

NOTE ON THE APPARENT SUBSTITUTION OF
BORON FOR BERYLLIUM IN MINERALS

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Abstract. Co-existing beryl and tourmaline from two pegmatite localities did not show any mutual exchange of B and Be. Notable B-Be-substitutions do not seem to occur in natural minerals.

In a number of cases it has been found that beryllium minerals—meliphanite, gadolinite, phenacite — contain subordinate amounts of boron (OFTEDAL 1964b). Notable contents of beryllium in boron minerals have also been observed in a few cases: danburite, hellandite, homilite (OFTEDAL 1963, 1964a, b). These observations seem to indicate that the two very small ions $B^{3+}(0.23\text{\AA})$ and $Be^{2+}(0.35\text{\AA})$ may substitute appreciably for each other in crystal structures. Other observations render such a conclusion very doubtful. No boron has been detected in chrysoberyl and beryl although in some cases boron was known to be present in the deposit. Likewise tourmalines did not show any content of beryllium (OFTEDAL 1964b).

Recently I have been able to examine two pegmatite specimens containing both beryl and tourmaline. One of these came from Ågskaret in the Holandsfjord. Here the beryl and the tourmaline were not in immediate contact, and the age relations of the two minerals are uncertain. The other specimen came from Torvelona in Iveland and was kindly sent me by Dr. H. BJØRLYKKE. It is a yellowish beryl crystal intergrown with and surrounded by black tourmaline. In none of these beryls could boron be detected by the spectrochemical method applied. Conversely, the tourmalines did not contain detectable beryllium. One would think that if B-Be-substitutions were at all possible (under pegmatitic conditions), they would be conspicuous in these cases. In any case, such substitutions must be rare and then

due to special structural features of the minerals in question. Minor contents of boron have been observed in a large number of beryllium-free mineral species. Among these the humite-group minerals and the cordierite should be mentioned here (OFTE DAL 1964c). The latter may contain notable quantities of boron as distinct from the structurally very similar beryl. It is quite obvious that boron as a trace element is by no means characteristic of beryllium-rich minerals. It is found in many minerals which do not contain any small ions at all. In these cases ordinary diadochic substitution is hardly conceivable. The cordierite might contain B in the 'channels' of its structure. But it is then surprising that no smaller ion than Li^+ is found correspondingly in beryl.

For a mutual substitution of B^{3+} and Be^{2+} the radius ratios do not seem favorable: the one radius differs from the other by about 50%. Considering other diadochic substitutions which are common in minerals, we find that the radius ratios are much nearer to unity than this. For instance the largest ion which may substitute notably for K^+ (1.33Å) is Cs^+ (1.67Å), and the smallest Na^+ (0.97Å), corresponding to radius differences of about 25%. The B-content found in e.g. meliphanite may very well be independent of the Be-content of the mineral. It may be recalled here that in hambergite B and Be occupy quite different structural positions. But of course one cannot exclude the possibility of minor structural irregularities, including interchange of a few B- and Be-positions.

REFERENCES

- OFTE DAL, IVAR 1963. Contributions to the mineralogy of Norway, No. 16. Danburite from the Kragerö District. Norsk geol. tidsskr. Bd. 43, pp. 73-74.
- 1964a. Contributions to the mineralogy of Norway, No. 24. On the chemical composition of hellandite. Norsk geol. tidsskr. Bd. 44, pp. 35-37.
- 1964b. On the occurrence and distribution of boron in pegmatite. Norsk geol. tidsskr. Bd. 44, pp. 217-225.
- 1964c. Note on boron-carrying minerals. Norsk geol. tidsskr. Bd. 44, pp. 441-442.

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