Eotrigonodon (OSTEICHTHYES, PLECTOGNATII) IN RICHARD BRECKNER'S COLLECTION (NATURAL HISTORY MUSEUM SIBIU)

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Abstract. The current paper presents data on the pharyngeal teeth belonging to the genus *Eotrigonodon* WEILER 1929, which are part of the Palaeontological Collection Richard Breckner. I described six teeth collected from the actual protected palaeontological area "Eocene limestones from Turnu Roşu (Porceşti)". The teeth are extremely flattened laterally and display a sickle shape. They miss their roots, but where small roots fragments are preserved, we may notice the difference in thickness between the crown and the root and vertical folds. Taking into account that the species determinations were made on the basis of oral teeth and their association with pharyngeal teeth (sickle type) with these, the latter were determined in the same way as they were found within the same deposits. At the same time, this type of tooth can be both pharyngeal and incisor. Due to these features and to the fact they were found in Eocene deposits, they may be considered as belonging to *Eotrigonodon* genus. Only three teeth were specifically assigned to *Eotrigonodon serratus* WEILLER 1929. This study is the first one to mention the genus and species at Turnu Roşu (Porceşti).

Keywords: pharyngeal teeth, eotrigonodontides fish, Eocene, limestone, Turnu Roşu (Sibiu)**.**

Rezumat. *Eotrigonodon* (Osteichthyes, Plectognatii) în colecţia Richard Breckner (Muzeul de Istorie Naturală Sibiu). În această lucrare sunt descrişi dinţi faringieni ce aparţin genului *Eotrigonodon* WEILER 1929, ce fac parte din Colecţia paleontologică Richard Breckner. Cei 6 dinţi faringieni descrişi provin din aria paleontologică protejată „Calcarele eocene de la Turnu Roşu (Porceşti)". Dinţii se caracterizează prin accentuata aplatizare laterală şi morfologia care imita forma de seceră. Rădăcinile lipsesc, dar la dinţii la care se păstrează o mică parte din ele se poate observa diferenţa de grosime dintre coroană şi rădăcină şi slabe riduri verticale. Determinările la nivel de specie s-au bazat pe dinţi orali, iar asocierea dinţilor faringieni (de tip cârlig) cu aceştia, în cadrul aceloraşi depozite, a atras şi asupra celor din urmă aceeaşi determinare. Acest tip de dinţi poate fi atât de tip faringian cât şi incisiv. Caracteristicile morfologice şi faptul că s-au găsit în depozite Eocene, conduc la atribuirea acestor dinţi genului *Eotrigonodon*. Doar 3 dinţi s-au determinat la nivel de specie, ca aparţinând la *Eotrigonodon serratus* WEILLER 1929. Acest studiu este prima menţionare a genului şi speciei în calcarele eocene de la Turnu Roşu (Porceşti).

Cuvinte cheie: dinţi faringieni, peşti eotrigonodontizi, eocen, calcare, Turnu Roşu (Sibiu).

INTRODUCTION

On the initiative of several Saxon Naturalist intellectuals, in a time when the Transylvanian as well as European Naturalism were crossing a period of fast development, on May 4th 1849, in Sibiu (Hermannstadt), after two years of meetings which took the form of book clubs, The Transylvanian Society of Natural Sciences (*Siebenbürghische Verein für Naturwissenschaften zu Hermannstadt*) was founded. The founders wanted to be part of a society that gathered people with a common passion for nature, who could also share their findings with their community, and not only as well as to educate the young generation in the spirit of knowledge and protecting nature.

The first collections of plants, animals, fossils, minerals and rocks were established even before the establishment of the Society (during the period when its founders were members of the Transylvanian Cultural Society – *Siebenbürghische Landeskunde*) (SCHNEIDER & STAMP, 1970). Due to the rapid growth of the collections, storage places changed constantly, however, after considerable financial efforts, the Natural History Museum was opened on May 12, 1895 as a public institution and main office for the Society. After more than 160 years from the creation of the Society, the palaeontological collection alone gathers 57,000 items.

