sankaran (Atomic Energy Establishment). The principles of the field emission and the field ion microscopes were the subject of symposium talks by Drs. Ramakrishna Rao and Bahadur.

Dr. (Mrs.) Satyavati M. Sirsat (Indian Cancer Research Centre) started the course in biological sciences with a lecture on the ultrastructure of the cell. She also gave two symposium talks, one on "Ultrastructural aspects of the Cancer Cell" and the second on "Macromolecules".

Dr. S. R. Bawa (Punjab University) discussed the preparation of tissues and sections of biological material for electron microscopy. In a symposium lecture (illustrated by a film projection) on "Organelles of Motility" Dr. Bawa indicated the usefulness of the instrument in unravelling the intricate details of the highly specialized organelles like flagella and cilia.

Various experimental techniques like shadow casting, ultra thin sectioning and negative staining in vogue for bacteria and viruses and the preparation of macromolecules by the pseudo-replica method for electron microscopic investigations were described by Dr. S. N. Chatterjee (School of Tropical Medicine). He also delivered a lecture on the Ultrastructure of bacteria and viruses correlating structure with function. Drs. P. Sadhukhan and D. N. Misra (Saha Institute of Nuclear Physics) discussed the different procedures of "particle counting by electron microscopy and its application in quantitative virology" and "the mass thickness of biological specimens".

Mr. S. C. Mehta (Indian Agricultural Research Institute) explained the mode of handling of specimens like spores and diatoms and the purification of viruses extracted from plants for electron microscopic study.

The recent development of the thin autoradiographic emulsion with improved resolution and the application of autoradiography to electron microscopy were considered by Dr. P. N. Shrivastava (University of Rajasthan). Mr. S. D. Paiekar from the same University discussed the methodology and applications of cytochemistry at the ultrastructural level.

All the participants, irrespective of their scientific background, had to undergo the practical course in the various techniques of specimen preparation in both physical and biological sciences and interpretation in the electron microscope.

The authors feel that the summer school in electron microscopy, the first of its kind in India, has more than fulfilled the object of the organisers.

