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Belgocaranx luypaertsi gen. and sp. nov., a new skeleton-based Carangid Fish from the Boom Clay (Rupelian, Early Oligocene) at Kallo (N. Belgium)

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Abstract

A three dimensionally preserved carangid skull from a concretion level at the top of the Boom Clay (Rupelian, Oligocene) in the Vrasenedok (Kallo, Belgium) is described and assigned to a new genus and species: *Belgocaranx luypaertsi* (Teleostei, Perciformes). Geometric and biostratigraphic calibration with outcrop and borehole sections close to the Vrasenedok allows the concretion level to be positioned within the upper middle part of the Boom Clay Formation, respectively around septaria-level S110 according to the dinoflagellate cyst correlation and around septaria-level S150 according to geometric extrapolation. The discovery of this fish skull illustrates a specific step in the evolution of carangid fishes, allowing estimation of the nature and rate of their evolution during the last 50 million years.

Key words: new perciform, osteology, Oligocene, Belgium.

Résumé

Un crâne de carangidé conservé en trois dimensions et provenant d'un niveau à concrétions au sommet de l'Argile de Boom (Rupélien, Oligocène) dans le Vrasenedok (Kallo, Belgique) est décrit et assigné à un nouveau genre et une nouvelle espèce: *Belgocaranx luypaertsi* (Teleostei, Perciformes). Un étalonnage géométrique et biostratigraphique avec des affleurements et des sondages proches du Vrasenedok a permis de situer ce niveau à concrétions au sommet de la partie moyenne de l'Argile de Boom, respectivement aux environs du niveau à septaria S110, d'après une corrélation avec les kystes de dinoflagellés, et aux environs du niveau à septaria S150, selon l'extrapolation géométrique. La découverte de ce crâne de poisson illustre une étape spécifique dans l'évolution des carangidés, permettant d'estimer la nature et le taux de leur évolution durant les 50 derniers millions d'années.

Mots-clefs: nouveau perciforme, ostéologie, Oligocène, Belgique.

Introduction

Since the late 1960s, several large, up to 25 m deep pits have been excavated in the area northwest of Antwerp for the construction of new docks and sluices for Antwerp harbour (see Fig. 1). These pits, extending down to the top of the Boom Clay (Rupelian, Early Oligocene), led to the identification of one of the most fossiliferous successions of the Belgian Basin (NUYTS, 1990; MARQUET, 1998, 2004), allowing re-assessment of the Neogene stratigraphy of Belgium (see GOOLAERTS, 2000 for an overview and references).

In 1982, during one of his reconnaissance trips to the Neogene of the Vrasenedok 3 km northwest of the Kallo village centre (map-sheet 15/1-2 St.-Gillis-Waas/Beveren; x = between 140.334 and 140.700, y = between 216.356 and 217.150), J.-P. Luypaerts collected several 10 to 20 cm diameter concretions from about 10 cm deep in the Boom Clay at the base of a large construction pit (see NUYTS, 1990 and VERVOENEN, 1995 for stratigraphic interpretations of the pit). These concretions often yielded crab carapaces or fragments, belonging to *Coeloma (Paracoeloma) rupeliense* STAINIER, 1887. The collections of the Royal Belgian Institute of Natural Sciences contain 651 specimens of this crab, gathered over the last century in several clay pits in the Rupel area and the area south of Antwerp (see VERHEYDEN, 2002 for a review of this taxon and its presence in Belgium). They all came from the Boom Clay, although much more stratigraphic precision could not be obtained from the available information. Only two of Luypaerts' fossil-bearing concretions yielded material other than crabs, respectively a well-preserved tooth of the large shark species *Carcharocles angustidens* (AGASSIZ, 1843) and a splendidly preserved fish skull. This skull is described here. Besides a thorough taxonomic analysis, we also tried to determine the stratigraphic position of the concretion level, through geometric calibration with nearby sections, in combination with micropalaeontological investigations. Finally, this find will be matched with other fossil fish records from the Boom Clay, in order to define its relevance for the Oligocene fish fauna of Belgium.

Geometric correlation of the fossiliferous concretion level

The crab and fish-bearing concretion level encountered at the Vrasenedok is located around -17.50 m T.A.W.

(= "Tweede Algemene Waterpassing" or Second General Levelling). Its stratigraphic position within the Boom Clay can be estimated using a series of well-calibrated reference points from borehole and outcrop sections along a NNW-SSE transect through or close to the Vrasenedok (Fig. 1a,b). Correlation between the Doel-2b borehole (VANDENBERGHE *et al.*, 2001; VANDENBERGHE, BRINKHUIS & STEURBAUT, 2003) and