In the present paper, I render the pharyngeal teeth belonging to the *Eotriogonodon* genus, part of Richard Breckner's palaeontological collection. For the majority of palaeontologists and naturalists, Richard Breckner is virtually unknown. However, his collection of fish teeth (mostly shark teeth) is unique in Romania. The fact that about 30% of this collection (teeth) is determined at the level of knowledge of the early 20th century speaks to Breckner's knowledge in the field.

Considering the importance of the collection for the Romanian fish palaeontology and not only, I have provided a few brief details regarding Richard Breckner (1900-1979). According to "*Schriftsteller - Lexicon der Siebenbürger Deutschen" / "The Lexicon of Transylvanian Saxon personalities*" (1998), Breckner was an art critic, journalist, literary secretary for the theatre and writer. Between 1933-1938 he was a freelancer making a living by writing scientific papers on the fossil collection from Transylvania. Neither the dictionary, nor any other reference talks about these papers or where the results of this scientific activity were published. Breckner's name appears more and more often between 1937–1946 in the Society paper, in the "Vereinsnachrichten" column, being praised for his work in registering and cataloguing the collections (even re-determining the shark teeth), especially palaeontological ones. In 1938 Richard Binder, the chairman of the Society, congratulated the diligence and competence of the one who "worked for years on the Porceşti tertiary fossils especially shark teeth". However there are no details concerning his writing activity or his collection, which we believe was created during this period (CIOBANU, 2007).

Breckner's palaeontological collection, part of which are the teeth in subject, contains fossils (molluscs) from Lăpugiu de Sus and 5,000 fish teeth, mainly shark, from Turnu Roşu (Porceşti). This collection was acquired in 1954 (according to the museum archives) from Heinrich Breckner (relative of Richard Breckner), a printer from Sibiu.

MATERIAL AND METHODS

The paper describes 6 pharyngeal teeth collected from the palaeontological reserve "Calcarele eocene de la Turnu Roşu (Porceşti)" (*The Eocene limestone from Turnu Roşu (Porceşti)*). The richness of the Eocene fauna recovered in these deposits, from which the fish teeth were also collected, caught scientists' attention as early as the beginning of the 19th century, when several valuable systematic research studies were conducted. The majority of the palaeontological studies referring to this peculiar area were conducted by the members of the Society.

These limestone rich in fauna are part of the Eocene shallow marine sequences lying north of the Făgăraş Mountains, on the southern border of the Transylvanian Basin. Around Turnu Roşu, the Eocene formations emerge like a limestone "patch" area on the northwestern ending of the Făgăraş metamorphic rocks (Fig. 1).

