

interpretation' rather than 'facies analysis'. Hallam argues that the latter term is more appropriate to facies models of a restricted scale whereas he is dealing with a larger-scale synthesis. However, before discussing his seven major topics the author does consider it necessary to devote his first three chapters to facies and facies analysis.

In Chapter 1 the author introduces the concept of facies and outlines techniques of facies analysis and facies modelling. At this early stage in the book the author sets the critical tone that he adopts throughout, in that he questions uniformitarianism and asks "... to what extent is the present the key to the past?".

Chapters 2 and 3 cover sedimentary environments and facies—Chapter 2 continental and marginal marine facies and Chapter 3 marine environments and facies. Both chapters are well illustrated with sedimentary logs and accompanying reconstructed cross-sections and block diagrams. Hallam makes reference to the potential hazards of facies analysis and stresses the importance of relating facies in the stratigraphic record to logs of present day sediments. Unless a reader is familiar with sedimentary facies analysis it is vital to read these chapters before attempting the rest of the book.

The first major topic, 'Sedimentation and Tectonics' is the subject of Chapter 4. After a brief historical review of geosynclinal terminology this chapter examines sedimentation in relation to the main plate tectonic settings; that is, spreading-related, subduction-related, transform-fault-related/pull-apart basins and continental collision. For a discussion of the Wilson cycle the author chooses the Appalachians and compares them with the Mesozoic–Cenozoic belt from Oman to Cyprus. The section on cratonic basin subsidence is short but emphasises the role of stratigraphy in interpretation and the occurrence of petroleum, using the North Sea as an example.

'Ancient Epicontinental Seas' is the subject of Chapter 5 and one of the most thought provoking aspects illustrated in this chapter is the great extent of these seas and the absence of any modern analogue. Hallam examines the model for an epicontinental sea in terms of a negligible tidal range, stagnant basins and abnormally high salinities by choosing a wide variety of examples. Throughout, the author critically discusses models for various environments, putting forward more than one side of each argument.

In Chapter 6 the author discusses 'Eustatic Changes in Sea Level'. After introducing cyclic sedimentation and outlining the debate relating to eustatic changes in sea level as opposed to local tectonism Hallam discusses methods of determining the rises and falls in sea level. As an example the Jurassic is used, and an examination is made of the character of the rock sequence, the distribution of marine deposits and the use of seismic stratigraphy. From this information Hallam demonstrates the preparation of chronostratigraphic charts and regional sea-level curves. The chapter continues with an outline of the results of recent work on Phanerozoic changes in sea level emphasizing major events and how controversy can arise when biostratigraphic control is poor. An overview of the variation in sea level throughout the Phanerozoic is presented and the chapter concludes with a discussion of the causes of eustasy and some quantitative estimates of sea-level change.

'Phanerozoic Climates' is the subject of Chapter 7. After listing the climatic criteria the author examines the variation in climatic conditions from the Cambrian onwards. This is really a list of where evaporites, coals and tillites occur in a sequence and this, coupled with palaeomagnetic evidence, is used to fit various parts of the world into climatic zones. Most climatic changes in the stratigraphic record are related to plate motions, but the causes of polar ice caps and long term global climatic changes also receive some treatment.

The nature of the 'Mesozoic and Cenozoic Oceans' is discussed in Chapter 8 and much of the information presented here has resulted from deep-sea drilling. The chapter begins by examining the evidence for fluctuations in the calcite compensation depth (CCD) and continues by noting rates of sedimentation, hiatuses and the changes in ocean currents together with the origin and significance of siliceous and anoxic deposits. A model for cyclic changes in the ocean over the last 200 Ma is outlined and then a very critical appraisal is made of some of these concepts. The chapter is concluded with an examination of the Mediterranean evaporite basin but here again the author emphasises caution in accepting the published accounts and puts forward counter evidence. These differences of opinion serve to illustrate the limits of knowledge and could lead students into fruitful areas of research.

Whilst the rest of the book is devoted to the Phanerozoic, Chapter 9 deals with 'Precambrian Environments'. The author very briefly describes the techniques used to establish environments in the Precambrian in the absence of biostratigraphic control and discusses the uncertainties frequently encountered in deciding whether a facies belongs to a marine or non-marine environment. Hallam refers to Precambrian glaciations, the unreliability of stromatolites as palaeontological clocks and indicators of tidal ranges, and to the role played by facies analysis in establishing models of continental growth and evolution. Half the chapter is devoted to the evolution of the atmosphere, hydrosphere and biosphere.

Two major topics are covered in Chapter 10, 'Facies and the Phanerozoic Fossil Record'; these are mass extinctions and faunal provinces. The author provides a comprehensive account of the control of faunal provinces by climate and plate movement but also demonstrates how faunal provinces can be used to date oceanic closure.

This very readable book largely achieves what the author intended and should be a valuable addition to reading lists for advanced undergraduates. I thought the author's critical approach a healthy one to pass on and it should encourage students to reason and question. My main criticism of the book is that it is biased towards the Mesozoic and Cenozoic. Occasionally I was lost geographically and needed to consult an atlas—more maps would have helped. Because the book is designed primarily for undergraduates I would have also liked to have seen a short concluding chapter pointing the reader towards areas in which the author considers more work would be rewarding. The book is reasonably priced, but even so a cheap paperback edition would be worth considering.

*D. E. Roberts*