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UPWELLING IN THE MINICOY REGION OF THE ARABIAN SEA

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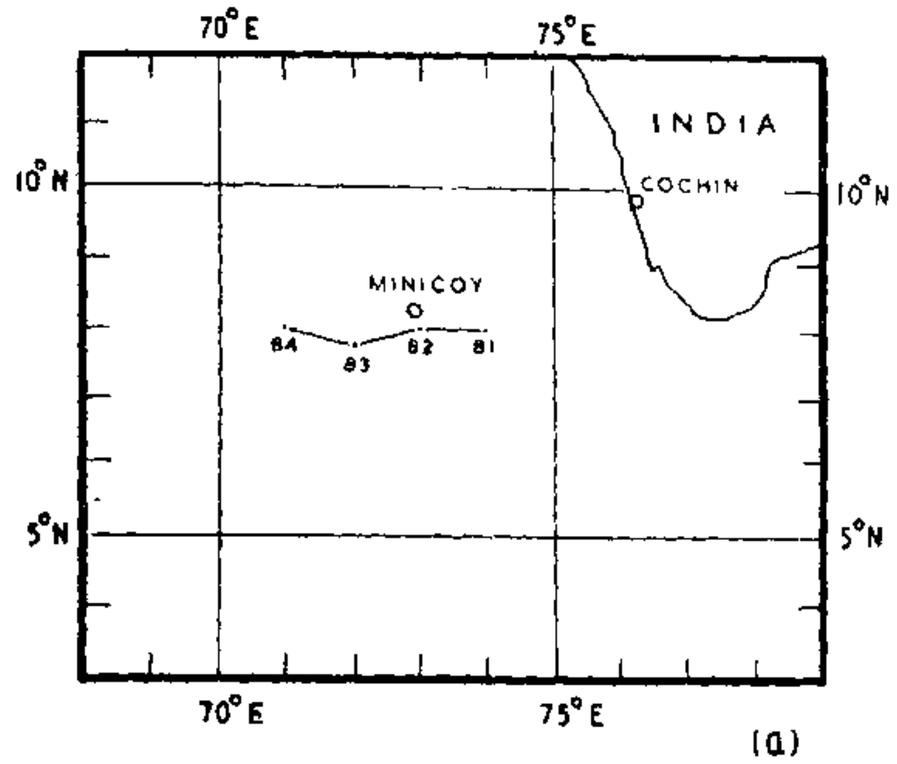
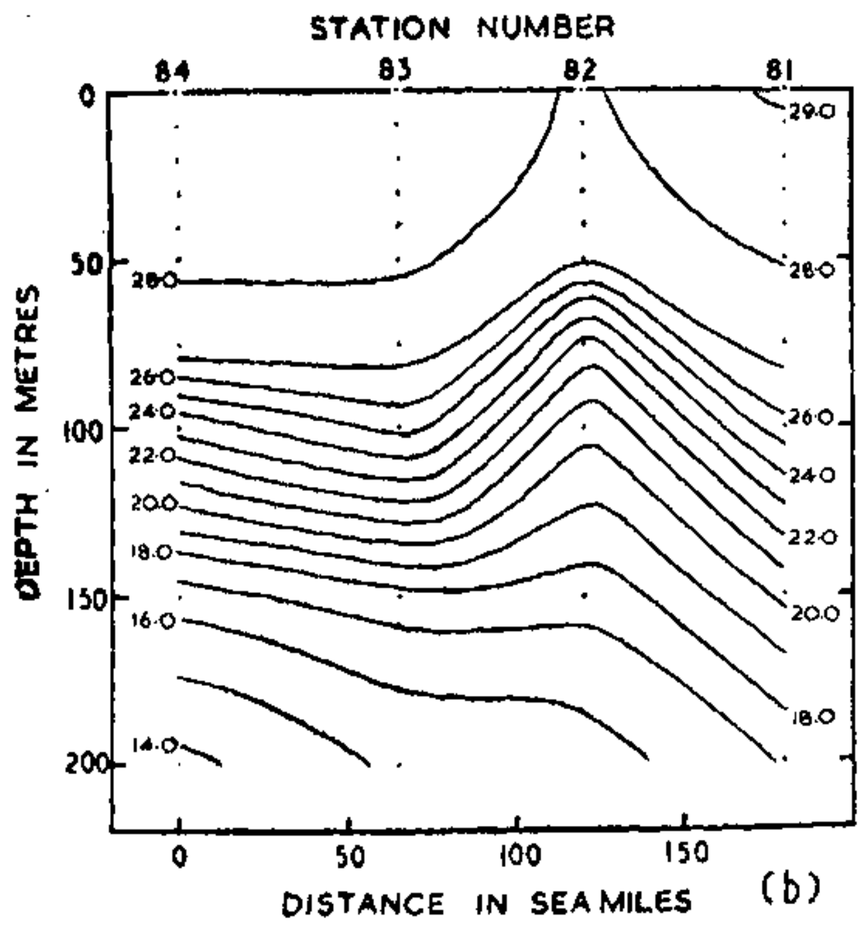
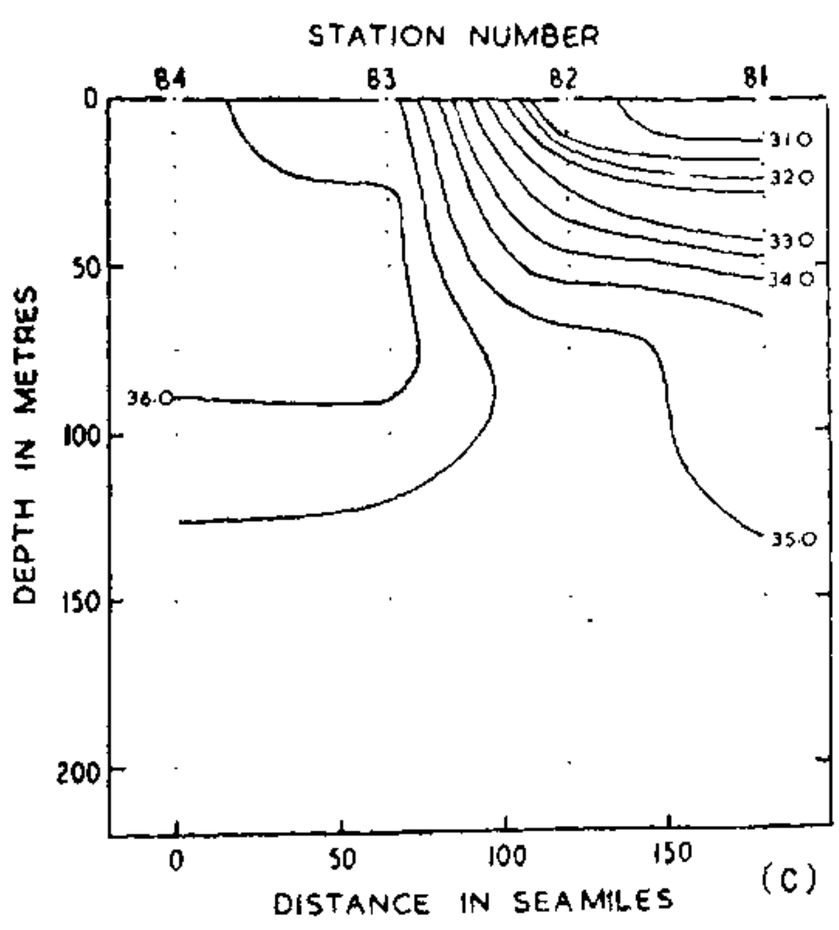
THE coral island, Minicoy (Latitude 8° 7′ N, Longitude 73° 18′ E), which is situated between the Laccadive and the Maldive Archipelagos is a major tuna-fishing centre in the Indian Ocean region.[1] While the importance of this region from the point of tuna fishery has been well recognized, we have very little data on the oceanographic conditions prevalent there. This is particularly noteworthy since in many areas, tuna investigations have always been supported by large-scale oceanographic studies.[2] It may also be mentioned here that one of the most important discoveries in modern oceanography, namely the Cromwell Current, is associated with the systematic investigations for tunas in the central and equatorial Pacific by the Pacific Oceanic Fishery Investigations (POFI) group.