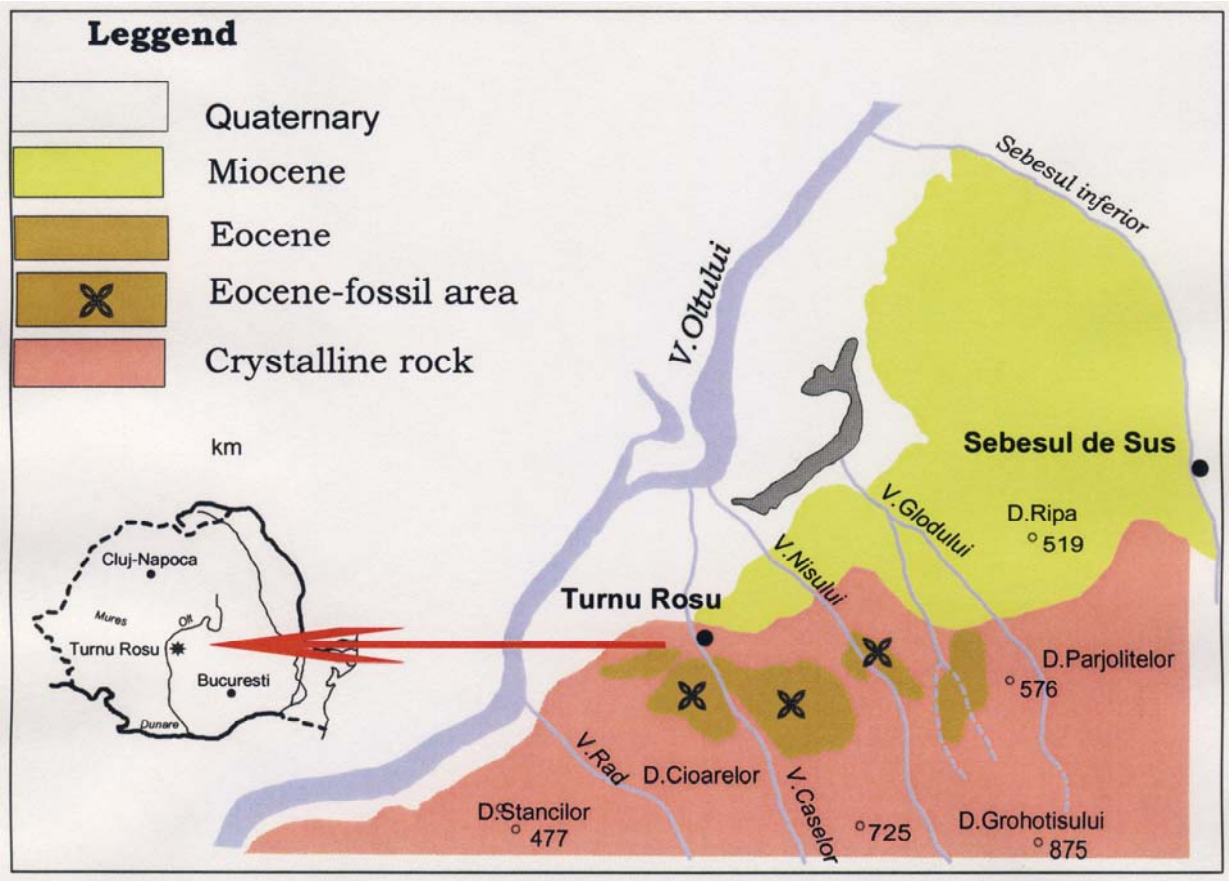

Figure 1. Geological map of Turnu Roşu palaeontological reserve (adapted after TĂTĂRÂM, 1970).
Figura 1. Harta geologică a rezervației paleontologice Turnu Roşu (adaptat după TĂTĂRÂM, 1970).

The latest concept regarding the stratigraphy of the limestone of Turnu Roşu belongs to MÉSZÁROŞ (1996) who defined the Turnu Roşu Group, including the Valea Nişului and Valea Muntelui formations (both Eocene). The faunal analysis underlined the existence of almost all Eocene groups and up to recently they represent the largest deposits bearing isolated fish teeth. Environment reconstructions based on correlation between fossil fauna and recent representatives of the species, indicate warm tropical-subtropical waters, rich in oxygen and biota (MÉSZÁROS & IANOLIU, 1972, 1973; BUCUR & IANOLIU, 1987; CIOBANU, 2006).

I believe the fish teeth were collected from Valea Nişului and Valea Caselor (Fig. 2), the fossiliferous outcrops of the natural reserve. Unfortunately, neither Neugeboren[1], nor other collectors – in our case Breckner – ever mentioned the exact location where they collected the fossils from. The sample of fish teeth collected in the last few decades is very small compared to the old collections.

[1] Ludwig Johann Neugeboren (1806-1887) carried out the first micro paleontological studies in Transylvania and published the first scientific study related to the Eocene sharks from Turnu Roşu.

