LEIDSE GEOLOGISCHE MEDEDELINGEN, Deel 49, Aflevering 2, pp. 277–283, 1-9-1973

ON THE PHYLOGENETIC POSITION OF THE GENUS BOUCOTINSKIA BRUNTON AND COCKS, 1967 (SPIRIFERIDA)

BY

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ABSTRACT

A morphological comparison of *Boucotinskia* Brunton & Cocks, 1967 and *Kozlowskiellina* Boucot, 1957 makes a phylogenetic relationship between the two genera obvious. *Boucotinskia* is placed in the subfamily Cyrtinopsidinae. The subfamily Cyrtinopsidinae is probably very closely related to the Eospiriferinae and the Cyrtiinae.

INTRODUCTION

A. Boucot (1957) established a new genus *Hedeina* with the type species *Anomia crispa* Linné, 1758 (10th ed., 1, p. 702, fig. 7). Boucot, on the assumption that the specimen figured by Linné (pl. 5, fig. 7) had been lost, selected a neotype for *Anomia crispa* being specimen 2282 A of the Hisinger collection in the Swedish Museum of Natural History, Paleozoological Department. In 1967 Brunton and Cocks rediscovered the original Linné specimen of *Anomia crispa* and it appeared that this specimen belonged to the Cyrtiacea, Cyrtiidae, Eospiriferinae, genus *Macropleura* Boucot, 1963. For priority reasons *Anomia crispa* Linné 1758 must be named *Hedeina crispa*, *Macropleura* Boucot, 1963 being a junior subjective synonym of *Hedeina* Boucot, 1957.

Consequently Brunton and Cocks (1967) established a new genus *Boucotinskia* with the type species *Delthyris sulcata* Hisinger which Boucot originally took as type species for his genus *Hedeina*. Brunton and Cocks choose the above-mentioned specimen 2282 A as the lectotype for *Boucotinskia sulcata* (Hisinger, 1828)*

MORPHOLOGICAL DESCRIPTION OF BOUCOTINSKIA

Most probably three species belong to *Boucotinskia:*
Boucotinskia sulcata (Hisinger, 1828) – Eke marl, Ludlovian, Gotland

Boucotinskia decemplicata (Hall, 1843) – Rochester shale, Wenlockian, New York
Boucotinskia tenuilamellata (Muir-Wood, 1925) – Buildwas Formation, Wenlockian; Britain.

In the U. S.National Museum, Washington, two of these species are present: *B. sulcata* from Gotland and *B. decemplicata* from New York.

As a superficial investigation of the specimens showed many intermediate forms between the two species, some doubt about a taxonomic distinction between the two species is justifiable. Moreover the micro-ornamentation as well as the internal structures of both species appeared to be identical. The question about the distinction between the two species is in the scope of this publication not relevant.

Micro-ornamentation

Boucot, 1957, p. 324 gives the following description of the micro-ornamentation: "the fine ornamentation consists of prominent growth lamellae which are prolonged anteriorly into frills and are radially crossed by raised lines which extend over the margin of each frill as a fringe of spines".

This is actually the same description as the one for the micro-ornamentation of *Kozlowskiellina*. The present author showed (Krans, 1969) that on the growth lamellae of *Kozlowskiellina* no spines are present.

Likewise a close examination of the USNM material reveals that the micro-ornamentation of *Boucotinskia* consists of more or less flat lying growth lamellae. Over the total length of the growth lamellae distinct radial capillae occur. The growth lamellae are not corrugated, the capillae are thin micro-costules lying in the growth lamellae. At the growing edge of the growth lamellae the

*Boucot, 1957, p. 326 states that his plate 2 figure 9 is the neotype of *Anomia crispa* Linné (number 2282 A) but in the plate-description he refers to collectionnumber 2282 C. Probably we are dealing here with a misprint.

