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TATARSTANICHTHYS BANNIKOVI GEN. AND SP. NOV., A NEW BOBASATRANIID FISH (ACTINOPTERYGII, BOBASATRANIIFORMES) FROM THE LATE PERMIAN (KAZANIAN) DEPOSITS OF THE KAMA RIVER (TATARSTAN, RUSSIA)

RIASSUNTO

Tatarstanichthys bannikovi gen. e sp. nov., dagli strati del Permiano superiore del fiume Kama (Tatarstan, Russia), è rappresentato dal solo olotipo, un cranio completo e una cintura pettorale. La presenza di due preopercoli e di un grande "quadratojugale" collegato alla mascella indica che il nuovo taxon appartiene ai Bobasatraniidae, una famiglia di pesci actinopterigi dal corpo elevato ed appiattito. *Tatarstanichthys bannikovi* merita il suo peculiare status di genere nuovo perché differisce da tutti gli altri bobasatrannidi conosciuti per almeno tre caratteri: (i) presenza di uno spazio tra i preopercoli dorsali e ventrali, (ii) presenza di una serie di numerosi suborbitali che si estendono anteriormente fino al livello del secondo infraorbitale e (iii) "quadratojugale" allungato situato lungo tutto il margine anteriore del preopercolo ventrale.

Parole-chiave: *Tatarstanichthys bannikovi* gen. and sp. nov., Bobasatraniidae, Permiano Superiore, Kama river, Tatarstan, Russia.

ABSTRACT

Tatarstanichthys bannikovi gen. and sp. nov., from the Upper Permian strata of the Kama river (Tatarstan), is known by a complete skull and a pectoral girdle. The presence of two preopercles and of a large "quadratojugal" connected to the maxilla indicates that it belongs to the Bobasatraniidae, a family of compressed body actinopterygian fishes. *Tatarstanichthys bannikovi*

deserves its peculiar generic status because it differs from all the other Bobasatraniidae by at least three characters. There is a gap between the dorsal and the ventral preopercles. A series of numerous suborbitals extends anteriorly till the level of the second infraorbital. The elongate "quadratojugal" is lying all along the anterior margin of the ventral preopercle.

Key words: *Tatarstanichthys bannikovi* gen. and sp. nov., Bobasatraniidae, Upper Permian, Kama river, Tatarstan, Russia.

INTRODUCTION

The Kama river flows from the western side of the Ural Mountains, through the Udmurt and Tatarstan Republics (Federation of Russia), and is the most important left tributary of the Volga river.

Abundant deposits of Permian age exist in the region of the Kama and Volga rivers. Silantiev *et al.*, (2015) explain in a detailed way the geology, the stratigraphy and the paleoclimatology of these Permian strata in the Tatarstan Republic.

These layers contain many fossil organisms and notably some fossil fishes. Fragments referred to the Platysomidae, a family of compressed body actinopterygian fishes, are numerous. "*Platysomus*" *biarmicus* Eichwald, 1857 is present in these deposits (Minich and Minich, 2009; among others).This species is now referred to the Bobasatraniidae, another family of compressed body fishes, and no more to the Platysomidae (Schultze *et al.*, 2021: 88).

The Capasso's public collection in Chieti contains a well preserved skull of "platysomid" look found in the Upper Permian strata (Kazanian) at Tichiye Gory, a Tatarstan locality along the Kama river. This material dates back of about 270 Mill. years.

The aim of our paper is to describe the osteology of this fish and to discuss its relationships.

MATERIAL AND METHODS

We studied the skull described in our paper with a stereomicroscope Leica Wild M 8. The photo of Fig. 1 was done by M. Luciano Lullo from the University of Chieti-Pescara. Fig. 2 was drawn by the first author (L. T.).

The material belongs to the Capasso's public collection in Chieti. This collection is legally registered by a decree of the Ministero per i Beni e le Attività Culturali under the date of October 11th 1999, following the disposition of the Italian law 1089/39. The specimens of this collection were also subject to prescription in order of conservation and availability to the studies on the

Fig. 1 – *Tatarstanichthys bannikovi* gen. and sp. nov. Head and pectoral girdle of holotype CLC S-1981. The scale is in mm.

basis of the article 30 of the Italian law N° 42/2004. The Soprintendenza per i Beni Archeologici dell'Abruzzo-Chieti has authorized the two authors to study this collection by two letters bearing the dates of May 5th, 2011 (ref.: MBAC-SBA-ABR PROT 0004537 05/05/ 2011 Cl. 34.25.01/2.1) and July 30th, 2014 (ref.: MBAC-SBA-ABR PROT 0005618 31/07/2014 Cl. 34.25.01/2.1).

