MICRO-ORNAMENTATION OF SOME SPIRIFERIDE BRACHIOPODS

by HOWARD BRUNTON

ABSTRACT. The use of the term microspine by Balinski (1975) for a variety of structures on several taxa of spiriferides is discussed and, in part, rejected. Balinski described two distinct structures; true microspines and a papillose ornamentation resulting from external shell erosion. Evidence for a microspinose ornamentation on species of *Crurithyris* is presented together with models distinguishing the growth of spines in spiriferides from that in productaceans.

BALINSKI (1975) described the changes in micro-ornamentation of some Devonian ambocoeliids during progressive stages of weathering. He demonstrated that the original external fine ribbing on *Ilmenia* specimens from the Holy Cross Mountains of Poland was removed by weathering and led to the exposure of a 'microspinous' ornamentation. In terms of shell structure this process involved the progressive loss of the primary shell layer, within which the ribbing was principally developed, and the exposure of externally forwardly projecting 'microspines' aligned radially along the original intercostellate spaces. These 'microspines' are described as being 'coarsely crystalline' and 'generally devoid of a distinct trace of [a] central canal'. Balinski described similar structures in other Givetian ambocoeliids and argued a case for interpreting them as having developed like the true microspines of other spiriferides such as *Nucleospira*, i.e. from mantle epithelium which, during ontogeny of the individual, retracted and sealed the spine cavity by shell deposition. Balinski's contention is, however, that his 'microspines' differ from true microspines in that the former never protruded from the original external surface of the non-weathered specimen. From this standpoint he discussed the dangers in using microspinous ornamentation as taxonomic criteria and suggested that some taxa may be falsely based as a result of ill-preserved material. In addition he suggested that most species of *Crurithyris*, normally described as being microspinous, only developed the type of ornamentation he described for *Ilmenia* by secondary weathering or erosion.

My view is that Balinski's warning of caution in the use of poorly preserved or eroded material is valid and doubtless his explanation of the variable ornamentation of *I. hians* (Buch) is correct. I am not confident that his interpretation of his 'microspines' on this and related species is correct and I am sure that he is incorrect in saying that no *Crurithyris* species ever had a true external ornamentation of a microspinous nature. His use of the term 'microspine' is confusing for a structure distinctive from the true microspines of other spiriferides, such as *Nucleospira*, *Crytina*, or *Spiriferellina* (Pl. 115, figs. 1–7), and I prefer to use here the term papillose for ornamentation protruding from the surface as a result of erosion such as described by Balinski for *I. hians*.

My confidence in asserting the primary nature of an external ornamentation, which I call truly microspinous, on some species of *Crurithyris*, arises from a study of very

[Palaeontology, Vol. 19, Part 4, 1976, pp. 767–771, pl. 115.]

finely silicified Viséan specimens from Co. Fermanagh, Ireland. These specimens belong to *C. urei* (Fleming), the type species of *Crurithyris* George, and are abundant in the silicified faunas collected. In his description of *Crurithyris*, George (1931) detailed the spinose ornamentation of three species, including *C. urei*, and pointed out that there appeared to be two series of spines of distinctly different sizes. My illustration (Pl. 115, fig. 2) shows the broken bases of two distinct sets of microspines on the ventral valve of *C. urei*, as well as the clearly developed lamellose growth-lines towards the anterior margin. I do not believe that this combination of ornaments, spines, and lamellae could have resulted from surface erosion of the shell and believe, therefore, that it is primary. The larger set of spines occurs in a roughly quincuncial arrangement and both must have grown rapidly at the valve margins, in a manner like that described by MacKinnon (1974) for *Spinatrypa* and by Dagis (1974), upon whose illustrations text-fig. 1 is based.

A truly spinose ornamentation, such as that illustrated here and well known on genera such as *Spiriferina*, occurs commonly on sufficiently well-preserved specimens of many taxa of the spiriferida. On the whole these spines differ from the cylindrical spines of the Productidina and Chonetacea in that those of the Spiriferida developed from a fold in the mantle edge whose borders continued to secrete shell material. Such growth led to the development of continually hollow spines, even after mantle retraction, and their cavities were sealed internally by the continued deposition of secondary shell. By contrast the productidine spine developed from a generative bud of mantle epithelium which, while growing away from the external surface, secreted a cylinder of shell material around itself. Some of these spines remained tissue filled until the death of the specimen while others 'died' soon after formation as a result of retraction of the epithelial evagination and the plugging of the cavity by shell material during the retraction process.