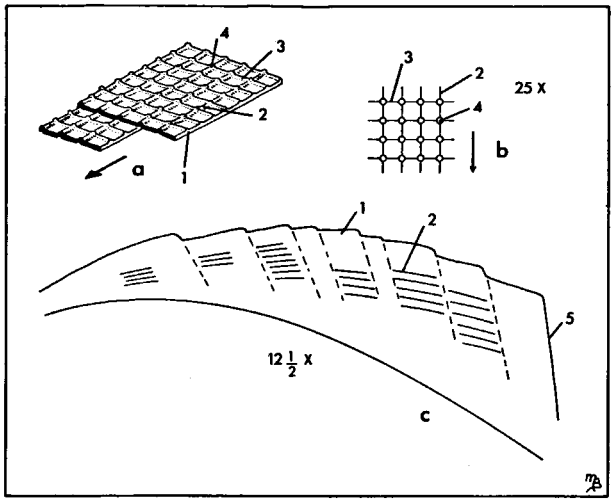

Fig. 1. Micro-ornamentation of *Boucotinskia*.

a = scheme of two growth lamellae
b = dimensions of the elements forming the micro-ornamentation
c = lateral view on the median fold
1 = growth lamella
2 = radial capilla
3 = minor growth line
4 = nodules on the intersections of 2 and 3
5 = commissure
Arrow indicates direction of growth

capillae correspond with furrows in the inner surface of the valves. These furrows are supposed to be related to the setal arrangement (cf. Krans, 1969, p. 267, text-figure 4). The capillae of the successive growth lamellae lie more or less in even lines, although intercalation of new capillae may locally disturb the capillar arrangement. In juvenile growth stages the capillae are thinner and more closely interspaced than in adult growth stages (text-figure 1). On the growth lamellae minor growth lines can be observed. By intersection of these minor growth lines with the radial capillae the latter get a nodular aspect. On the crests of the costae the growth lamellae show a concave curvature like in *Kozlowskiellina* and *Cyrtinopsis* (cf. Krans, 1969 and 1971).

Cardinal area

The lateral portions of the cardinal area of the pedicle valve bear flat lying growth lamellae with radial capillae and minor growth lines. The medial portions only bear weak growth lines. The cardinal area is in this manner of the same type as the cardinal area of *Kozlowskiellina* and *Cyrtinopsis* and consists of a lateral palintrope and a median interarea (cf. Krans, 1969, text-figure 5).

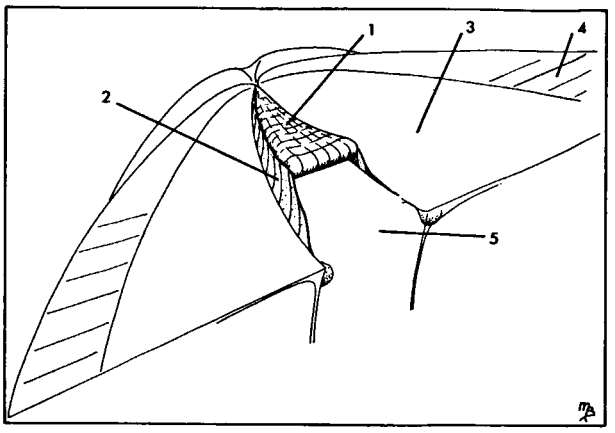

Fig. 2. Delthyrium and cardinal area of *B. sulcata*.

1 = pedicle collar
2 = deltidial plate
3 =ventral interarea
4 = ventral palintrope
5 = dental plate

Delthyrium

The delthyrium of *Boucotinskia sulcata* shows a small angle of about 30° (cf. Boucot, 1957, p. 3). The deltidial plates are inserted normal to the interarea. In some specimens from Gotland a pedicle collar has been formed constituted by a subhorizontal plate situated between the two deltidial plates (text-figure 2). The same pedicle collar can be observed in some specimens of *Cyrtinopsis*.

Pedicle valve interior

Serial sections of the apical region of the pedicle valve show two distinct thin dental plates with a very clear mediotest (Krans, 1965, p. 104). The dental plates are fused to the floor of the valve near the two intercostal spaces on the outside of the two costae bordering the sulcus (Plate I, Figs. 1, 2, 3).

