

fossil models. Chamberlain has a fascinating chapter on freshwater traces, Dörjes and Hertweck discuss some of the fine work on shallow marine environments being done by the Senckenberg Institute, and Hollister, Heezen and Nafe present a brief, largely pictorial review of deep-sea traces.

Part V, *Techniques in the Study of Lebensspuren*, concludes the volume with a chapter on experimental methods by Elders, which must be the only discussion of burrowing by means of a hydraulic skeleton which neglects to refer to Clark (1964), and a useful omnibus techniques chapter by Farrow.

In general, the book is well-written and well-illustrated. Typographic errors are few, and an errata sheet is included, correcting some major omissions. It is difficult to decide what specific need this book fulfills. Copies should certainly be on every library shelf, and in the collections of most paleontologists. The book is a review volume, however, containing little that is new or startling to workers in the field. Many of the illustrations are reprinted from previously-published work. The main value of this book would seem to be as a supplementary reference for upper-level undergraduate courses in paleontology and sedimentology. Any professor suggesting that his students lash out more than \$60 for a supplementary text runs the risk of becoming a thin carbonaceous film.

The Study of Trace Fossils is a necessary and timely work, coming at a time when scientists in other disciplines are beginning to appreciate the sorts of data available from ichnological research. Many of the chapters, especially those by Howard, Rhoads, Chamberlain and Dörjes and Hertweck, also reinforce one of my own opinions, that the main value of the study of fossil and recent traces lies in the future. Much of "marine biology", especially density distributions and animal-sediment relationships, is now studied by geologists. I look forward to seeing more work on things like nutrient cycling, pollutant dispersal, and hydrocarbon reserves being done by scientists who refer to themselves as "ichnologists".

References

Clark, R. B., 1964. *Dynamics in metazoan evolution*: Clarendon Press, Oxford, 313 p.

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Geological Hazards

By B. A. Bolt, W. L. Horn,
G. A. Macdonald, and R. F. Scott
*Springer-Verlag, New York, Heidelberg,
Berlin, 328 p. 1975.*
\$25.80

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This book deals with major geological events which are hazardous to mankind. It is divided into eight chapters that consider hazards from earthquakes, volcanoes, tsunamis, landslides, ground subsidence, snow avalanches and floods, in order of presentation. This reviewer found the book to be well written, generally informative and even exciting in scope and method of presentation. Although the authors say the book has been prepared for the general reader and the college student at the introductory level, a pre-knowledge of basic geology is a definite advantage. The use of dramatic case histories adds an element of excitement to most chapters.

Chapter 1 (Bolt) presents a thorough summary of the many causes of earthquakes set in the proper perspective of plate tectonics. Interesting correlations and relationships between intensity and ground acceleration, rupture length and magnitude, horizontal to vertical acceleration ratios, attenuation curves, etc., add considerable depth to the generally descriptive presentation.

Chapter 2 (Macdonald) presents a longish but impressive portrayal of volcanic hazards with truly incredible statistics on resultant direct and indirect casualties. Volcanic mud flows derived from ash, tephra and rain or crater waters are most interesting as are the discussions of secondary hazards. One is left with a very pessimistic view of mitigation of volcanic hazards.

Chapter 3 (Bolt) on hazards from tsunamis lacks technical content to the great detriment to the chapter. Some clear explanation of the translatory nature of a tsunami is necessary to graphically explain how a one m high wave can "run up" to a 20 m + height recorded for some of the world's great

tsunamis. Terms used in the chapter are also poorly defined.

Chapters 4, 5 and 6 (Scott) deal with landslides, subsidence and snow avalanches and are the most technical in the book. The landslide and subsidence chapters are considered in terms of descriptive soil mechanics including the role of pore pressures and effective stresses. Although well done, the technical discussions are so brief and encompass so many variables that they are probably beyond those readers lacking some knowledge of mechanics. The technical approach is undoubtedly the correct one since the basic principle must be understood by those dealing with landslides in particular. The subsidence chapter is marred by a typographical error on page 207 related to the total and effective stresses and by the lack of discussion of subsidence by both salt dissolution and sand grain crushing at contact stresses in excess of grain strength. The reference lists are notably weak in all three chapters.

Chapter 7 (Horn) on flood hazards is a wordy discussion of the many geological and meteorological variables that influence flooding. The effects of rainfall, snow-melt, drainage basin characteristics, frequency of occurrence are briefly described followed by an interesting section on techniques to alleviate or prevent major floods. The most interesting part of the chapter is the case history section which vividly portrays the real hazards of floods as comparable to earthquakes and volcanism.

Chapter 8 on hazard mitigation and control is far too brief to carry any impact. In fact, the section on insurance was more interesting than the sections on risk and hazard maps. As a wind-up to a useful book, Chapter 8 is unsuccessful.

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