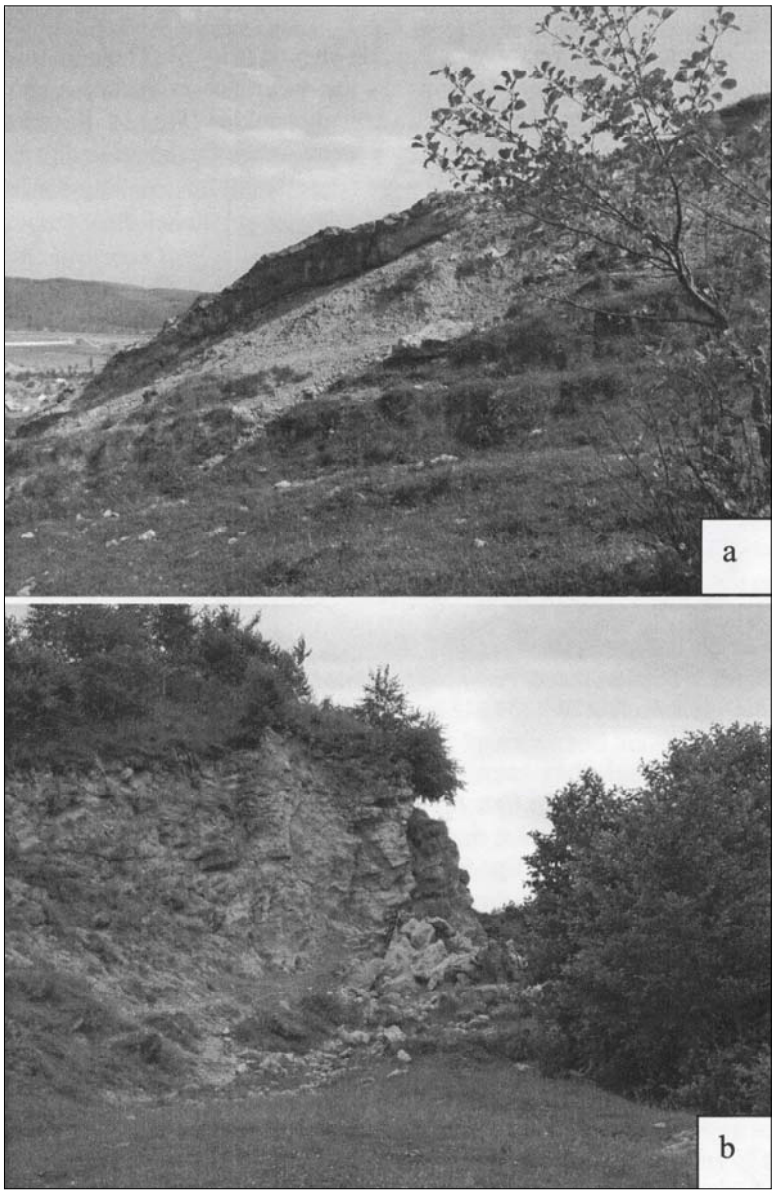

Figure 2. Eocene Limestone from Turnu Roşu (a-V.Caselor; b-V. Nişului).
Figura 2. Calcarul eocen de la Turnu Roşu (a-Valea Caselor; b-V. Nişului).

Systematic Palaeontology

Class Osteichthyes
Subclass Actinopterygii
Infraclass Teleostei
Order Tetraodontiformes *(*Plectognathi*)*
Suborder Balistoidei
Family Eotrigonodontidae WHITE 1935

The Eotrigonodontidae includes three genera: *Stephanodus* DAMES 1883, *Kankatodus* KUMAR & LOYAL 1987 and *Eotrigonodon* WEILLER 1929. The single European Paleogene genus is *Eotrigonodon*, the other ones being older (Cretaceous).

***Eotrigonodon serratus* WEILER, 1929**

(figs. 5, 6, 7, 8, 9; Pl.1)

Material: 3 pharyngeal teeth from R. Breckner's collection (PaBr 34145, PaBr 34146, PaBr 34147, PaBr 34148, PaBr 34150).
Origin: Eocene limestone from Turnu Roşu (Porceşti)

***Eotrigonodon* sp.**

(fig. 10; pl.1)

Material: 3 pharyngeal teeth from R. Breckner's collection (PaBr 34149)
Origin: Eocene limestone from Turnu Roşu (Porceşti)

Description

The teeth are laterally compressed, very flat and sickle-shaped (Fig. 4). Their roots are missing. However, for the ones that still keep a small root fragment one can observe the difference in thickness between the crown and root. The contact border between root and crown exposes fine vertical wrinkles (Fig. 3). Based on these features and the stratigraphy of the locality where they are originating from – Eocene – they can be related to *Eotrigonodon*.