List of abbreviations used in the text-Fig. 2

AN	=	angular
ANT	=	antorbital
ART	=	articular
BRSTG	=	branchiostegal ray
CLA	=	clavicle
CLT	=	cleithrum
DN	=	dentary
DPTE	=	dermopterotic
DSPH	=	dermosphenotic
ENPT	=	entopterygoid (= endopterygoid)
EXT	=	extrascapular (= supratemporal)
FR	=	frontal (= parietal)
GU (f.)	=	gular plate (fragment)
HCLT	=	hypercleithrum (= supracleithrum)
IORB 1-7	=	infraorbitals 1 to 7
LEP	=	pectoral rays
METH	=	mesethmoid
MX	=	maxilla
NA (l., r.)	=	nasal (left, rigth)
0P	=	opercle
PA	=	parietal (= postparietal)
PAL	=	autopalatine
PCLT	=	postcleithrum
POP (d., v.)	=	preopercle (dorsal, ventral)
PORO	=	postrostral
PSPI	=	postspiracular
PT	=	posttemporal
QJ	=	"quadratojugal"
QU	=	quadrate
RART	=	retroarticular
RO	=	rostral
SAN	=	surangular
SCACOR (f.)	=	scapulocoracoid (fragment)
SCL	=	sclerotic bony ring
SOP	=	subopercle

SORB 1-6	=	suborbitals 1 to 6
SY	=	symplectic
VO	=	vomer
pt. c.	=	posttemporal sensory canal

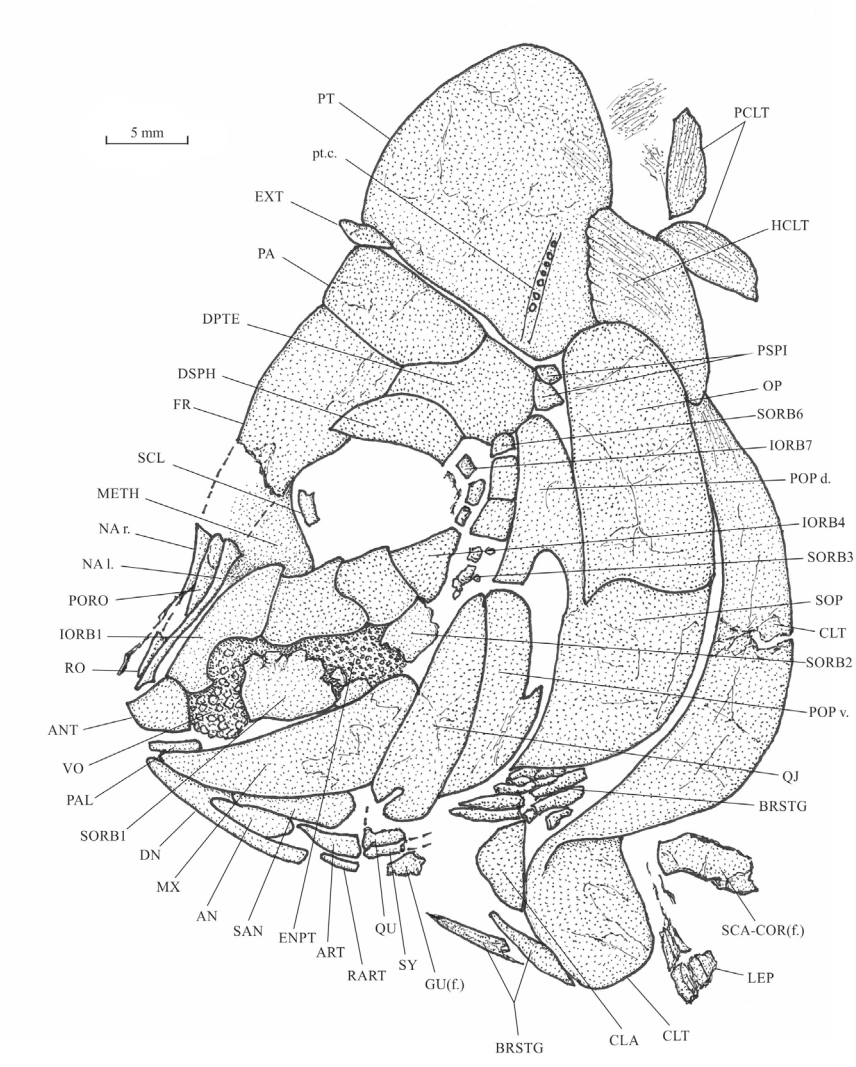

Fig. 2 – *Tatarstanichthys bannikovi* gen. and sp. nov. Reconstruction of the skull and of the pectoral girdle of holotype CLC S-1981.

