TEETH OF *DALATIAS BARNSTONENSIS* IN THE BRITISH RHAETIC

by

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Summary

Teeth of the shark *Dalatias barnstonensis* Sykes from the bone beds of the Westbury Formation of the Rhaetic at nine British localities are recorded, some being figured and briefly described, including a lower tooth with root attached, showing previously unknown features.

Introduction

Dalatiid teeth of Rhaetian age were first discovered during an excavation organised by the East Midlands Geological Society at the Barnstone railway cutting, Nottinghamshire (Sykes, Cargill and Fryer, 1970). The species *Dalatias barnstonensis* Sykes was established on specimens from this source (Sykes, 1971). Examination of bone bed material, collected from other localities, in museums and in private collections has shown that this species has a widespread distribution in the British Rhaetic.

Text-fig.1 shows the nine localities from which the teeth of *D. barnstonensis* have been obtained. All the material studied came from bone beds in the lower part of the Westbury Formation. Barnstone is the only locality which has so far yielded a large number of these teeth; here a large amount of bone bed was available and it was possible to extract the teeth from many kilograms of the friable rock by simple sieving and sorting. In contrast, the characteristics of the samples from the other localities were extremely varied. Only a few grams were available from Gainsborough, a museum sample, but it was easily disintegrated, and contained a large number of teeth. A large sample from Barrow-on-Soar was poorly fossiliferous, difficult to break down and yielded only rare teeth. A sample weighing about 1 kg., obtained from Blue Anchor Bay, Somerset, yielded after acetic acid treatment two teeth referred to *D. barnstonensis*.

Specimens of the teeth recorded from Aust, Westbury, Penarth, Lavernock and Axminster, were loaned to the author or examined in museums. The original characteristics and weights of the bone bed samples from which they were obtained is unknown.

Teeth of *D. barnstonensis* are always associated with other Rhaetian bone bed fossils and a richly fossiliferous sample of the bed is the one most likely to provide specimens of these teeth.

Description of the D. barnstonensis teeth from the nine localities

1. Aust Cliff, Gloucestershire (Grid Reference not known).

Four lower teeth from Aust Cliff have been obtained from varying sources.

Lower, left, posterior, lateral tooth

Leicester Museum and Art Gallery, Specimen No. O.S.1. 1973, figured Pl.2, fig. 6. The inner face is attached to the matrix. The outer face has a complete crown, a base with

Mercian Geol. Vol.5. No.1, 1974.
pp. 39-48, 3 text-figs. Plate 2.

Text-Figure 1

Localities from which *Dalatias barnstonensis* has been recorded

anterior and posterior processes also an external depression and external depression groove. Part of the root is attached.

Lower, right, lateral tooth

British Museum (Natural History), Specimen No. P 55871. This tooth has a very worn crown, a base and part of the root (1.7 mm high and 1.4 mm. long).

Lower, left, lateral tooth and lower tooth, possibly median

Mrs. P. Catchpole, personal collection. The lateral tooth has a crown and base (3 mm. high, 2.1 mm. long). The possible median tooth has the lower part of the crown and uppermost part of the base; it appears to be tall, upright and symmetrical (3 mm. high, 2.5 mm. long).

2. Axminster, Devonshire (Grid Reference not known)

Three specimens were found in one sample of sieved bone bed belonging to the Institute of Geological Sciences Museum. (Hereafter I.G.S.)

Three lower teeth fragments

I.G.S. London, No. G.S.M. 414.

Two of these have characteristics of the base and one is a serrate crown tip. Though fragmentary, their internal characteristics are also diagnostic (Sykes, 1971, p.13).

3. Barrow-on-Soar, Leicestershire (SK 575173)

A few kilograms of a weathered, basal bone bed has yielded few diagnostic Rhaetian fossils and only two lower teeth.

Two lower teeth fragments

J.H. Sykes personal collection. These fragments show the internal depression of the base and a few serrations of the crown.

4. Blue Anchor Bay, Somersetshire (ST 042432)

An extremely hard sample of very fossiliferous bone bed has yielded two specimens.