Unfortunately, since my evidence for spines comes from silicified material I am unable to study the shell structures associated with this ornamentation. However, it seems fairly clear from literature (MacKinnon 1974; Dagis 1974) that endopunctate spiriferinaceans, such as *Spiriferina* and *Labella*, have spines involving the secondary shell layer (and so these spines 'lived' longer) while most other microspines, such as those of *Crurithyris*, developed only within the primary layer.

EXPLANATION OF PLATE 115

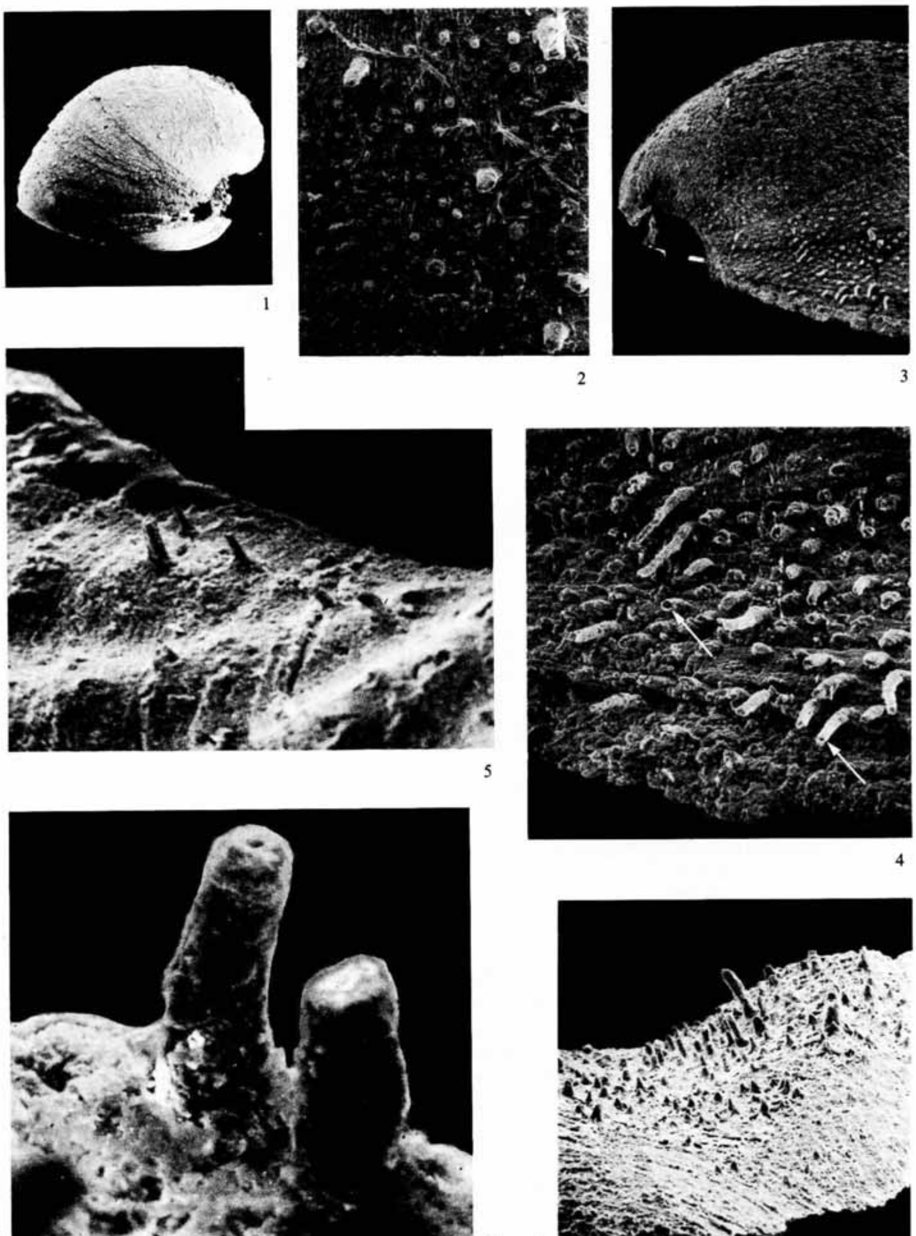
Scanning electron micrographs of three species of spinose Spiriferida, preserved as silica replicas, from the Viséan of Co. Fermanagh, Ireland. The specimens were collected by the author and are housed in the British Museum (Nat. Hist), London.

Figs. 1–2. *Crurithyris urei* (Fleming). 1, complete shell, dorsal valve to the bottom, with spines preserved anteriorly. ×15. BB 61624. 2, detail of antero-median region of the ventral valve showing the two different sizes of microspines. ×75.