In the plane of symmetry a low roof-like inward elevation has been formed covered with a layer of myotest (Krans, 1965, p. 94). There is no median septum. The lateral cavities have not been filled with secondary shell material (text-figure 3).

Brachial valve interior

Serial sections of the apical region of the brachial valve show two well developed crural plates. As the crural plates lie close to the inner socket ridges the outer hinge plates are hardly developed. The lateral cavities are

Fig. 3 A. Serial sections of *Boucotinskia decemplicata* from the Rochester Shale, Lockport, New York, USNM 10388.

1 = dental plate with mediotest
2 = myotest
3 = deltidial plate
4 = floor of apical cavity
5 = crural plate
6 = crural base
7 = hinge tooth

Section a=acetate peel 6822a1; b=6822a2; c=6822a3; d=6822a4; e=6822b; f=6822c.

B. Median projection of the dental plates and crural plates.

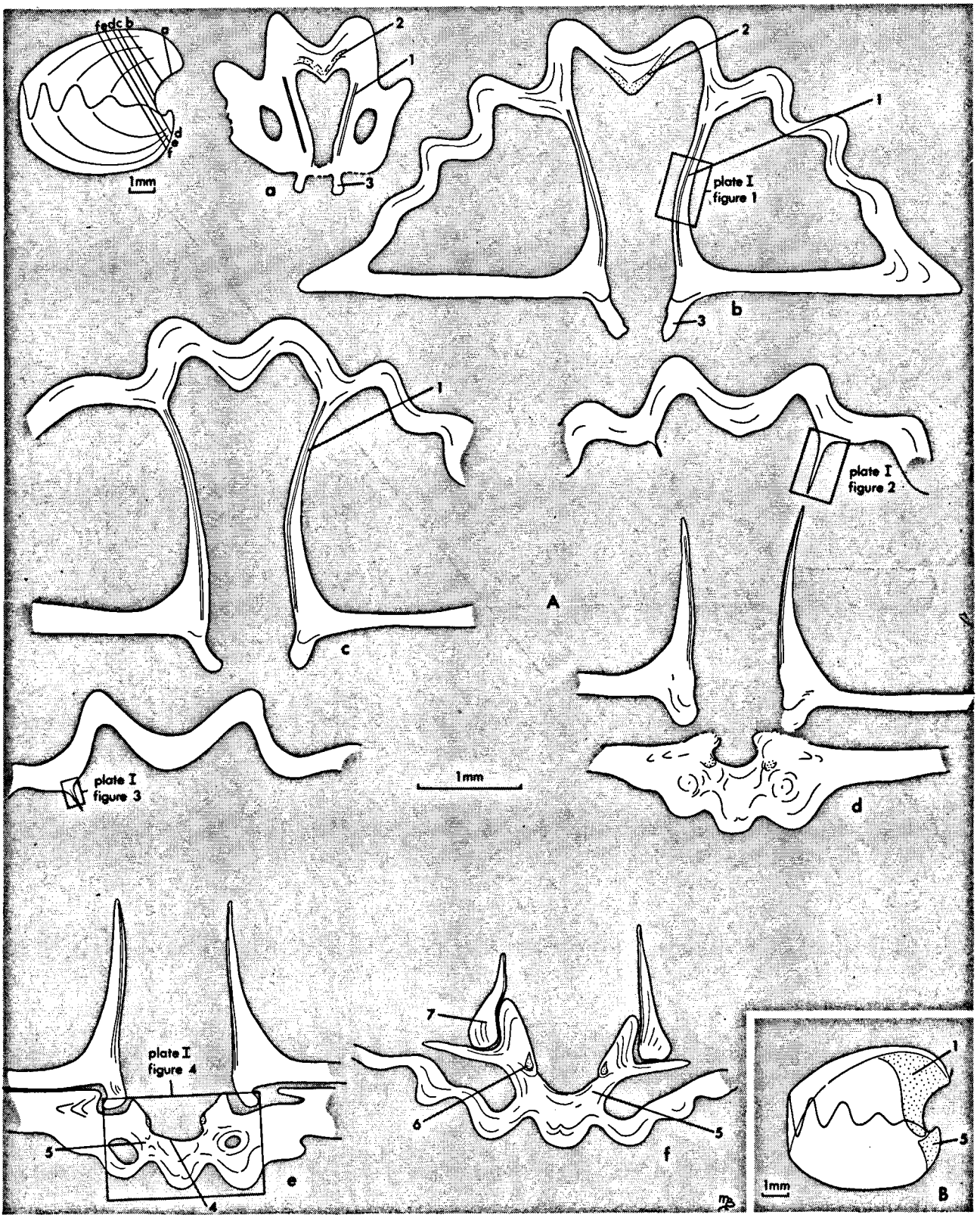
fedc b a
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plate I
figure 1
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figure 4
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shallow being posteriorly filled with secondary shell material (text-figure 3).