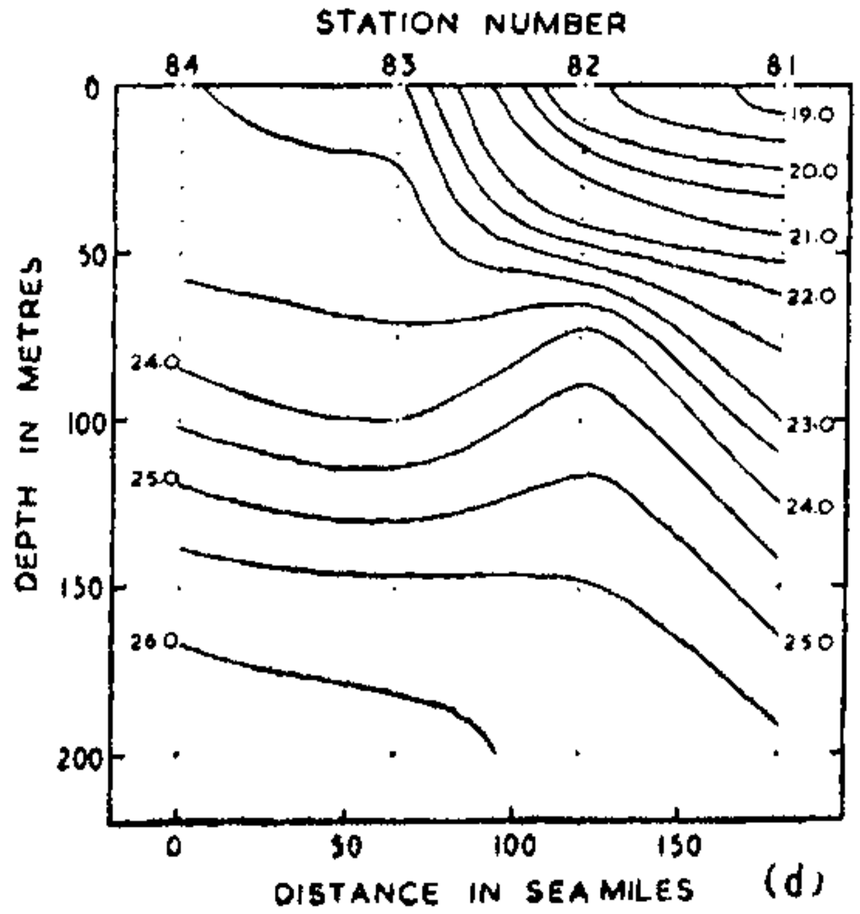
In one of the International Indian Ocean Expedition (IIOE) cruises in the Arabian Sea, INS KISTNA worked out a long section of 15 stations along the latitude 8° N from the 27th November to the 2nd December 1962. During the occupation of stations in the vicinity of Minicoy, it was particularly noticed by one of us (R.J.) that the ship was drifting considerably giving rise to large wire angles indicating the possibility of strong water movements in the area. In addition, while examining the distribution of various parameters along this 8° N

