

plex silicates. Total time required for the entire analysis is $2\frac{1}{2}$ hours, scanning each peak twice. Point counting two thin sections will also require two hours but a technician cannot usually do the work.

The most desirable technique for routine analysis of rocks by infrared absorption spectroscopy would use an internal standard. In spite of an extensive search no suitable standard was found, as most substances tried become unstable or react under the pressure required to produce the pellet necessary for the analysis.

Previous workers have shown that quantitative infrared absorption spectroscopy without an internal standard gives good results for a limited number of components or in certain specific fields of petrology. In spite of this it is concluded that with today's available techniques it is difficult to establish a practical infrared spectroscopic method for the routine modal analysis of all major constituents of rocks.

DETAILED PETROGRAPHY OF SOME LOWER ORDOVICIAN VOLCANIC ROCKS AROUND THE WHALESBACK MINE, NEWFOUNDLAND

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The rocks being studied lie around the Whalesback and Little Deer copper deposits on the Springdale Peninsula in Northern Newfoundland. These rocks are part of the Lush's Bight group of Lower Ordovician pillowed, basic volcanics which represent part of the early depositional phase in the development of the Appalachian mobile belt.

Because of extensive metamorphic alteration the rock types and the differences between rock types are very difficult to define. The chalcopyrite deposits show preferential development within one rock type but the relationships here are at present unclear.

It is hoped that the detailed petrographic and petrochemical work presently being carried out will shed some light on the nature and origin of the rocks and the relationships between the copper deposits and the host rock.

THE AGE OF ALKALINE AND CARBONATITE MAGMATISM IN ONTARIO AND QUEBEC

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A systematic study of the ages of alkaline rocks and carbonatite complexes in Ontario and Quebec has grown out of a comparative study of the argon retentivity of nepheline and other feldspathoidal minerals with biotite. Nepheline is found to be very suitable for dating by the K/Ar method and there is some indication that it gives even more reliable ages than biotite. All feldspathoidal rocks within the Grenville Province give ages in the range 855 to 1140 m.y. Nepheline syenites and carbonatites within the Superior Province fall into two age groups at approximately 1000 m.y. and 1700 m.y. Sodalite and cancrinite are of no practical value for K/Ar dating but are of considerable academic interest giving ages of up to 8500 m.y. indicating considerable excesses of radiogenic argon. Preliminary studies of scapolite suggest that it may also be a reliable mineral for K/Ar dating.

QUANTITATIVE DETERMINATION OF MONOCLINIC AND HEXAGONAL PYRRHOTITES BY X-RAY DIFFRACTION*

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Measurement of the difference in amplitude of components at about 51.75° and $51.40^\circ 2\theta$ (Co $K\alpha$ radiation) of the asymmetric x-ray diffraction peak resulting from partial superposition of strong diffractions from corresponding planes in hexagonal and monoclinic

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pyrrhotite structures allows rapid quantitative determination of amounts and proportions of these structures in certain sulphide ores carrying at least 3% of either pyrrhotite type. The differences in amplitudes from synthetic mixtures of the pure structure types are divided by the amplitudes of a nearby diffraction peak from an internal standard added in constant proportion; and the resulting ratios are plotted against the known proportions of either structure. The plot may be checked against weights of magnetic concentrates of monoclinic pyrrhotites from the ores under study.

Determination rates of at least two to three samples per hour at precisions averaging about $\pm 12\%$ of the amounts present may be readily attained with suitable instrumentation. Economical and relatively precise contouring of sulphide bodies for the amounts and distributions of hexagonal (paramagnetic) and monoclinic (ferromagnetic) pyrrhotites is thus feasible.

CRYSTAL SETTLING IN THIN SILLS: A MODEL

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An expression relating the concentration of cumulate crystals, at a given point in a thin sill, to their settling velocity and the rate of solidification at the roof and floor is derived for:

- i) settling from an homogeneous crystal suspension
- ii) settling of crystals nucleating and growing through a given fraction of the sill.

Account is taken of the effect on the settling velocity due to a magma viscosity gradient across the sill.

In the case of suspension settling the time required for crystallization at a given position in the sill is a function of the relative concentration of cumulative particles at that point. The solution for a natural sill requires a knowledge of the number of particles per unit volume and their size distribution, not just modal per cent as is universally reported in the literature. Nevertheless, this latter parameter allows us to make, with certain assumptions, an approximation of the time of crystallization at a given position in a sill.

The Fourier heat flow equation under appropriate initial and boundary conditions may yield a good approximation for the rate of solidification at the roof and floor of the sill. The form of the particle concentration vs. height curve can then be calculated for various nucleation and growth rates. The results appear to compare favourably with those found in natural sills. The average viscosity and settling velocity in natural sills can be estimated from theory for the case of suspension settling.

THE FELDSPARS FROM A THOLEIITE SILL, GRAND MANAN, N.B.

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The Triassic basalt flows and related sills of Grand Manan Island were mapped during the summer of 1965. A 500-foot tholeiitic sill was sampled in four sections, as a single section from the roof to the base was not available. Two of the sections extended upward from the chilled base and two from the roof downwards.

The chemistry of the sill has been defined by *x*-ray fluorescence and chemical analysis.

The results of a study of the feldspars by optical, chemical and *x*-ray methods are described. An attempt is made to relate these results to the chemistry and differentiation trend of the sill.