

will facilitate accumulation of data. Dr. Bouma fails to convince that it is essential—the whole of the present volume can be perfectly comprehended without recourse to this system.

The glossary, as the text, sometimes gives the impression of being definitive where no general agreement among specialists exists—this particularly applies to the nomenclature of sole-markings. To some extent this is compensated by a full bibliography; read with an awareness of the complexities of this controversial subject, Dr. Bouma's contribution is very valuable indeed.

J. E. PRENTICE

PERPETUUM MOBILE

Tectonics

By Prof. Jean Goguel. English translation from the French Edition of 1952 by Hans E. Thalmann. (Series of Geology Texts.) Pp. viii+384. (San Francisco and London: W. H. Freeman and Company, 1962.) 70s.

THIS is a translation, with minor additions, of *Traité de Tectonique* which first appeared in 1952. We quickly realize just how much the geophysical sciences have advanced our knowledge of the Earth's crust during the last ten years. Since 1952, numerous publications have given the results of seismic exploration, gravity and magnetic surveys and heat-flow measurements at sea. We have had geophysical investigations of continental margins, deep-sea trenches and mid-oceanic rifts. A wealth of results in palaeomagnetism has influenced our thinking about continental drift. Numerous advances in theoretical seismology have enabled a better probing of the crust and upper mantle. The use of electronic computing techniques has aided seismological investigations and the interpretation of geophysical surveys of granites, sedimentary basins and rift valleys. All these provide material for a re-appraisal of the tectonic history of the Earth. The most striking example is that the basic difference of the structure of oceanic and continental crust was not firmly established when this book was written. This must now surely be the starting point in structural geology, and it is sad that most university geology departments still teach the subject without recognizing the sea floor covers more than two-thirds the Earth's surface and whole *mémoires* have appeared on the results of oceanic exploration.

A translation of this kind is therefore necessarily outdated. However, the book contains much useful information and gives a profound coverage of classical thoughts and observations on the tectonics of the continental areas. There are excellent accounts of the observational powers of the geologist in investigations of erosion and deformation, morphology, stratigraphy, rock deformations and folding and faulting. There is a useful account of elementary geological mapping, including the use of bore-hole information and underground workings. There is a brief review of geophysical exploration and the geometric presentation of results and structural maps. All this is followed by a systematic description of basic structural forms and by various interpretations. Throughout, numerous examples provide adequate illustrations.

Prof. Goguel gives an impression of an ever-mobile Earth's crust. It seems that at almost any given time in geological history, field evidence can be produced from somewhere on the Earth's surface to reveal tectonic movements. Another phenomenon which is well brought out is the behaviour of the crust and mantle to stresses of different time constants. It is important to realize that the materials of the crust and mantle behave as solids to stresses for times of the order of 0.5 sec and as fluids to stresses for times of the order of 10^4 years. There is field evidence for this phenomenon and it is strange how little

it has been considered in theories of crustal movements and continental drift.

Finally, what is the fundamental cause of tectonic deformations? The Earth could be cooling, and the crust reflects stresses due to shrinkage. The Earth could be warming up and the sialic crust dissipated due to expansion. The Earth could be alternately warming and cooling and the various tectonic deformations through geological time could be a consequence of both expansion and contraction. Lastly, the surface structures and deformations may be due to convection currents in the mantle. In recent years, this last-mentioned hypothesis has been fashionable and Jean Goguel gives it much attention. From recent work in palaeomagnetism and exploration of the sea floor, especially the discovery of faults with horizontal displacements of the order of 1,000 km, mantle convection must be a strong possibility.

The book is well produced and carefully thought out. It also serves as a good introduction to continental geological literature. The translation is fair, a curiosity being that the translator seems to have given up translating metres to feet and inches after p. 14; a reminder that it is high time geology joined the other sciences in using the metric system.

R. W. GIRDLER

AUTOMATIC CONTROL

Automatic Control

An Introduction to the Theory of Feed-back and Feed-back Control Systems. By A. E. De Barr. (The Institute of Physics and the Physical Society Monographs for Students.) Pp. vii+118. (London: Chapman and Hall, Ltd.; New York: Reinhold Publishing Corporation, 1962. Published on behalf of the Institute of Physics and the Physical Society.) 7s. 6d. net.

Automatic Control Handbook

Advisory Editor, G. A. T. Burdett. Pp. xviii+864. (London: George Newnes, Ltd., 1962.) 90s.

Anatomy of Automation

By George H. Amber and Paul S. Amber. Pp. x+245. (Englewood Cliffs, New Jersey and London: Prentice-Hall Inc., 1962.) 60s.

THREE recently published volumes in the field of automatic control may broadly be described as dealing respectively with conventional linear theory, components and circuit techniques, and the philosophy of automation in industry.

Automatic Control is an inexpensive paper-backed volume in the Monographs for Students series in which is found a concise presentation of the basic linear theory of feed-back control systems, and a short chapter on non-linear systems. The author dispenses with the introduction to Laplace Transforms found in most standard text-books on this subject, and derives transfer functions and characteristic equations using only the differential operator. This approach leads to a demonstration of the dependence of the natural modes of the system on the roots of the characteristic equation that is not wholly satisfactory, but the saving in space is considerable and enables the concepts of circuit theory to be covered in the first chapter. Also introduced in this chapter of twenty-nine pages are Bode and Nyquist plots, segmented gain characteristics, and the result of the gain-slope theorem. In this last-mentioned connexion an error appears on p. 13 where minimum phase systems are described as having merely poles, rather than both poles and zeros, without positive real parts.

Closed-loop systems are introduced in the second chapter, which includes the frequency-response locus and Hall Chart, and in the third chapter a simple physical system is introduced together with an analysis of damping