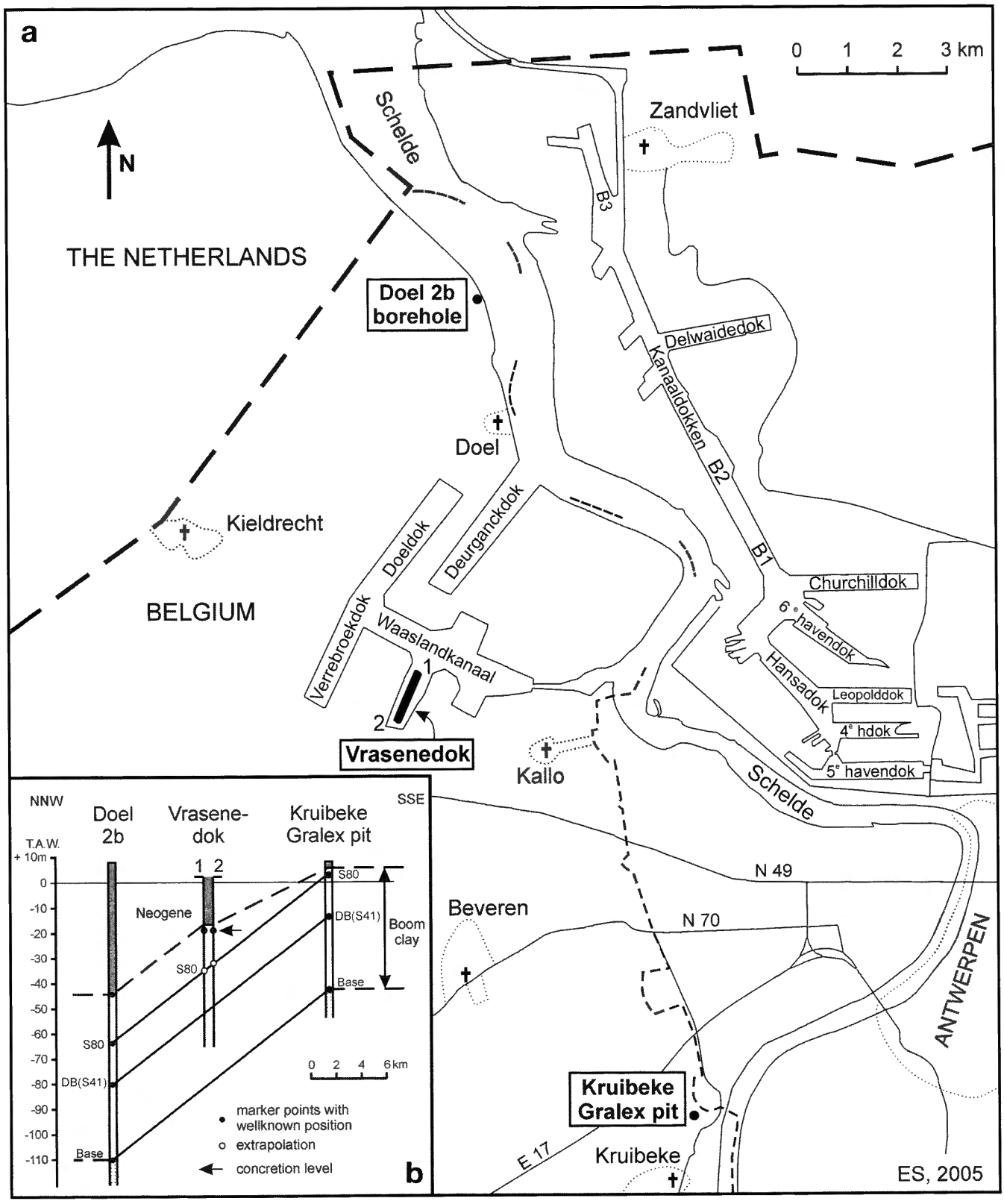

Fig. 1 — The Antwerp Harbour Area: a. Location of the Vrasenedok, the Doel-2b borehole and the Kruibeke-Gralex claypit. b. Position of the concretion level in the Vrasenedok using geometric extrapolation techniques.

the Kruibeke-Gralex outcrop, 17 km southeast (VANDENBERGHE *et al.*, 2003), shows that the beds are gently dipping to the north (0,4% or 2,3°) and that the thickness of the beds within the Boom Clay do not change along the transect. The base of the Boom Clay, the top of the "Double Band" (= DB on Fig. 1), also labelled bed S41, and septaria-level S80 are used as tie-points for correlation. The general trend of the dipping beds reveals that bed S80 has to be positioned between –33.50 m and –35.50 m T.A.W. at the Vrasenedok (depending on the exact position within the excavated area), thus, between 16 and 18 m below the fossiliferous concretion level. According to the position of the septaria levels in the Boom Clay (VANDENBERGHE in HOOYBERGHS, 1992; VAN SIMAEYS *et al.*, 2004) the concretion layer may correlate with levels around S150.

Biostratigraphical positioning of the fossiliferous concretion level

Micropalaeontological dating of the fish-bearing concretion was not successful as the calcareous sediment on the skeleton did not yield calcareous nannofossils and the material was too limited to allow foraminiferal and palynological analyses. Part of a crab-bearing concretion from the same level was processed for dinoflagellate cyst investigation using techniques described in VAN SIMAEYS *et al.* (2004). This sample revealed a rich and moderately well preserved palynomorph assemblage, dominated by dinocysts and bisaccate pollen. The dinocyst association, consisting of 38 taxa, is marked by high numbers of *Spiniferites* spp. (21.5%), *Dapsilidinium pseudocolligerum* (STOVER, 1977) BUJAK *et al.*, 1980 (18.2%) and *Operculodinium* spp. (13.0%). Other frequently occurring forms are *Cleistosphaeridium diversispinosum* DAVEY *et al.*, 1966 (8.3%) and *Reticulatosphaera actinocoronata* (BENEDEK, 1972) BUJAK & MATSUOKA, 1986 (5.2%). The presence of *Wetzeliella symmetrica* WEILER, 1956, *Gerdiocysta conopea* LIENGJARERN *et al.*, 1980 and *Chiropteridium* spp., coupled with the absence of *Distatodinium biffii* BRINKHUIS, POWELL & ZEVENBOOM, 1992, points to a mid-Rupelian age (STOVER & HARDENBOL, 1994, VAN SIMAEYS *et al.*, 2004). The co-occurrence of *Saturnodinium pansum* (STOVER, 1977) BRINKHUIS *et al.*, 1992 (represented by small atypical forms), rare *Enneadocysta pectiniformis* (GERLACH, 1961) STOVER & WILLIAMS, 1995 and rare *Phthanoperidinium filigranum* (BENEDEK, 1972) BENEDEK & SARJEANT, 1981 allows refining this age attribution, situating the concretion level at the base of the North Sea Oligocene dinocyst zone NSO-4b of VAN SIMAEYS *et al.* (2005). A similar dinocyst association was recorded in sample W27 (318.1 m depth) in the Weelde borehole, allowing the concretion level to be positioned around septaria level S110 in the Boom Clay Formation (VAN SIMAEYS *et al.*, 2004).

