Trap Magmatism and Ore Formation in the Siberian Noril'sk Region

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Trap Magmatism and Ore Formation in the Siberian Noril'sk Region

Volume 2. Atlas of Magmatic Rocks

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*To all the geologists who have contributed to the study of trap magmatism
and ore deposits of the Noril'sk region in connection with the 300th
anniversary of the Mining and Geological Service of Russia.*

Preface to the English Edition

Volume 2: Atlas of Magmatic Rocks

Results of petrographic investigations of traps of the Siberian Platform were published in numerous papers and monographs. The generalized collected data are reported in books by Dodin et al. (1971) and by Lurje et al. (1976). These works present the classification and nomenclature of traps, the localities of studied Rocks, brief description of their textures, and quantitative mineralogical composition. The data are illustrated by black–white photographs and drawings of thin sections and samples, and the chemical compositions are given for some Rocks. The mineralogical compositions of principal Rock-forming minerals are given on the base of optical constants determined by the Fedorov method. Both books present glossaries of terms commonly used by geologists in the region to characterize names of Rocks and their textural features.

In the second volume offered to readers, the diversity of all effusive and igneous complexes of the Noril'sk Region is considered in more detail and in a larger volume. Detailed petrographic description of the Rocks is given in the text part of the monograph (the first volume). The second volume represents an atlas of various Rock types. Characteristics of the complexes are given as results of detailed study of particular samples of typical Rock varieties, which can be regarded as peculiar reference samples. Each Rock type has been geochemically and petrographically characterized providing a formal identity with a photograph of corresponding thin section. Each reference sample is given in the atlas by its Rock indication; the latter presents the name of a Rock, the locality of sampling, and tables with results of chemical studies and microprobe analyses of constituent minerals of the Rock. Each Rock indication includes one or several color photographs of thin sections, which give a good indication of the Rock texture and forms of phases present in the Rock. In some cases, several Rock indications and only one-two photographs are present for Rocks from some horizons characterizing by homogenous petrographic composition. Conversely, in other cases, only single Rock indications are given, but textural features of Rocks are illustrated by a series of photographs. Analytical tables for such sections are given in Appendix (volume I). Photomicrographs of the Rocks in the atlas will be useful for visualizing the diversity of all effusive and igneous Rocks in the Noril'sk Region. Alongside with typical Rocks, exotic Rock varieties and Rocks, which are not of frequent occurrence, are present. For layered igneous Rocks, there are given Rock indications and photomicrographs of principal Rocks types that occur in their sequences. Rocks of platinum-bearing horizons from upper endocontact zones of the Noril'sk Intrusions and the Dzhaltul massif as well as from peculiar magmatogenic breccia of the Kharaelakhsky branch of the Upper Talnakh Intrusion have received much attention.

Large amount of color photomicrographs of thin section is given in the atlas for the first time in the world petrographic practice. This has been made not only as a traditional supplement to the petrographic work of the reference-book type, but it pursues a goal to give rise to dying interest of geologists to petrographic investigations. Each petrographic Rock type has a specific texture and relatively stable mineralogical composition. However, the diversity of Rocks is so large that it is impossible to find two Rock samples that are completely identical in nature even within the same region or within the same Rock type. It can be stated

with certainty that each photograph impresses the unique natural phenomenon. The diversity of traps becomes more obvious if variations in the composition of Rock-forming phases are taken into account.

It is common knowledge that the introduction of the term “petrology” provided the tendency for understanding of petrography as *ad litteram*, that is, as a descriptive science (Petrov et al. 1981). Currently, in geology of igneous Rocks, only the auxiliary role is assigned to petrography, mainly for a general diagnostics of Rocks. In the present-day petrology, much attention is given to high-precision geochemistry, results of which are processed using standard procedures, and the data obtained are interpreted on the base of conventional genetic models developed earlier (Likhachev 1997; Zolotukhin 1997; Ryabov 1999). Applying such approach to petrological investigations in geology of igneous Rocks, it is unlikely that any new ideas and discoveries in cognition of natural regularities will appear. This produces an impression that the petrography is stiffen in its development at the archaic, physiographic level within the framework of formalized concepts of Rock textures, genetic nature of which is not quite obvious. Alongside with this, it should be remembered that it was petrographic investigations on the basis of which the genetic concepts in the field of geology of igneous Rocks have been formulated and ideas for experimental investigations of physical–chemical systems have appeared. Studying thin sections under a microscope, we can see the diversity of igneous Rocks, and unfortunately, we should state that the available petrogenetic concepts developed on the base of known experimental data reflect only some general regularity of magmatic processes. So far evolution of multicomponent systems could not be explained by these concepts in full measure. In this respect, petrography is a favorable medium for perception of natural processes. It would seem that the petrography did not exhaust its own potentialities, and a purposeful idea is needed for its renewal in its new capacity. The general tendency for development of natural sciences follows the path of extending knowledge of natural phenomena and of passing to the cellular, genetic, and molecular level. In this regard, the geology of igneous Rocks is not exception, and its further progress is associated with development of genetic petrography due to development of up-to-date methods of microprobe analyses and other mineralogical–geochemical investigation methods of a matter. This gives an impact for studying natural processes and appearance of new approaches for solving the problems of differentiation and crystallization of melts and ore formation.

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List of Abbreviations

Minerals Abbreviations

Amf	amphibole
Ap	apatite
Arm	armalcolite
Bi	biotite
Bw	bowlingite
Chl	chlorite
Cpx	clinopyroxene
	Ca-tcher – Ca-tschermakite component
	En – enstatite component
	Fs – ferrosilite component
	Wo – wollastonite component
Cr	spinel group mineral (chromite series)
Cub	cubanite
Di	diopside
f	$\text{FeO} \times 100 / (\text{FeO} + \text{MgO}) \text{ at\%}$
Fsp	potash feldspar
Gr	garnet
H	halite
Hem	hematite
Ilm	ilmenite
Leu	leucite
Mh	mooihoekite
Mt	spinel group mineral (magnetite series)
MW	magnesiowüstite
Ol	olivine
	Fa – fayalite component
	Fo – forsterite component
Opx	orthopyroxene
	En – enstatite component
	Fs – ferrosilite component
	Wo – wollastonite component
Per	periclase
Phl	phlogopite
Pl	plagioclase
	Ab – albite component
	An – anorthite component
	Or – orthoclase component
Plg	palagonite
Po _h	hexagonal pyrrhotite

Po _m	monoclinic pyrrhotite
Pn	pentlandite
Pr	perovskite
Px	pyroxene
Qu	quartz
Rut	rutile
Sp	spinel group mineral (spinel series)
Tn	talnakhite
Tr	troilite
Usp	ulvospinel component
Wü	wüstite

Concentrations of oxides and S in the chemical analyses of Rocks are given in wt%, chemical elements in ppm.
In microprobe analyses of minerals, all concentrations are given in wt%.

LOI loss on ignition

Internal Intrusion Structure Abbreviations

CZ	central zone
LZ	lower contact zone
UZ	upper contact zone