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EDITED BY

T. SHEPPARD, F.G.S.,
THE MUSEUM, HULL;

AND

T. W. WOODHEAD, F.L.S.,
TECHNICAL COLLEGE, HUDDERSFIELD;

WITH THE ASSISTANCE AS REFEREES IN SPECIAL DEPARTMENTS OF

J. GILBERT BAKER, F.R.S. F.L.S., **GEO. T. PORRITT, F.L.S., F.E.S.,**
Prof. P. F. KENDALL, M.Sc., F.G.S., **JOHN W. TAYLOR,**
T. H. NELSON, M.B.O.U., **WILLIAM WEST, F.L.S.**

Contents :—

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ON THE BELEMNITES OF THE CHALK OF YORKSHIRE.

(PLATE XV.)

By C. DAVIES SHERBORN, F.G.S.

So far as at present known, the Belemnites found in the Chalk of Yorkshire are limited to five forms—

Actinocamax granulatus (De Blainville). *Micraster cor-anguinum* zone to *A. quadratus* zone.

Actinocamax verus Miller. *M. cor-anguinum* zone to *A. quadratus* zone.

Actinocamax grossouvrei Janet. The subject of a special note by Mr. Crick (page 155.)

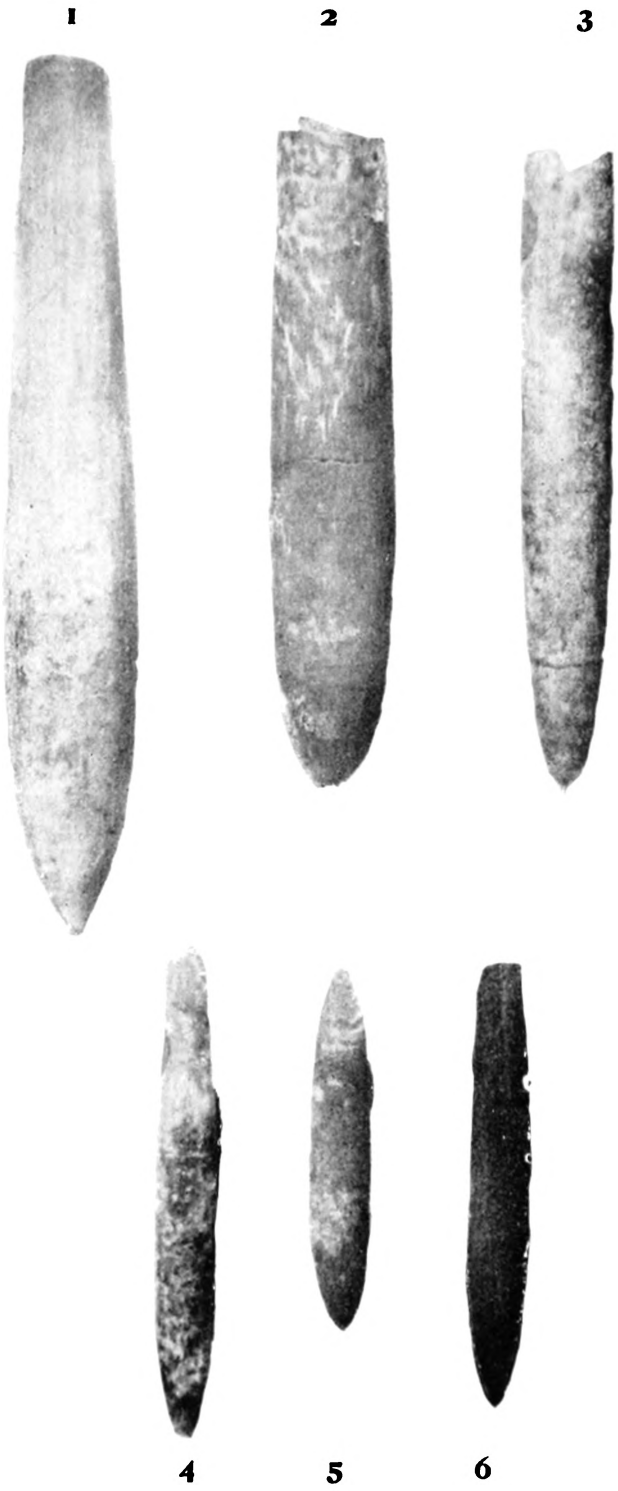
Actinocamax plenus (De Bainville). *A. plenus* zone.

