

A NEW DALATIID FISH FROM THE RHAETIC BONE BED

AT BARNSTONE, NOTTINGHAMSHIRE

by

J.H. Sykes

Summary

A new species of shark belonging to the family Dalatiidae is founded on isolated upper and lower teeth from the Rhaetic Bone Bed at Barnstone and is allocated to the genus *Dalatias*. The previously established range of the Dalatiidae begins in the Palaeocene. This record, therefore, extends the range of the family by well over a hundred million years.

Introduction

The teeth were collected from the two to three inch (50 - 76 mm.) thick Bone Bed horizon, eighteen inches (0.4m.) above the base of the Rhaetic in the Barnstone railway cutting (SK 739358), which is about half a mile east of the village (Sykes, Cargill and Fryer, 1970). Specimens are quite rare and are scattered fairly evenly throughout the bed, although they are rather more concentrated in a few places. The teeth are preserved in dark brown to black, probably phosphatic material, and are delicate. The roots and crowns are internationally porous, the pores being mostly filled with calcite. This feature, along with their distinctive shape, makes these teeth readily distinguishable from all other species in the Bone Bed. Sixty six lower teeth were collected, all of which were broken off at or above the median canals in the root. Of those which are sufficiently complete to show their orientation in the mouth, nineteen belong to the right side of the jaw, twenty five to the left side, and seven are median teeth. Fourteen teeth have been collected belonging to the upper jaw, a few of which are almost complete.

Systematic Palaeontology

Class Chondrichthyes

Order Selachii

Suborder Squaloidea

Family Dalatiidae Gill, 1893

[≡ Scymnorhinidae Gill *ex* Goode and Bean, 1895]

Genus *Dalatias* Rafinesque, 1810, p.10.

*Type species* (by original designation); *Scymnus licha* Bonnaterre, 1788, p.12.

*Dalatias barnstonensis* sp. nov.

1970, Scymnorhinidae, gen. indet. Sykes, Cargill and Fryer, p.234, pl. 17, and text-fig.5.

Diagnosis

The upper and lower teeth differ widely. The upper teeth are thorn-like with minor lateral points; incurved, upright or inclined. They have a laterally compressed, bifid root. The lower teeth are blade-like with a coarsely serrate triangular crown on a sub-quadrate

base and root. The crowns are medially upright becoming lower and more oblique posteriorly. A median tooth overlaps its neighbour basally on each side. Each lateral tooth overlaps the one posterior to it.

Holotype

B.M., P 51407 (J.H. Sykes Coll.); a left lower lateral tooth from the Lower Rhaetian Bone Bed, Barnstone, Nottinghamshire (Pl.2. fig.1)

Paratypes

B.M. P 51408 - 51414 (J.H. Sykes Coll.); isolated upper and lower teeth, from the Lower Rhaetian Bone Bed, Barnstone, Nottinghamshire (Pl.2. and text-figs. 1 and 2).

Dimensions

Holotypes:	length	height	depth
B.M. P 51407; left lower lateral tooth	2.5 mm	3.1 mm	0.7 mm
Paratypes:			
No.1, B.M. P 51408; left lower lateral tooth	1.5	2.3	0.5
No.2, B.M. P 51409; left lower lateral tooth	2.5	2.9	0.6
No.3, B.M. P 51410; right lower posterior lateral tooth	2.6	1.8	0.5
No.4, B.M. P 51411; lower median tooth	2.7	3.5	0.8
No.5, B.M. P 51412; lower median tooth	4.1	5.6	1.2
No.6, B.M. P 51413; upper symphyseal tooth	1.0	2.6	0.9
No.7, B.M. P 51414; right upper lateral tooth	1.5	2.9	1.0

Description of teeth

Holotype: left lower lateral tooth, B.M. P 51407 (Pl. 2. fig.1).

The tooth consists of an incomplete triangular apex on a rectangular base with part of the root attached. The crown is very compressed and has pronounced serrations on its upper edges. The serrate portion of the crown is slightly incurved, inclined posteriorly, and thins towards the edges on which are four anterior and six posterior, damaged serrations. The upper part of the crown has parallel, crack-like striations. The basal part of the crown has two vertical depressed areas, on the posterior and anterior borders respectively. The posterior depression (i.d.) is on the inner face being open at the top; the anterior depression (e.d.) is on the outer face being closed at the top and having a groove along the upper part of the inner margin. The base extends posteriorly to form a posterior process. At the top of the anterior border there is a small anterior process, below which the border is rather undercut. The tooth thickens downwards, especially on its inner face, initially from the sides and the centre, and then completely transversely. It then thins and curves gently outwards to a point where two central median canals pass from the external median foramina to the inner face. At the base of the outer face there is a depressed area which extends obliquely upwards posteriorly. It has a porous surface and is part of the root of the tooth. On the inner face there are two central grooves which deepen and lead into the median canals.