SYSTEMATIC PALEONTOLOGY

Subclass ACTINOPTERYGII Cope, 1887
Superorder PALAEONISCIMORPHA Lund, Poplin and McCarthy, 1995
Order BOBASATRANIIFORMES Berg, 1937
Family BOBASATRANIIDAE Stensiö, 1932
Genus ***Tatarstanichthys*** gen. nov.

Type species
Tatarstanichthys bannikovi gen. and sp. nov. (here designated).

Diagnosis
As for the species (monospecific genus).

Etymology
The generic name refers to the Tatarstan Republic in the Federation of Russia. The Greek word *ichthys*, fish, is added.

Species ***Tatarstanichthys bannikovi*** gen. and sp. nov.

Diagnosis
Small bobasatraniid fish. Snout pointed. Frontal profile rectilinear. Rostral and postrostral present. Nasal elongate and extremely narrow. Long maxilla, with an acuminate anterior extremity and a broad posterior region. Hypertrophied "quadratojugal" connected to the maxilla and lying all along the anterior margin of the ventral preopercle. Antorbital reaching the tip of the snout. Infraorbitals 1 to 4 with a large membranous component. Infraorbitals 5 to 7 short and tubular. A series of six suborbitals, the first one under the second infraorbital. Presence of a gap between the two preopercles and the subopercle. A small spiny process on the posterior margin of the ventral preopercle. Opercle and subopercle with the same size. Two small postspiraculars.

Etymology
The specific name is given to honour our friend and colleague, the Russian paleoichthyologist Alexandre Bannikov.

Holotype and only material
CLC S-1981, a complete and well preserved skull, with the pectoral girdle (Fig. 1).

Formation and locality
Upper Permian (Kazanian, P2), Tichiye Gory, Kama river, Tatarstan Republic.

Osteology

The skull (Figs. 1, 2)

The head, without the posttemporal, is a little higher than long, with an almost rectilinear and obliquely oriented frontal profile. The snout is short and slightly pointed, with a terminal mouth. The orbit is large. The skull roof is composed of two impair bones, the rostral and the postrostral, and of five paired bones, the nasals, the frontals, the parietals, the dermosphenotics and the dermopterotics. The dermal skull bones are not ornamented. The cranial sensory canals are not visible. The endocranium is not known, except for the mesethmoid that is partly preserved.

A part of the massive mesethmoid is visible just before the orbit. A portion of a wide toothed vomer is preserved behind the antorbital, under the first infraorbital and above the maxilla. The nasals are elongated, tubular and extremely narrow. They extend along and on both sides of the rostral and the postrostral. These two last bones are strongly reduced. The nasal does not reach the dermosphenotic. The frontal is broad and seems long but its most anterior part is missing due to an artefact of fossilization. Laterally, the frontal is connected to the dermosphenotic, which is firmly integrated in the skull roof, and, posteriorly, to the large rectangular parietal and to the dermopterotic. The postorbital process of the dermosphenotic is weakly marked. The skull is medioparietal. The parietal and the dermopterotic form the posterior border of the skull roof. A small and narrow extrascapular (= supratemporal) is located between the parietal and the posttemporal. There are two small postspiraculars positioned just behind the posterior ventral corner of the dermopterotic. The parasphenoid is hidden under the infraorbitals.

The jaws are toothless. There is no premaxilla. The maxilla is a long bone, with an acuminate anterior extremity and a broad posterior region. Dorsally, the bone is free and separated from the infraorbitals. The posterior margin of the maxilla is connected to another large and long bone that is generally considered as an enlarged quadratojugal, a supramaxilloquadratojugal, a supramaxilla or as a ventrally displaced suborbital but it could also be the most ventral element of the preopercular series as it bears often a part of the preopercular sensory canal. The posterior margin of this elongate "quadratojugal" extends all along the anterior border of the ventral preopercle. The lower jaw is narrow and has approximately the same length than the maxilla. The dentary is divided in two posterior branches. The angular, the suprangular, the articular and the retroarticular are also visible.

A short rod-like autopalatine overlaps the most anterior part of the dorsal margin of the maxilla and slightly protrudes in the mouth. A part of the quadrate and of the symplectic are positioned just behind the lower jaw. Both bones are articulated with the articular of the lower jaw. A wide portion of the entopterygoid is visible between the infraorbitals, the suborbitals and

the maxilla. This entopterygoid is entirely covered with small teeth. The other elements of the palatoquadrate arch and the hyomandibula are not visible.