On the inner sides of the outer hinge plates two small outgrowths have been formed, which are very weakly laminated. These laminated outgrowths most probably served as an attachment area of the diductors and can be described as a poorly developed, bilobed cardinal process. The floor of the apical cavity is smooth (Plate I, Fig. 4).

PHYLOGENY OF THE GENUS BOUCOTINSKIA

In view of the poor morphological knowledge of the three species attributed to the genus *Boucotinskia* no clear phylogenetic relationship of these species within the genus can be postulated. However the micro-ornamentation and the interior of the apical region do tell something about the phylogenetic relation of the genus *Boucotinskia* to other genera.

In an earlier paper (Krans, 1969) the present author showed the phylogenetic relations of the different species in the genus *Kozlowskiellina*:

– the Wenlockian species of *Kozlowskiellina* show flat lying growth lamellae with rather widely spaced radial capillae. In the Devonian species of *Kozlowskiellina* free hanging and corrugated growth lamellae occur.

– two Wenlockian species of *Kozlowskiellina* (*K. strawi* and *K. vaningeni*) show clear dental plates with mediotest though *K. vaningeni* shows a reduction of these dental plates to dental ridges in adult specimens. The Devonian species of *Kozlowskiellina* invariably show the reduction of the dental plates to dental ridges also in juvenile specimens, in some species giving rise to the formation of a spondylium-like trough.

– the Wenlockian species *K. vaningeni* shows no median septum in the pedicle valve but a low roof-like elevation in the floor of the valve. *K. strawi*, also Wenlockian, shows a real broad median septum without mediotest whereas all Devonian species of *Kozlowskiellina* possess a median septum with mediotest.

– the interior of the brachial valve of the Wenlockian species *K. strawi* and *K. vaningeni* shows a very poorly developed bilobed cardinal process hardly laminated, with a smooth apical cavity. The Devonian species all have a well developed bilobed cardinal process, deeply laminated.

A comparison of *Kozlowskiellina* with *Boucotinskia* makes it obvious that the latter has a close phylogenetic relationship with the Wenlockian species of *Kozlowskiellina*. In Krans, 1969, text-figure 24 the Wenlockian species of *Boucotinskia* can be very easily placed in such a position on the base of the phylogenetic tree, that *Kozlowskiellina* most probably developed from the genus *Boucotinskia*, in one direction with the formation of a median septum without a mediotest to *K. strawi* and in the other direction with the reduction of the dental plates towards *K. vaningeni* etc. Within the genus *Boucotinskia* a rather conservative evolution took place, most probably without any evolution in the micro-ornamentation and the apical complex. The only traceable evolution within the genus *Boucotinskia* seems to be a very small reduction of the radial costae.