The fossil fish skeleton

Description

Division TELEOSTEI
Subdivision EUTELEOSTEI
Superorder ACANTHOPTERYGII
Series PERCOMORPHA
Order PERCIFORMES
Suborder PERCOIDEI
Family CARANGIDAE
Genus *Belgocaranx* gen. nov.

DIAGNOSIS
Same diagnosis as the species (monospecific genus).

TYPE-SPECIES
Belgocaranx luypaertsi sp. nov., here designated.

DERIVATIO NOMINIS
The generic name refers to Belgium and to the carangid genus *Caranx*.

Species *Belgocaranx luypaertsi* sp. nov.

DIAGNOSIS
Carangid teleost with a deep skull and a short snout; both jaws ending at the same level; a large orbit; anterior face of the mesethmoid vertically oriented and bearing a median keel; frontals forming along the midline of the skull a low median crest that lengthens forward the supraoccipital median crest; each frontal bearing a strong lateral crest reaching the pterotic; anterior frontal portion of the supraorbital canal opened and forming a broad groove; parietal crest not extending on the frontal; very large supramaxilla; ventral border of the first infraorbital slightly serrated; a narrow subocular shelf on the second infraorbital and the anterior part of the third infraorbital; preoperculum with a short ventral branch; upper posterior margin of the opercle feebly notched.

MATERIAL AND METHOD
Holotype IRSNB Nr P. 8120, a skull preserved in three dimensions, reaching about 10 cm in length, 9 cm in maximum height and 3,25 cm in maximum breadth (Pl. 1).

The material was studied using a Wild M5 microscope equipped with a camera lucida. The drawings of the text-figures were made by one of us (L.T.).

FORMATION AND LOCALITY
Collected at the Vrasenedok, Kallo near Antwerp (Belgium), 10 cm below the top of the Boom Clay (Rupelian, Oligocene) at the base of a 25 m deep pit (VERVOENEN, 1995: 58-62).

DERIVATIO NOMINIS
The specific name is dedicated to Mr. Jean-Pierre Luypaerts, the discoverer of the Rupelian carangid skull of Kallo.

OSTEOLOGY (Figs. 2-5)

The skull is moderately compressed, deep posteriorly, but becoming shallower towards the anterior end. The snout is short, with both jaws ending at the same level. The orbit is very large.

The mesethmoid is well developed and lies before the frontals but slightly downwards in regard to their anterior border. Dorsally the mesethmoid is a large, almost quadrangular and slightly concave plate. Its anterior portion is rather broad, vertically oriented and bears a median keel. Posteriorly, the mesethmoid extends back as a thin vertical sheet of bone forming on each side of the snout the greatest part of the two rounded nasal fossae. The lateral ethmoids are high and narrow. They form the rear of the olfactory fossae. Ventrally the lateral ethmoid is widened and comes in contact with the palatine and the first infraorbital. A small anterior fragment of the vomer is visible inside the mouth. Only the right nasal is preserved but displaced into the orbit because of the fossilization. It is a long tubular bone carrying the most anterior part of the supraorbital sensory canal.

The frontals are large and cover a great part of the skull roof. Their inner borders are slightly raised upward along the midline, forming a small median crest that carries

