

reviews

Assuming the mantle of soothsayer

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Earthquake Prediction. (Developments in Solid Earth Geophysics, Vol. 9.) By Tsuneji Rikitake. Pp. xvi+357. (Elsevier Scientific: Amsterdam, Oxford and New York, 1976.) Dfl.95; \$37.95.

STRONG earthquakes hold such terror for unprotected populations that those capable of forecasting earthquakes with any degree of reliability whatsoever, have a ready and appreciative audience. Thus, earthquake prediction has been the business of psychics and astrologers for centuries. The unhappy consequences of recent severe earthquakes have inspired significant effort in four nations to spur science to assume the mantle of soothsayer. Government-sponsored prediction research has been undertaken on a major scale in the USSR (since 1949), Japan (1963), China (1966) and the US (1971). In these countries, concerted efforts have been made in what must be the first priority in any programme—obtaining base-line information. These activities have been carried out to varying degrees in each country by measurement of strains, geodetic measurements, observations of micro-earthquake activity, geomagnetic, geoelectric and elastic properties, and collection of geochemical information.

Each of the four programs has its own emphasis. Professor Rikitake has been a leader of the Japanese program, and writes as an authority eminently qualified to review the Japanese program. The longest chapter in the book (62 pages) is concerned with geodetic surveying methods for observing precursory deformation of the Earth's surface and summaries of observations of such deformation before a number of earthquake events. Although geodetic observations are comparatively lightly emphasised in the other programs, they are a cornerstone of the Japanese national program.

The reader should not expect to receive a broad exposure to the basic problems of earthquake prediction or to the arguments and uncertainties that pervade the subject. Instead, this book provides a thorough review of

the phenomenology of observations deemed pertinent to prediction. The reader who expects to derive understanding of the processes that underly the observations should look elsewhere.

The physical basis of earthquake prediction is unsatisfactorily treated. The shortest chapter in the book (4 pages) is concerned with the dilatancy model of the focal zone; in this model, the volume of matter increases due to the formation of small cracks shortly before rupture. Dilatancy is the only physical model proposed so far that has the promise of providing an understanding for the various precursory phenomena. Professor Rikitake withdraws from a detailed discussion of dilatancy, including the controversy over the role of water as an active agent in the dilatancy process.

The lengthy chapter entitled "The Theory of Earthquake Prediction", has no theory therein, but is concerned instead with statistical approaches to earthquake prediction plus an exten-

sive catalogue of the events for which precursors have been observed. Two or three pages of the book are devoted to the phenomenology of brittle fracture and strike-slip processes; nothing is presented describing the physical basis in fracture mechanics for the earthquake event.

The book is well written in language understandable to the non-expert. The non-idiomatic use of the English language is not offensive. The editing and the selection of topics make the book a highly personal view of earthquake prediction. Major aspects of the topic deserve to be presented more broadly than is done here. In spite of extraordinary omissions, this book is useful for the extensive tabulations of observations of diverse precursory phenomena. □

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Magnetic resonance techniques

Magnetic Resonance of Biomolecules: An Introduction to the Theory and Practice of NMR and ESR in Biological Systems. By P. F. Knowles, D. Marsh and H. W. E. Rattle. Pp. 343. (Wiley-Interscience: New York and London, May, 1976.) Cloth £9.75, \$19.75; paper £4.25, \$8.75.

THE applications of magnetic resonance techniques to biological problems are now of sufficient importance to merit inclusion in any well-balanced undergraduate degree course in biochemistry or biophysics. Although there are several specialist books dealing with such applications there has been no text written primarily for the undergraduate student.

Drs Knowles, Marsh and Rattle have now produced such a book dealing with the applications of nuclear magnetic resonance (NMR) and electron spin resonance (ESR) spectroscopy to biological problems. On the whole, they have produced a very useful book for both student and teacher alike. The parts of the book dealing with ESR are particularly

valuable because such teaching material is not easily accessible elsewhere.

The basic theory of NMR and ESR are discussed together in an opening chapter and other chapters deal with the spectral parameters, practical aspects and biological applications of each technique. The carefully selected material is presented in an interesting manner and due emphasis is placed on the advanced experimental techniques which are required for successful biological studies. In general the theoretical aspects have been dealt with adequately although I would have preferred to see the theory of NMR and ESR introduced separately. In the NMR section a more detailed account of chemical exchange and relaxation behaviour would have been useful in view of the importance of these aspects of the theory in biological studies.

In some of the examples it was not always clear how the biological information had been derived from the NMR data. For example, a conformational structure for oxytocin was presented but none of the NMR argu-