Kyoto Prefecture, collected a small fossil Carangid fish from the Miocene tuffaceous bed exposed in a small valley near Ashidani, Ine, Yosa-gun, Kyoto Prefecture.

The authors have reached the conclusion that this represents a new species closely related to the living Carangid fish *Chorinemus orientalis* TEM. et SCH. inhabiting from Sagami Bay to the southern Pacific coast moreover to subtropical zone.

The geological environment around the locality, where is situated in the northeastern part of the Okutango Peninsula, composed mainly of the Neogene rocks consisting of conglomerate, sandstone, muddy shale, andesite-lava, tuff-breccia and tuff. These Neogene rocks were classified into two parts by HIROKAWA and KURODA (1957, 1959). The lower part is mainly composed of sedimentary rocks and was named the Yosa group (middle and upper Miocene), while the upper part called the upper Neogene volcanic rocks is composed of andesitic lava and agglomerates which unconformably overlies the Yosa group and is Pliocene in age. According to this classification, it is said that the bed which the present new species occurred belongs to the upper horizon of the Yosa group.

Afterwards, IKEBE, WADATSUMI and MATSUMOTO (1965, 1966) made the stratigraphical studies on the Neogene volcanic rocks in San'in district. In their studies, the above classification in this area was recomposed into a new unified stratigraphical classification in the comparison with the situations of Neogene volcanic rocks of other areas in San'in district and named Hokutan group and Teragi group (Pliocene). According to their detailed report on the stratigraphical sequence in this area (WADATSUMI, IKEBE and MATSUMOTO 1966), the position of the bed can be situated in Fukunouchi member of Toyooka formation (Table 1). The Toyooka formation has two different geological facies between the northwestern and northeastern parts and the central and southern parts of Okutango Peninsula. The lower members of this formation in each part commonly show the facies of a lake deposit or a fan-deposit formed in an inland basin on an early stage of the process of those deposition. What is said above is of course evident in the occurrence of a few fossil plants belonging to Daishima type flora that is from conglomerate, sandstone and shale beds distributing widely in each part. The middle and upper members of the formation show the facies of the deposit accumulated in the lake which seems to have been enlarged in its southern part and to have changed into a shallow sea in its northern part by the transgression in response to a serial movement of the basement of this age under intrusions of volcanic rocks such as rhyolite or volcanic eruptions. The yellow tuffaceous shale (Fukunouchi member) exposed at Koshiyama, Ashidani (the locality of the present species) and Fukunouchi in the northeastern part of the Peninsula is just the part of a marine deposit accumulated under such circumstance.

Table 1. Stratigraphical sequence of the Tertiary deposits developed in the Okutango Peninsula, Kyoto Prefecture. (After WADATSUMI, IKEBE and MATSUMOTO 1966, partly revised)

		The northeastern part of Okutango Peninsula		The southern and central part of Okutango Peninsula	
		Member	Remarks	Member	Remarks
Hokutan Group (Miocene)	Taigo F.				
	Amino F.	Choen ss tf			
		Nojiri wtf			
		Honzaka Rh			
		Sugano A			
		Kittani wtf			
		Takine cgl		Dake cgl	
	Toyooka F.	Fukunouchi tft ss ms Hide Rh	Clupeoid fishes marine fishes *Comptonia naumanni*	Kamiseya sh ss tf	Cyprinid fishes *Castanea miomollissima* *Quercus miovariabilis* *Fagus antipofi* *Metasequoia occidentalis* *Zelkova ungeri*
		Atsugaki sh			
		Oshima ss cgl		Komakura cgl ss	
		Honmaru cgl			
				Matsuo cgl	
				Uchiyama cgl ss	
				Shimoseya ss	
	Yo.	Andesite		Andesite	
	Ta.	Tourakuji cgl ss		Tourakuji cgl ss	*Fagus antipofi*
Miyazu Granite					

ss: sandstone, tf: tuff, Rh: rhyolite, A: andesite, cgl: conglomerate, tft: tuffite, sh: shale, wtf: welded tuff

Till now, the authors have collected many well preserved Clupeid fishes such as *Harengular* sp., a small species of family Gobiidae, *Hypomesus* sp. of family Osmeridae, a large species of family Congridae, *Acanthopsetta* sp. of family Pleuronectidae and new species *Chorinemus inensis* of family Carangidae from the above two localities (Koshiyama and Ashidani) (FURUHASHI 1977).

