EUCLASE FROM IVELAND, OCCURRING AS AN ALTERATION PRODUCT OF BERYL

BY

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With two text-figures

Abstract. Pseudomorphs of beryl from the Hovåsen feldspar quarry, Eptevann in Iveland, consist mainly of bertrandite and muscovite and contain in subordinate amounts a mineral identified as euclase by an optic and X-ray examination.

Recently a sample of beryl pseudomorphs from Iveland was sent to the Geological Survey of Norway for examination by Mr. Arthur Jacobsen of Kristiansand. The material consisted mainly of bertrandite [$Be_4Si_2O_7(OH)_2$] and muscovite, but proved to contain also the rare beryllium mineral euclase [$BeAlSiO_4(OH)$], which has not earlier been recorded from Norway.

Iveland, situated about 50 km north of Kristiansand in the southernmost part of Norway, is famous for its granite pegmatites rich in rare minerals, monographed by H. Bjørlykke (1935). The material sent by Mr. Jacobsen came from the feldspar quarry on Hovåsen, Eptevann (No. 87 in Bjørlykke's list of the pegmatite occurrences of Iveland, l. c., p. 238). As stated by Bjørlykke the large pegmatite dyke of Hovåsen contains beryl in crystals of varying size, according to Mr. Jacobsen the altered beryl with bertrandite occurs near to the margin of the dyke. It may be noted that the earlier records of bertrandite from Iveland described by Th. Vogt (1911) came from Tveit, thus not from the same locality as the material here described.

Fig. 1. Microphotograph of the beryl pseudomorph. In the center a single grain of euclase (see the text), partly covered by a loosened flake of bertrandite. The other minerals are muscovite and bertrandite (a large grain in the lower right part).

The samples at hand are made up of two pieces, one of which shows the hexagonal prism faces of the original beryl. As already mentioned, they consist of muscovite, occurring as spherulitic or sheaf-like aggregates, coloured yellowish by an iron-bearing substance, forming a matrix in which the bertrandite occurs as partly idiomorphic laths in size varying from 0.5 to 3 mm (Fig. 1). The bertrandite also occurs in vug cavities as clear laths 3 to 4 mm in size. Quartz and albite have been found in very subordinate amounts.

The bertrandite is clear and translucent. In powder preparations and in slides the rhombic symmetry is well shown by the perfect cleavages on all the three pinacoids, and almost all the grains in powder form are orientated with an optic normal, or one of the bisectrices in a normal position, γ — 1.613 $\pm$ 0.003, β — 1.603 $\pm$ 0.003, α — 1.588 $\pm$ 0.003, — 2 V 70°, measured on the universal stage. The optic constants are thus near to those given for the mineral bertrandite. As this mineral has been exactly examined and described from a similar occurrence in Iveland by Th. Vogt (1911), there should be no doubt of the identification.

When powder preparations of the beryl pseudomorphs were

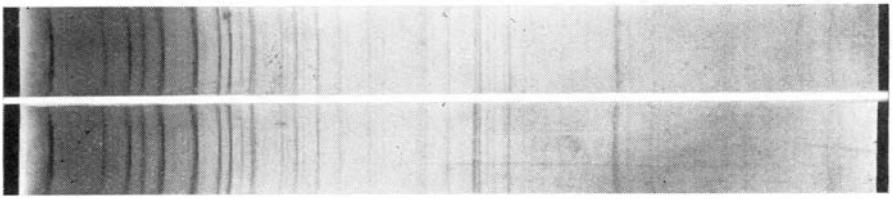

Fig. 2. X-ray powder diagrams of euclase, 9 cm camera, iron radiation with manganese filter. Upper diagram: euclase from Muso, Brazil, lower diagram: euclase separated from beryl pseudomorphs from Hovåsen, Eptevann, Iveland.

examined in an immersion liquid with an index of about 1.600, near to the mean index of bertrandite, a few grains of a mineral with index distinctly higher than the liquid were noticed in each of the samples examined. At least half of the grains in question were orientated with the optic normal in a vertical position, thus indicating the presence of a direction of good cleavage coinciding with the axial plane. Most of the grains so orientated showed cleavage cracks or a straight edge making an angle of 42° to 43° with γ. Also a second cleavage making an angle of nearly 10° with α was noticed. Refractive indices γ — 1.675 $\pm$ 0.003, 1.655 $>$ $\beta \geqq$ 1.650. Two grains properly orientated showed a positive optic axis with an angle of 40—50°, estimated from the curvature of the isogyre, with distinct dispersion r $>$ v. The axial angle, 2 V, was found to be + 45° on the universal stage by the method of the characteristic extinction (Berek). The optic characters come close to those given for euclase by Larsen and Berman. There is a full agreement in cleavages and optic orientation, when the axial plane cleavage is being correlated with (010) and the two other cleavages observed with (100) and (001) of the euclase.

Of two slides prepared from the beryl pseudomorphs only one contained a single grain of the euclase (Fig. 1). It has the distinct (010) cleavage, coinciding with the axial plane, almost normal to the plane of the section and a positive optic axis near the normal of the section, 2 V $\sim$ 40°.

Due to a proposal by Dr. Henrich Neumann the optic identification of the euclase was checked by a separation and X-ray examination of the mineral, this work was carried out at the Mineralogical-Geological Museum of the University of Oslo under the super-

vision of Dr. Neumann. The separation was carried out by Mr. Thor Siggerud by means of acethylene tetra bromide, sp. g. 2.97, the material being crushed to a size of 80 mesh. The only mineral to sink during the separation process was the euclase. From about 30 g of the beryl pseudomorph only some centigrammes of the euclase was obtained. The euclase thus makes up certainly less than one per cent of the material, which is in agreement with the impression gained by the microscopic examination.

An X-ray powder diagram of the separated material was taken by Mr. Jens Hysingjord, for comparison a diagram was taken of a specimen of euclase from Muso, Brazil in the collection of the Museum. The result, shown by Fig. 2, leaves no doubt of the identity.

The occurrence of the euclase together with bertrandite and muscovite makes it clear that in the present case this mineral was formed by an alteration of beryl, which in the main may have taken place according to the equation:

$$\begin{array}{ccccccc} 12 \text{ beryl} & + & 4\ K_2O & + & 17\ H_2O & \rightarrow & \\ 100 & & 5.7 & & 4.8 & & \\ 9 \text{ bertrandite} & + & 8 \text{ muscovite} & + & 30\ SiO_2 & & \\ 33.0 & & 49.5 & & 28 & & \end{array}$$

The numbers give the percentage proportions by weight in relation to the original beryl, the proportions by volume are only slightly different. The very small contents of quartz indicate that most of the silica was removed during the process, and the presence of vug cavities shows that some net decrease in volume has taken place (cf. p. 2, *ante*). As the contents of the bertrandite can be estimated to be about one third of the pseudomorphic aggregate, there should have been no loss of Be. The formation of the euclase may be ascribed to the circumstance that potash was not available in wholly sufficient amounts to transfer all of the alumina of the original beryl into muscovite.

According to Doelter (1917, p. 600 f.) euclase has been found, besides in alluvial occurrences, as a primary mineral in mineral veins and pegmatites and in vugs in granite. As far as the writer has been able to find out, a paragenesis like the present one has not earlier been recorded for the mineral.

The material here described has been deposited in the Geological-Mineralogical Museum of the University of Oslo.

As will appear from the foregoing, the writer is greatly indebted to Dr. Neumann and to Messrs. Hysingjord and Siggerud.

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