Upper tooth

I.G.S. No. Zr9723, figured Pl. 2, fig. 8, text-fig. 2, fig. 6. This tooth has a complete crown which has a lateral point on either side. The internal protuberance with the internal median foramen is present and also part of the root. The basal anterior and posterior extensions are broken off.

Lower median tooth

J.H. Sykes personal collection. A part of the base is contained within the matrix showing a section with two internal depressions.

5. Gainsborough, Lea Railway Cutting, Lincolnshire

A 6½ oz (185 grams) sample of rotted, pyritic bone bed supplied four teeth (3 lower and 1 upper).

Lower tooth, possible median

Wollaton Hall Museum of Natural History, Nottingham, (Chamberlain Collection). This tooth has its inner face attached to the matrix; it has almost a complete, tall, upright, equilateral crown and part of the base with an internal depression (4.5 mm high (2.5 mm. long).

Abbreviations used in Text-Figures

(Mostly after Casier, 1961)

a.p.	anterior process
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
i.d.	internal depression
i.m.f.	internal median foramen
i.p.	internal protuberance
m.c.	median canal
p.p.	posterior process
r.	root

EXPLANATION OF TEXT-FIGURE 2

Fig. 1 Lower, median tooth; inner view, same specimen as on pl. 2, fig. 1. No Zr9724 (2.8 mm × 1.6 mm).

Fig. 2 Lower, right, anterior, lateral tooth; outer view, same specimen as on pl. 2, fig. 2, No. Zr9718, (5.0 mm × 2.7 mm).

Fig. 3 Lower, left, lateral tooth; outer view, same specimen as on pl. 2, fig. 4, No Zr9719 (4.0 mm × 3.3 mm).

Fig. 4 Lower left, posterior, lateral tooth; inner view, same specimen as on pl. 2, fig. 5, No Zr9720, (2.1 mm × 2.4 mm).

Fig. 5 Upper tooth; outer view, same specimen as on pl. 2, fig. 7, No Zr9721, (3.0 mm × 1.0 mm).

Fig. 6 Upper tooth; lateral view, same specimen as on pl. 2, fig. 8, No Zr9723, (1.8 mm × 0.8 mm).

Zr numbers refer to specimens in the Institute of Geological Sciences, London.

Quoted measurements are of the heights and widths respectively in each figure.

EXPLANATION OF TEXT-FIGURE 3

Figs 1 to 4 Lower tooth fragment, possible median or left lateral; same specimen as on pl. 2, fig. 9, No Zr9722.

Fig. 1 Outer view, (4.1 mm × 2.1 mm).

Fig. 2 Inner view, (4.1 mm × 2.1 mm).

Fig. 3 Lateral view with internal depression, showing axes of root and tooth, (4.1 mm × 1.5 mm).

Fig. 4 Lateral view of broken area, (4.1 mm × 1.5 mm).