Both the central and southern parts of the lake had kept its state since an early stage and formed a thick lake sediment, for example it is characterized by Kamiseya member with the black shale bed exposed at Kigo, Miyazu City, which contains many fossil plants and a fresh water fish such as *Xeno-*

cyprinus (Cyprinidae) inhabiting in Chinese fresh waters.

The stratigraphical position of Fukunouchi member of the northeastern part in the Peninsula is possibly upper than that of Kamiseya member in that each member has an entirely fauna of fishes above mentioned.

Acknowledgements

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The authors wish to express their hearty thanks to the gentlemen mentioned above by name.

Description

Family Carangidae

Genus *Chorinemus* CUVIER et VALENCIENNES 1831

Species *Chorinemus inensis*, new species

Species name: Latin *inensis* after the locality of the holotype

Japanese name: Ine'ikegatsuo (Ikegatsuo is Japanese name of *Chorinemus orientalis* TEMMINCK et SCHLEGEL)

D: ?+I+20, P: 17, V: I+5, A: II+I+18, Vert: 10+16

Figs. 1, 2, 3. Tables 2, 3, 4. Plates 19, 20

Holotype: #MSHS 760521, Mineyama Senior High School, no. 1185, Furudono, Mineyama, Naka gun, Kyoto Prefecture, Japan; collectd by Toshihiko OHE, Mineyama Senior High School, May, 1976.

Locality: An exposed cliff on the east side in the small valley situating at about 550 meters south-south-east of Ashidani (35°42′N Lat., 135°13′3″E Long.), Ine, Yosa-gun, Kyoto Prefecture.

Horizon: Fuknnouchi member (WADATSUMI, IKEBE and MATSUMOTO, 1966), Toyooka formation, Hokutan group (Middle Miocene).

Occurrence: Tuffite bed, strike N20°W, dip. 30°E, with an alternation by paralleling black and gray laminae and which bears many small Clupeid fishes without mollusca.

Diagnosis: The head is large; its length is 3.8 times in the total length and the ratio is the smallest among other living species in genus *Chorinemus* (Table 3). The upper maxillary may reach beyond the vertical from the centre of the eye (Fig. 2). The lower jaw (dentary including articular) is very slender and not thick; its dorsal margin is straight without an interosseous space between the upper arm of dentary and the dorsal border of articular owing to their close mutual contact. Scales are slender and lanceolate. The first interhaemal spine is exceedingly strong with a expansion; its lower half being bent forward; its proximal end fuses into the expanded haemal spine under the first caudal centrum. Both of the second and dorsl fin and the anual fin change into some fin-lets without membranes at their posterior parts. A triangle-shaped suborbital shelf situates between SO1 and SO2 of the circumorbital bones. The caudal vertebrae consist of sixteen centra.

Description: The specimen is a small and elongated rhombus transversely in shape and is somewhat incomplete lacking the superior margin from the head to the anterodorsal part and skeletons below the margin; its total length is 81 mm. The dimension of the specimen is measured as in Table 2.

The head is large and its length is just a little longer than the depth of the body. The mouth cleft is large. The maxillary and premaxillary are not well preserved. But the space between the inferior circumorbital bone and the row of

