

CONTRIBUTIONS TO THE MINERALOGY OF NORWAY

No. 24. On the Chemical Composition of Hellandite

BY

IVAR OFTEDAL

(Institutt for geologi, Oslo 3)

Abstract: Spectrochemical analyses show that hellandite is a borosilicate containing more than 10% B_2O_3 in addition to the known major constituents. It is not possible to derive the correct formula from the present chemical data.

Optical spectrograms of several specimens of rare earth silicate minerals revealed minor boron contents, up to about 1% B_2O_3 , in the gadolinites and thalenites and, most unexpectedly, major contents of boron in the hellandite specimens. Only the hellandite will be considered in the present note.

Hellandite was described by W. C. BRØGGER (1903) (1907) (1922) mainly from a crystal morphological point of view. The substance of the crystals is apparently always more or less altered, so that the optical and other physical properties of really fresh material are at most very incompletely known. Brøgger discussed the chemical composition at length on the basis of 3 analyses and arrived at a rather complicated formula which he himself considered more or less tentative. Thus the mineral is not well defined chemically.

The optical spectrograms of hellandite, both relatively fresh (brown) and strongly altered (white, earthy), showed as major constituents in addition to B: Y, Yb, Si, Al, Ca, Mn, Fe, in accordance with the analyses quoted by Brøgger. Be is a considerable minor constituent. Small quantities of Pb indicate the presence of U (and/or

Th). The strongly altered hellandite is relatively enriched in Be and Fe and contains rather unusual concentrations of V (probably several thousand ppm).

A spectrochemical determination of the B content of hellandite was carried out as follows. Standard mixtures containing 1% and 0.1% B_2O_3 were prepared from tourmaline diluted with alkali feldspar, and a working curve was constructed from repeated exposures of these, the spectrograph being a „Hilger Large” with a rotating stepped sector in front of the slit. Similarly the hellandite was diluted with alkali feldspar to give mixtures containing 20%, 4% and 0.8% hellandite. Exposures of these mixtures were evaluated by means of the working curve. The 20% mixture gave B lines rather too strong for convenient intensity reading, but the 4% and 0.8% mixtures agree well in giving 12.5% B_2O_3 for the hellandite. This figure is probably fairly close to the correct value for the examined hellandite specimen. Thus hellandite is a genuine borosilicate.

Reporting on the analytical work BRØGGER (1903, p. 217) said: „Bor und Fluor kamen nicht vor”. This statement he also repeated (and amplified) in the later paper (1907). It is surprising that two analysts overlooked a B_2O_3 content of more than 10%. Under these circumstances their analyses are certainly incorrect also in other respects. In particular their figures for SiO_2 are probably far too high, and also those for Al_2O_3 may be somewhat high. Even if the remaining data may perhaps be fairly reliable, it is no wonder that Brøgger had great difficulties in giving a reasonable interpretation of the analyses. To arrive at the correct formula a new analysis is obviously necessary; possibly a partial analysis would suffice. But the available quantities of „fresh” hellandite are probably far too small for chemical work. On the other hand Brøgger found that the analyses of „relatively fresh” and „strongly altered” hellandite agree quite well apart from somewhat higher contents of H_2O and SiO_2 in the latter. Also, as found by P. CHR. SÆBØ in this Institute, the X-ray powder patterns of the two materials are identical, both sharp and clear. The „strongly altered” hellandite therefore must consist mainly of small crystals of „fresh” hellandite. Thus a chemical analysis of the „strongly altered” material, which is available in fair quantities, would probably give valuable information. It is hoped that such an analysis will be completed fairly soon.

Most of the existing hellandite material is kept in the Mineralogisk-Geologisk Museum in Oslo, which has also supplied specimens for this investigation. I would like to thank Mr. P. Chr. Sæbø for valuable cooperation.

REFERENCES

- BRØGGER, W. C., 1903: *Nyt Mag. Naturv.*, *41*, 215.
— 1907. *Zeits. Kryst.*, *42*, 416.
— 1922. *Vid.-Selsk. Skr.*, I, No. 1, 1.

Accepted for publication October 1963

Printed March 1964.