Paratype No.1: A left lower lateral tooth, (Pl. 2. fig.2; text-fig.1, figs 6 and 10).

This is a similar tooth to the holotype but with a more intact crown. It is, however, much smaller than the average and is singular in having only one median canal instead of two. One

other unusual feature is that the upper boundary of the depressed root area is almost horizontal. The serrations on the crown are strongly developed and increase in size towards the prominent apex. There are five serrations on the posterior edge and three on the anterior edge.

Paratype No.2: A left lower lateral tooth, (Pl. 2. fig.3; text-fig.1, figs. 7 and 11).

On this tooth, above the anterior process, the upper anterior edge of the crown rises at a low angle which makes the crown lower than in the previous type and also more rearward pointing. The height of the base of the crown is also shortened and the posterior process is more prominent. The points of the serrations are little damaged, there being six both posteriorly and anteriorly.

Paratype No.3: A right posterior lower lateral tooth, (Text-fig.1, fig.1).

In this tooth the same developments are more pronounced producing a very low crown pointing extremely rearwards. It has three posterior and four anterior serrations.

Paratype No.4: A median tooth, (Text-fig.1, fig.14).

The crown of this tooth is almost upright. The tip is broken off horizontally leaving six broken serrations of corresponding size on either side. Lateral expansion of the base is equal on both sides. Both the vertical depressions are on the inner face and are open at the top.

Paratype No.5: A median tooth, (Text-fig.1, fig.15).

This tooth is much larger than the average specimen. The upper part of the crown is very worn but the equilateral nature of the tooth is shown by the equal lateral expansion of the base of the crown, the symmetrical depressed root area with its concave upper boundary, and the similar vertical depressions on the inner face.

Paratype No.6: An upper symphyseal tooth, (Pl. 2. fig.4).

This tooth consists of an acute thorn-like crown on a shallow, forwardly extended, bifid root. The crown is upright, has lateral cutting edges, is curved rearwards and is rather angled a short way above the base. Here there is a small, upwardly directed, lateral point on either side. As in the lower teeth the crown has crack-like striations in its upper part. The root has a porous exterior and a flattened undersurface. It is narrow where it projects slightly beyond the inner face of the crown (i.p.). It widens and extends beyond the outer face of the crown where it is split into two prongs (b.p.e. and a.p.e.) by a groove at the base of the outer face of the crown which deepens and widens. On the internal protuberance of the root the internal median foramen locates the median canal which (as proved in other specimens) passes through the root parallel to the base and emerges near the fork on the bifid part of the root.

Paratype No.7: A right upper lateral tooth, (Text-fig.2, figs.3-4.)

In this tooth the crown is curved both inwards and laterally. Lateral points are barely developed and the posterior basal extension is much less developed than the anterior basal extension.

#### Remarks

Sharks of the family *Dalatiidae* have slender, conical upper teeth and pointed, blade-like lower teeth. Each lower tooth overlaps its posterior neighbour. There are six genera though only three significant types of teeth. In the genera *Somniosus*, *Heteroscymnus*, *Euprotomicrus*, and *Heteroscymnoides*, the smooth-edged crowns are so oblique that they form an almost continuous cutting edge. Only the two genera *Dalatias* Rafinesque (1810) and *Isistius* Gill (1864) have teeth with upright triangular crowns. The teeth of the lower jaw of *Isistius* differ from those of *Dalatias* in being more symmetrical and lacking serrations on the crowns.

In the British Museum (Nat. Hist.) a specimen of *Dalatias* sp. (P 37360) from the Lower Miocene of Barbados has a flattened, serrate-edged, triangular crown on a rectangular base. The base is incomplete and there is no interior or exterior depression, though the striations of the enamel compare with those of other Dalatiid species. The fossil species of the family *Dalatiidae* referred to in the Catalogue of Fossil Fishes in the British Museum (Woodward, 1889, p.33) are founded on teeth alone, but all the Dalatiid genera are, however, represented in the present day oceans.

The teeth of *Dilatias licha* (Bonnaterre) have been fully described by Bigelow and Schroeder (1948, p.506). The upper teeth are thorn-like on forwardly extended, bifid bases. They are curved rearwards, erect towards the centre of the mouth but moderately oblique towards the corners. The lower teeth are blade-like with quadrate bases and triangular crowns, the latter with regularly serrate edges. They are erect at the centre of the mouth but moderately oblique towards the corners. The median tooth is symmetrical, weakly notched on both edges at the junction of the crown with the base and it overlaps its neighbours on either hand. The lateral lower teeth are notched only on the outer side each overlapping the next outermost tooth.