section, some very interesting features were observed in respect of stations in the Minicoy region. It was, therefore, thought desirable to make a detailed analysis of the data for various parameters in this region in particular (Stns. 84–81). The location of stations and the verti-









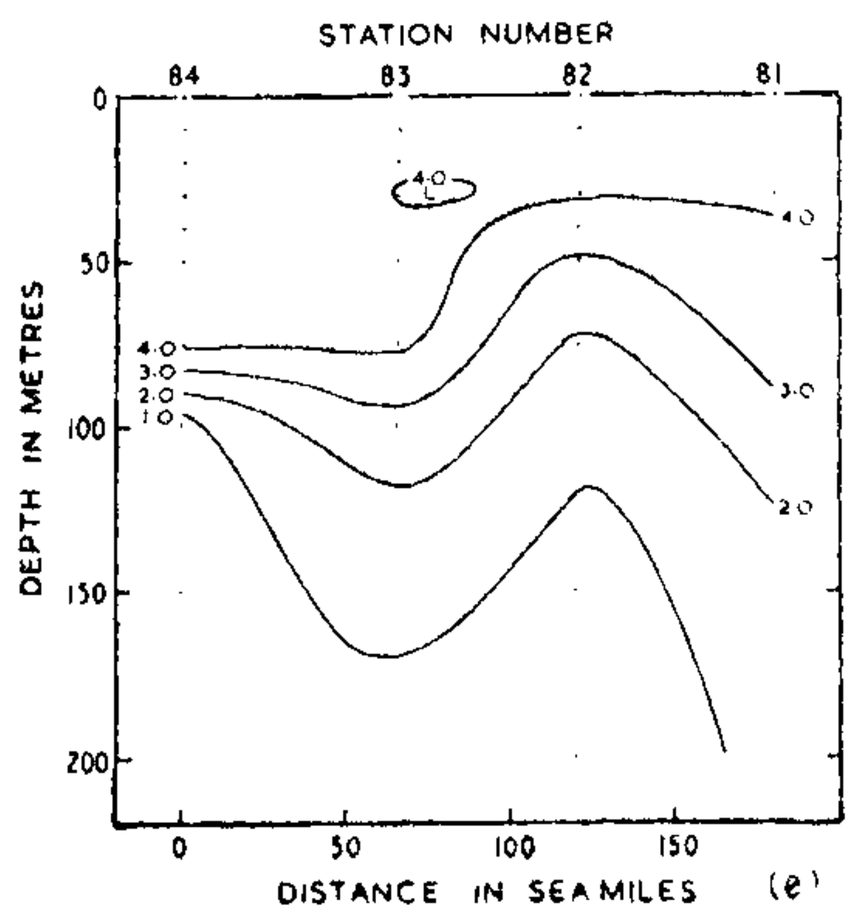


FIG. 1. Vertical distribution of temperature, salinity, density and dissolved oxygen along a section south of Minicoy Island during the last week of November, 1962. (*a*) Shows the location of station along the section. (*b*) Shows the temperature distribution-contour interval 1 C. (*c*) Shows the salinity distribution-contour interval 0·5‰. (*d*) Shows the distribution of density in terms of σ_t-contour interval 0·5 gm./litre. (*e*) Shows the distribution of dissolved oxygen contour interval 1 ml./l.

cal distribution of various parameters in the upper 200 metres are shown in Fig. 1 (*a-e*).

