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SHORT NOTE

Depth Maxima of *Conchocelis* and *Phymatolithon rugulosum* on the N. W. Shelf and Rockall Plateau

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ABSTRACT: *Conchocelis* filaments in shells have been found at depths from 46 to 78 m below Chart Datum on the Malin Shelf, and the coralline red alga *Phymatolithon rugulosum* at 90 m on the Rockall Plateau. The use of *Conchocelis* growing in shells as a means of assessing the lower limits of the photic zone is restricted to coastal waters where an adequate *Porphyra* spore 'rain' is likely.

Recent studies on the depth distributions of sublittoral marine algae in the Clyde Estuary and Firth have shown that the shell-perforating red alga *Conchocelis* is usually the deepest growing plant, sometimes accompanied by the encrusting coralline red alga *Lithothamnium sonderi* Hauck, (Clokie et al. 1979; Clokie and Boney, 1980). Data from the stations worked in the Firth of Clyde, extending from the deep channel in the Estuary to both the inner and outer regions of the Firth, revealed that the lower limit of *Conchocelis* (measured from Chart Datum) progressively increases from 9 m in the Estuary, through 20–28 m in the Inner Firth, to 38 m due south of Arran and 40 m south of Kintyre (Clokie and Boney, 1980). These data have led us to propose the utilization of the lower limit of *Conchocelis* as an indication of the lower limit of the photic zone in the Firth of Clyde. The shell-boring filaments of *Conchocelis* in this work have been used as 'form range' organisms. In fact they represent the perennating phase of *Porphyra* spp. and *Bangia atropurpurea* (Roth). C.Ag., (Drew, 1954, 1958), and are sources of spores (the conchospores), which in turn replenish the intertidal stocks of the membranaceous *Porphyra* spp. and the filamentous *Bangia*. In a recent cruise on the R. R. S. Shackleton in June 1978 it was possible to extend our knowledge of the maximum depths reached by *Conchocelis* in shells on the N. W. Shelf north of Malin Head and south of the Sea of the Hebrides, and of *Phymatolithon rugulosum* Adey west of the Rockall Trough on the Rockall Bank.

Collections were made with a Van Veen Grab (Holme and McIntyre, 1971). As in the Firth of Clyde studies, the approximate *Conchocelis* limits were first bracketed by widely set samples, then collections made more precisely across the distribution boundaries. The mean depth between the deepest positive record and the shallowest negative was then recorded as the lower limit of distribution, and expressed in m below Chart Datum. The methods of screening the grab samples for 'infected' shells, and the decalcifying of shells for microscopic examination where necessary, were carried out as already described, together with careful examinations of pink or red coloured shell material to ensure that there was true *Conchocelis* 'infection' (Clokie and Boney, 1980).

The depth distributions of the two red algae on the transect west from Jura and Islay are shown in Figure 1. *Conchocelis* in shells was found at depths of 46 m between Jura and Islay (Fig. 1 J, I); at 53 m south of Mull (Fig. 1 M); at 57 m south of Tiree (T in Fig. 1) and at 50 m about midway between Malin Head and Tiree. Further west on the Malin Shelf the deepest recorded occurrence of *Conchocelis* was at 78 m. At the maximum depth sampled on the Rockall Bank just east of Rockall (90 m) *Conchocelis* was not found, but the encrusting coralline red alga *Phymatolithon rugulosum* Adey was present.

Our earlier records for the Firth of Clye showed that *Conchocelis* in shells was found at progressively greater depths as one proceeded from the Estuary through the inner and outer Firths. Maximum depths recorded were at 38 m south of Arran and 40 m south of Kintyre. The data from the Malin Shelf show that there was a