The teeth of *Dalatias barnstonensis* have much in common with those of *Dalatias licha*. The sequence in the lower jaw consists of a single median tooth which overlaps its neighbours on both sides, each succeeding tooth being interlocked in a single series, each one overlapping the one posterior to it (Text-fig.2, fig.13). As in *D.licha* (James, 1952, pl.2) the teeth vary from being upright anteriorly to being more inclined and depressed posteriorly. Both species have a similar transverse thickening followed by a thinning downwards, they have similar internal and external depressions and the external depression groove compares closely in both species. Both have similar posterior and anterior processes the anterior border of the base being undercut whilst the posterior border is projected rearwards by the tooth being notched at the junction of the base and the upper posterior edge. They both also have crack-like striations on the enamel surface. The vascular systems are comparable in the two species by having median canals in both the upper and lower teeth which allow the passage of blood vessels from one series of teeth to the next (Casier, 1961a, p.47). A transverse section of a lower right lateral tooth (Text-fig.2, fig.14) displays an axial pulp canal with secondary pulp canals leading from it. This compares well with the internal structure of other teeth belonging to the family Dalatiidae, for example, *Isistius trituratorus* Winkler (Casier, 1961a, p.25, fig.11).

Sections of the upper and lower teeth of *D.barnstonensis* show that they both have a similar spongy internal structure with a layer of solid enamel on the inner and outer faces of the crown. It is also significant, in relating the upper teeth to the lower, that they are in the same size ratio as in the modern species.

*D.barnstonensis*, however, has a number of distinctive features. In the lower teeth the serrations on the upper edge of the crown are so much stronger than those of the modern species of *D.licha* that some tend to become individual, upwardly directed points. There about 25 serrations on each edge of the crown of *D.licha*, whereas, in *D.barnstonensis* there is an average of about seven on the posterior edge and five on the anterior edge. The teeth of *D.barnstonensis* are only about half the size of those of *D.licha* and are smaller than most other Dalatiid teeth. Furthermore, whereas *D.licha* has one median canal and two lateral canals in the lower teeth, *D.barnstonensis* has just two median canals placed lower down the tooth. In the upper teeth the presence of up to three lateral points is quite distinctive. The basal extensions are less extended laterally than those of *D.licha* and there is no groove along the base of the root. The angular aspect of the inward curve is also another distinguishing feature.

#### Discussion

Fossil Dalatiid teeth are said to occur in the Upper Cretaceous of Western Asia and North America (Romer, 1947 p.577; Bigelow and Schroeder, 1948, p.501), but these records have not been substantiated and the earliest certain record is of *Isistius trituratorus* (Winkler, 1847) from the Palaeocene of Morocco (Patterson, 1967, p.72).

The presence of Dalatiid sharks in the Rhaetic means that the range of this family is extended backwards in time by about 130 million years. An attempt has been made to find alternative families to which the new species could be assigned, without such an anomalous time range. Species of *Hybodontis* and *Priohybodus*, which are hybodonts with teeth having serrate-edged crowns, are described by G.d'Erasmus (1960). These teeth, however, are extended laterally with lateral crowns, have no quadrate base and root, and do not overlap. In *Orthocodus* and *Notidanus* (G.de Beaumont, 1960.) the teeth either have lateral crowns or a small number of distinct crowns spread laterally. They also do not have quadrate bases and do not overlap. The Lower Cretaceous Hybodont *Pororhiza*, (Casier, 1961b, p.19, fig.2) has teeth with a quadrate root having two central canals but they do not overlap in series and the crowns, which are well delineated from the roots, are low and rounded.

Though many fossil shark species have been founded on isolated teeth, these are but a small part of the whole fish. It may be that the species *D.barnstonensis* differed in many respects from the modern *Dalatias*. However, these are restrictions imposed by the nature of the fossil record and within these limits, it seems justifiable to refer these teeth to the genus *Dalatias*.

It is not possible to define evolutionary trends from one early type but there are three aspects which may be noted. The modern teeth are larger with a more complex vascular system in the lower jaw; the serrations of the lower teeth are smaller and more regular; the upper teeth have no lateral points. The teeth of *D.barnstonensis* are small and rare; further investigation may bring to light other species of the family Dalatiidae which lived during the long period between the Rhaetic and Tertiary times.

#### Acknowledgements

I am extremely grateful to Mr. A.J. Rundle of the Department of Geology, Nottingham University, for his guidance and assistance in preparing this paper; also for his work on the production of the plate. I should also like to thank members of the staff of the British Museum (Nat.Hist.), especially Mrs. C. Welch, Dr. C. Patterson and Mr. H.A. Toombs for their helpful discussion.