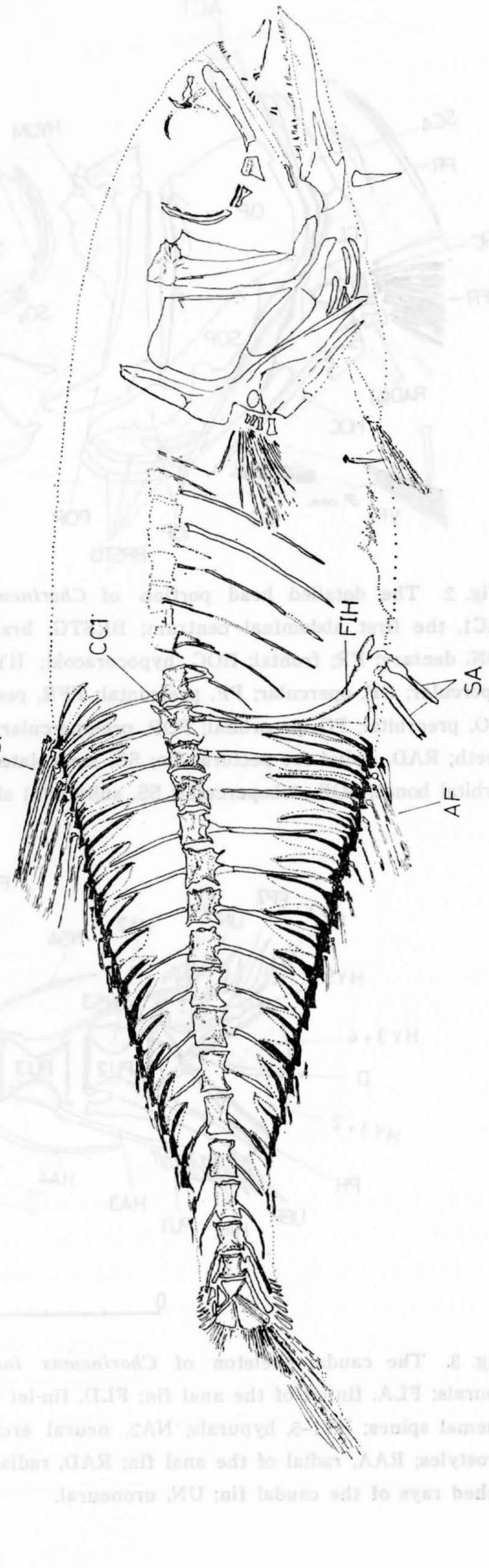

Fig. 1. The general profile of *Chorinemus inensis* n. sp. AF, the anal fin; CC1, the first caudal centrum; FIH, the first interhaemal spine; SA, spines of the anal fin; SDF, the second dorsal fin.

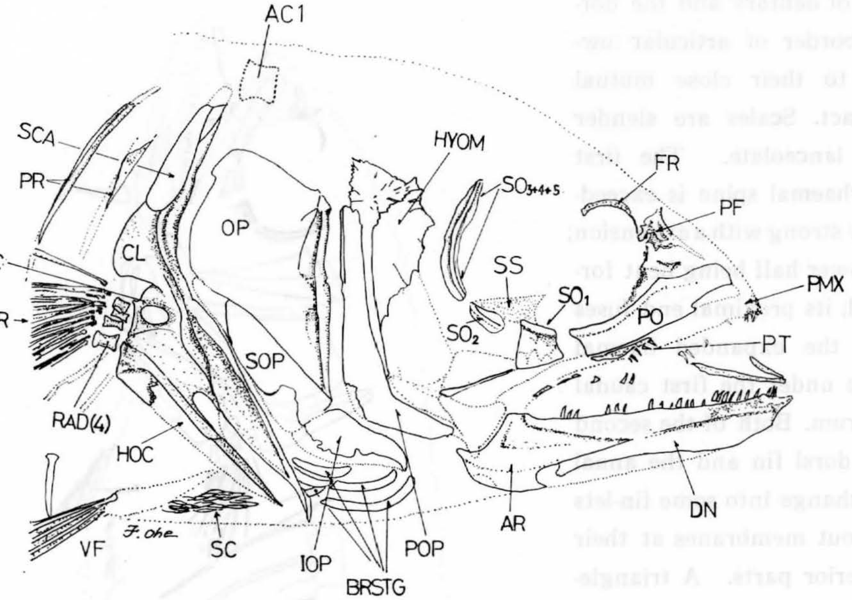

Fig. 2. The detailed head portion of *Chorinemus inensis* n. sp. AR, articular; AC1, the first abdominal centrum; BRSTG, branchiostegal rays; CL, cleithrum; DN, dentary; FR; frontal; HOC, hypocoracoid; HYOM, hyomandibular; IOP, inter opercular; OP, opercular; PF, prefrontal; PFR, pectoral fin ray; PMX, premaxilla; PO, preorbital; PO, preorbital; POP, pre-opercular; PR, pleural ribs; PT, palatine teeth; RAD, radial for pectoral fin; SC, lanceolate scale; SCA, scapular; SO1–5, sub-orbital bones; SOP, subopercular; SS, suborbital shelf; VF, ventral (pelvic) fin.