Belemnites minimus (Sowerby *ex* Lister). Red Chalk.

B. minimus, the common fossil in the Red Chalk, can easily be found in those beds as exposed on the shore at low tide under the Speeton Cliffs. The shape and length of this species varies considerably with age.

A. plenus, long known from the zone to which it gives its name, from Lincolnshire to the South of England, has only recently been found in Yorkshire. (C. Thompson, *Naturalist*, July, 1905, p. 202.)

A. verus, usually common in the *Uintacrinus* band of the *Marsupites* zone in the South of England and for many years known only from the top of the *Micraster cor-anguinum* zone of Micheldever in Hampshire and Northfleet in Kent, was found by Dr. Rowe in the same position at Walmer in Kent in 1903. In Yorkshire, though rare numerically, it has a much more extended range vertically, and Dr. Rowe and I have collected it on the Yorkshire coast from within fifty feet of the flinty chalk of the *Micraster cor-anguinum* zone to the south of High Stacks, right through the *Marsupites* and *A. quadratus* zones to within 25 feet of the highest part of the latter zone as exposed at Sewerby Cliff. We did not, however, find it in the successively higher *quadratus* chalk as exposed in the pits between Sewerby and Ruston Parva. Mr. Mortimer showed us an undoubted example of this form, which he says came from the flinty chalk of Fimber. This gives an undoubted range of 650 feet for *A. verus*, a range in striking contast to that of 68 feet at Margate,



1. ***Actinocamax plenus.*** *A. plenus*-zone. Blue-Bell Hill Pit, Burham, Kent. B.M., C. 8563.
2. ***Actinocamax granulatus.*** *Micraster cor-anguinum*-zone. Northfleet, Kent. B.M., C. 8590.
3. ***Actinocamax granulatus.*** *Marsupites*-band (above the Bedwell line). Rifle Butts, Margate. B.M., C. 7273.
4. 5. ***Actinocamax verus.*** *Uintacrinus*-band (below the Bedwell line). Botany Bay, Margate. B.M., C. 7269.
6. ***Belemnites minimus.*** Red Chalk, Speeton, Yorkshire. B.M., C. 3001.

which, so far as is known at present, is the greatest measured thickness for this Belemnite in the South of England.

A. granulatus, known only from the upper part of the *Micraster cor-anguinum* zone at Gravesend in Kent, passes through the *Marsupites* zone, where it is common, and occurs somewhat abundantly in the lower 150 feet of the *A. quadratus* zone in the South of England. In Yorkshire, not only is it found in the flinty base of the *M. cor-anguinum* zone at Fimber (Mortimer: See Rowe, Proc. Geol. Assoc., XVIII. (4), 1904, p. 270), but Dr. Rowe and I have traced it right through the remainder of this zone on the Yorkshire coast, up through the zone of *Marsupites* to the top of the highest *quadratus* chalk as exposed at Sewerby. Further than this, we have followed it successively through the higher beds of this zone from Bessingby to Carnaby, Burton Agnes and Ruston Parva, thus demonstrating an unbroken range in Yorkshire for this form of about 800 feet, or nearly five times as great a range as known in Sussex, hitherto the greatest known. Moreover, throughout the whole of this great thickness it is clear that it is only one form, and the slow evolution of the species can be traced, step by step, until at last we are at the point, so to speak, of the next form, the so-called species *Actinocamax quadratus*, which gives its name to the zone. But a true specimen of the deep and quadrate alveolated form known as *A. quadratus* has not yet been found in Yorkshire; and if, as is probable, that Ruston Parva gives us the highest part of the *quadratus* zone which has escaped denudation in the county, it never will be found, for the true *quadratus* occurred in the higher beds which have long since been destroyed.

For further particulars of Yorkshire Chalk Belemnites, that is the two latter forms, the reader must refer to the paper mentioned above (Rowe, Proc. Geol. Assoc., XVIII. (4), 1904, pp. 193-296), where the whole of the White Chalk and its fossils of the Yorkshire coast is described. I reproduce here the figure and legend there given of the alveolar ends of *A. granulatus*, showing the progressive deepening of the alveolar cavity as the belemnite ascends in the zones. I also give figures of the five forms discussed for handy reference (plate XV.), and call attention to a remarkable deformed specimen of *A. granulatus* described by Mr. Crick in an appendix to Dr. Rowe's paper, and reproduced in the 'Naturalist' for May, 1904.

