GROWTH FORMS OF STROMATOPOROIDS IN THE SILURIAN OF SOUTHERN NORWAY

By

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Abstract. Stromatoporoids are found in which 1) the margins are invaginated so as to include tongues of sediment, 2) there are inclusions of sediment within the coenosteum, 3) both tongues and inclusions occur. These stromatoporoids probably grew under conditions of varying rates of sedimentation. Where the marginal tongues or inclusions of sediment are concentrated on one side of a stromatoporoid, it is suggested that this was the lee side of the growing coenosteum during unidirectional current action. In some cases, growth of the stromatoporoids was such that the specimens are now seen to 'lean' into the direction of the current.

Introduction

Stromatoporoids are relatively common among the Silurian fossils of southern Norway. They are especially abundant locally where they may form reef-like masses, for instance on the small island of Braksöy, Ringerike (Kiær 1908 pp. 89–90 and Fig. 15), and on the summit of Kapitelberget, Skien, Telemark (Kiær 1908 pp. 279–282).

Growth forms

The stromatoporoids considered in this paper are characterized by 1) lateral margins which are invaginated so as to include tongues of sediment (Fig. 1a), or 2) inclusions of sediment within the coenosteum (Fig. 1d), or 3) both marginal tongues and inclusions of sediment (Fig. 1c). When seen in vertical section, as in quarry or cliff exposures, the stromatoporoids sometimes show an approximate bilateral symmetry with respect to outline or enclosed sediment lenticles (Fig. 1a), but, more frequently, the stromatoporoids are asymmetrical in these

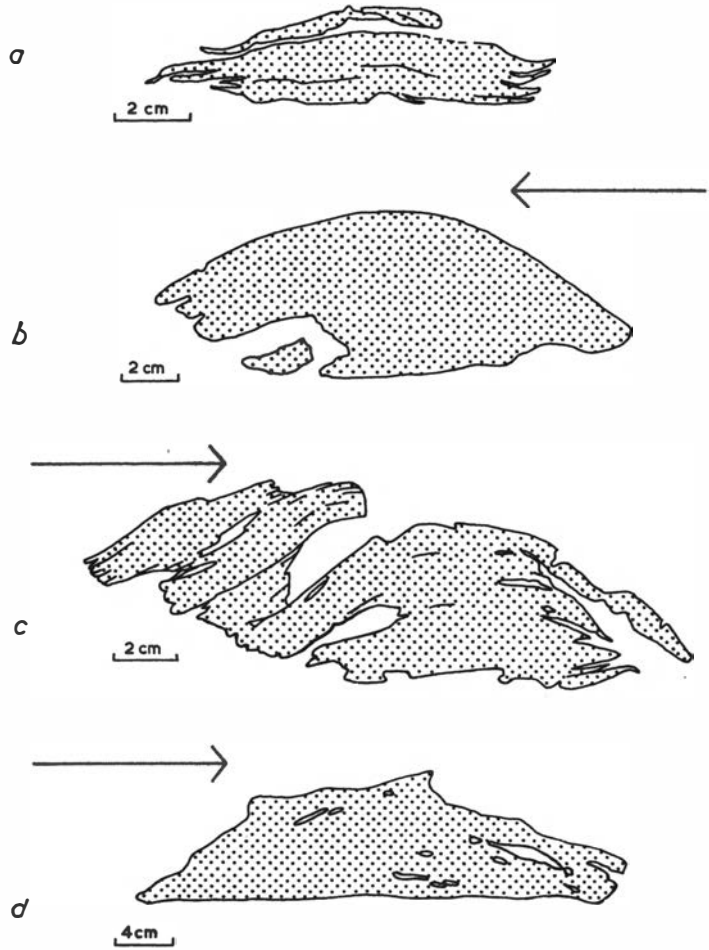

Fig. 1. Stromatoporoids developed under conditions of varying rates of sedimentation, with a) little evidence of unidirectional current in the plane of the section and b–d) evidence of unidirectional current in directions indicated by the arrows. a) Roadside, Highway E 68, Vik, Hole, Ringerike (7c*α*). b) Alongside steps leading from Övre Elvegate to Tomtegate, Skien, Telemark (6b). c) Roadside, Highway E 68, Vik, Hole, Ringerike (7c*α*). d) Roadside, Highway E 68, ca. 500 m east of Vik, Hole, Ringerike (7c*β*).

respects (Fig. 1b, c, d). All of these stromatoporoids contain latilaminae, but much of the original detail structure has been modified by recrystallization (see GALLOWAY 1957). Tongues or inclusions of sediment in stromatoporoids have been recorded previously by GALLOWAY

(op. cit.) and SCOFFIN (1965) and in *Stromatactis*-like forms by LOWENSTAM (1950).

The development of invaginated flanks is due, apparently, to variations in the amount of sediment which accumulated on the surface of the coenosteum during the course of growth. In periods of heavier sedimentation, the outer and topographically lower surface of the stromatoporoid was presumably engulfed by sediment so that the soft tissues there were killed. Provided the central and higher parts of the stromatoporoid could survive, then the colony was able to expand again once the sedimentation rate had fallen below a critical level. This suggestion is in accord with that of JUX (1957), who considered that stromatoporoids with latilaminae lived under conditions where sedimentation proceeded slowly and with interruptions, i.e. not at a constant rate.

In the case of stromatoporoids with enclosed lenses of sediment, such as that of Fig. 1d, the accumulation of sediment was not restricted to the outer parts of the flanks. Such cases are found where the growth form is wide and low so that the surface of the colony was never very far from horizontal and sediment could accumulate just as easily part way up the flank as on the edge.

Influence of bottom currents

In the case of the stromatoporoids approaching bilateral symmetry (e.g. Fig. 1a), the effect of the 'stop–go' pattern of sedimentation must have been roughly equal on the two sides, and in the section available there is virtually no indication of unilateral current action across the specimen. The possibility must, of course, be borne in mind that the section available could lie in a plane normal to the direction of a former current, and this possibility can be checked only by further study of the specimen. But where there is an asymmetrical development of the invaginations or sediment lenticles (e.g. Fig. 1b, c, d), then there is clear evidence not only of fluctuation in rate of sediment accumulation but also of current action from one dominant direction. Under the influence of such a current, sediment would be expected to settle in the slacker water to the lee of the stromatoporoids, and those figured in Fig. 1b, c, d would therefore develop invaginations or lenticles of sediment on the downcurrent side. Changes in the positioning of the

invaginations or sediment lenticles would be an indication of differing current directions. If information regarding current direction is required from such evidence of stromatoporoids, it is, of course, essential to consider more than one section in each case and to bear in mind the possibility that the stromatoporoid colonies may have been rotated by currents either during or after life.

Stromatoporoids such as figured in Fig. 1d where the central axis of part of the colony is highly inclined are of special interest. Examples are difficult to find, but specimens may be seen in the red beds of the Upper Llandovery (beds 7c*a* of KIÆR 1908) exposed along the main road at Vik, Hole, Ringerike (the locality from which the specimen of Fig. 1d was obtained). In the specimen of Fig. 1d, development was at first roughly bilaterally symmetrical, and the 'stop–go' nature of sedimentation resulted in the development of an invaginated margin. But later growth was markedly asymmetrical, and the specimen is seen to 'lean' to the southeast (left in the diagram). This asymmetrical growth is apparently the consequence of relatively strong current action so that sediment was deposited on the lee side of the colony. Maximum growth was presumably on the stoss side where the oncoming current was strong enough to keep the stromatoporoid surface clear of accumulating sediment.

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