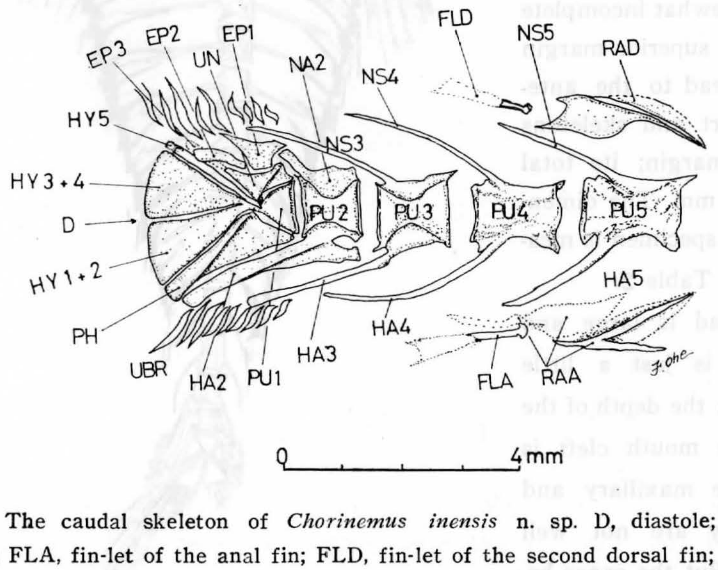

Fig. 3. The caudal skeleton of *Chorinemus inensis* n. sp. D, diastole; EP1–3, epurals; FLA, fin-let of the anal fin; FLD, fin-let of the second dorsal fin; HA2–5, haemal spines; HY1–5, hypurals; NA2, neural arch; PH, pre-hypural; PU1–5, pre-urostyles; RAA, radial of the anal fin; RAD, radial of the dorsal fin; UBR, unbranched rays of the caudal fin; UN, uroneural.

Table 2. Dimension of *Chorinemus inensis* n. sp.

Total length	81 mm
Standard length	69.9 mm
Body depth	18.4 mm
Least depth of the caudal peduncle	4.2 mm
Head length	21.5 mm
Postorbital head length	9.6 mm
Snout length	4.7 mm
Eye-diameter (the inside diameter of the circle which is formed by circumorbital bones)	6.4 mm
Lower jaw (including articular bone)	11.0 mm
Distance between the top of mouth and the beginning of the second dorsal fin	40.0 mm
Preabdominal length (distance between the top of mouth and the beginning of ventral fin)	23.5 mm
Distance between the top of mouth and the first spine of the anal fin	36.0 mm
Distance between the top of mouth and the first fin-let	43.9 mm
Length of the base of the second dorsal fin	25.0 mm
Length of the base of the anal fin	24.7 mm
Maximum ray of the pectoral fin	6.0 mm
Maximum ray of the pelvic fin	8.5 mm
Length of the first spine of the anal fin	4.5 mm
Maximum one among fin-lets of the anal fin	6.5 mm
Length of the first ray of the second dorsal fin	8.1 mm
Length of the maximum one among pleural ribs	11.8 mm
Length of the third haemal spine	7.5 mm
Length of the neural spine on the third centrum of caudal vertebra	4.7 mm
Length of caudal vertebra (distance from the anterior margin of the first centrum to the posterior margin of the hypurals)	36.6 mm
Abdominal depth beneath the first centrum of the caudal vertebra	10.6 mm
Dorsal height on the first centrum of the caudal centrum	6.1 mm
Average length of centrum of the caudal vertebra	2.1 mm

teeth is very narrow, therefore the maxillary seems to be elongate and slender. The snout seems to be about as long as the diameter of the eye. Preserved teeth are slender, small, sharp-pointed and their distal ends are slightly curved backward. In the arrangement and situations of teeth, it is guessed that there are teeth beneath not only the premaxilla but also the pterygoid (Fig. 2).