I should also like to express my appreciation to Lord Energlyn for permission to use the facilities of the Department of Geology, Nottingham University; and finally thank my friends Mr. J.S. Cargill and Mr. H.G. Fryer who made this paper possible.

J.H. Sykes,  
138 Harlaxton Drive,  
Lenton Sands,  
Nottingham.

#### References

- BIGELOW, H.B. and SCHROEDER, W.C.  
1948. Fishes of the Western North Atlantic. Memoir Sears Foundation for Marine Research. pt.1, New Haven, XVII+576 pp., 106 figs.
- BONNATERRE, M.  
1788. Tableau Encyclopédique et Methodique des Trois Règnes de la Nature. Paris, 215 pp., 100 pls.
- CASIER, E.  
1961a. Transformations des systèmes de fixation et de vascularisation dentaires dans l'évolution des Selaciens du Sous-Ordre des Squaliformes. Mem. Inst. r. Sci. Nat. Belg., (2), no. 65, 61 pp., 34 figs.  
1961b. Materiaux pour la Faune Ichthyologique Eocretacique du Congo. Annls. Mus. r. Afr. cent., Sci. géol. 8vo, no. 39.

## EXPLANATION OF TEXT-FIGURE 1

### Teeth of the Lower Jaw of *Dalatias barnstonensis*

- Figs. 1-4     Right lateral teeth (outer view)
- Fig.1.     Posterior lateral tooth, paratype No.3, B.M.No.P 51410 (1.8 x 2.6 mm)
- Fig.2.     Lateral tooth (2.9 x 2.5 mm)
- Fig.3.     Lateral tooth (3.0 x 2.5 mm)
- Fig.4.     Anterior lateral tooth (2.9 x 2.3 mm)
- Figs. 5-8     Left lateral teeth (outer view)
- Fig.5.     Anterior lateral tooth (3.2 x 2.4 mm)
- Fig.6.     Lateral tooth, paratype No.1, B.M.No.P 51408 (2.3 x 1.5 mm)
- Fig.7.     Lateral tooth, paratype No.2, B.M.No.P 51409 (2.9 x 2.5 mm)
- Fig.8.     Posterior lateral tooth (1.8 x 2.6 mm)
- Figs.9-11     Right and left lateral teeth (inner view)
- Fig.9.     Right anterior lateral tooth, same specimen as Fig.4.
- Fig.10.     Left lateral tooth, same specimen as Fig.6.
- Fig.11.     Left lateral tooth, same specimen as Fig.7.
- Figs.12-13.     Right and left lateral teeth (lateral view)
- Fig.12.     Left lateral tooth, same specimen as Fig.7. (2.9 x 0.6 mm) (anterior lateral view)
- Fig.13.     Right lateral tooth (3.7 x 0.8 mm) (posterior lateral view)
- Figs 14-15.     Median teeth (inner view)
- Fig.14.     Median tooth showing two internal depressions, paratype No.4. B.M.No. P 51411  
(3.4 x 2.7 mm)
- Fig.15.     Median tooth showing internal depressions and median canals, paratype No.5,  
B.M.No. P 51412 (5.6 x 4.1 mm)