The antorbital is triangle-shaped. It reaches the tip of the snout, above the upper jaw. The first infraorbital is a long and arched bone. The second, third and fourth infraorbitals contain a large membranous component and form the ventral margin of the orbit. The fifth, sixth and seventh infraorbitals are short and tubular. They are located along the posterior margin of the orbit. There is a series of six suborbitals. The first one is a large bone located between the second infraorbital and the maxilla. The second one is smaller and positioned against the third infraorbital. Only small fragments of the third suborbital are preserved. The fourth, fifth and sixth suborbitals are still smaller and are located along the anterior border of the dorsal preopercle. A bony sclerotic ring is present. There is no supraorbital.

Two well developed preopercles are present. The dorsal one is positioned against the opercle. The ventral preopercle is connected to the "quadratojugal" anteriorly and to the subopercle posteriorly. There is a large gap between the dorsal preopercle, the ventral preopercle and the subopercle. The ventral posterior corner of the dorsal preopercle is fused to the anterior dorsal corner of the subopercle. The ventral preopercle exhibits a small spiny process at mid-length of its posterior margin. This spine forms the bottom of the gap. The opercle and the subopercle are well developed and have approximatively the same size. They extend along the cleithrum. Fragments of at least six short branchiostegal rays are visible under the subopercle and before the ventral extremity of the cleithrum. A small part of the gular plate is preserved just under the symplectic.

The pectoral girdle (Figs. 1, 2)

The post-temporal is hypertrophied. It overhangs the top of the skull like an gigantic hap. The bone is more or less triangular, deep, with a rounded upper border and a broad ventral region that is lying on the parietal and the dermopterotic. The posttemporal bears a vertically oriented sensory canal. The hypercleithrum (= supracleithrum) is short. Its ventral extremity is pointed, while its broad anterior dorsal border is articulated with the posttemporal. The cleithrum is elongated, with a long dorsal branch and a short obliquely oriented ventral branch. The bottom of the ventral branch is curved, forming a sort of wide spatula. A small clavicle is lying just before the ventral region of the cleithrum. Two postcleithra are located behind the hypercleithrum. A fragment of the scapulocoracoid and weakly marked traces of some pectoral fin rays are visible behind the cleithrum.

DISCUSSION

In the past, the compressed body lower actinopterygian fishes with two or three preopercles and a large "quadratojugal" sutured to the posterior border of the maxilla were referred to the Bobasatraniidae and the Platysomidae, two families generally included in an order Bobasatraniiformes or Platysomiformes. Now, all the fossil fishes with that peculiar morphology of the cheek and of the upper jaw, including many species formerly assigned to the genus *Platysomus* Agassiz, 1833, are reported as belonging to the Bobasatraniidae and no more to the Platysomidae (Schultze *et al.*, 2021: 85-89). Only a few species with one preopercle and devoid of "quadratojugal" are maintained in *Platysomus* and in the family Platysomidae (Schultze *et al.*, 2021: 118-123).

The skull of *Tatarstanichthys bannikovi* has the general morphology until recently attributed to the Platysomidae and more particularly to the genus *Platysomus*. However, the presence of two preopercles and of a large "quadratojugal" articulated with the maxilla proves that this fish belongs to the family Bobasatraniidae.

With its pointed snout, its rectilinear frontal profile and its anteriorly acuminate maxilla, *T. bannikovi* clearly differs from *Ecrinesomus* Woodward, 1910 and *Bobasatrania* White 1932, two genera having a rounded snout, an arched frontal profile and a maxilla with a deep anterior region (Lehman, 1956: Figs. 4, 5). It also differs from *Ebenaqua ritchiei* Campbell and Phuoc, 1983 and from "*Platysomus" schultzei* Zidek, 1992, two species with protruding jaws (Campbell and Phouc, 1983: Fig. 4; Zidek, 1992: Fig. 24C).

Tatarstanichthys bannikovi seems more closely related to the other bobasatraniid species formerly included in the genus *Platysomus* or to *Enzichthys* Selezneva, 1988 that have the same pattern of snout, frontal profile and maxilla (Zidek, 1992: Fig. 20C; Selezneva, 1988: Fig. 1; among others). However, *T. bannikovi* also exhibits important specialized features not present in all these other fishes, *i. e.*, a , long tubular nasals, reduced rostral and postrostral, free maxilla not sutured with the infraorbitals, an elongate "quadratojugal" lying all along the ventral preopercle, a gap between the two preopercles and the subopercle and a series of suborbitals that extends from the level of the second infraorbital till the dermopterotic.

Obviously, *T. bannicovi* deserves its peculiar generic status within the family Bobasatraniidae.

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