Circumorbital bones are well preserved in their shape and consist of one preorbital and five suborbital bones. Its constitution is just sidelong fallen j-shaped. The preorbital (PO) is a long membranous bone with a rhomboidal notch at its anterior end is larger than any other suborbital bone. The suborbital (SO1) is trapezium-shaped. SO2 and other suborbital ones are narrow. On their surfaces the sensory canal runs in parallel along the upper margin or their middle part. The laminal suborbital shelf seems to be on the upper space between SO1 and SO2 in the scanty impression.

The preopercular is j-shaped with smooth posterior margin and its anterior margin makes an obtused angle (123°). The opercular is higher than wide, irregularly quadrangular and its posterodorsal margin has a small constriction. The subopercular is longer than the interopercular in the vertical length. The shoulder girdle is strong and large, and is composed of seven constituents. Neither posttemporal nor supratemporal is preserved at the highest level. The supraclavicle is smooth and elongated ellipse; its distal end formed by a round margin. The radials for the pectoral fin ray four in number and their laterals become hollow like one of centrum. The hypercoracoid has a large and round opening. The upper half of the cleithrum projects backward as a triangle-shaped membranous bone with the vertical elongation.

The first dorsal fin is composed of a small number of free spines and can generally find in every subfamily of Carangidae, which is not preserved in this specimen. The second dorsal fin originates just above the first abdominal centrum. Two anal spines separate from the soft portion. Both posterior rays of the second and the anal fins are detached or semidetached without membrane and are penicillated. Scales are well preserved on the abdominal part between the ventral fin and the first spine of the anal fin, and also on the pectoral part. They are lanceolate and about five or six times longer than broad; its disposition looks like fingers crossed each other with a wavy direction.

The estimated length of abdominal centra (21.1 mm) in comparison with living species (*Chorinemus orientalis* TEM. et SCH.), namely the distance between the position (Fig. 2, AC1) of the first abdominal centrum above the opercular and the anterior margin of the first caudal centrum, divided by the average length of caudal centrum (2.1 mm), gives ten of the number of the abdominal centra.

Each caudal centrum is rather stout and its horizontal length is a little longer than its vertical length; especially in four centra from the tenth to the thirteenth. The haemal arch originates beneath the ninth abdominal centrum. The neural and haemal spines are rather strong. The first interhaemal spine is exceedingly strong and its lower half bends forwards. Every other interhaemal is dilated as a transparent membrane and triangle-shaped bone; in their center there is a strong axis which is curved backward and supports their membrane; the number of them is nineteen on the anal fin; beneath the dorsal fin there are twenty-one interneural spines (Fig. 1).

The pleural ribs are curved backward and are rather even and stout in the shape; those preserved are eight in number.

Both neural and haemal spines on the forth pre-urostyle (the thirteen caudal centrum) are gradually curved inwards; their length are more longer than those of the following centrum; their distal end are pointed (Fig. 3). The haemal spine of PU3 as in the Fig. 3 is slightly expanded as a thin board. The haemal spine of PU2 becomes a wide paddle and its proximal end has a filmy plate which protrudes forward. On the contrary, the neural spine does not extend and its proximal part changes into an expanded neural arch. Hypurals are composed of three bones; two of which are fan-shaped (HY 1-4) and fuses to one in their basal part, but separates into two ones by a narrow crevice (diastole) on their posterior margins. The prehypural adheres intimately to PU1 as an irregular quadrilateral. Epurals above PU1 seem to be composed of three small bones; the first epural (EP1) is trapezium-shaped against the other two epurals being small rectangle-shaped.

Discussion: This small fossil has generally fundamental features of the subfamily Chorineminae which contains two genera (*Chorinemus* CUVIER et VALENCIENNES 1831; *Oligoplites* GILL 1863).