TAXONOMIC CONSIDERATIONS

The genus *Kozlowskiellina* shows a very close relation ship with the genus *Cyrtinopsis* (cf. Krans, 1971). Con-

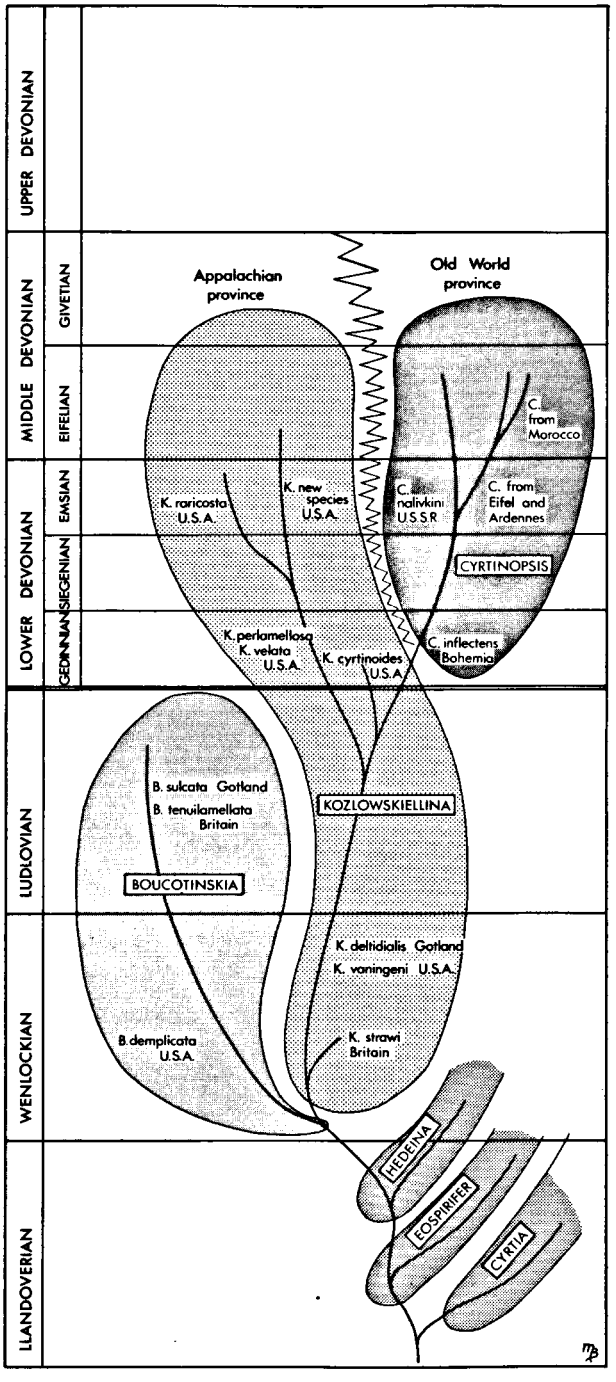

Fig. 4. Phylogeny of *Boucotinskia*, *Kozlowskiellina* and *Cyrtinopsis* and the supposed relation between the Cyrtinopsidinae and the Cyrtiidae (cf. Krans 1969, 1971).

sequently the two genera were grouped together in the subfamily Cyrtinopsidinae. The present study makes it quite logical to place the genus *Boucotinskia* in the same subfamily. The definition of the subfamily as given in Krans, 1971, p. 106 needs no adjustment.

PHYLOGENETIC POSITION OF THE SUBFAMILY CYRTINOPSIDINAE

A remarkable, almost unique character of the subfamily Cyrtinopsidinae is the micro-ornamentation. We consider the micro-ornamentation as one of the valid characters with respect to the phylogeny. In this view we must consider the most 'primitive' micro-ornamentation of the Cyrtinopsidinae. So the micro-ornamentation of the Wenlockian species needs our first attention.

It appears that the micro-ornamentation of the Wenlockian Cyrtinopsidinae and of some Eospirifers, especially species where by mantle retraction growth lamellae were formed, is identical; e.g. the micro-ornamentation of *Hedeina eudora* and of *Boucotinskia sulcata.*

Moreover the formation of the cardinal process in the early kozlowskiellinins and in *Boucotinskia* comes very close to the formation of a very weakly developed cardinal process in some eospiriferinins like *Hedeina, Janius, Eospirifer* and *Striispirifer.*

In these latter genera we also found well developed dental plates with a clear mediotest, comparable to the earlier Cyrtinopsidinae.