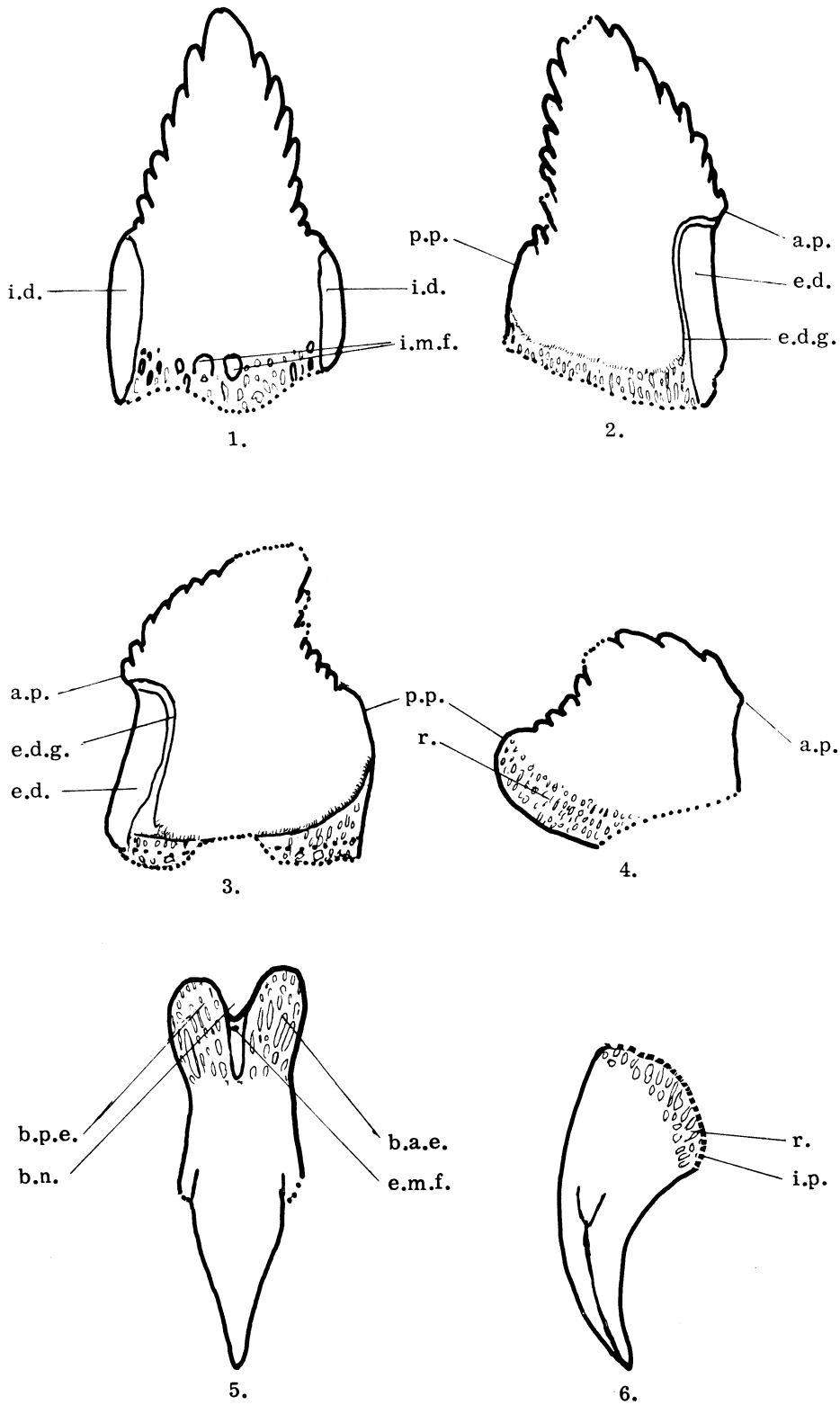
Fig. 5 Upper tooth; lateral view, same specimen as on pl. 2, fig. 7, No Zr9721, (3.0 mm × 1.4 mm).

Fig. 6 Diagram of the relationship between axes of tooth, root and median canals.

Zr numbers refer to specimens in the Institute of Geological Sciences, London.

Quoted measurements are of the heights and widths respectively in each figure.

Text-Figure 2



Two lower tooth basal fragments

Wollaton Hall (Chamberlain Collection). Both have a distinctive external depression with external depression groove.

Upper tooth

Wollaton Hall (Chamberlain Collection). This tooth has most of the crown with one lateral point on either side. The internal protuberance with the internal median foramen is present, also part of the root.

6. Lavernock foreshore, Glamorganshire (ST 187682)

A sample of the excellent Storries Bed owned by Dr. H. Ivimey Cook provided one lower tooth whilst a large sample from a less fossiliferous horizon at the same locality yielded one lower tooth fragment. Both samples were broken down by acetic acid treatment.

Lower, left, lateral tooth

I.G.S., No. Zr9670. This tooth has the lower part of the crown and part of the base with the internal depression (2.3 mm. high, 2.2 mm. long).

Lower tooth fragment

J.H. Sykes personal collection. This is a fragment of a crown with a few serrations and characteristic internal structure.

7. Penarth, Glamorganshire (ST 186697)

Eight *D. barnstonensis* teeth (7 lower and 1 upper) were found amongst the unclassified specimens collected from this locality by Dr. J. Griffiths.

Lower, median tooth

I.G.S., London, No. Zr9724, figured Pl. 2, fig. 1, text-fig. 2, fig. 1). This has a complete crown with seven serrations on either side. The base extends laterally, equally on either side and has two internal depressions. The preserved part of the root has fairly complete median canals.