Five species belonging to genus *Oligoplites* inhabit widely in the tropical and subtropical zones of Atlantic and Pacific Oceans (limited near Lower California, JORDAN and EVERMAN 1923). While genus *Chorinemus* has seven species inhabiting in Indo-west Pacific and Central Pacific Ocean, East coast of south Africa and Australia. They attain to a length of from 60 to 120 centimeters and some of them enter brackish water, while other are more numerous at some distance from the shore.

It is evident the present specimen belongs to genus *Chorinemus* in having the suborbital shelf in the cricumorbital bones and sixteen caudal vertebrae (MATSUBARA 1963; STARKS 1911). Genus *Oligoplites* has not the above features (absence and fifteen vertebra) and other Carangid species have mainly fourteen in number of caudal vertebrae except several examples.

In anatomical and taxonomical studies on the Carangid fishes of Japan by SUZUKI (1962), the present species definitely conforms to his osteological figures and internal description on *Chorinemus orientalis* TEM. et SCH; especially jaw (Fig. 19B, p. 77), shoulder girdle (Fig. 37, p. 107) and vertebral column (Fig. 49N, p. 126). It also fits closely *Chorinemus orientalis* in the data of the identification of species based vertebral column which was studied by TAKAHASHI (1962).

The ratio of the head length to the total length in the fossil fits well that of living *C. orientalis* TEM. et SCH. (Table 3 and Plate 19). But the ratio of the head length to the total length in the fossil is small in value and does not fit any of those of living species.

The biginning of the second dorsal fin situates in front of the position just above that of the anal soft ray, of course it situates behind the position above the anal spine. This feature can be not found in the living seven species (*C. tol, C. lysan, C. toloo, C. tala, C. tolooparah, C. sancti-petri* and *C. orientalis*) of genus *Chorinemus* (SUZUKI et al. 1964; SMITH 1965; KURONUMA and ABE 1972; GUSHIKEN

Table 3. The ratios of the body depth and the head length to the total length in eight species.

Species	The body depth in the total length	The head length in the total length	
Chorinemus inensis n. sp.	4.4	3.8	OHE (1977)
C. lysan C. et V.	4.0	5.5	GUNTHER (1860)
C. tala C. et V.	4.0	5.5	〃
C. toloo C. et V.	4.0	5.5	〃
C. tol C. et V.	5.5	6.0	〃
C. sancti-petri C. et V.	5.0	5.0	〃
C. orientalis TEM. et SCH.	4.3	5.0	〃
C. orientalis TEM. et. SCH.	4.2	5.2	OHE (1977)

1973; MASUDA, ARAGA and YOSHINO 1972). Namely in the living species, the situational arrangement of both the fins is contrary to that of the fossil species.

In other hand, fossil Carangid fishes have been reported with merely several examples from the Eocene beds in Italy and the Miocene strata in California (USA) and Caucasus (USSR); i. e. *Caranx, Carangopsis, Decapterus, Trachurus, Seriola* and *Oligoplites* (DANILTSHENKO 1964). Only fossil species in genus *Oligoplites*, which is *O. spinosus* SMIRNOV from the Maikop deposit of northeastern Caucasus, closely resembes the present species with many common features (DANILTSHENKO 1967; fig. 22, pp. 115–118). But in the detail it differs from *C. inensis* in having long bases of both fins of anal and second dorsal, the same fin-arrangement as it can be found in the living species and short trunk length. The evident difference is also recognized in the data of the numerical comparison among three species (the present species, *Oligoplites spinosus* and living *Chorinemus orientalis*) as in Table 4.

The above mentioned diagnosis and actual differences satisfy well necessary qualification for a new species of genus *Chorinemus*.