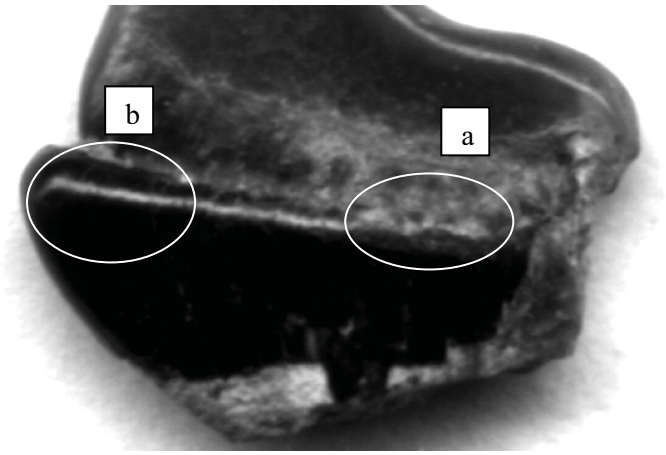

Figure 3. Details of tooth Pa 34.149 (a-vertical folds; b-root crown border).
Figura 3. Detalii ale dintelui Pa 34.149 (a-cute verticale; b-marginea rădăcinii coroanei).

As for these last teeth, although they have the general characteristics of this genus, they have a few easily recognizable differences. Therefore, the teeth in figs. 6, 9, and 10 have their apex of the cusp more upright than sickle shaped. The tooth in fig. 10 has its apex worn out, most probably due to wear and the teeth in figs. 7, 8, and 10 have vertical folds in the lower part; at the tooth in fig. 5 the border between the root and the cusp of the tooth is done through a strip with vertical folds. The tooth from fig. 9 resembles to the one illustrated by LERICHE (1906), figs. 66-69 like *Eotrigonodon serratus*; it is possible for the apex to have been worn away by wear. The teeth of figs. 5, 6, 7 resemble those illustrated by Priem (1897) in pl. VII like *Ancistrodon armatus*.

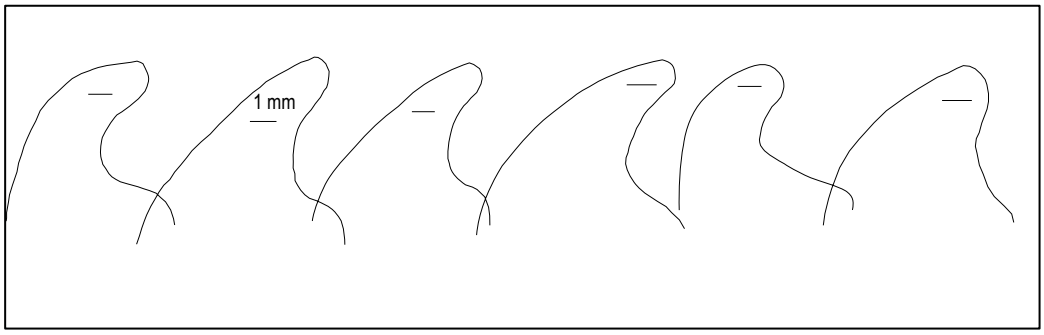

Figure 4. The sickle-shaped shown by the teeth (left to right - tooth 1 - 6).
Figura 4. Forma curbată a dinților (de la stânga la dreapta - dintele 1 - 6).

DISCUSSIONS

In Romania, the first reports on "*Eotrigonodon*" teeth in the Paleogene of Transylvania belong to KOCH (1900), who mentioned the presence of *Capitodus* in the limestone formations of Cluj in a faunal list. However, it is possible that this fossil could be rather an *Eotrigonodon* tooth. CODREA et al. (1997) includes also *Eotrigonodon* in the list of fossil fish originating from the Cluj Limestone. For Romania, the first mention related to their presence in Cretaceous deposits was done by DICA et al. (1998), referring to a single oral tooth of *Eotrigonodon serratus*.

In a complex study on palaeoenvironment reconstruction based on fish assemblages, DICA (2005) mentioned 6 pharyngeal teeth and 1 oral tooth belonging to *Eotrigonodon serratus*, in the Cluj Limestone (Priabonian), Racoți Sandstone and Jibou. From all 6 of the pharyngeal teeth, only a single one was however, described.