Lower, left, lateral tooth

I.G.S., No. Zr9725. An almost complete crown and part of the base with an anterior process, external depression and external depression groove (2.7 mm. high, 1.5 mm. long).

Lower, left, lateral tooth

I.G.S., No. Zr9726. A part of a crown with part of the base showing anterior process, external depression and external depression groove.

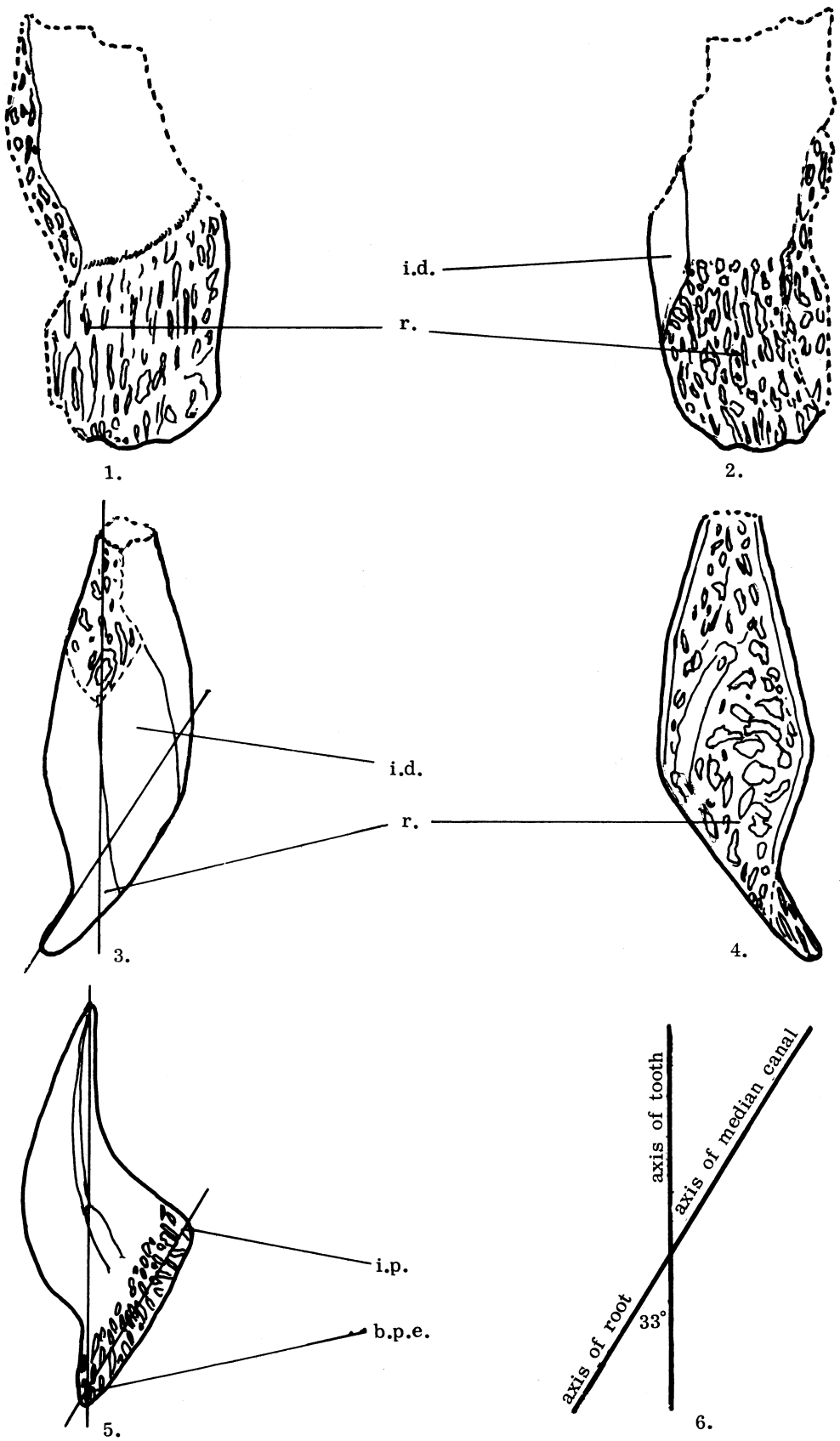
Four detached crowns

I.G.S., No. Zr9727. One with the tip broken off.