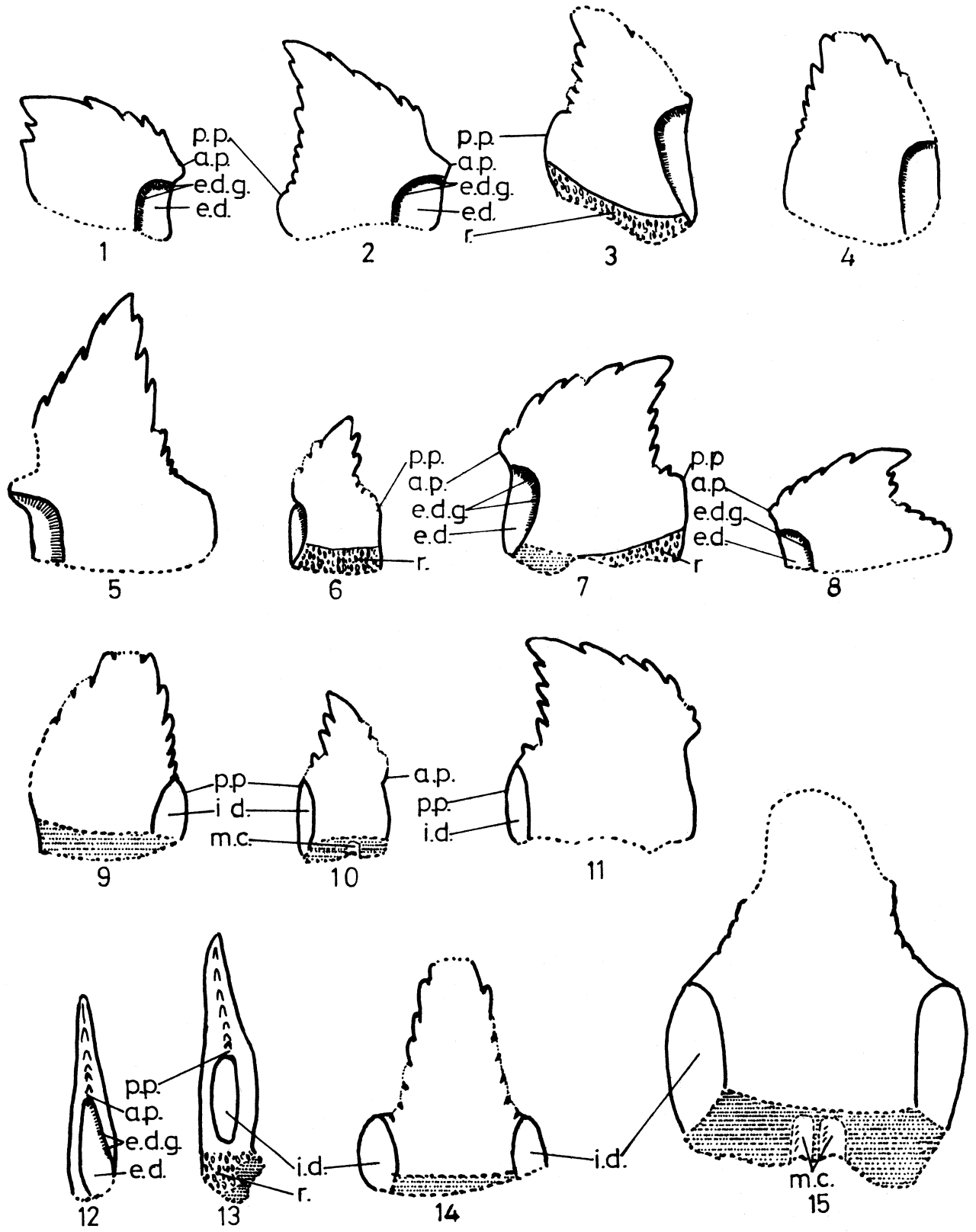
All quoted measurements are of the heights and widths respectively in each figure. All the teeth are drawn to the same scale.

### Abbreviations Used in Text Figures

(Mostly after Casier, 1961a)

a.p.	anterior process.
a.p.c.	axial pulp canal.
b.a.e.	basal anterior extension.
b.p.e.	basal posterior extension.
b.n.	basal notch.
e.d.	external depression.
e.d.g.	external depression groove.
e.m.f.	external median foramen.
g.	groove.
i.d.	internal depression.
i.l.f.	internal lateral foramen.
i.m.f.	internal median foramen.
i.p.	internal protruberance.
m.c.	median canal.
o.	opening (en "boutonniere").
p.p.	posterior process.
r.	root.
s.p.c.	secondary pulp canal.

# Text-Figure 1



## EXPLANATION OF TEXT-FIGURE 2

### Upper and Lower Teeth of *Dalatias barnstonensis* and *Dalatias licha*

- Figs. 1-4      Teeth of the upper jaw of *D. barnstonensis*  
Fig.1.        Right lateral tooth (3.2 x 1.0 mm) (inner view)  
Fig.2.        Right lateral tooth, same specimen as Fig.1 (3.2 x 1.0 mm) (posterior lateral view)  
Fig.3.        Right lateral tooth, paratype No.7, B.M.No. P 51414 (2.9 x 1.0 mm) (anterior lateral view).  
Fig.4.        Right lateral tooth, same specimen as Fig.3. (2.9 x 1.5 (inner view)  