The genera and species assignations are faced with major odds, as all discoveries refer exclusively to isolated teeth and not to a full dental apparatus. The already discovered teeth expose wide morphological variability but also present similarities between related taxa. Furthermore, there is a lack of comparative material.

These flat sickle-shaped teeth drew researchers' interest and were described in references since the second half of the 19th century. These teeth were found in deposits ranging from Cretaceous until the end of the Eocene. This

morphological teeth type which expose differences in size between the crown and root were firstly described by Gervais (1848-1852) under different names: *Sargus, Armatus, Serratus* etc.

DAMES (1883) named these teeth as "*Ancistrodon*" type; he thoroughly described them and he even distinguished several different species out of the *Sargus* genera defined by Gervais. He firstly showed that "*Ancistrodon*" teeth are actinopterygian pharyngeal teeth and belong to the sparid type. In the majority of the papers from the 19th / 20th centuries boundary, the flat sickle-shaped teeth were called "*Ancistrodon*". As Dames observed that they are similar to pharyngeal teeth belonging to other species from the same Tetraodontiformes / Plectognathi order, like *Balistes*, he doubted the previous findings of some forerunners.

PRIEM (1897) specified that he sometimes found flat sickle isolated teeth with the root wider compared to the base of the crown in "Senonian" and Lower Cenozoic formations. He described and illustrated an *Ancistrodon armatus* pharyngeal tooth from the Mont Mokattam Eocene limestone. Priem presents the opinions of authors who have described up to then the "Ancistrodon" teeth. Although he agreed with Dames' findings, he showed at the end of the paper, that Woodward, who published a catalogue in 1895, considered that the teeth published under the name of *Ancistrodon* teeth are actually pycnodontes prehensile incisors. He concludes his paper stating that the teeth in question are actually pycnodontes prehensile teeth.

LERICHE (1906, 1910), studying the Eocene fish fauna in Belgium, noted that the *Ancistrodon* teeth resemble the *Balistes* incisors – both genera have claw shaped teeth which fish used for nibbling coral biohermes. Therefore, Leriche believes that at least for the Eocene in Belgium, *Ancistrodon armatus* are not pharyngeal teeth but real incisors and wear is the main cause for the different teeth morphologies.

WEILLER (1929) defined for the first time the *Eotrigonodon* genera based on several *Trigonodon* oral teeth with dentate oral edge, considering that this species occupies an intermediary position between *Stephanodus* (Cretaceous) and *Trigonodon* (Cenozoic). The author believes that "*Ancistrodon*" teeth which accompany incisors do not belong to the *Trigonodon* species but they resemble more the Sparidae and Sciaenidae teeth.

CASIER (1946) seems to agree with Weiller; and he further explains the relative richness of pharyngeal teeth found in the strata by explaining that each individual has 4 incisors (2 superior and 2 inferior) and 70 pharyngeal teeth. Casier also explains the morphological variations though wear.[2] Furthermore, he mentions that these teeth have a sideway flattened root, slightly thicker than the crown and with folds.

In the majority of works, the *Eotrigonodon* species are based on oral teeth. The association between oral and pharyngeal teeth is highly uncertain because it is based on the fact that they are just found together in the same sediments.

There were also other authors who described the "claw" or "sickle" shaped teeth as belonging to different species of pycnodontes. So, WOODWARD (1901) noted that some pycnodontes have teeth claw type in their gill chamber, whereas BELL (1986) described the "claw" teeth type as being gill teeth belonging to the pycnodont *Hadrodus* genera.

CASE (1994) considers that the "*Ancistrodon*" teeth are "nibbling" teeth for eating at coral biohermes. They are situated alongside each other in groups of 4 to 6 flattened teeth in the symphyseal regions of the jaws.

KRIWET (2005) realized a complex study of pycnodonte fish skulls and mentioned that during his research he observed several "Ancistrodon" gill teeth at Cretaceous pycnodontes. Furthermore, there are present species of Balistes and Pyconodontes whose sickle-shaped, laterally compressed teeth are placed on the edge of the lower and upper jaw.