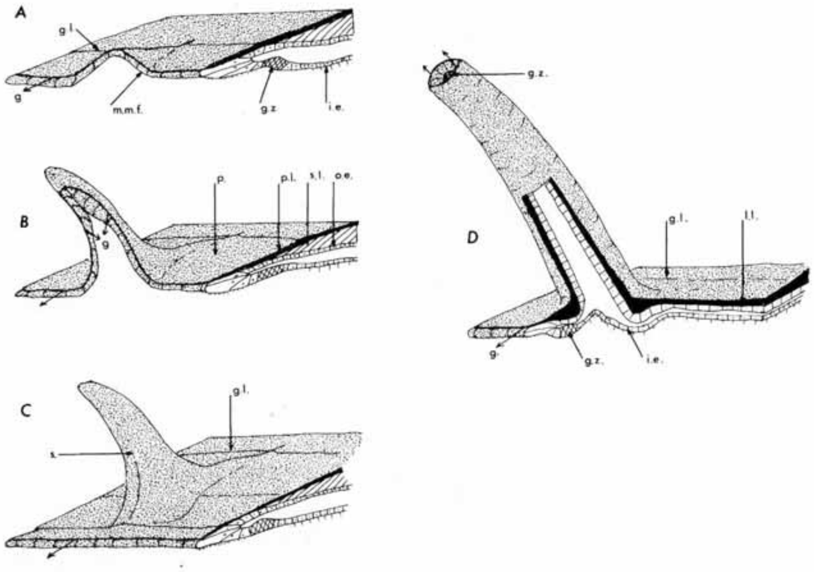
Figs. 3–4. *Nucleospira* sp. 3, the posterior half of a ventral valve. ×50. 4, detail from the above picture in which the original hollow centres of the spines can be seen (arrowed). ×150. BB 61625.

Figs. 5–6. *Spiriferellina insculpta* (Phillips). 5, postero-lateral region of the ventral valve showing the bases of several spines, normally associated with rib crests. The umbo is to the right. ×50. 6, detail of two spines from the above specimen which show signs of the original cavities. ×500. BB 61626.

Fig. 7. *Cyrtina* sp. Part of the mid-region of a ventral valve looking towards the commissure. ×50. BB 61627.



BRUNTON, spiriferide micro-ornamentation



TEXT-FIG. 1. Stylized illustrations showing the development of a spine in a spiriferide (A–C) and a productidine (D). In A the mantle edge started to fold up after the last growth halt (g.l.). In B the forward and outward growth of the mantle fold, and the shell it secreted, has ceased and the mantle edges draw back towards the original valve margin. Mantle edge thickening probably sealed the shell in the spine positions when the valves were closed. In C the spine is complete. The mantle has returned to its normal position and shell has closed the anterior face of the spine. In D the isolated generative zone at the spine tip may continue to proliferate and secrete shell, increasing the spine length, after it has been left well behind the valve margin. Mantle, covered by periostracum, seals the distal end of the spine and inner epithelium the internal opening to the spine. g, growth direction of shell at the valve margin; g.l. growth line, indicating a pause in growth; g.z., generative zone of mantle epithelium; i.e., inner epithelium; l.l., laminar shell layers; m.m.f., mantle margin, folded in this region at the start of development of a spine; o.e., outer epithelium; p., periostracum (dotted) extending over the shell from the generative zone; p.l., primary layer of shell; s., suture line on front face of spine; s.l., secondary layer of shell.

While Balinski thought that his 'microspines' on ambocoeliids were secondary structures he nevertheless thought they developed and functioned like true microspines in other spiriferides. Thus although I think him incorrect in extending his *Ilmenia* observations to all other ambocoeliids I think he is generally correct in saying that the structures he saw and illustrated on specimens of *Ambothyris*, *Nucleospira*, and *Proreticularia* are microspines. In addition the different structures he illustrated on eroded *Ilmenia* and *Crurithyris* species should not be termed 'microspines' as they are probably quite unrelated to spines (in the normal sense of a protuberance from the surface having considerably greater length than breadth), but are more similar to the papillae seen in the primary shell layer of some terebratellaceans. The terms papillae and spine are general and descriptive but distinctive. The former is ill-defined in the *Treatise* (1965) and should include any conical or nipple-shaped protuberance on inner or outer surfaces, such as are illustrated by Balinski on *Ilmenia* (1975, pl. 33, figs. 2, 5).

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Typescript received 7 November 1975
Revised typescript received 28 January 1976