Figs.5-8      Teeth of upper jaw of *D. licha*  
Fig.5.        Right anterior lateral tooth (8.0 x 2.4 mm) (outer view)  
Fig.6.        Right lateral tooth (9.0 x 3.0 mm) (outer view)  
Fig.7.        Right lateral tooth, same specimen as Fig.6 (6.0 x 1.3 mm) (posterior lateral view)  
Fig.8.        Right lateral tooth, same specimen as Fig.6 (6.0 x 3.0 mm) (inner view)  
Figs.9-12     Teeth of the lower jaw of *D. licha*  
Fig.9.        Right anterior lateral tooth (14 x 7 mm) (outer view)  
Fig.10.       Right anterior lateral tooth, same specimen as Fig.9 (14 x 2 mm) (anterior lateral view)  
Fig.11.       Right anterior lateral tooth, same specimen as Fig.9 (14 x 7 mm) (inner view)  
Fig.12.       Median tooth and first left anterior, showing their relative positions and the limits of the root area (median tooth 16 x 8 mm) (outer view)  
Fig.13.       Diagrammatic plan of five Dalatiid teeth showing their relative positions in a single series. One median tooth (m), two right anterior laterals l.1, l.2). The upper drawing shows the teeth as associated in the mouth: the lower drawing shows the dissociated teeth.  
Fig.14.       Right lateral lower tooth of *D. barnstonensis*; transverse section showing the axial pulp canal with secondary pulp canals leading from it (2.6 x 2.4 mm)