The taxonomy of fossil eotrigonodontid fish is hard to deal with because of the lack of complete fossilized jaws, recent comparative material and references. There are debates on their taxonomy, but the majority of authors catalogue them as *Plectognathi* – marine tropical fish with unified teeth to form a beak which they use for nibbling at coral biohermes. Regarding the taxonomy of fossil genera *Eotrigonodon*, ROMER (1966) considers them as belonging to the Trigonodontidae family and their present systematic position was established by CASIER (1966).

CONCLUSIONS

Considering that the species of eotrigonodontid fish had oral teeth and that they are associated to the same rocks with the claw shaped pharyngeal teeth, the same identification may result. Although this type of teeth can be either pharyngeal, or incisors, their systematic classification and identification can be uncertain. According to the available references, I believe these teeth can be referred to as *Eotrigonodon*. Considering that the teeth in figs. 5, 6, 7, 8 are sickle shaped and are similar to the teeth described in the references, I came to the conclusion that they belong to *serratus* species. As the teeth in fig. 6 display a sharper end (they resemble the ones presented by Kumar, Loyal in 1987), I believe they resemble the ones presented within *indicus* species. However, these species were described only for Late Cretaceous–Paleocene of India. As a result, I consider that this tooth can be assigned only up to genus level.

Eotrigonodontids, the extinct puffer fish are analogous to the present day tetraodontidae. They are characterized by four oral teeth in the jaws, the pair in each jaw forming a parrot like beak. Besides the oral teeth, they have a number of pharyngeal teeth. *Tetraodon cutcutia* the common puffer fish is native to the fresh and slightly brackish waters of India. In India eotrigonodontids are much more abundant in the Lower Eocene marine sequence also in the Middle Eocene in brackish to fresh water transitional sequence (KUMAR & LOYAL, 1987).

[2] LERICHE (1906) explains as well the large variability of morphologies due to wear.

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Figure 5. *Eotrigonodon serratus* WEILLER 1929.

Figure 6. *Eotrigonodon serratus* WEILLER 1929.

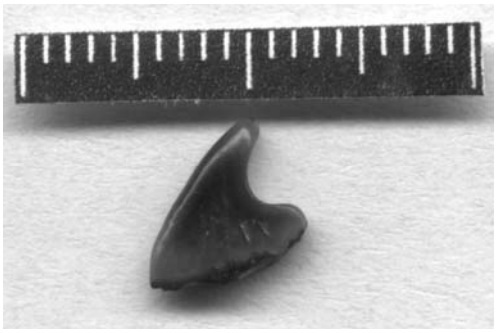

Figure 7. *Eotrigonodon serratus* WEILLER 1929.

Figure 8. *Eotrigonodon serratus* WEILLER 1929.

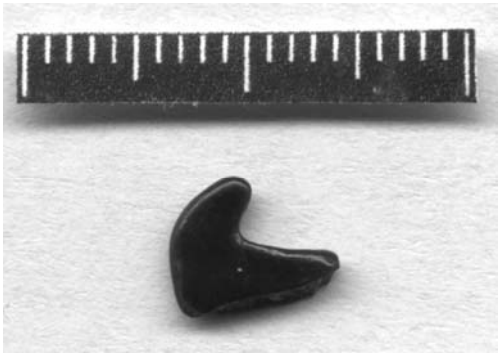

Figure 9. *Eotrigonodon serratus* WEILLER, 1929.

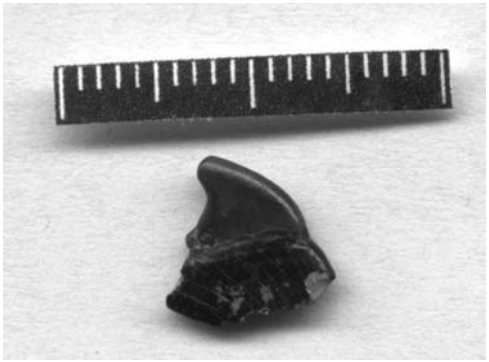

Figure 10. *Eotrigonodon* sp.

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