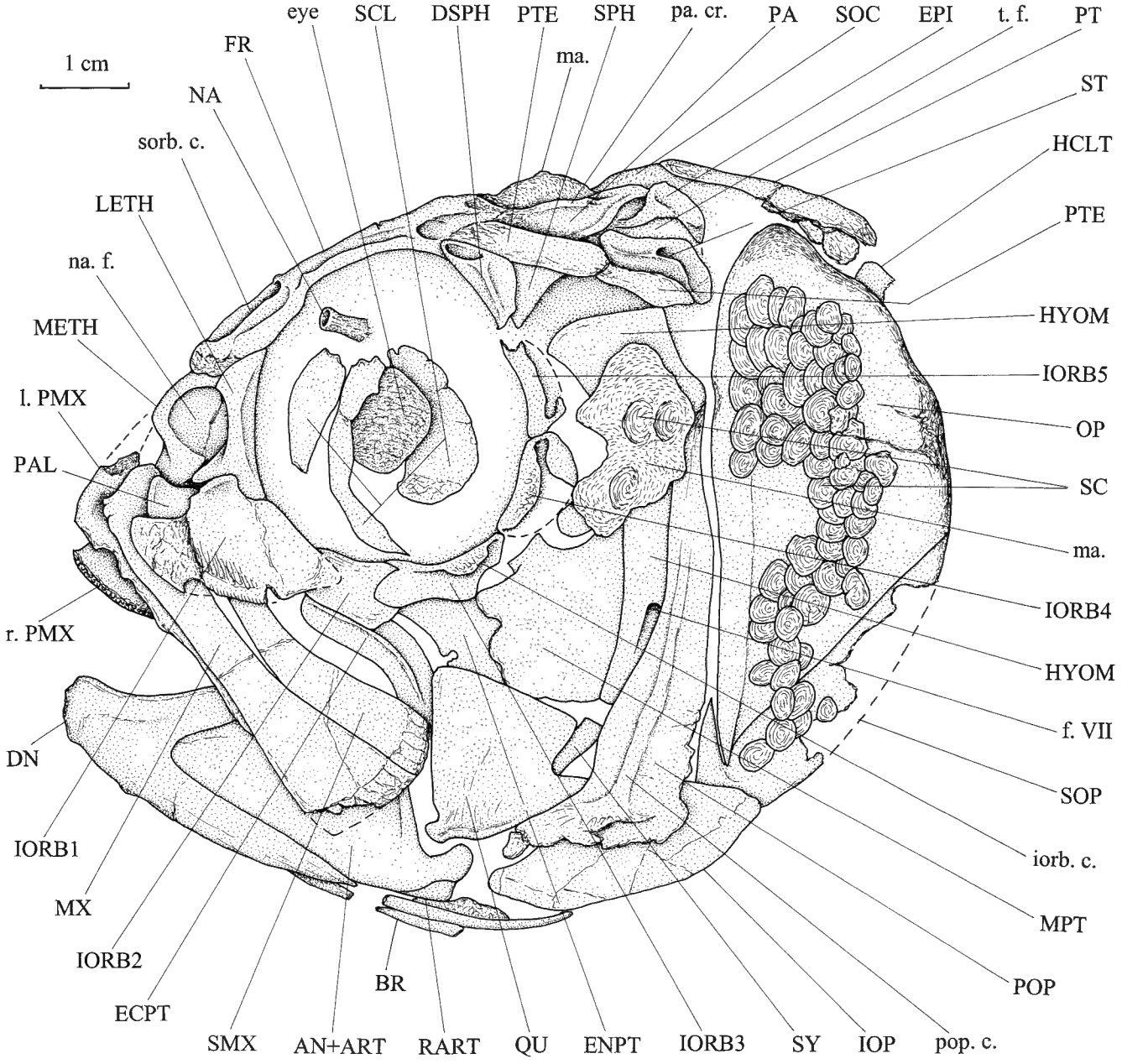

Fig. 2 — *Belgocaranx luypaertsi* gen. and sp. nov. IRSNB N° P. 8120 skull in left lateral view.

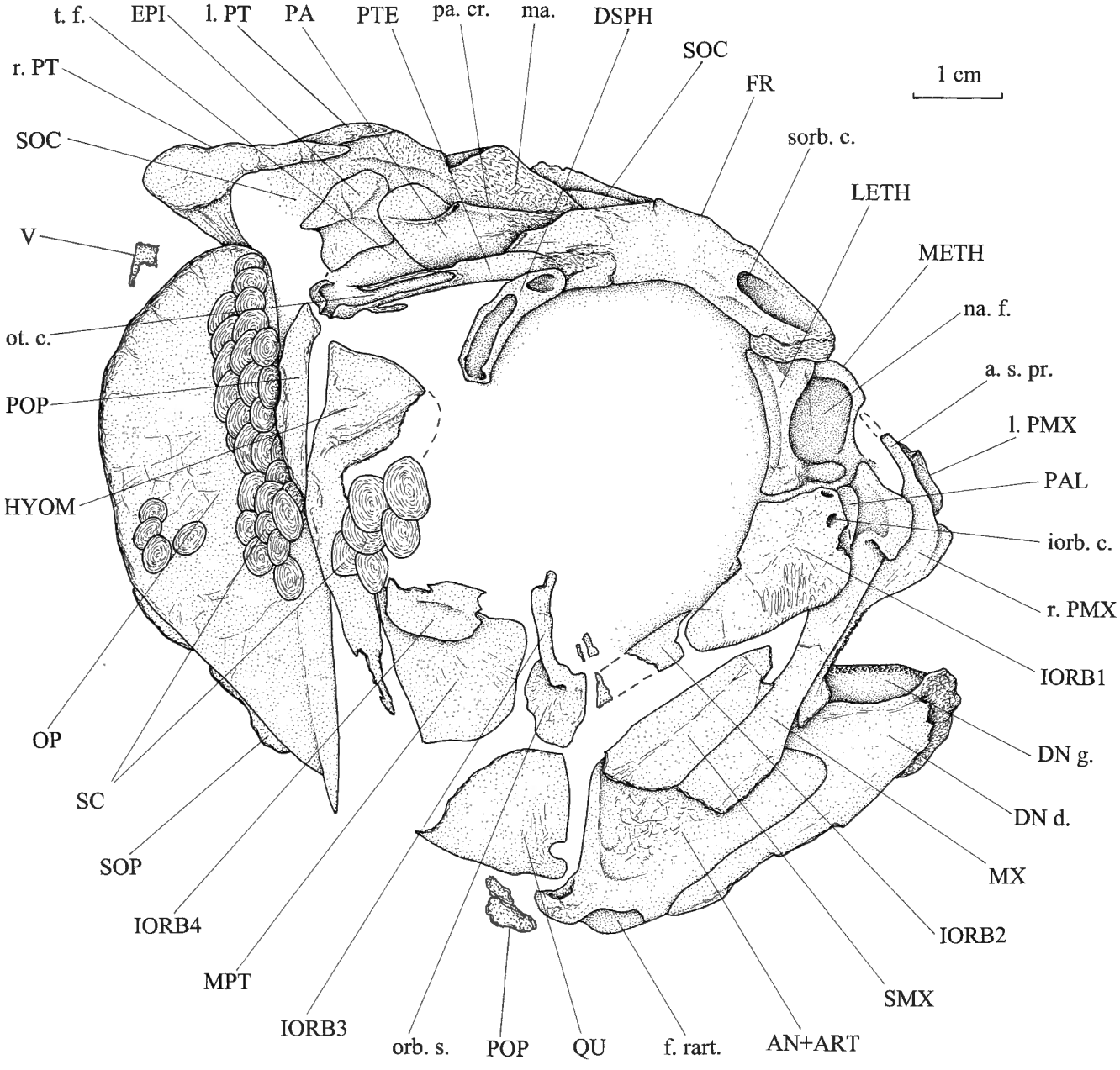

Fig. 3 — *Belgocaranx luypaertsi* gen. and sp. nov. IRSNB N° P. 8120 skull in right lateral view.