At Stn. 82, the temperature structure shows a sudden decrease in the thickness of mixed layer and the presence of relatively colder water in it. In association with this feature, a sharp rise of thermocline to 50 m. depth is seen, while in the neighbouring stations it is deeper (75–100 m.). The salinity distribution shows a parcel of relatively low saline water in the surface layers at Stns. 81–82 and the resulting local halocline is seen to be surfacing at Stns. 82–83. The density structure indicates the presence of a parcel of relatively lighter water in the surface at Stns. 81–82 with its westward boundary being situated between Stns. 82–83. The isopycnals exhibit an upward tilt under Stn. 82 at 50–150 m. depth. The dissolved oxygen content is seen to be less at 40–100 m. depth under Stn. 82 compared to its value under the neighbouring stations at the corresponding depths. The distribution of all these parameters clearly indicate that upwelling is present at Stn. 82, which is situated very close to Minicoy. The phenomenon appears to be limited to the upper 150 metres.

Among the various factors examined with a view to finding out the causes of this upwelling, the most obvious seems to be the presence of diverging current systems. As the observations were taken in the last week of November, the typical circulation established for the earlier half of the north-east monsoon season (November to January)[3] can be taken as the representative circulation for the period of observation. During this period, the general set of current in the southern part of the Arabian Sea is westerly. Owing to the coastal conformation, a north-north-westerly current develops off the west coast of India. These two currents diverge in the vicinity of Minicoy leading to upwelling in this region. The relatively low saline lighter water seen in the surface layers at Stns. 81–82 may be the Bay of Bengal water possibly carried westward by the north equatorial current.

It is pertinent to point out here that according to Jones and Kumaran (*loc. cit.*) in the Minicoy area, tuna fishery is operative from September to April, the peak season being from December to March. It is possible that the upwelling, which has been observed during late November, may have considerable impact on the peak tuna catches of this region. The exact sequence of events and the ultimate correlation between these physical processes and the tuna fishery of Minicoy require more detailed investigation.

The authors wish to express their deep sense of gratitude to Dr. N. K. Panikkar, Director, National Institute of Oceanography, C.S.I.R., New Delhi, for advice and encouragement.

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NEW RECORD OF FOLIAR SCLEREIDS IN THREE DICOTYLEDONOUS GENERA

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IN order to select a few plants as experimental materials for the morphogenetic studies of foliar sclereids, the leaf anatomy of certain local dicotyledons was investigated. More than 200 species were surveyed this way, and in the lamina of certain species, the sclereids were present. A reference to the earlier literature revealed that in most of them the presence and distribution of foliar sclereids was either already recorded or described. However, in these three genera, *Agrostistachys* (Euphorbiaceæ), *Taxotrophis* (Moraceæ), and *Timonius* (Rubiaceæ) the occurrence of foliar sclereids appears to be unrecorded so far.[1-3] A brief account on the cellular characters and distribution of the foliar sclereids in these forms is presented here. The leaf clearings, sections and macerations were prepared following the procedures previously outlined by Foster.[4]

Agrostistachys sessilifolia Pax and Hoffm. is an unbranched or sparingly branched shrub, common in lowland forests of Malayan Peninsula. On top of the wiry stem a tuft of elongated leaves are compactly arranged in a whorl, with humus collection in the centre, giving a characteristic appearance to the plant. An examination of cleared mature leaves shows that the sclereids are densely arranged and the fibre-like individual cells are entangled with one another (Fig. 1). Their relationship with