All quoted measurements are of the heights and widths respectively in each figure. Figures 1-4 drawn to the same scale. Figures 6-11 after Casier (1961a). Figures 5 and 12 drawn from specimens in the British Museum (Nat.Hist.)

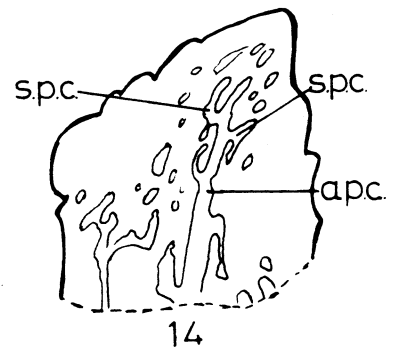
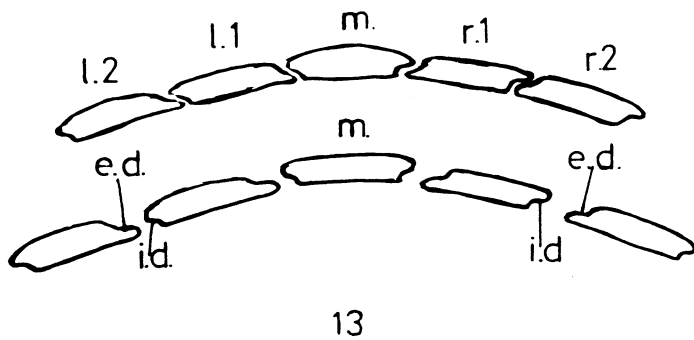
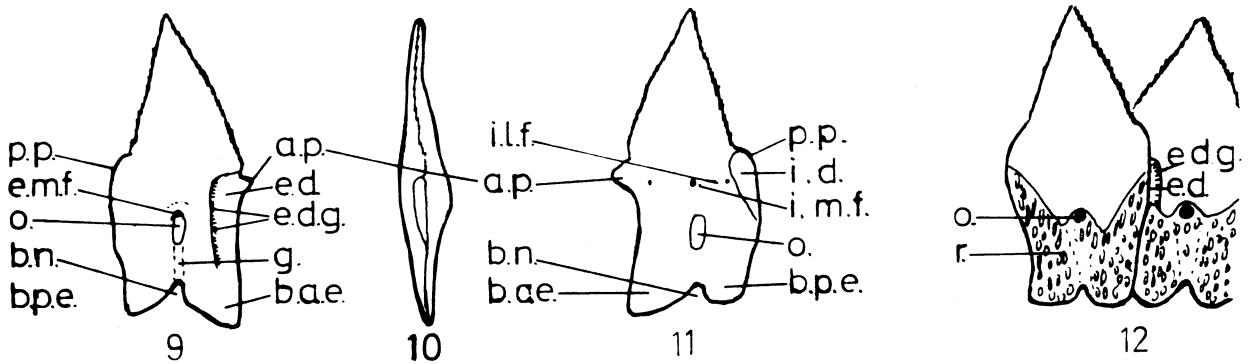
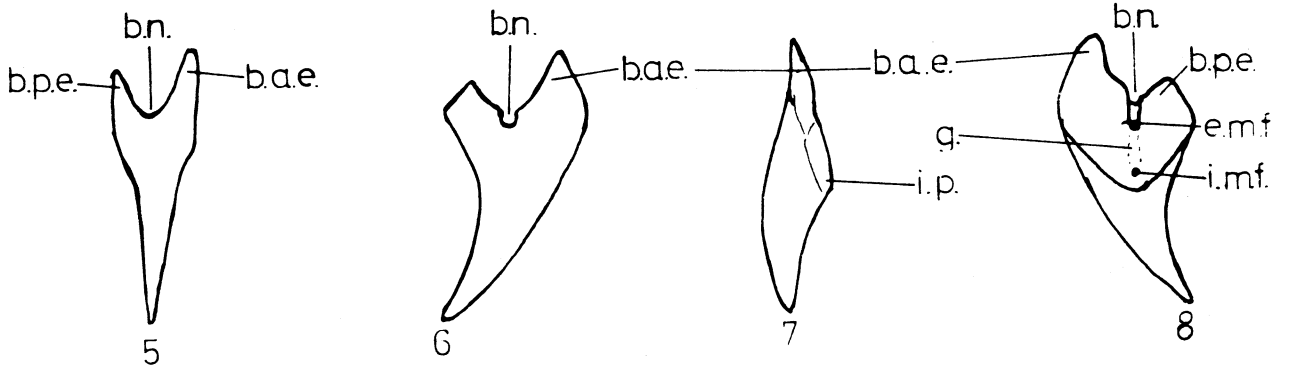
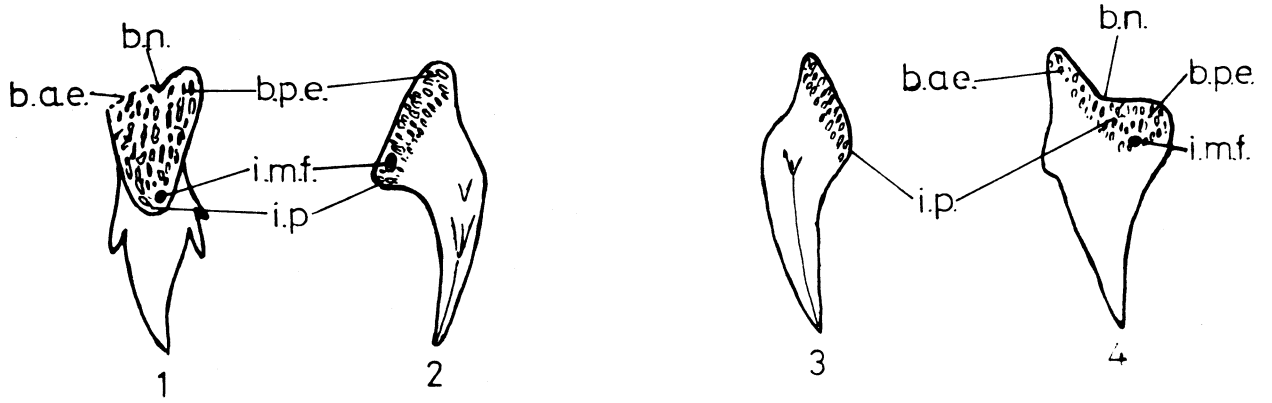
### Abbreviations Used in Text Figures

