Deep Sea Sediments. Edited by Anton L. Inderbitzen. Pp. ix+497. (Plenum: New York and London, 1974.) $42.00.

THIS volume, resulting from the proceedings of a symposium conducted by the Ocean Science and Technology Division of the US Office of Naval Research in 1973, is remarkably comprehensive. The 23 papers achieve more than adequately the purpose of the book, to bring into sharper focus the "state-of-the-art" regarding the physical and mechanical properties of sediments and the need to establish some degree of coordination among investigators. What has had to be left out has been amply included in the references at the end of each paper which, in total, comprise a truly universal bibliography in the field of sediment mechanics.

From a panoramic viewpoint the volume deals mainly with the present situation regarding sampling devices, laboratory measurements (both mechanical and physical) and the extension of laboratory investigations to the field.

In the Atlantic, Indian and Pacific Oceans, physiographic provinces have been devised as a means of establishing some order to the quantity of mechanical data which is becoming available. Empirical equations relating mechanical and physical properties have shown minute spatial variations within each province, and carbonate distribution studies may explain some of these variations. It is, however, stressed that the provinces are not homogeneous entities and that although the mechanical/physical correlations may indicate trends, overall correlations are less accurate than those obtained for single provinces.

A number of papers deal with an extension of the correlations from laboratory/laboratory to laboratory/field, and serve to indicate that, at present, the prediction of *in situ* sediment properties and of the settlement of structures to be placed on the sea floor are woefully inadequate, with up to 30% error under ideal conditions of measurement.

Therefore, questions are posed concerning the measurements being taken. Is the macroscopic approach of the engineer good enough? Shall we ever achieve good all-round working prediction models using these macroscopic methods? The safety factor of the engineer conceals a lot of what is lacking in theory. Thus, it seems that more effort is required in a study of microstructure—so that the engineer's methods may become modified for the sediment researcher.

The urgency of the situation is stressed amply in these papers which indicate the imminence of commercial enterprise in the mining of ferromanganese deposits as a source of copper, nickel and cobalt and which consider the resulting public concern over the protection of fauna and environment.

There is a need for better instruments for obtaining undisturbed samples. Box covers seem to give good samples but are at present limited to the near surface (36 cm). There is, however, an even greater need for undisturbed material from greater depths. The transport of core material, as well as the actual sampling procedure, produces varying degrees of disturbance. That, and the weakness of prediction models, has stimulated more *in situ* work.

Yet the contributors have not forgotten that their research is often limited by economic stringency and that laboratory work relating to the deep sea environment must always play a vital role.

It is, however, pointed out that economic constraints can be lessened by means of a coordinated approach to sediment research.

There is a call also for the standardisation of techniques, symbols and units of measurement, concerning which this volume has put forward many worthwhile proposals. Standardisation would necessarily save much time and confusion.

The bibliography, data, problems and ideas presented in this volume will be invaluable for future work in sediment mechanics. **Sinclair Buchan**

Natural Gases in Marine Sediments. Edited by Isaac R. Kaplan. Pp. viii+324. (Plenum: New York and London, 1974). $30.00.

THIS volume consists of 17 chapters, which originally derive from papers presented at a symposium held at Lake Arrowhead in November 1972. The various possible sources of gas in sediment are discussed in the early chapters, together with such analytical information as is available. Because of sampling difficulties, most of the data refer to shallow water cores or to certain Deep Sea Drilling Project sites; by now, much of this information has been available in the literature for some time, but it is useful to have it presented in one volume, if only because it emphasises the restricted range of data available.

The latter half of the book is given over to consideration of the physical state of the gases in deep sea sediments, with particular regard to the possibility that gas–water clathrate compounds, or 'gas hydrates', may occur under the *in situ* conditions of low temperature and high pressure. Three chapters on the known thermodynamic properties of such compounds establish the areas of the world ocean in which these ice-like solids are stable; and as gas concentrations must be very high, some mechanisms, such as the *in situ* production of methane by the bacterial decomposition of organic material, or the injection of carbon dioxide, hydrogen sulphide, or methane from geothermal vents, must also be available.

Given that, the possible zone of hydrate occurrence is bounded on the upperside by the increase of temperature and decrease of hydrostatic pressure as the sea surface is approached from below and on its lower side by the increase in temperature resulting from the geothermal gradient For instance, in sea water which is 2 km deep, and which has a bottom temperature of 2 °C, it is shown that methane hydrate would be stable to a depth of about 600 m within the sediment. Although the hydrate would theoretically also be stable in the water column above the sediment at all depths below about 500 m, it is not likely that the required gas concentrations could be sustained outside the sedimentary column. Thus, the phenomenon is to be expected only within the upper regions of deep sea sediments.

Although no unequivocal proof of the existence of gas hydrates is given, three chapters describe the occurrence of sub-bottom acoustic returns which could be interpreted in such terms. Two authors also describe laboratory rigs for the formation and study of hydrate–sediment mixtures, and preliminary results are given.

One editorial function, which is particularly difficult with symposium volumes, is to ensure that a subject is covered evenly and without unnecessary repetition. The editor of this volume has included a useful and well written introduction which draws together the threads of research presented by the various contributors; it is a pity that he could not at the same time have eliminated redundancy. It is, for instance, irritating to be told five times of Humphry Davy's discovery of chlorine hydrate. The appearance of the book, apparently produced by a photo-offset process from a very superior, accurate and uniform typescript, is beyond reproach. *Natural Gases in Marine Sediments* can be recommended to all those interested in marine sedimentation, as a useful introduction to an under-explored field of study.

T. R. S. Wilson