forward the supraoccipital crest to the ethmoid region. The supraorbital sensory canal opens on the anterior third of the frontal and forms there a broad groove, which is surrounded on each side by a crest. More posteriorly and laterally, the frontal bears another very large longitudinal crest reaching the pterotic. The posterior opening of the supraorbital canal is located at the latero-posterior corner of the frontal, near the crest. A dense and very tough matrix covers the parietals and the supraoccipital, but parts of these are however visible. The parietals are large, widely separated by the supraoccipital and they bear a strong crest that does not continue on the frontal. Only the most anterior part of the supraoccipital is preserved. It forms a long, sharp, but low crest, of which the position is anterior to that of the parietals. The posterior part of the supraoccipital is badly eroded and, at that level, the supraoccipital crest is not preserved. The epiotics are small and somewhat triangular in dorsal view. Only the left sphenotic is visible. It is a small bone partly hidden by the dermosphenotic. The pterotics are rather small but they exhibit a long anterior process passing forward over the sphenotic to meet the frontal at the level of the supraorbital sensory canal posterior opening. The otic (= postorbital) sensory canal is visible on the right side

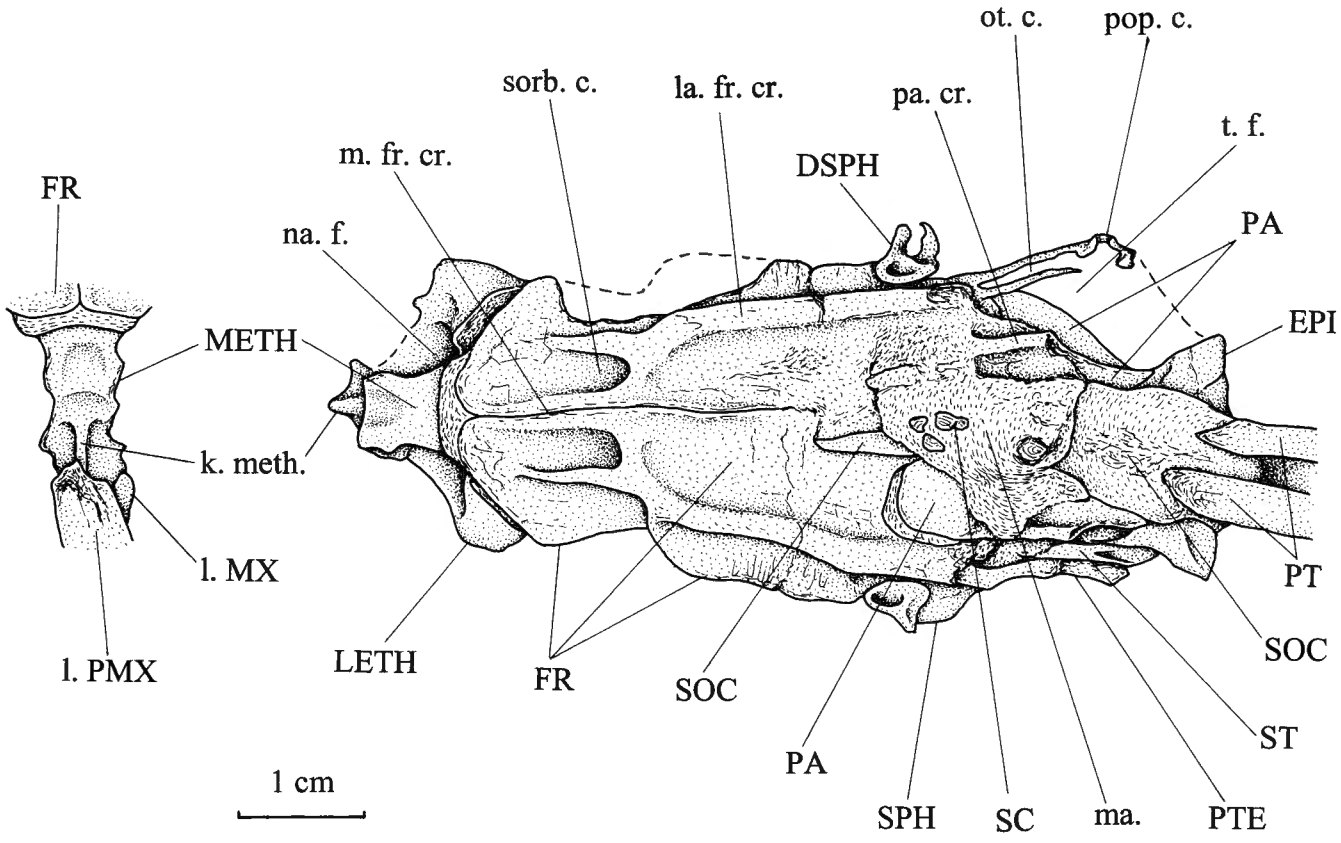

Fig. 4 — *Belgocaranx luypaertsi* gen. and sp. nov. IRSNB N° P. 8120 skull in dorsal view, with the mesethmoid in anterior view at left.

