

Many of the students are on scholarships provided by the oil companies operating in Venezuela, which give the student not only cash to live on, but opportunity for field and laboratory work during vacations.

BOOK REVIEW

CONTRIBUTIONS TO THE KNOWLEDGE OF THE CHEMICAL COMPOSITION OF THE EARTH'S CRUST IN THE EAST INDIAN ARCHIPELAGO, I, II.

I. The spectrographic Determination of the Elements according to Arc Methods in the Range 3600–5000 Å.

II. On the Occurrence of Rarer Elements in the Netherlands East Indies.

W. VAN TONGEREN, Assistant in Mineralogy, University of Utrecht. Pp. 181, Figs. 14, $19\frac{1}{2} \times 26\frac{1}{2}$ cm. D. B. Centen's Uitgevers—Maatschappij N. V. *Amsterdam*, 1938. Price dutch fl. 4.50: Part I alone, dutch fl. 3.

This book describes a composition analysis by spectrographic methods of about 300 samples of rocks and minerals from the Dutch East Indies. The study concerns only the estimation of the rarer elements, which, determined as oxides, were present in amounts of 1% or less. For such analyses the spectrograph has a great advantage, since, by examination of a single spectrogram—in an hour or so—a large number of elements may be determined, with a precision at least as good as that of chemical methods in the low percentages, and often better in the minute percentages. Any spectrographic analysis is a comparative method and involves, first, a choice of a suitable light source and, second, a calibration of the apparatus by the use of natural or artificial samples of known composition. Dr. Van Tongeren has used in his work the light from the "cathode layer" of a carbon arc, according to the technique developed by Mannkoff and Peters in Professor Goldschmidt's Mineralogical Laboratory at Göttingen University. In this method, which is especially suitable for mineral and other non-conducting samples, the pulverized sample is placed in a cavity of the lower, negative electrode of a carbon arc and the light studied is that emitted in the "cathode layer," just above the cathode. Comparison, in number and intensity, of the spectral lines of the various elements with those emitted by known percentages of the same elements in the standard samples permits an estimate of the percentage of each element.

Part I describes the apparatus, and the preparation and use of the standard samples, which were made by grinding up known amounts of the oxides of the various elements with quartz powder. The method could be applied to all of the metals and metalloids, with, of course, varying sensitivities. Actually, for various reasons, fifty elements were tried and about thirty-five, including most of the rare earths, were found to give satisfactory results for the problem in hand.

Part II gives the detailed result of the spectrographic examination of 300 mineral samples. Twenty-eight of the elements sought were found in determinable quantities, ranging from .0001% up to 1% or more. Average values are given for the amount of these rare elements in the earth's crust in the Dutch Indies and there is some discussion of their presence on the basis of atomic theory. The accuracy appears to be a factor of about two in either direction. It could, of course, be greatly improved by the substitution of a photom-

eter for eye estimation of spectral-line intensities. However, the work amply demonstrates the power of the spectrograph for rapid analytical survey of mineral composition. It is a valuable pioneer work in a new field and the author promises more extensive and accurate data.

The printing and paper are excellent. As is to be expected in a book written and printed in English in a foreign country, some errors in vocabulary, usage, and typography appear. However, these faults interfere but little with reading the work, and the style, in general, is clear and straight forward. By writing in English Dr. Van Tongeren has wisely made his work available to a much wider circle of readers.

R. A. SAWYER, *University of Michigan*