

ANMELDELSER OG KRITIKKER

K. A. VLASOV, M. V. KUZ'MENKO and E. M. ES'KOVA: *The Lovozero Alkaline Massif*. 627 p. – Oliver & Boyd, Edinburgh, 1966. £ 12-12-0.

The monograph on the Lovozero alkaline massif of the Kola Peninsula by K. A. VLASOV, the late director of the Institute of the Mineralogy, Geochemistry and Crystal Chemistry of the Rare Elements, Moscow, and his colleagues M. V. KUZ'MENKO and E. M. ES'KOVA was published in Russian in 1959 and has now been translated into English by D. G. FRY and K. SYERS. The English translation has been edited by S. I. TOMKEIEFF and M. H. BATTEY.

Of the many alkaline intrusions of the Kola Peninsula, Khibina and Lovozero are the most imposing and the ones richest in rare minerals. While a good deal of information has been available about Khibina since the early studies of RAMSAY, FERSMAN, and others, the literature of Lovozero has been more scattered even if a great number of papers were published before 1959, first by RAMSAY in 1887, later by FERSMAN and his colleagues and students. The geology and petrology of Lovozero were studied especially by VOROB'EVA and ELISEEV, the mineralogy primarily by GERASSIMOVSKY.

The systematic study of Lovozero taken up by VLASOV and his collaborators resulted in a wealth of new information. 70 minerals, of which 11 are new, were found during this project (especially by E. I. SEMENOV), so that a total of about 130 minerals was known at the time of publication of the monograph. New data were also collected during the examination of the minerals known previously. A number of chemical analyses and trace element analyses of the rocks and minerals of the intrusion are given.

The monograph is divided into four parts. The first part deals with the geology and petrology of the intrusion and contains rather generalized descriptions of the distribution of rocks and of the petrography and chemical composition of the rocks. Four stages are distinguished in the crystallization of each rock type: 1) fluid magmatic, 2) fluid gaseous, 3) fluid hydrothermal and 4) hydrothermal. Each rock is analyzed paragenetically according to this pattern. It is especially pointed out that there is a close connection between the development of monomineralic rocks such as urtites, and concentrations of rare elements, and also that rocks containing for instance eudialyte as an essential mineral are poor in rare minerals. It is thus demonstrated that the spatial distribution of rare-metal minerals depends on the distribution of the main rock-forming minerals.

Part II describes on 177 pages the pegmatites of the intrusion and their relation to the three main complexes of rocks: the eudialyte lujavrite complex, the differentiated complex (urtite, foyaite, lujavrite) and the poikilitic syenites. A group of hybrid pegmatites is also described. A great number of pegmatites are analyzed paragenetically in a way similar to that used by Vlasov in the study of granite pegmatites. An evolutionary series of pegmatites is established from simple (facies) pegmatites developed by in-situ crystallization of patches of magma enriched in volatile components to complex (phase) pegmatites forming veins and "stocks" and characterized by pronounced zonal structures and replacement processes. Each rock type is accompanied by its special suite of pegmatites.

This part of the book provides by far the most comprehensive analysis of pegmatites associated with alkaline rocks published in any country. The authors distinguish four stages of crystallization also in the pegmatites. According to the number of zones present 14 paragenetic and structural types of pegmatites are established.

In part III 108 of the minerals occurring in Lovozero are described in great

detail. Chemical analyses, optical and X-ray data and DTA-data are recorded for most of these minerals, of which many contain rare elements and about 10 have only been found in Lovozero and about 10 others only in Lovozero and in the Ilímaussaq intrusion in South Greenland.

Part IV deals with the geochemistry and genesis of the massif. The average chemical compositions of each rock complex and of the whole intrusion are calculated on the basis of 39 chemical analyses of average samples of the rocks. The distribution of 53 elements is described and discussed. The processes responsible for the evolution of the massif and for the distribution of the elements are: 1) the initial concentrations of the elements in the magma, 2) assimilation, 3) emanation processes (volatile transfer of material), 4) crystallization differentiation, 5) isomorphism, and 6) transport by hydrothermal solutions. These processes are discussed in a qualitative way practically without reference to crystal chemical and physical chemical relations.

An interesting account is given of the development of igneous layering in the differentiated complex which is regarded as having been formed by crystallization from the top of the magma reservoir downwards. The layering is considered a result of slow diffusion from the non-crystallizing part of the magma to the front of crystallization in such a way that the material removed from the front by crystallization is not replaced by addition of a fresh supply during the consolidation of the magma in the front zone.

The Publishers are to be thanked for making this monumental study of the paragenesis of alkaline rocks and pegmatites available to mineralogists and petrologists who cannot read the original Russian edition, in spite of the fact that the number of scientists in English-speaking countries interested in this special and rare type of alkaline rocks and their very rare minerals is certainly very small. However, it is to be hoped that the book will be widely distributed because of its rich content of mineralogical and geochemical data and because of its outstanding paragenetical analyses of the rocks and pegmatites of Lovozero which introduce into the study of agpaite nepheline syenites a system of classification of their pegmatites which is the counterpart of the existing systems of classification of granite pegmatites.

