Analysis of K–Rb covariance in 21 igneous and quasi-igneous suites of high-quality published data resolved the controversy and helped define three principal trends. The first is characterized by near-constancy of the ratio in each of 12 suites, with an overall average of 263, but slight decrease as K increases; this main trend extends from 0.002–8 per cent K and 0.1–500 ppm Rb. The second is a trend of decreasing K/Rb ratios from more tha 3,500, merging with the main trend, and shown by all and only by oceanic tholeiites (and achondrites). The third is the pegmatitic-hydrothermal trend of extreme Rb concentration while K remains constant in the range 3–10 per cent or may even decrease.

These trends depend on (a) phase petrology, since K and Rb partition ratios differ with mineral species, and (b) presence or absence of a fluid phase, in which Rb concentrates preferentially to K. Several aspects of these trends, however, are obscure.

K/Rb ratios provide a criterion for certain kinds of metasomatic replacement.

THE COMPOSITION OF THE CANADIAN PRECAMBRIAN SHIELD AND THE UPPER MANTLE, WITH PARTICULAR REFERENCE TO U, Th, AND K

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A new estimate of the composition of the Canadian Precambrian Shield is: SiO_2, 64.93; TiO_2, 0.52; Al_2O_3, 14.63; Fe_2O_3, 1.36; FeO, 2.75; MnO, 0.07; MgO, 2.24; CaO, 4.12; Na_2O, 3.46; K_2O. 3.10; P_2O_5, 0.15; H_2O^+, 0.79; H_2O^-, 0.13; CO_2, 1.28; S, 0.06; Cl, 0.01; F, 0.05; C, 0.02, all in per cent and Be, 1.3; Ga, 14; Cr, 99; V, 53; Li, 22; Ni, 23; Co, 21; Cu, 14; Zr, 400; U, 2.5; Th, 10.3; Sr, 340; Ba, 1070; Rb, 118, all in ppm. This estimate is based on numerous analyses of composite and individual rocks from northern Quebec–Ungava, Baffin Island, southwestern Quebec, northeastern Alberta, northern Saskatchewan, and northwestern Ontario. Differences between regions are striking, especially for trace elements.

The concentrations of U, Th, and K, taken as typical of the whole continental crust, could have been produced by differentiation of an achondritic earth, leaving concentrations suitable for simulating the sub-oceanic and sub-continental upper mantles from various possible mixtures of dunite, eclogic, oceanic tholeiite, and oceanic alkalic basalt. The achondritic parent was assumed to contain 0.05 ppm U, 0.20 ppm Th, and 0.035 per cent K; its heat production, averaged over the whole earth surface, is 3.19×10^{-6} cal/cm^2/sec, which is higher by a factor of 2 than the observed average. Alternative models, based on the average chondrite or the average type I carbonaceous chondrite, have suitable heat production but unsatisfactory compositions.

X-RAY DIFFRACTION AS A STRATIGRAPHIC TOOL IN THE PLEISTOCENE OF NORTHERN VERMONT AND SOUTHEASTERN QUEBEC

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X-ray diffraction patterns of silt-clay reflect provenance changes in the late Wisconsin drift of northern Vermont. Comparing the ratios derived from the diffraction line intensity of chlorite (7.16 Å) divided by the intensity of quartz (4.26 Å), a definite response to changing drift lithologies was noted. Chlorite ratios drop sharply on the down-ice side of the contact of high chlorite, Green Mountain schists with low chlorite limestones and slates. For multiple till sections near Sherbrooke in southeastern Quebec, tills with northwest fabric were consistently lower in chlorite/quartz ratio than those with northeast fabric. Illite/quartz ratios are also consistently higher in northeast tills than in northwest, *x*-ray diffraction confirms fabric and mega-lithology data obtained independently by McDonald.

X-ray diffraction studies can establish correlation among tills in separated sections within the area investigated. Furthermore, comparison of the chlorite modes in heavy mineral separates from Vermont samples to their chlorite/quartz ratios demonstrates that *x*-ray diffraction has a sensitivity to provenance changes comparable to that of heavy mineral analysis.

The *x*-ray data have been found to be reproducible and are probably less subject to observational bias than other provenance indicators.

DISTRIBUTION OF MAJOR MINERALS IN A STOCK OF NELSON PLUTONIC ROCK, SOUTH-CENTRAL BRITISH COLUMBIA

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A 21 square mile, porphyritic, leuco-quartz monzonite stock of Nelson plutonic rock is centred about Mt. Carlyle in Slocan mining camp, West Kootenay district, south-central British Columbia. The pluton intrudes the Triassic Slocan Series of quartzite, pelitic sediment, and limestone. Limestone is abundant north and east of the intrusion, giving way to quartzites and pelitic sediments to the west and south. The Slocan Series south of the pluton forms a septum several hundred feet wide that separates the stock from the main body of the Nelson batholith.

Modes, excluding K-feldspar phenocrysts, were determined for 62 sample locations. Large stained rock slabs were projected onto a grid and 500 points counted.

First to fourth order trend surfaces were established from plagioclase, K-feldspar, and quartz modal data. Percentages of plagioclase and K-feldspar vary systematically, quartz is more erratic. Planar trend surfaces show a southwesterly increase in K-feldspar and a corresponding decrease in plagioclase. Plagioclase planar residuals are high near the border of the intrusion, whereas those of K-feldspar are low. Cubic and quartic surfaces approximate hand contoured data.

The planar trend data are consistent with an hypothesis of Ca-enrichment related to calcareous contact rocks to the north and east of the stock. Peripherally high plagioclase and low K-feldspar planar residual values may be related to differentiation during progressive crystallization.

MELTING RELATIONS IN UNDERSATURATED ALKALINE ROCKS II

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Experimental data are presented on the melting relations of undersaturated alkaline rocks whose liquidus temperatures and crystallization sequences have been determined at water vapor pressure up to 2,000 kg/cm^2 and under controlled P_{O_2} conditions. Plutonic rocks are represented by naujaite, foyaite, and lujavarite from Ilimaussaq complex Greenland and foyaite from Grounedal-Ika complex, Greenland showing agpaitic tendencies, and four phonolites and nepheline syenites from Tanganyika and Kenya were investigated.

The experimentally determined sequence of crystallization in many of the rocks studied is feldspar, pyroxene, and nepheline or pyroxene, feldspar, and nepheline. There is a relationship between the amount of volatile bearing minerals and the melting interval in some of the rocks which reflects the probable role of volatiles in their genesis. The partial pressure of oxygen was controlled by buffer assemblages for some of the iron-rich rocks resulting in liquidus temperatures being lowered for only minor changes in the crystallization sequence. The possible genesis of alkaline rocks by processes involving crystal $\rightleftharpoons$ liquid equilibrium is discussed in the light of this data.