Upper, right, lateral tooth

I.G.S., No. Zr9728. An almost complete tooth with one lateral point on either side (8 mm. high, 2 mm. long).

Text-Figure 3



8. Westbury-on-Severn, Gloucestershire (Grid Reference not known)

One lower tooth loaned from the collection of Mr. C. Duffin.

Lower, left, anterior, lateral tooth

Mr. C. Duffin personal collection, figured Pl.2, fig.3. The specimen is attached to the matrix by the inner face. The crown is almost complete. The base shows the anterior and posterior processes also the external depression and the external depression groove. Part of the root is also present.

9. Barnstone Cutting, Nottinghamshire (SK739358)

158 lower and 35 upper teeth have been collected from this locality. They are distributed in three groups in the following manner.

66 Lower teeth (25 left, 19 right, 7 median, 15 fragments) and 14 Upper teeth

British Museum (Natural History) including holotype and paratypes Nos P51407 to P51414.

88 Lower teeth (36 left, 43 right, 9 median) and 20 Upper teeth

J.H. Sykes personal collection

4 Lower teeth (2 left, 1 right, 1 fragment) and 1 Upper tooth

Institute of Geological Sciences, London, Nos Zr9718 to Zr9722, figured Pl.2, figs. 2, 4, 5, 7, 9, text-fig.2, figs. 2, 3, 4, 5, text-fig.3, figs. 1, 2, 3, 4, 5.

Briefly, the lower teeth are transversely compressed having a single, serrate, triangular crown on a rectangular base and a root which is usually broken off at or above the median canals. The median teeth have a tall, upright, near equilateral crown on a base which is laterally expanded on both sides having two internal depressions overlapping the teeth immediately on either side. In the lateral teeth the crowns vary between high, almost upright, anterior types to low, inclined, posterior types. Each base has a small anterior process and a larger posterior process. They have a posterior internal depression and an anterior external depression which allows the base of each tooth to overlap the one immediately posterior to it. The upper teeth have a thorn-like crown; the majority have one but some have up to three lateral points on either side, near the base. They have a bifid root (text-fig.2, fig.5) with a median canal passing through parallel and close to the base (text-fig.3, fig.5).

The Roots of the Lower Teeth

Sharks' teeth are continually being broken off and shed into the water by the progression of a series of teeth towards the edge of the mouth. In *Dalatias barnstonensis* the transverse thinning of the lower teeth and the vascular system of the root tend to create a weakness which detaches the tooth from the lower part of the root. However, one specimen from Barnstone has been found with a part of the base of its root intact (Pl.2, fig.9, text-fig.3, figs. 1, 2, 3, 4).

Description of the Root Specimen

This tooth is broken off above the base; it is also broken longitudinally and lacks the median canals. The distinct root is transversely compressed; when viewed laterally it is curved outward and tapered downward to a rounded basal edge. The lower part of the internal depression is present and it extends about half the length of the root. The preserved edge is slightly concave towards the base. The basal edge is rather worn but its median rounding suggests the possible presence of a basal notch. The broken edge exposes the pulp cavity

with its many connecting pores, the larger ones being near the thickest part of the tooth. On the outer face, the distinct boundary of the root extends obliquely, posteriorly upwards. The outer root area is depressed and bears pores and longitudinal striations. On the inner face, the upper boundary of the root is almost horizontal; the surface is rather worn, but has longitudinal corrugations similar to those on the inner face of the roots of the upper teeth.

Angles of Roots and Median Canals in relation to the Axis of the Tooth

Two lower teeth were found to have been broken off with sufficient of the root intact to show the angle of inclination between the axis of the root and the axis of the tooth. When viewed from the side with the median canals upright, the axes of the roots were also upright. This shows that the direction of the axis of the root coincides with the direction of the median canals (text-fig. 3, figs. 3, 6). The respective angles between these coincident directions and the axes of the teeth are 33° and 34°. In the specimen with part of the root base intact (pl. 2, fig. 9), the angle between the root and tooth is estimated at 31° (text-fig. 3, fig. 3) thus the average angle is about 33°.

