several subsamples must be taken so as to represent the whole area within the box because the sediment surface is somewhat disturbed. Box corers seldom produce a sample with an undisturbed surface layer and it is unlikely that, when subsampled, the distribution of the meiofauna in the surface layer of the recovered box-core sample will be the same as its distribution in the sea bed prior to sampling.

A new corer was designed to overcome these various problems, and a description is given of a multiple corer (Barnett *et al.* 1984), based on the principle of the Craib (1965) corer, which takes short samples of shelf, bathyal and abyssal sediments with virtually no disturbance. An array of up to twelve plastic core tubes is lowered slowly into the sediment by a hydraulic damper mounted on a supporting framework. Experience has shown the corer to be reliable and capable of taking cores with clear, overlying water with no disturbance of the sediment/water interface.

Photographs have confirmed the undisturbed nature of the sampling process in sand, mud and ooze sediments. This has been used to advantage to sample the seasonally-deposited phytoplankton debris that forms a flocculent detrital layer on the surface of deep-sea sediments at certain times of the year. The corer has proved to be a successful method of sampling for studies of the microbiology and meiobenthos of shelf and deep-sea sediments. A recent development has been its use in the measurement of oxygen uptake in sediment cores incubated virtually *in situ* at depths down to 5000 m.

Barnett, P. R. O., Watson, J. & Connelly, D. 1984. A multiple corer for taking virtually undisturbed samples from shelf, bathyal and abyssal sediments. *Oceanologica Acta* **7**, 399–408.

Craib, J. S. 1965. A sampler for taking short undisturbed marine cores. *Journal du Conseil permanent international pour l'Exploration de la Mer* **30**, 34–39.

Sampling deep-sea benthos

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The benthic sampling programme of the Scottish Marine Biological Association has investigated the distribution, abundance and biology of the animals living on the floor of the Rockall Trough at depths ranging from about 200 to 3000 m. Repeated sampling at two fixed stations over a ten-year period, together with more widespread sampling, has created a unique time series of samples from the deep-sea bottom.

The low density of most benthic animals dictates the use of towed samplers in order to obtain sufficient specimens for detailed studies. A Woods Hole-pattern epibenthic sledge with a 1 mm mesh, decreasing to 0·5 mm meshes in the cod end extension, has been successfully used for the recovery of the small sized faunal taxa. The "megafauna" (those animals generally large enough to be seen in sea-bed photographs) has been sampled using a 3 m-wide Agassiz Trawl. Both trawls are normally towed on the bottom for one hour. Quantitative samples have been

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taken with a large USNEL spade box corer, which removes a relatively undisturbed mud core of $0{\cdot}25\,m^2$ in area, and up to 40 cm deep. Such a large and cumbersome corer is necessary when sampling sparsely-distributed species at these depths in order to recover a large enough sample of the mainly burrowing fauna associated with the muddy sediment. The use of an acoustic pinger is essential for monitoring the operation of the corer on and near the sea bed.

The Cumacea (Crustacea) of the INCAL cruise

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Along with the other groups of the peracarid crustaceans, the Cumacea have been found in recent years to be numerically an important part of the deep sea benthos. The majority inhabit shallow burrows in muddy substrates and sort through the surface material for organic matter. Most are less than 8 mm long. As many as forty-three separate species have been collected in a single epibenthic sledge haul taken at about 2000 m depth in the Rockall Trough.

The INCAL Cruise of R.V. *Jean Charcot* from the Centre Océanologique de Bretagne, Brest, took place in July and August 1976. It was designed to compare the efficiency and selectivity of different collecting gear and methods developed by several institutions, namely SMBA, Dunstaffnage, COB, Brest and IOS, Wormley. A series of stations was worked in the Rockall Trough, followed by others in the Porcupine Bight and Abyssal Plain and the Bay of Biscay. Cumacea were obtained in forty-five of the samples. One hundred and fourteen species were represented, of which probably twenty-three have not yet been described. Seventy-six species were found in the samples from the Rockall Trough and ninety-two in those from further south, fifty-four of these being common to both areas. A further twelve of these species have been recorded previously from both areas, making nearly 60% in common. These numbers demonstrate the high level of speciation that has occurred among the cumaceans in the deep sea.

The species and samples from the INCAL Cruise were analysed by detrended correspondence analysis. The first axis scores for the ordination of the samples (Fig. 1) fall into two groups. The left hand group includes all the samples from depths of less than 3000 m and the right hand group all those from more than 4000 m. The ordination of the species is less clear cut but those obtained almost exclusively from less than 3000 m are clustered to the left while those from more than 4000 m are set to the right. However, most of the samples from less than 3000 m were taken in the Rockall Trough and all those from more than 4000 m in the southern area. The ordination is therefore not simply related to depth but also to geographical location. Since about 60% of the species obtained are common to both areas it may be assumed from the data available that the depth is the more important factor controlling their distribution.

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