world-soils; nor is there much new material in the chapter on chernozems, but a much-needed clarification of ideas on hydromorphic soils can be found in the chapter dealing with these soils. Little that is fresh can be said of the saline soils, for the earlier workers seem to have elucidated most of their problems. It must be confessed that the chapter on tropical soils is disappointing; this cannot be attributed entirely to the author, for there are few adequate descriptions and analyses available, nomenclature is not agreed upon and the pedogenic processes involved are not clear.

The classification of soils is an important subject on which there has been much debate, and more can be anticipated, so that the philosophical introduction is both apt and very necessary for many students of soil science, most of whom have a strong practical bias. The feeling arises that Prof. Robinson was unduly modest in the treatment of his own classification, which seems simple to grasp and is adequate for many purposes. It is obvious that recent journeys contributed material to the discussion of the geography of soils. This is a distinct gain, and it is to be lamented that his recent death has prevented his expanding this and the chapters on the soils of the principal world-groups in subsequent editions at the expense of the previous chapters which now contain material of a historical nature—even though the science is but young. One would like to see greater use made of the concepts developed in the earlier chapters to explain the pedogenesis of the soils discussed later. The remaining chapters are germane in so far as they provide the non-technical reader with an insight into both the vast amount of work needed to make a soil map even of small areas, let alone continents, and also of the implications of a subject of importance to the whole human race.

It is easy to find faults and imperfections, for errors have been carried over from the second edition, and there is evidence of poor proof-reading. Such minor points do not greatly detract from what is undoubtedly 'a good thing' and a book that makes the reader think, while opening up many lines of research for the worker who may imagine that the field is unprofitable to plough. D. A. OSMOND

EARTHQUAKE GEOGRAPHY

Seismicity of the Earth and Associated Phenomena
By B. Gutenberg and C. F. Richter. Pp. ix+273.
(Princeton, N.J.: Princeton University Press;
London: Oxford University Press, 1949.) 80s. net.

THE geographical distribution of earthquakes and associated phenomena is a very large subject which calls for the exercise of the critical faculty in a marked degree. Since there are about a million earthquakes every year, most of which are recorded at some observatory or other, it becomes necessary for cataloguing purposes to draw the line somewhere between those earthquakes to be included and those to be left out. One criterion would be that the shock should be recorded at more than ten observatories; but, as seismological observatories are not uniformly distributed over the surface of the earth, this method is open to criticism. Drs. B. Gutenberg and C. F. Richter took a big step forward when they defined instrumental earthquake magnitude¹, and the present work is the logical outcome of this definition.

According to these authors, the first effective instrumental record of a distant earthquake was on April 17, 1889. Earthquakes occurring during the years 1904-47 have been classified according to instrumental magnitude: thus class *a* is magnitude $7\frac{1}{2}$ - $8\frac{1}{2}$; *b*, 7.0-7.7; *c*, 6.0-6.9; *d*, 5.3-5.9; and *e* less than 5.3. Those of the last class, in general, have been omitted. Earthquakes have been further subdivided according to their depth of focus: shallow, not exceeding 60 km.; intermediate, 70-300 km.; and deep, exceeding 300 km. Even within all the above limits, judgment has had to be used since, for example, most earthquakes in Great Britain are less than magnitude 5.3, and, if all the earthquakes greater than magnitude 6 were included, the Japanese maps would be overcrowded. Seismologists and others interested will thus be indebted to their indefatigable colleagues, Drs. Gutenberg and Richter, for choosing what is significant from a welter of data. The book is in line with the work of the great seismologists of the past, including Montessus de Ballore, Milne and Turner, and brings the work up to date to include the findings of the most recent research.

The present work is intended: (1) to evaluate the present relative seismicity of various parts of the earth, and (2) to discuss very briefly the geography and the geological character of the zones and areas of seismic activity. This includes correlation with alignments of active volcanoes and gravity anomalies, and with oceanic deeps, mountain structures and other topographical features. Mechanism is discussed, particularly with reference to crustal folding and block faulting. Tsunamis are also briefly discussed. The surface of the earth is found to consist of relatively inactive blocks separated by active zones of four groups: (1) circum-Pacific zone, (2) Mediterranean and trans-Asiatic zone, (3) narrow belts of shocks along the principal ridges in the Atlantic, Arctic and Indian Oceans, (4) moderate activity associated with rift structures, such as those of East Africa and the Hawaiian Islands. During the period covered by the book, earthquakes with the greatest magnitudes (near $8\frac{1}{2}$) had shallow foci and occurred on January 31, 1906 (Colombia), August 17, 1906 (Chile), January 3, 1911 (Tien Shan), December 16, 1920 (Kansu), and March 2, 1933 (Japan); there were five intermediate-depth shocks with magnitude near 8, and three deep-focus shocks with magnitudes $7\frac{1}{2}$ -8. These few shocks accounted for much of the energy released over the period in question, which was of the order of 10^{27} ergs per year, or roughly 10^9 kilowatts.

As will be realized from the 101 pages (imperial 8vo) of text, which includes short tables, diagrams and numerous maps, the work is not exhaustive, but has been sketched by master hands in bold outline. This is followed by twelve crowded pages of valuable references in 7-point type, and 149 pages of tables. The whole is adequately indexed. In a work of this sort, which will require constant additions and perhaps some revision as more data accumulate and research work is done, it is fortunate that such laboratories as the one at Pasadena exist to carry on the work. This book will be invaluable to students of geophysics, geology, geography, civil engineering and earthquake insurance, and to others interested. As may be expected of a book published by the Princeton University Press, the printing and format are beyond reproach. ERNEST TILLOTSON

¹ Gutenberg, B., and Richter, C. F., "Earthquake Magnitude, Intensity, Energy and Acceleration", *Bull. Seism. Soc. Amer.*, 32, 163 (1942).