One specimen shows the median canals partly broken away and has part of the inner root surface intact. This shows that the median canals run close to the base of the root, as is the case in the upper teeth (text-fig. 3, fig. 5) where the internal and external median foramina can be seen in complete specimens (text-fig. 2, fig. 5, and pl. 2, figs. 7, 8).

Comparison with other Dalatiid Teeth

The species *D. barnstonensis* was founded on comparison with other fossil Dalatiid teeth and also with those of the modern species *Dalatias licha*.

When viewed transversely, the outline of the *D. barnstonensis* root compares well with those of *D. licha* figured in Bigelow and Schroeder (1948, p. 502). Casier (1961, p. 20) shows that in *D. licha* the internal depression extends about half way down the root, as in the root specimen *D. barnstonensis* (text-fig. 3, figs. 2 & 3). In *D. licha* there is a groove which runs from the basal notch to an opening. These features are unproven in *D. barnstonensis* though from the evidence available it is to be inferred that the median canals are nearer to the base of the root in *D. barnstonensis* than in *D. licha*. When viewed laterally the root of *D. licha* is almost straight (Casier 1961, p. 20) whereas the lower part of the *D. barnstonensis* root is angled outwards. This feature combined with the characteristic of the median canals running parallel and close to the inner surface of the root is common to the lower and upper teeth of *D. barnstonensis* (text. fig. 3, figs. 3, 5) and also to the upper teeth of *D. licha* (Casier, 1961, p. 20).

Conclusions

Although only a few specimens of teeth are recorded from localities other than Barnstone it is to be concluded that the species *D. barnstonensis* is geographically widespread in the Westbury Formation of the British Rhaetic.

The root of the lower tooth curves outward to an angle of approximately 33° from the axis of the tooth and tapers to a rounded basal edge.

Acknowledgements

I should like to thank Dr. J. Griffiths for the kind donation of his collection and also Mr. C. Duffin and Mrs. P. Catchpole for the loan of specimens.

I am grateful to Mr. M.D. Jones of the Leicester Museum, Dr. C. Patterson of the British Museum (Natural History), Mr. B.R.P. Playle of the Wollaton Museum and Dr. H. Ivimey Cook of the Institute of Geological Sciences for their generous assistance in providing access to

museum material. I should like to thank Dr. H. Ivimey-Cook and Mr. A.M. Honeyman for reading the typescript, and making useful suggestions on the presentation of the paper. I am further indebted to the Dept. of Geology and Wolfson Institute of Nottingham University and to Mr. J.S. Cargill for assistance in producing Plate 2.

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EXPLANATION OF PLATE 2

Fig. 1 Lower, median tooth; outer view, × 24 Penarth, (text-fig.2, fig.1), No. Zr9724.

Fig. 2 Lower, right, anterior, lateral tooth; inner view, × 13, Barnstone, (text-fig. 2, fig. 2), No Zr9718.

Fig. 3 Lower, left, anterior, lateral tooth; outer view, × 15, Westbury-on-Severn, Mr. C. Duffin personal collection.

Fig. 4 Lower, left, lateral tooth; inner view, × 13, Barnstone, (text-fig. 2, fig. 3), No. Zr9719.

Fig. 5 Lower, left, posterior, lateral tooth; outer view, × 17, Barnstone, (text-fig. 2, fig. 4), No. Zr9720.

Fig. 6 Lower, left, posterior, lateral tooth; outer view, × 14, Aust, Leicester Museum, No. O.S.1.1973).

Fig. 7 Upper tooth; inner view showing internal median foramen × 22, Barnstone (text-fig. 2, fig. 5; text-fig. 3, fig. 5), No. Zr9721.

Fig. 8 Upper tooth; inner view showing internal median foramen, × 32, Blue Anchor Bay, (text-fig. 2, fig. 6), No. Zr9723.

Fig. 9 Lower tooth fragment; outer view showing root features, × 16.5, Barnstone (text-fig. 3, figs. 1 - 4), No. Zr9722.

Zr numbers refer to specimens in the Institute of Geological Sciences, London.

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Teeth of *Dalatias barnstonensis*.