Most probably there exists a close phylogenetic relationship between the Cyrtinopsidinae and the Eospiriferinae, which according to Pitrat (1965, p. H668) must be placed in different superfamilies: the Spiriferacea and the Cyrtiacea respectively. Text-figure 4 shows a tentative scheme of the phylogeny of the subfamilies Cyrtiinae, Eospiriferinae and Cyrtinopsidinae.

ACKNOWLEDGEMENTS

I am greatly indebted to dr. G. A. Cooper for giving me permission to examine the brachiopod collection of the U. S. National Museum, Washington D. C.

I wish to thank dr. Arthur J. Boucot, at the time at the Californian Institute of Technology, Pasadena for allowing me to study his collections and for giving me most valuable comments and suggestions.

The present study was supported by The Netherlands Organization for the Advancement of Pure Research (Z. W. O.), grant no. 5-854-34 which made it possible for me to spend a year in the United States of America (1967-1968).

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PLATE I

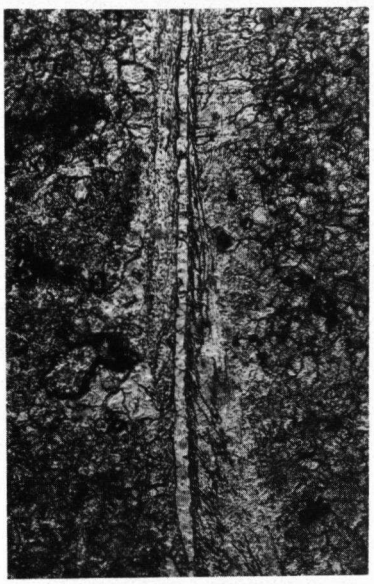
Boucotinskia decemplicata (Hall, 1843), Rochester Shale, Lockport, New York, USNM 10388

Fig. 1. Part of dental plate with mediotest. Acetate peel 6822a2, the same section as the one in text-figure 3 A, section b.

Fig. 2. Upper part of right dental plate with mediotest in section 6822a4, the same section as the one in text-figure 3 A, section d.

Fig. 3. Upper part of the dental plate with mediotest in section 6822B, the same section as the one in text-figure 3 A, section e.

Fig. 4. Brachial valve in section 6822b (see also text-figure 3 A, section e).



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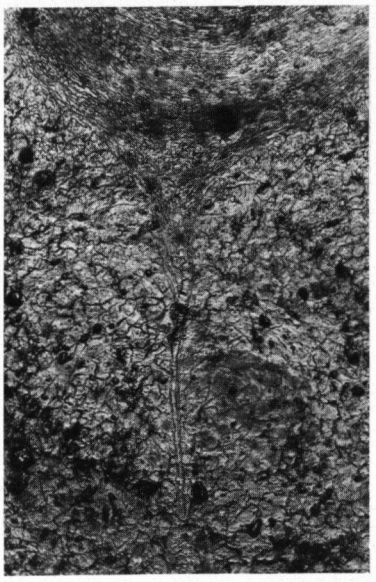

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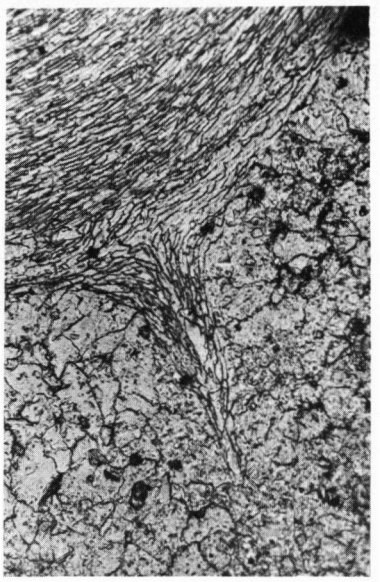

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