(Mostly after Casier, 1961a)

- a.p.        anterior process.  
a.p.c.      axial pulp canal.  
b.a.e.      basal anterior extension.  
b.p.e.      basal posterior extension.  
b.n.        basal notch.  
e.d.        external depression.  
e.d.g.      external depression groove.  
e.m.f.      external median foramen.  
g.          groove.  
i.d.        internal depression.  
i.l.f.      internal lateral foramen.  
i.m.f.      internal median foramen.  
i.p.        internal protruberance.  
m.c.        median canal.  
o.          opening (en "boutonniere")  
p.p.        posterior process.  
r.          root.  
s.p.c.      secondary pulp canal.

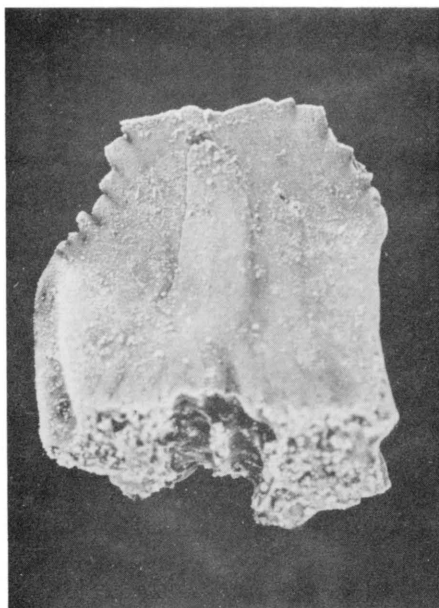


# Text-Figure 2

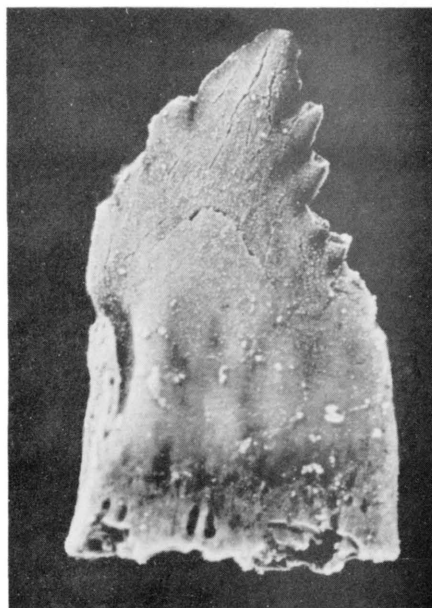


- d'ERASMO, G. 1960. Nuovi Avanzi Ittialitici Della "Serie Di Lugh". Palaeontgr. Ital., 55, 23pp., 1Tav.
- de BEAUMONT, G. 1960. Contribution a l'étude des genres *Orthocodus* Woodw. et *Notidanus* Cuv. (Selachii). Mem. Suisses Paleont., 77.
- GILL, T.N. 1864. Synopsis of the Eastern American Sharks. Proc. Acad. Nat. Sci. Philad., pp.259-265.
1893. Families and subfamilies of fishes. Mem. Nat. Acad. Sci., Washington, vol.6, pp.127-138.
- GOODE, G.B. and BEAN, T.H. 1895. Oceanic ichthyology. Smithsonian Institution, Washington. 553pp., 417 text-figs.
- JAMES, W.W. 1953. The Succession of Teeth in Elasmobranchs. Proc. Zool. Soc. Lond., vol.123, pp.419-474.
- PATTERSON, C. 1967. Family Dalatiidae. In Harland, W.B. et al. (Eds.) The Fossil Record. London (Geological Society).
- RAFINESQUE, C.S. 1810. Caratteri di Alcuni Nuovi Generi e Nuove Specie di Animale e Piante Della Sicila. Palermo, 105pp., 20 text-figs.
- ROMER, A.S. 1947. Vertebrate Palaeontology. 3rd Ed. Chicago and London. University of Chicago Press, 687pp., 377 figs.
- SYKES, J.H. CARGILL, J.S. and FRYER, H.G. 1970. The Stratigraphy and Palaeontology of the Rhaetic Beds (Rhaetian: Upper Triassic) of Barnstone, Nottinghamshire. Mercian Geologist, vol. 3, pp.233-264.
- WOODWARD, A.S. 1889. Catalogue of the Fossil Fishes in the British Museum. Brit. Mus.(Nat. Hist.) pt.1, 474pps., 17 pls.

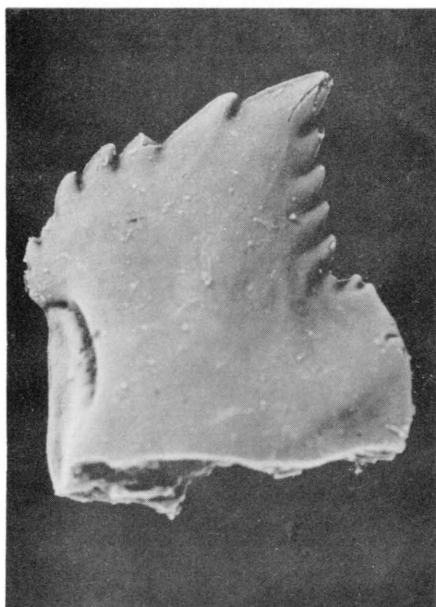
Manuscript received 23rd November 1970.



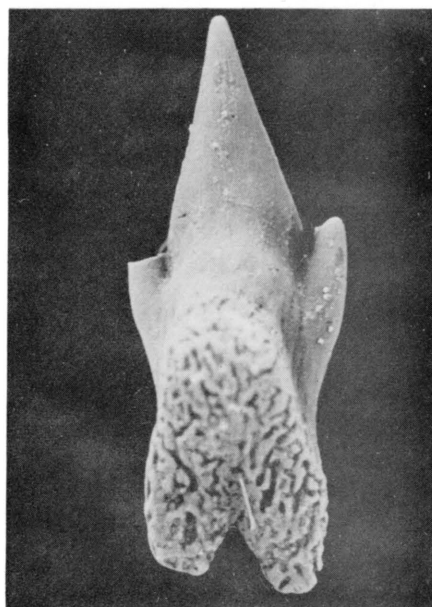
1



2



3



4

Plate 2. Teeth of *Dalatias barnstonensis*.

Fig.1. Left lower lateral tooth, holotype, B.M. No. P 51407 (3.1 x 2.5 mm), inner view.

Fig.2. Left lower lateral tooth, paratype No.1, B.M.No. P 51408 (2.3 x 1.5 mm), outer view.

Fig.3. Left lower lateral tooth, paratype No.2, B.M. No. P 51409 (2.9 x 2.5 mm), outer view.

Fig.4. Upper anterior tooth, paratype No.6, B.M. No. P 51413 (2.6 x 1.0 mm), inner view.