Shallow layers of the Continental Shelf

Exploring the Geology of Shelf Seas. By R. McQuillin and D. A. Ardus. Pp. 234. (Graham and Trotman: London, 1977.) £10.50.

As with many books, the title is a little misleading. Although the subject matter is concerned with general techniques that may be used in mineral or even oil exploration, it would be incorrect to say that the book is concerned with exploration specifically. The NERC/IGS, of which the authors are members, uses the techniques described more as mapping devices than as exploration tools.

The purpose of the work is to describe how information about the shallow layers of the Continental Shelf down to about 300 metres or beneath Quaternary cover, may be obtained. Over the past decade, considerable attention has been given by the oil companies to the "deep geology" of the North-West European Continental Shelf resulting in the discovery of major oil and gas fields in almost every geological formation from the Carboniferous to the Tertiary. In contrast, however, very little is known of the near subsurface, and there are hardly any maps or data published on this topic, even by the IGS who have by their own confession done the most work. There is thus a large gap in our knowledge about the nature and extent of bottom sediments. This is the region with which the IGS is concerned and on which the book concentrates.

Seven of the chapters are devoted to geophysical techniques and only one to the acquisition of geological information by sampling and drilling. This tends to give the book a basic imbalance, and it is often not fully clear how the results of geophysical work are utilised by the geologists in making maps. Just such an account would have placed the book in perspective. Nonetheless, the book is clearly written and the reader should have little difficulty in understanding basic priniciples even if he is left a little in doubt as to the usage of the methods.

The opening chapter deals with the problems of position fixing at sea. This is a useful chapter by itself, as it is often difficult to find concise accounts explaining the various methods. Once at sea, two sorts of observation may be made. The first area is the sea itself, and the nature of the seafloor; the second, the strata beneath the sea bed, from which information may be obtained either directly or indirectly. Ways of studying the former using echo-sounding and side-scanning solar techniques thus follow, but by far the greatest emphasis is placed not unnaturally on the latter: gravity and magnetics, but particularly continuous seismic profiling techniques, both sub-bottom—sparker—and deep penetration seismic. These tools, perhaps above any others, have provided the means of mapping large areas using relatively few geological control points.

Although well intended, the chapter on sampling methods does not fully relate to the rest of the book, and is itself somewhat disjointed, reading more like a catalogue than an explanation of how geophysical data is used to site sampling and drilling locations, or indeed of how maps are constructed.

One cannot hope, however, for everything, and the book will be of value in explaining little-known facets of geophysical techniques to students of the earth sciences who might otherwise find it difficult to locate the information.

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Planetary atmospheres

The Physics of Atmospheres. By J. T. Houghton. Pp. xiii+203. (Cambridge University: Cambridge, London, New York and Melbourne, 1977.) £6.50.

PROFESSOR HOUGHTON has written a most interesting book with the intent "to introduce physics students at both undergraduate and graduate levels to the physical processes which govern the structure and circulation of a planetary atmosphere." He is completely successful. The book is very strong on the aspects of radiative transfer, as might be expected because Houghton's group is the world leader in this field. Chapter 2, "A Radiative Equilibrium Model", and chapter 4, "More Complex Radiation Transfer", are completely devoted to radiative transfer; the latter includes a most valuable discussion of how to proceed from molecular properties, such as line widths, to computations of radiative heating rates in realistic atmospheres. Chapter 5, "The Upper Atmosphere", also focuses on radiative transfer and contains a unique detailed treatment of the breakdown of thermodynamic equilibrium. Chapter 6, "Clouds", is mainly concerned with their radiative properties.

Chapter 7, "Dynamics", chapter 8, "Atmospheric Waves", and chapter 10, "The General Circulation", provide an excellent introduction to the role of the large scale motions in governing atmospheric structure. I found the approach here, and in chapter 9, "Turbulence", straightforward and efficient. It reminded me of some very clear lectures on the subject that I heard from Dr John Green of Imperial College in 1971. Houghton acknowledges a set of dynamics' lectures by Dr R. S. Harwood who was formerly associated with Dr Green. From these chapters, the student could easily tackle the more advanced texts on atmospheric dynamics.

Chapter 3, "Thermodynamics", includes a treatment of available potential energy as crystallised by Lorenz. This concept is carried, too, in later chapters and is most valuable in explaining structure. I have used it myself in lectures on the physics of the upper atmosphere. One can most easily perceive from this approach that the observed structure is the result of a continuous interplay between radiative and dynamical processes.

Chapter 11, "Numerical Modelling", and chapter 12, "Global Observation", again stress the radiative transfer aspects. Chapter 13 has the longest title of all, "Atmospheric Predictability and Climatic Change", but consists of only two pages of text and three figures, and seems to be an unnecessary afterthought which is not at the same level as the rest of the book. Chapter 6 is also a little too short to catch the essence of the physical aspects of clouds. These are, however, minor complaints, for the book as a whole is very well written, and does not pretend to provide all of the physics of atmospheres.

I learned much from working through some of the examples (provided with solutions) which are an integral part of the text. The interested student could, in fact, teach the subject to himself with the text, the useful information in the appendices and a hand-held calculator. Although references are provided, little from them is needed to work through the text. I recommend the book to all physics students interested in atmospheres. To all physics students, the text presents live examples of the laws of physics, which may replace the older examples of steam engines and ice skaters. Many first-year meteorology students would also benefit from working through this text. An early overview of the subject might be very helpful before immersion in two years of concentrated courses at the graduate level.

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