ON MINOR ELEMENTS IN THORTVEITITE

IVAR OFTEDAL

Institutt for Geologi, Universitetet i Oslo

OFTEDAL, IVAR: On minor elements in thortveitite. *Norsk Geologisk Tidsskrift*, Vol. 49, pp. 77-79. Oslo 1969.

Thortveitite samples representing most of the known localities in the Iveland area were examined by optical spectrograms. They all show characteristic Sn-contents, in the majority of cases close to 0.25%. Zr is also always present, but only in the order of 0.01%. Other minor elements are Fe, Mg, Mn.

Institutt for Geologi,
Universitetet, Blindern, Oslo 3,
October, 1968

In the original description of thortveitite — $(Sc,Y)_2\ SiO_2$ — Schetelig (1922) reported contents of 2.1 % Fe_2O_3 and 0.8 % FeO. A second analysis made at his request by Jan Sterba in Prague gave in addition about 0.5 % BeO and traces of Mn. Schetelig believed the Be to be a true constituent of the thortveitite, as the sample in question had been prepared very carefully. He also discussed the very considerable content of Zr reported to be present in the newly discovered thortveitite from Befanamo, Madagascar, and mentioned the trace of Sn found in this thortveitite. Goldschmidt & Thomassen (1924) and Björlykke (1935) found Zr and Hf in several thortveitite specimens from Iveland by X-ray fluorescence analysis, but did not estimate the concentrations. Björlykke also reported Fe and Mn. An analysis by Marble (1942) of a thortveitite from Iveland showed considerable amounts of Fe and Al in addition to a number of other common elements, but no Zr. The material was suspected to be 'less pure', especially because of the very high Al-content. Levinson & Borup (1960) examined two thortveitite specimens from Iveland and one from Befanamo by X-ray fluorescence analysis and found Zr and Hf contents of the order of 1 %. The present writer (1939) looked for Sn by optical spectrography in a number of thortveitite samples from various localities in Iveland and Evje. Very distinct Sn lines were observed in all cases. The Sn-contents were estimated at approximately 1 % in most samples, but the method then applied was rather inaccurate. The Befanamo thortveitite also gave a similar Sn-content. A more recent find of thortveitite, in Ravalli County, Montana, has been described by Parker & Havens (1963). They reported Zr O.15 %, Sn 0.07 %, Fe 1 %, Mn 0.03 % by semiquantitative spectrographic analysis. A Zr-content of the order of 0.1 % has been reported in a Japanese thortveitite by Sakurai, Nagashima & Kato (1962).

The present note is based on new optical spectrograms of a number of thortveitite samples, primarily taken to obtain a more accurate determination

of the Sn contents. The spectrograms were taken with a large quartz spectrograph, and the experimental conditions — including the quantity of substance evaporated in the carbon arc — were kept carefully constant. The base substance of the standard mixtures was a Tördal amazonite which is known to be unusually rich in Pb. This was mixed with cassiterite in concentrations of 1 %, 0.1 %, and 0.01 %. Exposures of these mixtures gave a well defined working curve, the Pb acting as internal standard. The thortveitite samples were all prepared from pure crystal fragments, and mixed with twice as much amazonite before arcing. This made the samples somewhat similar to the standard mixtures; at the same time the Pb internal standard was always present. As thortveitite made up one third of each evaporated sample, and since the quantity of amazonite was reduced to two thirds as compared with the standard mixtures, the Sn contents, as read directly from the working curve, had to be multiplied by 2 to give the contents in thortveitite. The intensity readings were made on the lines Pb 2833 and Sn 2840 in all cases.

The results are as follows. Eight out of 14 thortveitite samples from several localities in the Iveland area gave about 0.25 % Sn, 2 nearly 0.3 %, 1 about 0.2 %, 1 about 0.15 %, 1 about 0.1 % and 1 about 0.05 %.The Befanamo thortveitite gave about 0.15 % Sn. In all thortveitite samples Zr-contents of the order of 0.01 % were found. The contents of Fe, Mn, and Mg were estimated at about 0.2 %. Magnetite and gadolinite from thortveitite-bearing deposits did not show any trace of Sn. It appears that Zr is a true minor constituent of thortveitite, but occurs in minute concentrations only. The higher Zr-contents sometimes reported may be caused by zircon contaminations. Sn appears to be a very characteristic constituent of thortveitite from Norwegian localities. Thortveitite apparently accepts practically all of the Sn available to it during crystallization. It is not difficult to propose a possible crystal-chemical explanation: 2 parts of Sc^{3+} may be replaced by 1 part of Sn^{4+} + 1 part of $(Fe, Mn, mg)^{2+}$. But the seemingly extreme tendency towards such a diadochy must depend on special properties of the thortveitite structure and on the special conditions of formation.

ACKNOWLEDGEMENTS.

Material was supplied by the Mineralogisk-Geologisk Museum. The samples were prepared and the spectrograms taken at the Institutt for Geologi. I am specially indebted to Mr. P. Chr. Sæbö, lecturer, for valuable assistance.

REFERENCES

BJÖRLYKKE, HARALD. 1935: The mineral paragenesis and classification of the granite pegmatites of Iveland, Setesdal, Southern Norway. *Norsk Geol. Tidsskr. 14*, 211-311.

GOLDSCHMIDT, V. M. & THOMASSEN, L. 1924: Geochemische Verteilungsgesetze der Elemente, III. *Skr. Videnskr.-Selsk. i Kristiania, I Kl., No. 5*, 58 pp.

LEVINSON, A. A. & BORUP, R. A. 1960: New data on the hafnium, zirconium and yttrium content of thortveitite. *Am. Min. 45*, 712-715.

MARBLE, JOHN PUTNAM & GLASS, JEWELL J. 1942: Some new data on thortveitite. *Am. Min. 27*, 696-698.

OFTEDAL, IVAR. 1939: On the occurrence of tin in Norwegian minerals. *Norsk Geol. Tidsskr. 19*, 314-325.

PARKER, RAYMOND L. & HAVENS, RAYMOND, G. 1963: Thortveitite associated with fluorite, Ravalli County, Montana. *U.S. Geol. Surv. Prof. Paper 475-B*, 10-11.

SAKURAI, KIN-ICHI, NAGASHIMA, KOZO & KATO, AKIRA. 1962: Thortveitite from Kobe, Omiya, Kyoto, Japan. *Bull. Chem. Soc. Japan, 35*, 1776-1779.

SCHETELIG, JAKOB. 1922: Thortveitit, Gadolinit, Kainosit und Orthit. *Skr. Vidensk.-Selsk. i Kristiania, I Kl., No. 1*, 51-87.

Institutt for Geologi, Universitetet, Oslo 3,
October, 1968.