

analysis result as a by-product of this automation; for example measurements of anisotropy, i.e., elongations of certain grains in certain directions.

SYN-OROGENIC NEPHELINE ROCKS IN EASTERN ONTARIO AND NORTHERN NORWAY

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Syn-orogenic nepheline-bearing and related alkaline rocks occur in fold belts of various ages around the world. Most of these rocks are gneissic; some have the structure of intrusive plutons while others occur as migmatite-like or banded gneiss complexes. Examples of rocks of this origin are described from eastern Ontario and the island of Sörøy, northern Norway. The identification of such occurrences as syn-orogenic rather than pre-orogenic depends on structural and textural criteria.

The Sörøy alkaline rocks were emplaced into a complex of metasedimentary and metamorphosed igneous rocks during the course of the Caledonian orogeny. Structural analysis indicates that they formed concurrently with the second major phase of deformation but were strongly folded and sheared during late expressions of this movement phase. A great variety of alkaline gneisses, many of which are nepheline-bearing, resulted from the introduction of a highly fluid nepheline-pegmatite magma which injected or permeated into the host rocks according to the physical condition of the latter. Rocks of carbonatitic affinities with allied fenites are also present.

In eastern Ontario both igneous and metasomatic varieties of alkaline rocks are present and were emplaced during the Grenville orogeny. Detailed work on the Wolfe Belt of Lyndoch township, one of the metasomatic occurrences, suggests that these gneisses acquired their alkaline characteristics during the lull between the first and second major phases of deformation. The igneous varieties are probably coeval with the metasomatic and are attributed to be the source of the nephelizing fluids throughout the eastern Ontario alkaline district. However, in many cases, including that of the Wolfe Belt, a direct relationship between igneous and metasomatic rocks cannot be demonstrated.

GEOCHEMISTRY OF NORANDA, QUEBEC, VOLCANIC ROCKS

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Volcanic rocks revealed in a cross-section of part of the Noranda volcanic belt, 10 to 15 miles west and southwest of Lac Duparquet, Quebec, form the north limb of a regional synclinorium. Dips are generally southward but the continuity of the stratigraphic succession is broken by a small double fold within the cross-section. North of this fold a steeply-dipping part of the assemblage is about 40,000 feet thick whereas south of it a shallow- to flat-dipping part is about 5,000 feet thick. The latter lies at the centre of the synclinorium and must be at least partly younger than the thick sequence north of the fold but their full stratigraphic relationships are uncertain.

The section was mapped in detail and sampled at stratigraphic intervals of about 400 feet. Each sample was analyzed for major elements by x-ray fluorescence and rapid chemical methods and composite samples were checked by classical chemical analyses.

The assemblage is composed essentially of basalt and andesite mostly of submarine deposition. Acid volcanic rocks, prevalent in assemblages a few miles eastward, are represented by minor fragmental rocks of mixed acid-basic composition in the upper part of the section.

Salient features of the volcanic chemistry are: (i) Al_2O_3 increases steadily with stratigraphic height throughout the thick succession north of the fold, the upper 15,000 feet being high alumina lavas; the gently-dipping part of the sequence has a normal alumina content; (ii) Iron content and the colour index decrease markedly, and the MgO content slightly, with increasing stratigraphic height but the MgO/MgO+FeO (tot.) ratio, commonly an indicator of fractional crystallization, shows little systematic change. (iii) the remaining constituents show indistinct trends but SiO_2 and K_2O values are generally higher in the upper parts of the section, particularly in the gently-dipping segment; (iv) the assemblage, in common with other geosynclinal volcanic assemblages of the Canadian Shield, is extremely low in K_2O , averaging 0.28 per cent.

The chemical variations of the Noranda volcanic rocks can be explained in part by reference to the high pressure experiments of Green, Green, and Ringwood.

TEXTURE, COMPOSITION, AND ORIGIN OF GRAPHIC GRANITE

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Graphic granite is an intergrowth of subhedral skeletal quartz prisms in a K-feldspar or sodic plagioclase host. In pegmatites of the Llano region, Texas, and many other localities, K-feldspar graphic granites coexist with plagioclase graphic granites. The host feldspar compositions average $\text{Or}_{71}\text{Ab}_{29}\text{An}_3$ and $\text{Or}_5\text{Ab}_{79}\text{An}_{16}$, and indicate crystallization under the ternary feldspar solvus. Bulk compositions of the plagioclase graphic granite and K-feldspar graphic granite assemblages coincide with isobaric quaternary minima in the system $\text{NaAlSi}_3\text{O}_8\text{—KAlSi}_3\text{O}_8\text{—SiO}_2\text{—H}_2\text{O}$ at water pressures above 1,000 bars. In the K-feldspar graphic granites, quartz averages 27 volume per cent, versus 36 volume per cent in the plagioclase graphic granites.

Graphic granite is a product of simultaneous crystallization of quartz and the feldspar host; either phase grows on an earlier nucleus or substrate. During the earliest stages of growth, dendritic quartz may make up more than half the intergrowth. As the host feldspar widens and lengthens from the site of nucleation, the more regular graphic texture is attained and the quartz content falls to a lower and more constant value.

Graphic granites thus are distinct from granophyric intergrowths, formed by simultaneous crystallization of quartz and a hypersolvus alkali feldspar at low water pressures.

THE STRUCTURE OF POLLUCITE

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Náray-Szabó concluded that pollucite must be pseudo-cubic and proposed a tetragonal structure, in spite of evidence of isometric symmetry. In recognizing the known similarity to analcime he assumed the cell formula to be $16(\text{CsAlSi}_2\text{O}_6 \cdot \text{H}_2\text{O})$. From powder data he deduced that the general features of the structure consist of the analcime framework $[(\text{Si},\text{Al})_{48}\text{O}_{96}]$ with 16 Cs occupying the large voids at $\frac{1}{2} \frac{1}{2} \frac{1}{2}$, etc.

Our structure determination was made on a specimen from Rumford, Maine. The space group is verified to be $Ia\bar{3}d$, as determined by Strunz, and the cell edge is $a = 13.69 \text{ \AA}$. Integrated intensities, measured on a single-crystal diffractometer, and using $\text{CuK}\alpha$ radiation, were corrected for Lorentz and polarization factors, absorption, and anomalous scattering. Interpretation of a three-dimensional Patterson function located the Cs at $\frac{1}{2} \frac{1}{2} \frac{1}{2}$. A Fourier synthesis phased upon the cesiums revealed the $[(\text{Si},\text{Al})_{48}\text{O}_{96}]$ -framework. The parameters for these atoms were then refined by least squares. Computations, based on an analysis by Foote, indicated 12Cs, 4Na, and $4\text{H}_2\text{O}$ per cell.