clusters. Moreover, theoretical efforts to understand mass outflows in young stellar objects outside the T-Tauri regime would seem to be essential.

The observational results summarized at the symposium demonstrated quite dramatically the growing quantity and quality of infrared data for a wide variety of stellar objects. As summarized by Dr W. Stein (University of California, San Diego), these data now demand application of far more sophisticated theoretical tools for proper interpretation. Much more detailed treatments of radiative transfer in circumstellar gas and dust envelopes of various geometries are particularly needed. Detailed laboratory analysis of the optical properties of many of the more abundant solid constituents of circumstellar dust envelopes would also be valuable.

PALAEONTOLOGY

Seminar on Carbonates

from a Correspondent

A NEW experiment in "in-service teaching" was successfully organized by Dr J. A. E. B. Hubbard (King's College, London) for the Palaeontological Association at the Robertson Research Co. Ltd Laboratories, North Wales, from June 23–26. The seminar, which was about processes in carbonate environments, attracted thirty palaeontologists and was led by Dr R. G. C. Bathurst (University of Liverpool).

The Palaeontological Association had felt that there was a need for palaeontologists to have refresher courses in associated parts of geology. The field of carbonates was an excellent choice for a first seminar, for there have been many developments in the subject in the past five to ten years, particularly in regard to the processes and effects of diagenesis, the study of reefs and the relationships between carbonate and associated evaporite rocks. Many of these problems have been approached through studies of recent sediments.

The first day of the seminar was devoted to submarine sediments but dealt chiefly with coral reefs. Dr T. P. Scoffin (University of Edinburgh) showed how the study of present day Bermuda patch reefs had helped his interpretation of ancient reefs from Wenlock Edge in Shropshire. Dr. J. Schröder (Technical University of West Berlin) developed a general model for reefs based on his work on Bermuda cup reefs. Both speakers stressed the important balance between the growth of the corals and algae which build the reef and the boring shells, rasping fish and the like, which are eroding it simultaneously. Dr Hubbard showed the first of several excellent underwater cine films taken in Florida. These submarine traverses help in understanding sediment distribution and its control and should be obligatory viewing in all undergraduate carbonate sediment courses.

On the second day participants looked at intertidal and supratidal sediments. Dr P. Garrett (University of Leeds) has been studying recent intertidal carbonates in the Bahamas and showed how their structures and binding by algal mats are governed by the length of time they are exposed by seawater. Moving to a more arid part of the world, Dr P. Bush (Imperial College, London) described the carbonates and associated anhydrite and gypsum evaporites which are now forming in the Abu Dhabi area of the Arabian Gulf. The similarities between these sabkha deposits and many ancient rocks (for example, the Jurassic rocks of the Dorset coast) are most interesting. This type of evaporite deposit is quite thin (measured in tens of metres) and there is still much debate about the origin of the thick evaporites (hundreds of metres) such as the Permian ones under the North Sea.

Dr J. A. Dickson (University of Nottingham) gave an elegant demonstration of the use of staining methods to reveal hidden variations in limestone fabrics. He later used these methods in an analysis of the seeding and growth of calcite crystals in limestones. He showed that diagenetic studies of limestones should never be based on petrographic studies of single thin sections; several of these from one hand specimen of the Faringdon sponge gravel showed great variability.

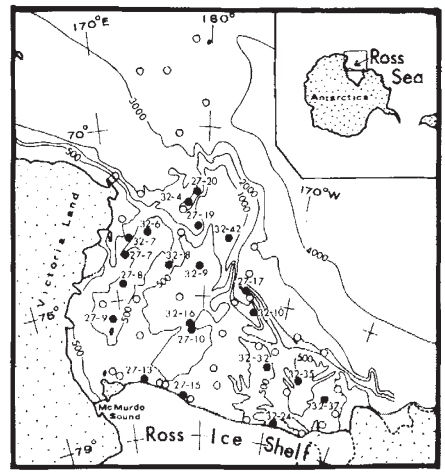
On the third and fourth days the discussions turned to the complex processes of diagenesis which turn the loose carbonate sediment into a limestone rock. During these lectures, and indeed throughout the four days, the importance of the presence of much organic matter in the carbonate sediments was stressed repeatedly. Dr J. D. Hudson (University of Leicester) showed how some fossils on the Jurassic of Skye are so well preserved that original shell microarchitecture is still present. Using this material he pointed to the problems in using carbon and oxygen isotopes to interpret environments of deposition. Dr Schröder illustrated the many cement fabrics that begin to form within the original cavities in a sediment. His scanning electron microscope pictures and microprobe analyses indicate the chemistry of the processes which turn an unstable, organism derived, carbonate mineral assemblage into a limestone rock composed of calcite.

Dr D. J. Shearman (Imperial College, London) showed that the matters discussed were not of purely academic interest. Many petroleum bodies are located in carbonate and evaporite rocks similar to those that had been discussed. His examples ranged from the Ordovician evaporites of Ellesmere Island to the Permian limestones of Texas. Dr Shearman also described the replacement of limestones by gypsum and other minerals. Some of these transformations produce a very porous rock which is ripe for petroleum storage. When capped by a good impermeable evaporite the ideal reservoir rock is produced. Dr Bathurst completed the story of limestone cementation by describing the

Widespread Submarine Erosion in Ross Sea

A WIDESPREAD survey of the Ross Sea bed has been carried out by R. H. Fillon, of the University of Rhode Island, and some results are reported in next Monday's *Nature Physical Science* (July 17). Although the position of this sea, at relatively high latitudes but associated with the Ross Ice Shelf, makes it ideal for studying the relationships between palaeoclimatology and palaeo-oceanography of the Antarctic, only limited surveys have previously been available.

Fillon's study is based on sediments obtained from sixty-four cores taken from within and just north of the Ross Sea (see figure—both open and solid circles denote core locations). He finds evidence for widespread submarine erosion, with most sediment younger than 2 m.y. having been removed, and only little deposition having taken place recently. The cause of this may be a scouring action resulting from increased velocities of the bottom water currents produced by the growth of the Ross Ice Shelf. These and other data point to a change in climatic conditions in the area occurring abruptly about 2 m.y. BP, corresponding closely with the results of similar studies of the Tasman Sea (see, for example, N. D. Watkins and J. P. Kennett, *Science*, **173**, 813; 1971).



Map of Ross Sea. Bathymetric contours are marked in metres.