

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 $\text{MgO}/(\text{MgO}+\text{FeO})$ (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 $\text{Or}_{71}\text{Ab}_{28}\text{An}_3$ and $\text{Or}_{56}\text{Ab}_{79}\text{An}_{16}$, 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 $\frac{1}{8}\frac{1}{8}\frac{1}{8}$, 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 $\frac{1}{8}\frac{1}{8}\frac{1}{8}$. 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.

Either $|12\text{Cs} + 4\text{H}_2\text{O}|$ or $|12\text{Cs} + 4\text{Na}|$ must occupy the voids at $\frac{1}{8} \frac{1}{8} \frac{1}{8}$ etc. A Fourier difference synthesis, based upon calculated structure factors, but omitting H_2O and Na, showed residual electron-density peaks near $\frac{1}{8} \frac{1}{8} 0$, lying midway between the Cs locations. These represent the H_2O molecules lying between Na ions (or Na and Cs). The final model was refined by least squares to an R value less than 5.7 per cent.

THE QUANTITATIVE X-RAY POWDER DIFFRACTION DETERMINATION OF MINERALS IN SOME METAMORPHOSED VOLCANIC ROCKS

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A method has been developed for the quantitative x -ray powder diffraction determination of minerals in metamorphosed volcanic rocks of the greenschist, epidote-amphibolite, and amphibolite facies. This method exploits the principle that the intensities of x -ray diffraction reflections for any crystalline substance in a mixture vary with the concentration of that substance in the mixture. In this investigation a powdered metallic Cu internal standard was employed. The ratios of the intensities of specific reference reflections for each of the minerals to that of the Cu standard were determined. These ratios were plotted against the known weight percentages of the component minerals in the mixtures. The ratios for the mineral components of metamorphosed volcanic rocks in the above facies may be compared with those for the mixtures and the weight percentages of the minerals in the rocks may be determined.

The minerals selected for this investigation were actinolite, albite, chlorite, epidote, muscovite ($2M_1$), and quartz in the greenschist facies; actinolite, almandine, anthophyllite, biotite, hornblende, plagioclase An30, and quartz in the epidote-amphibolite facies, and almandine, diopside, hornblende, plagioclase An30, and quartz in the amphibolite facies. Reproducibility and accuracy are within $2\frac{1}{2}$ –5 weight per cent of the results indicated by comparative Rosiwal analyses.

A NEW COPPER-IRON SULFIDE*

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A copper-iron sulfide mineral from Noril'sk, Western Siberia, discovered and described as cubic chalcopyrite by Bud'ko & Kulagov (1963), is shown to be a discrete mineral entity and not to be confused with cubic chalcopyrite. The term cubic chalcopyrite does, in fact, refer to a valid phase, which is the face-centered cubic high-temperature polymorph of chalcopyrite.

The new sulfide mineral tarnishes very rapidly in air, changing from the chalcopyrite color to hues of pink and brown, and eventually becoming iridescent. Electron-probe microanalyses of several grains using synthetic standards gave Cu = 36.1, Fe = 31.6, S = 31.9, Ni = 0.7, total = 100.3%. The strongest of the x -ray powder diffraction lines (in Å) are 3.04(10), 2.656(5), 1.879(9), 1.598(7), 1.210(5), 1.079(6), and 1.0193(5). The (110) reflection at 7.52 Å (3) clearly differentiates it from cubic chalcopyrite. Single-crystal x -ray diffraction indicates that it has a large cubic cell with $a = 10.64 \pm 0.02$ Å, possible space group $I43m$, and a probable composition of $\text{Cu}_{18}(\text{Fe}, \text{Ni})_{18}\text{S}_{32}$. This

*The name talnakhite has since been proposed by Bud'ko and Kulagov to the Mineralogical Society of the U.S.S.R.