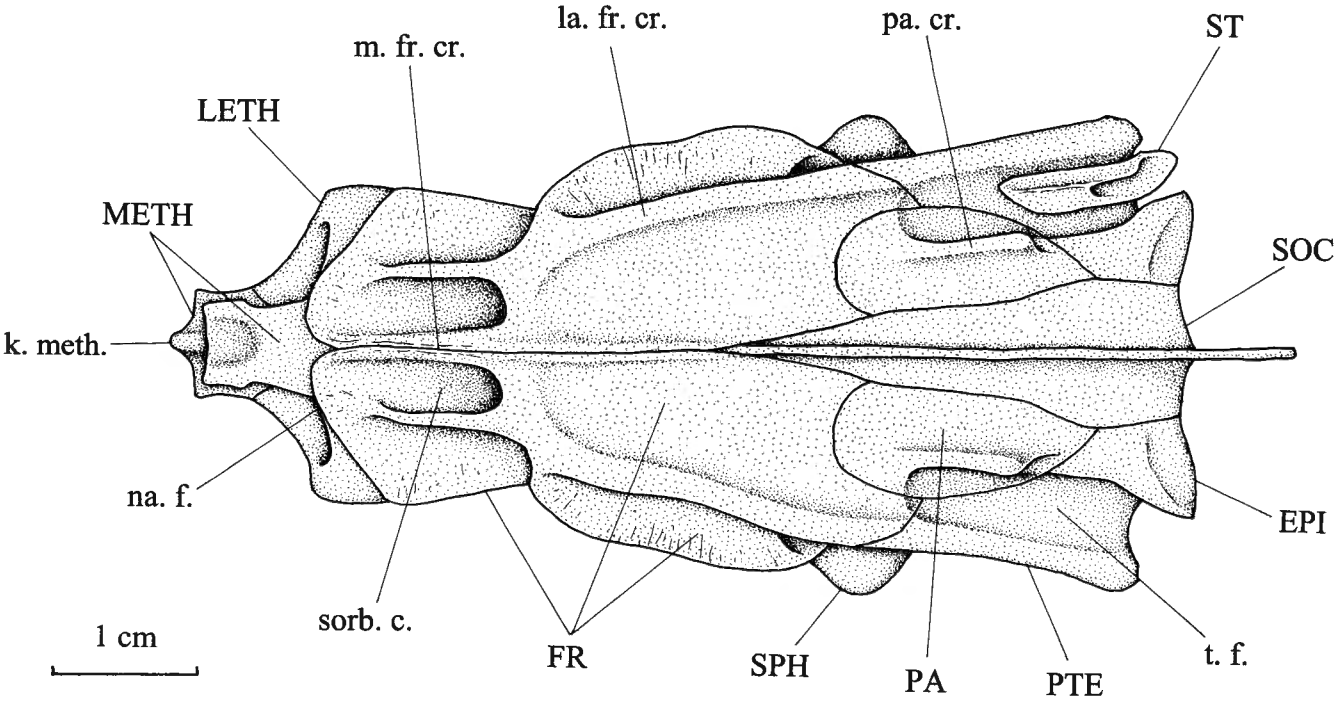

Fig. 5 — *Belgocaranx luypaertsi* gen. and sp. nov. Reconstruction of the skull in dorsal view.

where the pterotic is broken. Posteriorly, the canal exhibits a ventral opening, which marks the junction with the preopercular sensory canal.

The large posttemporal fossae are unroofed. Their floor is formed by the pterotic and their inner wall by the parietal and the epiotic. The supratemporal is preserved on the left side. It is a small bone carrying the basal part of the extrascapular sensory commissure and is located above the posttemporal fossa.

The pleurosphenoids, basisphenoid, parasphenoid, prootics, intercalars, exoccipitals and basioccipital are deeply embedded into the matrix and thus not accessible for a study.

Only the anterior tip of the palatine is visible on each side of the skull between the articular head of the maxilla and the first infraorbital. The entopterygoid and ectopterygoid appear on the left side. The ectopterygoid is rather stout, broad, not very long, curved and it bears a well-marked crest. The entopterygoid is partly hidden by the third infraorbital and the metapterygoid, which is a large and thin bone. The quadrate is triangular, with a weakly-developed quadrato-jugal process and a thickened antero-ventral condyle for the articulation with the lower jaw. The symplectic is rod-like. The hyomandibular exhibits a moderately expanded dorsal head and a long, narrow ventral branch running along the preopercle and almost reaching the symplectic. Its opercular process is reduced to a small bony knob. The foramen for the *truncus hyoideomandibularis* of the facial nerve (VII) is located low on the ventral branch of the hyomandibular.

The upper jaw is formed on both sides by three bones, the premaxilla, the maxilla and the supramaxilla. The premaxilla is bordering the greatest part of the mouth. Its long and thin alveolar process bears along its oral border a narrow band of very small teeth of whom only the sockets are preserved. Anteriorly the premaxilla ends in a well-developed symphyseal ascending process but its tip is broken. Its articular and post-maxillary processes are hidden by the maxilla. The maxilla is long, broad and toothless, and with a well developed anterior rounded premaxillary process. It borders the mouth behind the premaxilla. Its posterior end is expanded and compressed. The supramaxilla is long and broad. Such a large supramaxilla is unusual within the Perciformes. Most of them exhibit a reduced supramaxilla or have lost that bone. However in the Carangidae and their closely allied family, the Nematistiidae, a large supramaxilla is not uncommon (SUZUKI, 1962: figs. 13-17; ROSENBLATT & BELL, 1976: fig. 4A; SUDA, 1996: fig. 33D).

The lower jaw is not very long, with a moderately high coronoid process. Each half of the mandible comprises the dentary, the angulo-articular and the retroarticular. The coronomeckelian is not visible. The quadrate-mandibular articulation is located below the posterior border of the orbit. The oral border of the dentary bears a narrow band of small teeth. But, as for the premaxilla, only the sockets are preserved. The angulo-articular is large and penetrates deeply between the dorsal and ventral branches of the dentary. The retroarticular is lost on the right side of the mandible (only its articular fossa in the angulo-articular is visible) but is preserved on the left side. It is a small bone excluded from the joint surface for the quadrate. The mandibular sensory canal is not visible.

The orbital series consists of six bones, five infraorbitals and the dermosphenotic. The first infraorbital (lachrymal) is large, much longer and deeper than the others. It is located beneath the lateral ethmoid with which it is connected. Its ventral edge is feebly serrated. Its antero-dorsal corner bears two pores for the opening of the orbital sensory canal. The external surface is partially ornamented with small narrow vertical ridges. The second to fifth infraorbitals are smaller but however they still retain a membranodermic component. A narrow subocular shelf is borne on the second infraorbital and on the anterior part of the third one. The orbital canal opens partially on the third to fifth infraorbitals. The dermosphenotic is narrow. It covers the anterior part of the sphenotic and reaches the frontal border, connecting the orbital sensory canal with the supraorbital canal. Fragments of three large sclerotic plates appear in the left orbit. They surround the mineralized eyeball.