1906 May 1.

C. 1.—From the base of the *Micraster cor-anguinum*-zone, High Stacks.

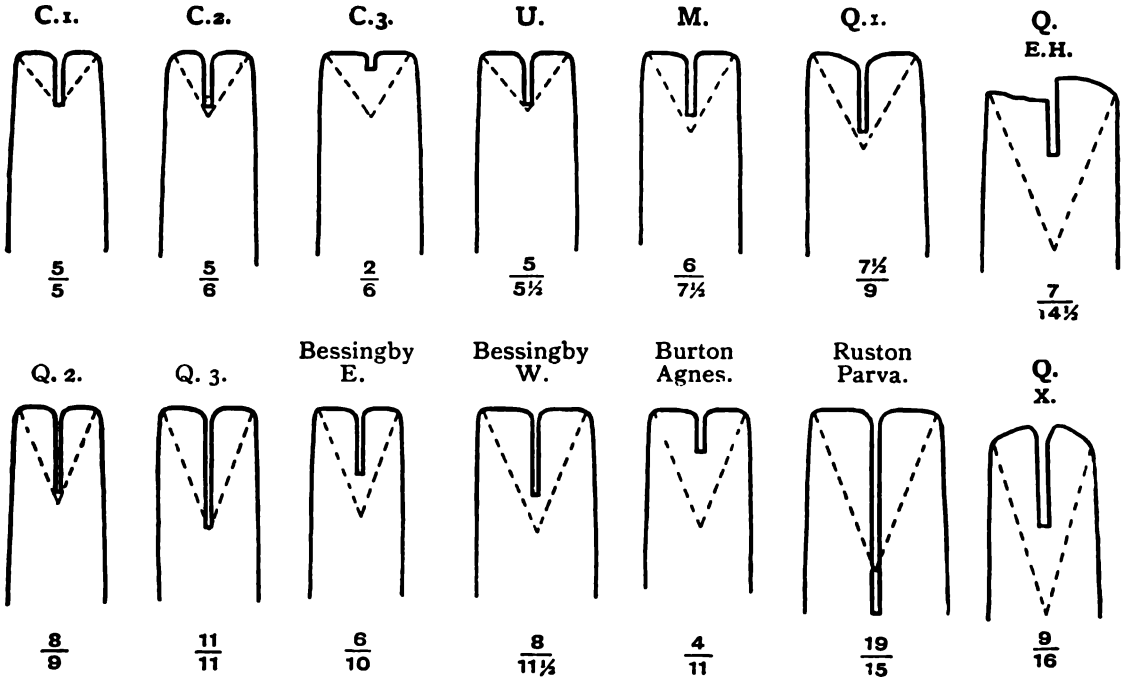
C. 2.—From the *Micraster cor-anguinum*-zone, between High Stacks and South Sea Landing.

C. 3.—From the upper part of the *Micraster cor-anguinum*-zone, west of South Sea Landing.

U.—From *Uintacrinus*-band, between South Sea Landing and Danes' Dike.

M.—From *Marsupites*-band, west of Danes' Dike.

Q. 1.—From *quadratus*-zone, Sewerby Cliff.



Drawings of Alveolar-Ends of *Actinocamax granulatus*, showing Progressive Deepening of the Alveolar Cavity as the Belemnite ascends in the Zones.

(Measurements in millimetres.)

(*By permission of Dr. Rowe and the Council of the Geologists' Association.*)

Q. 2.—From *quadratus*-zone, Sewerby Cliff.

Q. 3.—From *quadratus*-zone, Sewerby Cliff.

Bessingby E.—From *quadratus*-zone, East Bessingby.

Bessingby W.—From *quadratus*-zone, West Bessingby.

Burton Agnes.—From *quadratus*-zone at Burton Agnes.

Ruston Parva.—From *quadratus*-zone at Ruston Parva.

Q. x.—Typical example of *Actinocamax quadratus* from the *quadratus*-zone of Harnham, Salisbury. This specimen shows the deep alveolus of the true *quadratus* form, and the cross-section of that cavity is of the typical quadrangular shape.