On relationship of the fossil species to congenetic genera in family Carangidae or near family: Both subfamily Trachinotinae and Chorineminae are presumed to have deviated from the some direct descendants in earlier stage of the evolutionary process to the Carangidae to sustain their situations. *Chorinemus inensis* new species, of which the shoulder girdle resembles that of *Trachionotus bailloni* (LACEPEDE) in the shape and especially in having vertically elongated upper portion of cleithrum with sharp margin. The composition of caudal skeleton resembles fundamentally that of *Trachionotus glaucaus* C. et V. (MONOD 1968; fig. 622, p. 348). The long preopercular and opercular with a smooth upper margin shows rather nearer feature to those of genus *Trachionotus* than to those of living *Chorinemus*. The present species has not positively some resemblances to genera *Elagatis, Seliola* and *Nacratus* systematized as ancestors in the main stem of the

Table 4. The numerical comparison among three species.

Species / Each length	*Chorinemus inensis* n. sp.	*Chorinemus orientalis* TEM. et SCH. (OHE,1977)	*Oligoplites spinosus*(SMIRNOV) (DANILTSHENKO, 1960)
% of the standard length			
Head length	30.7	21.9	25–28
Body depth	26.3	26.7	22–24
Least depth of the caudal peduncle	6.0	4.0	4
Length of the base of the second dorsal fin	35.0	43.3	42–45
Distance between the top of mouth and the beginning of the second dorsal fin	49.3	49.8	46–49
Distance between the top of mouth and the large anal spine	63.2	49.4	45–48
Distance between the base of pelvic fin and the beginning of the anal fin	28.8	27.1	20–22
% of the body depth			
Least depth of the caudal peduncle	22.8	14.9	17–18
Length of largest soft rays of second dorsal fin	44.0	59.7	31–34
Length of largest soft rays of pectoral fin	36.6	50.7	58–65
Length of largest soft rays of pelvic fin	46.0	43.3	59–61
Length of five centra from the first caudal vertebrae	82.6	65.7	70–75
% of the head length			
The body depth	85.6	82.0	81–85
The snout length	21.9	20.9	17–18
The postorbital length	44.7	37.3	49–51
The horizontal eye diameter	30.3	20.6	32–33

phylogenetical tree of the Carangidae. Merely the suborbital bones resemble those of *Elagatis bipinnulata* (QUOY et GAIMARD) in the arrangement and form of ring except the large SO1 (Fig. 2). On account of the close morphological resemblances between the Carangidae and Scombridae, genus *Chorinemus* had frequently been united into Scombridae with synonym named *Scomberoides* LACEPEDE 1802 (Histoire naturelle des poisons, vol. 3, p. 50). In the following osteological points as the possession of large number of more or less discontinous fin-let, the non protracticle premaxillaries and a slight increase in the interior of the cranium, SUZUKI (1962) has expressed the opinion that *Chorinemus* is more nearly allied to Scombridae rather than to other subfamilies of the Carangidae. But the authors recognized the distinct differences with Scombridae of the present species which has an enlarged interhaemal spine closely attached to the haemal spine beneath the first caudal centrum and has two strong spine before the anal fin. In the arrangement of the suborbital bones, the new species has also an evident morphological difference with a typical species of family Scombridae. According to the extensive study on skulls of fishes by GREGORY (1933), its arrangement differs from that of *Scomber* sp. (Fig. 188, p. 310) and rather resembles that of *Coryphaena hippurus* L. of family Coryphaenidae except in details (Fig. 183, p. 306). Moreover referring to the study on the suborbital shelf of fishes by SMITH and BAILEY (1962), the arrangement in the present species seems to be more affinitive to that of the family Centropomidae or Cerranidae than to those of some evolved species in family Carangidae.