The preopercle has a long tapering dorsal limb and a short ventral limb. There is no spine on its posterior and ventral edges. The preopercular sensory canal is clearly visible. The interopercle is a large plate-like bone. Its upper part is hidden under the preopercle and its posterior margin covers the antero-ventral corner of the subopercle. The opercle is deep, rather narrow, with a straight anterior edge ending in a sharp ventral point, and rounded dorsally and posteriorly. On the left side, the upper posterior margin of the bone is feebly notched at the level of the posttemporal enlarged basis. The notch is not visible on the right opercle, its upper posterior margin being more eroded. A large notch is usually present in Carangidae (SUZUKI, 1962: figs. 18-27; SUDA, 1996: fig. 35). The opercle is devoid of any spine. The subopercle is long. It tapers posteriorly. Its antero-dorsal corner bears a broad spike lying before the opercular ventral point. Some fragments of the branchiostegal rays are visible on the left side beneath the retroarticular and the interopercle.

The posttemporal is large and divided in two well-developed branches, a dorsal one resting on the supraoccipital, and a ventral one directed towards the rear of the neurocranium. The uppermost part of the hypercleithrum is preserved on the left side.

A fragment of a vertebra is visible on the right side.

Small cycloid scales are covering the hyomandibular, the opercle, the preopercle and the subopercle. Fragments of such scales also appear in the matrix covering the parieto-occipital region of the skull.

Discussion

The following cranial features of the fossil teleost from Kallo allow to determine its familial relationships: (1) the frontals raise upward on the midline, extending the supraoccipital crest to the mesethmoid; (2) the anterior portion of the supraorbital canal opens on the frontal, forming a broad groove; (3) the frontal bears a large

longitudinal crest; (4) the parietal also bears a crest; (5) the supraoccipital extends far forward the parietals; (6) the teeth on the jaws are small and arranged in narrow bands; (7) the supramaxilla is very large; (8) the preopercle and opercle are not spiny; (9) the upper part of the opercular posterior border is slightly notched; (10) the scales are small and cycloid.

Within the perciform families present in the Belgian marine Oligocene (LERICHE, 1910; NOLF, 1977; STEURBAUT & HERMAN, 1978), only one, the Carangidae, matches all those osteological characters (STARKS, 1911; SUZUKI, 1962; SUDA, 1996). *Belgocaranx luypaertsi* differs from Recent Carangidae by its frontal crest not connecting the parietal crest, its feebly notched opercle and its especially large supramaxilla, evidencing its peculiar generic status.

Belgocaranx luypaertsi and its relevance for the Oligocene fish fauna of Belgium

The perciform fish family Carangidae, which appeared during the Ypresian (PATTERSON, 1993: 646), is extremely rare in the Oligocene of Belgium, as witnessed by a few bony fragments (LERICHE, 1910: 305) and the unique record of a generically undeterminable otolith (STEURBAUT & HERMAN, 1978: 311, pl. 3, fig. 15). Its paucity in the North Sea area during the Rupelian may have been palaeo-environmentally controlled. A close inspection of the distribution of carangids through the Neogene of different European Basins may help in understanding the causes of this restricted representation. Otolith data (GAEMERS & SCHWARZHANS, 1973; NOLF, 1977, 1978) show that carangids represent less than 0.1% of the total number of otoliths in the shallow marine Miocene and Pliocene deposits of the North Sea Basin. The percentage of carangid specimens increases progressively in southward direction in Europe within contemporaneous equivalent facies belts (coastal areas with sandy seabottoms): 0.8% of the total otolith number in "Bretagne" – western France (LANCKNEUS & NOLF, 1979), 3% in the Aquitaine Basin (STEURBAUT, 1984), 3% in Catalunia – northern Spain (NOLF & MARTINELL, 1980) and 6% in Portugal (NOLF & MARQUES DA SILVA, 1997). This is not true for the deeper water facies of southern Europe, where carangids are almost completely absent (none in the Tortonian deposits of Italy, NOLF & STEURBAUT, 1983; <0.1% in the Pliocene deposits of Southeast France, NOLF & CAPPETTA, 1988).

Nowadays carangids consist of about 32 genera and 140 species (NELSON, 1994: 354). They inhabit tropical and temperate marine waters. Many are near shore, although the family also comprises pelagic fishes. A few species even enter in brackish waters. Carangids are currently found in Atlantic, Pacific and Indian Oceans and in the Mediterranean. *Trachurus trachurus* (LINNAEUS, 1758) is the only Carangid taxon inhabiting the North Sea (WHEELER, 1969). It is frequently fished, although represents only 1% of the total catches in the North Sea area (NIJSSEN & ZIJLSTRA, 1990). Other taxa, like *Naucrates ductor* (LINNAEUS, 1758) and *Trachinotus ovatus* (LINNAEUS, 1758) only sporadically appear in this area.

The above-mentioned data reveal that the way of life of carangids did not fundamentally change during the last 40 million years. During their entire evolutionary history carangids essentially consisted of tropical to warm temperate forms, of which the distribution and frequency were controlled by water temperature.

The discovery of this new fish skull does not fundamentally enhance our knowledge of the fish fauna of the Boom Clay, in terms of its general composition and its palaeo-environmental and palaeobiogeographic significance. It indicates once more that fossilisation of fish skeletons is an exceptional phenomenon, depending on special bottom conditions (preferentially anoxic) and occurring at random even within the most poorly represented groups. However, from a phylogenetic point of view, this find is extremely important, as it reveals a specific step in the evolution of carangid fishes, and, consequently, allows estimating the nature and rate of their evolution since their origination about 50 million years ago.