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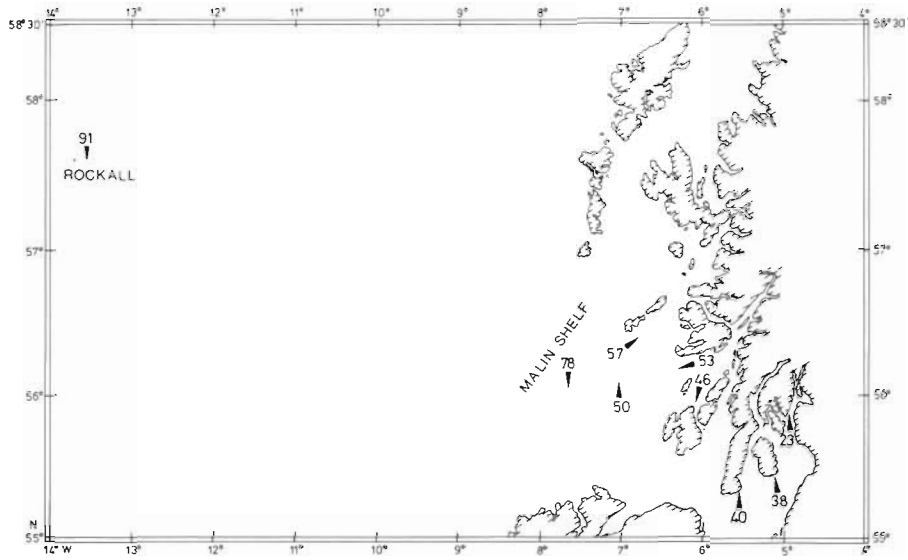

Fig. 1 Lower distribution limits of *Conchocelis* as measured on a transect west from Jura and Islay and on Malin Shelf. Stations as described in text. Data from Firth of Clyde and Clyde Estuary included for comparison

continuing and increasing depth distribution in the offshore waters. The presence of the shell-boring filaments requires a spore inoculum (the alpha-spores in the case of *Porphyra* spp.) produced by the intertidal *Porphyra* populations, and subsequent spore drift into the sublittoral which will enable spore germination on the shell surfaces. The abundance of *Porphyra* spp. on the shores of the Firth of Clyde will ensure this rain of spores in sublittoral habitats. Similarly the *Porphyra* populations of the island and mainland shore can serve as spore inoculum sources for the shell flora of the Malin Shelf, together with any sediment drift which may move the shell fragments along the seabed. The absence of *Conchocelis* from Rockall Bank shells may well be a reflection of the lack of a *Porphyra* spore source in the near vicinity. The most recent summary of the Rockall flora was that given by Powell and Chamberlain (1956). This listed the marine algae collected on the H. M. S. Vidal expedition in September 1955 which annexed the rocky outcrop for Great Britain. Powell and Chamberlain combined the 1955 data with those algal species listed by Hamel (1922) from the collection made by Le Conte on July 1st 1921 when a small party from the R. V. 'Pourquoi Pas?' made a landing. Of the 22 algae listed, 6 were species of red algae, of which *Porphyra leucosticta* was one, with a population of a few small fronds (Hamel, 1922), or one small plant (Powell and Chamberlain, 1956). More vigorous but isolated growths of *Bangia atropurpurea* were described (as *B. fuscopurpurea* [Dillw.] Lyngb.), particularly from the top half of the rocky outcrop in 1955. A more recent landing on Rockall has confirmed the presence of *Bangia* and the comparative lack of *Porphyra* (Moore, 1977). Whilst *Bangia* is known to produce a *Conchocelis* phase (Drew, 1958), this has not yet been described for *Bangia* in the British Isles. Drew's (1958) experiments were carried out with *Bangia* at Naples (Italy). The possible significance of spore drift over long distances is one of the least well understood aspects of the biology of red algae. The presence of *Phymatolithon rugulosum* was to be expected. Capt. Vidal on the H. M. S. 'Pike' survey made numerous soundings on the Rockall Bank between 6–20 September 1831, and reported patches of 'coral fragments' (Fisher, 1956).

In two earlier papers we have described the use of *Conchocelis* growing in shells as a means of indicating the lower limits of the photic zone (Clokie et al., 1979; Clokie and Boney, 1980). The results of the present survey show that the reliability of this photic zone assessment will be limited to those coastal waters where an adequate *Porphyra* spore 'rain' is likely.

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