

## OUR BOOKSHELF.

*Die radioaktive Strahlung als Gegenstand wahrscheinlichkeits-theoretischer Untersuchungen.* By Prof. L. v. Bortkiewicz. Pp. 84. (Berlin: Julius Springer, 1913.) Price 4 marks.

THIS mathematical work is a critical application of the theory of chance to the breaking down of radio-active atoms. Its discussion is mainly based on the experiments of Rutherford and Geiger. Scintillations were produced on a screen by polonium, and were counted over a succession of equal short intervals of time, and the intervals were classified by the number of them which showed either no scintillation or one or two or more. The experimenters found that their numbers agreed well with those predicted by the theory of pure chance, but they gave no criterion as to the closeness of agreement to be expected. The calculation of the "mean errors" is a simple matter, but in the comparison of such a series of numbers it is only likely that in a few of the cases the mean error should be considerably exceeded. Prof. Bortkiewicz therefore provides a single test for the whole experiment. He works out twelve cases, and concludes that the results are, on the whole, slightly closer to their most probable values than is predicted by theory. He suggests an experimental cause for this small discrepancy. He also discusses one of the experiments of Marsden and Barratt, who made their analysis by classifying the lengths of time between each two successive scintillations, and he concludes that the distribution is normal. In this case his test is not perfectly satisfactory, as it involves the use of quadrature and interpolation formulæ, processes which would seem to be very unsuitable for problems of chance. In both types of experiment distributions can be contrived which pass his tests, and yet are in reality very improbable, but no doubt there are great mathematical difficulties in the way of deriving the true probability test. From his work we may conclude that the search for regularity, other than the regularity of chance, in the disintegration of radio-active atoms is not a hopeful quest.

C. G. D.

*A Pocket-Book for Miners and Metallurgists: Comprising Rules, Formulæ, Tables and Notes for use in Field and Office Work.* Compiled by F. D. Power. Third edition, corrected. Pp. xiv + 371. (London: Crosby Lockwood and Son, 1914.) Price 6s. net.

MINING engineers are nowadays called upon for knowledge and powers in so many directions that to anticipate moderate success and escape serious blame, they must exhibit qualities for which Gilbert and Sullivan's heavy dragoon could not hope. To be ready to act at short notice as an explorer, a geologist, a civil and mechanical engineer, a chemist, a metallurgist, a doctor, and a lawyer, a man needs some little book in his pocket which he can consult as each new problem comes into view. Such a book Mr. Danvers Power set himself to construct many years ago, and the third

edition, now issued, is not less successful than its forerunners. There is no trace of the amateur about the little volume. It is the work of a professional man who has set down the things he wanted to know himself. Like all pocket encyclopædias, it does not contain everything that could be wished for. There might have been included something about furnaces, refractory substances, and melting points, a few tips on mine-surveying problems, a little more about the strength of materials, and perhaps some information on first aid. But although there may be a few omissions, so much is included that the book deserves a trial by every prudent miner or metallurgist.

## LETTERS TO THE EDITOR.

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**The Constitution of the Interior of the Earth as Revealed by Earthquakes.**

ON p. 45 of Dr. G. W. Walker's recently published book, "Modern Seismology," I find the following sentence:—"It has sometimes been asserted that S never reaches beyond a certain distance, and to explain this an impenetrable core of the earth has been assumed. We see that no such hypothesis is at all necessary to explain the observations." The reference here seems to be to a paper, by myself, "The Constitution of the Interior of the Earth as Revealed by Earthquakes," which was published in the Quarterly Journal of the Geological Society (vol. lxiii., 1906), or, more probably, to the references to this paper contained in Prof. Wiechert's paper, "Ueber Erdbebenwellen," published in the *Nachrichten d. K. Gesellschaft d. Wissenschaften* (Göttingen, 1907), and as the summary dismissal of the subject indicates an imperfect appreciation of the problem, which is one of the important problems of the immediate future of seismological research, I trust you will afford me space to state the position.

In my paper, referred to above, I pointed out that the twofold character of the preliminary tremors, representing the arrival of two distinct forms of wave motion, can be traced continuously up to a distance of about  $110^\circ$  or 1200 km. from the origin, and that a comparison of the times of arrival of the waves at different distances shows a progressive and gradual increase of interval with distance, and affords no indication of any great change in the character of the material traversed by the wave paths. Beyond 12,000 km., however, the second phase can no longer be recognised with certainty, and has either entirely disappeared or is represented very feebly and with a considerable delay, as compared with the time of arrival which would be anticipated from the records of observations at lesser distances from the origin. From this I concluded that the wave paths to these more distant stations must have entered a central core of matter differing markedly in constitution from the outer portion of the earth, in that it was either quite incapable of transmitting the second-phase waves, or only transmitted them with a considerable diminution of energy and of rate of transmission.

Prof. Wiechert explains the facts in a different manner. From the laws of reflection, and assuming a tolerably homogeneous earth, he deduces the con-