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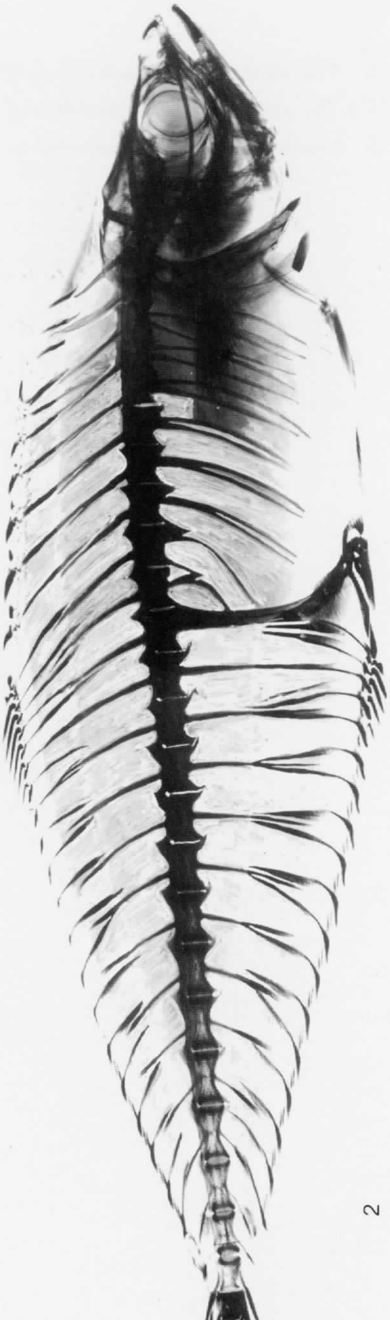
Plate 19

Fig. 1. *Chorinemus inensis* n. sp. Holotype

Fig. 2. *Chorinemus orientalis* TEM. et SCH., by the "Softex", ultra-soft roentogen ejector.
Material of the Fishery Department of Mie University. TL, 28.5 cm; ST, 25.1 cm; HL, 5.5 cm.

1



2

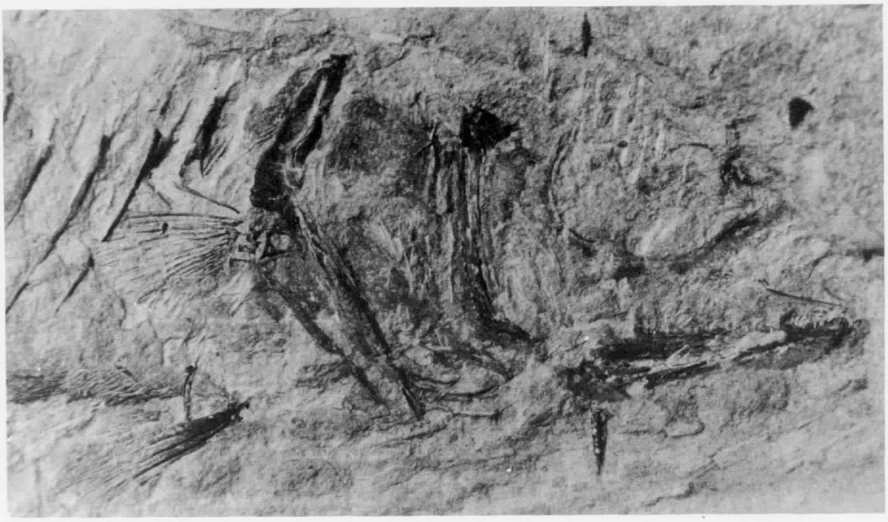
Plate 20

Fig. 1. The enlarged head portion of *Chorinemus inensis* n. sp.

Fig. 2. The enlarged caudal skeleton of *Chorinemus inensis* n. sp.

Fig. 3. Lanceolate scales preserved in the abdominal part of new species.

1



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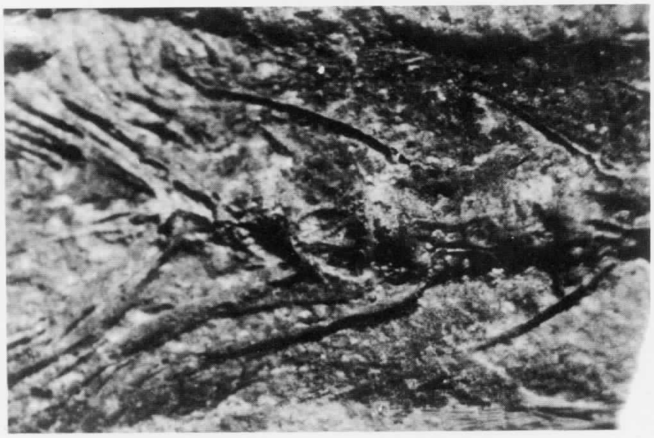

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