

Comment on the paper “Pseudoleucite from the Gardar of South Greenland”

by Stephen P. Hesselbo

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This paper (Hesselbo, 1986) reports the first occurrence of pseudoleucite in the Precambrian Gardar province of East Greenland. In summarizing previous work on the “pseudoleucite problem” the author states that there is a “lack of proper descriptions of pseudoleucite intergrowth textures” and that “photomicrographs of unaltered intergrowths of nepheline and K-feldspar illustrated by Fudali (1963, p. 1102) are the only ones published”. It is unfortunate that Hesselbo does not appear to be aware of the paper by Gittins et al. (1980) which does in fact contain the clearest and most comprehensive discussion of the problem in the literature, together with illustrations of all the textures described by Hesselbo and some additional ones. The paper contains chemical analyses of the individual mineral phases (K-feldspar, nepheline, kalsilite, and leucite) as well as estimates of the bulk composition of the intergrowths (both nepheline – K-feldspar, and K-feldspar – kalsilite). In addition it discusses the various types of phenomenon that have been termed “pseudoleucite”, suggests limitations on the use of the term, and discusses the mechanisms by which the different types might have formed. Although interesting, most of Hesselbo’s description and discussion is redundant as it has been done before.

The paper of Gittins et al. (1980) discusses the occurrence of various types of intergrowth in the Batbjerg Complex of East Greenland, some of which have in other locations been called “pseudoleucite”. These are:

- a) flame-like vermicular intergrowths of nepheline and potassium feldspar forming areas quite devoid of crystal outline, but sometimes growing outward from discrete grains of nepheline;
- b) fingerprint intergrowths of kalsilite and potassium feldspar resembling a micrographic texture.

These, it is suggested, should not be called “pseudoleucite” because it is unlikely that they were at any time leucites. An explanation was put forward based on direct igneous crystallization under increasing water pressure that shrinks the leucite stability field. An interesting alternative explanation, but still involving direct magmatic crystallization, has been proposed by Zeng and MacKenzie (1984) following their confirmation of the existence of a maximum on the field boundary between nepheline and potassium-rich feldspar in the system $\text{NaAlSi}_3\text{O}_8 - \text{KAlSi}_3\text{O}_8 - \text{SiO}_2 - \text{H}_2\text{O}$ at a water pressure of 5 kbar.

In reviewing the use of the term “pseudoleucite” Gittins et al. recognized a further type of intergrowth that does not occur at Batbjerg, but which has been described commonly in alkalic rocks. This is described as “patchy and vermicular intergrowths of nepheline and alkali feldspar (dominantly potassic) with euhedral outline characteristic of sections through the icositetrahedral form of leucite”. The Gardar occurrence described by Hesselbo (1980) is of this type. Gittins et al. (1980) conclude that it is the only type of intergrowth that should be called “pseudoleu-

cite". They propose that it arises either as leucite crystals that have become sodic by sub-solidus ion exchange reactions followed by exsolution, or that it is due to sub-solidus breakdown of potassium-rich analcite. This is also the general conclusion of Hesselbo who states that "a sub-solidus reaction took place during or after crystallization of the dyke matrix probably in response to increasing fluid pressure". In short, little has been added to the subject.

The Batbjerg rocks are completely unaltered. In contrast the Gardar specimens are very extensively altered, and so there must be a lot of supposition in their interpretation. For example the alleged identification of potassic cancrinite on the basis of XRD must be considered at best dubious. However, although cancrinite can be of direct magmatic crystallization in alkalic rocks its presence here, if correctly identified, is likely to indicate the former presence of nepheline as Hesselbo suggests. But this will involve the introduction of CO₂ and possibly of S. Such metasomatism casts further doubt on the validity of any interpretation of original composition of the pseudoleucite precursor. There is something of a circular argument involved. Calculation of the present pseudoleucite composition based on the structural formula of a leucite (p.16) yields a

substantial deficiency in alkalis and it is stated that "the alkalis are depleted by about one third of the probable initial value". There is further reference to "the now vacant sites", yet no vacant sites are proved to have existed. They may well be an consequence of choosing the leucite composition as the basis of calculation.

The paper of Hesselbo (1980) is an interesting contribution to the mineralogy and petrography of the Gardar province, but it can not be considered as contributing anything of lasting value to the problems of what have been referred to as "psedoleucite".

References

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