Conclusions

A thorough investigation of concretions from a level at the top of the Boom Clay at the Vrasenedok (Kallo, Northern Belgium) has led to the discovery of a well-preserved fish skull, pertaining to the new carangid fish taxon *Belgocaranx luypaertsi* gen. and sp. nov. This taxonomic assignment is based on a series of osteological characters, such as the very large supramaxilla, and on the position and morphology of teeth and scales. Geometric correlation with the nearby well-calibrated Doel-2b borehole section and the Kruibeke-Gralex outcrop section allows the concretion level to be positioned around septaria level S150, within the upper middle part of the Boom Clay. Dinoflagellate cyst investigation of a crab-bearing concretion from the same level indicates the base of North Sea Oligocene dinocyst zone NSO-4b. This suggests correlation with septaria level S110, and, hence, a slightly lower position (about 7 m in the Antwerp area) of the concretion level compared to the position based on geometric extrapolation. This new fish skull belongs to a group, which is poorly represented in the North Sea area since its origination during the Ypresian, and, consequently, does not fundamentally enhance our knowledge of the fish fauna of the Boom Clay. Nevertheless, this find clearly illustrates a specific step in the evolution of carangid fishes, and, consequently, throws new light on the nature and rate of carangid evolution since their origination about 50 million years ago.

Acknowledgments

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List of abbreviations used in the text-figures

AN+ART:	angulo-articular
BR:	branchiostegal rays
DN:	dentary
DSPH:	dermosphenotic
ECPT:	ectopterygoid
ENPT:	entopterygoid (= endopterygoid, mesopterygoid)
EPI:	epiotic (= epioccipital)
FR:	frontal
HCLT:	hypercleithrum (= supracleithrum)
HYOM:	hyomandibular
IOP:	interopercle
IORB 1-5:	infraorbitals 1-5
LETH:	lateral ethmoid
METH:	mesethmoid
MPT:	metapterygoid
MX:	maxilla
NA:	nasal
OP:	opercle
PA:	parietal
PAL:	palatine
PMX:	premaxilla
POP:	preopercle
PT:	posttemporal
PTE:	pterotic
QU:	quadrate
RART:	retroarticular
SC:	scales
SCL:	sclerotic plates
SMX:	supramaxilla
SOC:	supraoccipital
SOP:	subopercle
SPH:	sphenotic (= autosphenotic)
ST:	supratemporal (= extrascapular)
SY:	symplectic
V:	vertebra
a. s. pr.:	ascending symphyseal process of the premaxillary
f. VII:	foramen for the *truncus hyoideomandibularis* of the facial nerve (VII)
f. rart.:	articulation fossa on the angular for the retro-articular
iorb. c.:	infraorbital sensory canal
k. meth.:	anterior vertical keel of the mesethmoid
l.:	left
la. fr. cr.:	lateral frontal crest
ma.:	matrix
m. fr. cr.:	median frontal crest
na. f.:	nasal (= olfactive) fossa
orb. s.:	suborbital shelf
ot. c.:	otic (= postorbital) sensory canal
pa. cr.:	parietal crest
pop. c.:	preopercular sensory canal
r.:	right
sorb. c.:	supraorbital sensory canal
t. f.:	temporal (= posttemporal) fossa

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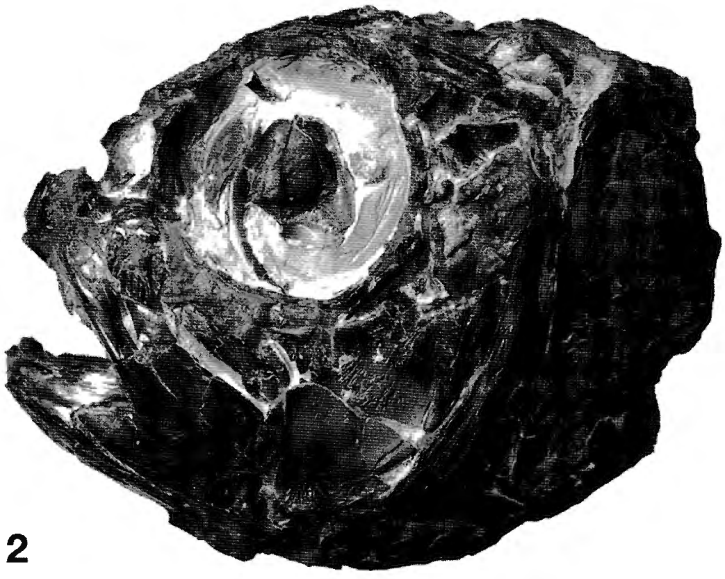
Explanation of Plate 1

PLATE 1

Belgocaranx luypaertsi gen. and sp. nov. IRSNB Nr P. 8120: (1) skull in right lateral view, (2) in left lateral view and (3) in dorsal view. (4) Details of the jaws to show the narrow bands of small teeth. (5) The cycloid scales.

1



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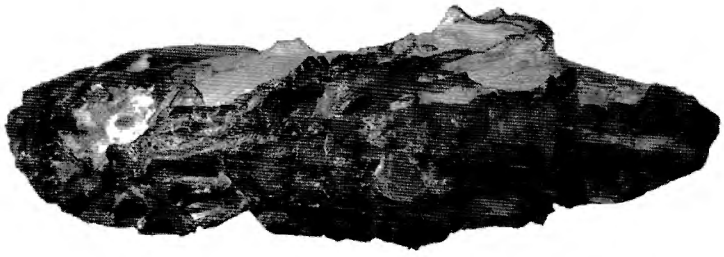

3

2 cm

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PLATE 1