The English edition has some advantages when compared to the original Russian book. It is printed so well and on such high quality paper that the illustrations, especially the photographs, are much better reproduced in the translation. There is furthermore a subject index, which is totally lacking in the original as in most other Russian books. A number of printing mistakes are corrected, for instance the total in the chemical analysis of karpinskyite which erroneously is given too high in the original description of this mineral and also in the Russian edition of the book.

When reading the book one is struck by the many repetitions and very lengthy and wordy descriptions and discussions. The group of geologists working in the Ilímaussaq alkaline intrusion in South Greenland, which in many respects is closely related to Lovozero, have used the book by VLASOV, KUZ'MENKO and ES'KOVA extensively since it appeared in 1959. At first we made full translations later we made only reviews of the chapters since we found it uneconomical and unnecessary to translate every word. When reviewing the translation published now I have reconsidered this. It would have been quite easy to prepare an abbreviated edition of the book containing all factual data and the views of the authors and much easier to read. However, I think that the editors of the translation have made the right choice as this really monumental monograph certainly deserves to be available to geoscientists in all countries in its original shape. The few scientists directly involved in the study of agpaite rocks will probably make their own abstracts of the book.

The translators should be congratulated on a well done job, I have only a few comments. Eudialytic lujavrite is used instead of eudialyte lujavrite which would be in better agreement with usual practice (olivine gabbro, nepheline syenite, etc). There is an "M" too much in fig. 31. In fig. 41 on p. 102 (description of microcline), p. 140, line 29 and p. 332, lines 10 and 12, foot wall and hanging wall have

been confused. Late and early have been confused on p. 98, line 5. Chalcedonic natrolite should be chalcedony-like natrolite. On p. 73 nepheline is said to occur as inclusions; it should be as segregations. In fig. 26 one Russian "H" has not been translated into "N". In fig. 63 the Ae in the centre should be F. On p. 142 there is a reference to quartz-bearing nepheline syenite pegmatites from Greenland; these pegmatites occur in augite syenite.

On p. 170, line 9, 150 m should read 15 m according to fig. 77. The nicols cannot be crossed in fig. 81.

Instead of the expression pelitization of feldspars (for instance on p. 181) I should prefer alteration into clay minerals

In a number of places the English translations orthoclase, microcline and potash feldspar is not consistent with the terms used in the Russian text which is to be regretted as there are paragenetically important reasons for maintaining the distinction made by the authors. I have found this inconsistency on pages 197, lines 2 and 37; 198, lines 23 and 26; p. 199, lines 22 and 41; p. 208, lines 17, 18, 22, 27, 28; p. 209, line 3; p. 210, lines 1 and 3 from the bottom; p. 211, lines 9, 11, 12, 36; p. 215, line 3; p. 222, line 22; p. 226, lines 19 and 24; p. 233, fig. 109 and lines 7, 11; p. 234, line 10.

On p. 198, line 25 a phrase has been omitted after prismatic natrolite: "much higher contents of minerals containing RE, Th and Be". P. 233, line 8 from bottom after niobium read ":", instead of "and of the". It is not always clear if "secondary" means "of secondary formation" or "of secondary importance". On p. 388, in the caption to table 104, Magnet Bay should be Magnet Cove.

During the seven years between the first appearance of the monograph and the printing of the translation a great number of papers have been published on the mineralogy, geochemistry and geology of the Lovozero intrusion in Russian periodicals. It is to be regretted that the translation does not contain a list of this additional information, or just the major contributions made since 1959. The following minerals not included in VLASOV's book have now been found in Lovozero: zirkelite, pyrophanite, wolframite, cristobalite, todorokite, burbankite, schairerite, polysphaerite, epistolite, rosenbuschite, tundrite, keldyshite, thorite, orthite and tugtupite (beryllosodalite) (personal information, E. I. SEMENOV, first half of 1967). A number of geochemical studies by V. I. GERASSIMOVSKY and collaborators has been published in "Geochimija", a compilation of these results was published by V. I. GERASSIMOVSKY, V. P. VOLKOV, L. N. KOGARKO, A. I. POLJAKOV, T. V. SABRYKINA and YU. A. BALACHOF (Geochimija Lovozerskovo Schelotchnovo Massiva, Izd. "Nauka") in 1966. I. A. PETERSILIE and others have undertaken very interesting studies of the gas phase trapped in the rocks and minerals of Lovozero and Khibina and have demonstrated the existence of large quantities of hydrocarbons and bitumens.

The view of VLASOV, KUZ'MENKO and ES'KOVA on the petrological evolution of Lovozero is not shared by all students of this intrusion. Thus GERASSIMOVSKY and his colleagues have in the monograph mentioned above presented a quite different interpretation, partly based on the early studies of GERASSIMOVSKY, partly on papers by VOLKOV and KOGARKO containing a physical-chemical analysis of the igneous layering and the petrological evolution of the massif. Recently I. V. BUSSEN and A. S. SACHAROV of the Kola Branch of the Sovietic Academy of Sciences have published a geological description of Lovozero in which the evolution is discussed mainly in the light of geological observations (Geologija Lovozerskich Tundr, Izd. "Nauka", 1967). This paper contains a map of Lovozero in the scale of about 1 : 25 000; the scale is however not indicated and the topography is sketchy).

It is to be hoped that this new information about Lovozero also may be made available in reviews or translations to readers outside the U.S.S.R.

Henning Sørensen