PETROGENESIS OF RAPAKIVI GRANITES AND RELATED ROCKS

BELYAEV, A. M., Department of Geology, University of Leningrad, University Embankment 7/9, 198834, Leningrad, USSR

On the basis of recent geological, geochemical and isotopic data the author suggests the following model for the origin of the rapakivi granites and related rocks of the Salmi, Wiborg, and Berdiaush (the Urals) massives.

Gabbronorites and anorthozites represent an older complex which was formed long before granites. Afterwards they were granitized under influence of reducing hot fluids along deep fracture zones. Anhedral and ocellar quartz was formed, plagioclase was replaced by potassium feldspar, and pyroxene by amphibole and biotite. Concentrations of Si, K, Rb, Sn, F, and REE (excluding Eu) increased, Ca, Mg, and Fe decreased, and Fe was reduced to Fe2+. Such elements as Ca, Mg, and Fe were mobilized in the process of granitization and, together with Sn, Zn, and Cu, they contributed to the formation of the early metasomatic ore bodies.

The increase of temperature in the granitized zones was accompanied by generation of anchieutectic or anchicotectic granitic and quartz-syenitic magmas containing hard blocks of metasomatically transformed gabbros and unmelted xenocrysts of ocellar quartz, potassium feldspar, plagioclase, amphibole and biotite. Formation of plagioclase mantles around potassium feldspar megacrysts started when supply of potassium from deeper zones stopped. Intrusion of granitic magma into the upper parts of the Earth's crust (along old, activated fracture zones) resulted in association of the granite bodies with earlier hypabissal gabbro intrusions and ore deposits. Crystallization of granite was followed by formation of secondary ore deposits (skarns, greisens, cassiterite-sulphide veins) in the hose rocks.

During subsequent partial melting of brecciated and feldspathized unsaturated gabbros in deeper zones under the influence of high temperature mantle-generated fluids alkaline and nepheline syenite magmas were generated. Basic magmas were melted in the still deeper parts of fracture zones. Alkaline and nepheline syenite bodies and lamprophyre dikes were formed by intrusion of these magmas into earlier granites and basic rocks.

ON THE PROBLEM OF THE FORMATION OF OVOIDS IN GRANITES: EVIDENCE FROM MINERAL COMPOSITION

RUNDQUIST NATALIA D., Central Geological Museum, Sredney pr., 74, Leningrad, 149026, USSR; BELYAEV ANATOLIY M., Department of Geology, University of Leningrad, University Emb., 7, Leningrad, 199034, USSR; and SUTCLIFFE RICHARD H., University of Western Ontario, London, Canada, N6A 5B7

The main types of ovoid-containing granites from the Wiborg (Soviet part) and Salmi batholiths were examined to determine the mode in which the ovoids were formed. The typical rapakivi texture appears in a variety of granite from the Wiborg batholith known as wiborgite - biotite-hornblende granite with medium to coarse (4-12 cm) ovoids of potash feldspar mantled by plagioclase and containing inclusions of mafic minerals with a concentric distribution. The presence of at least two generations of rock-forming minerals in the groundmass is also a specific characteristic of wiborgite. Variations of the features mentioned above occur in other ovoid-containing granite types of these batholiths.

Potash feldspar ovoids are characterized by zonal structure. The general trend of decreasing Ba, Na, Sr, and K/Rb and increasing K, Rb from the core to margin of the ovoid was identified. Local alterations of K content of the ovoids are recorded, especially in the middle parts of coarse ovoids from wiborgites. Mafic mineral inclusions in the ovoids are also zoned, with hornblende predominating in the central zones and biotite in the marginal zones. The inclusions vary systematically in composition with increasing FeO tot and K and decreasing Mg, Na, (and Ca in hornblende) from the core to the edge of the ovoids. The mafic minerals of the groundmass are similar in composition to inclusions of mafic minerals in the peripheral zones of the ovoids and the plagioclase rims. The plagioclase inclusions in the ovoids show normal zoning inside the grains and are enriched in the albite component to the edge of the ovoids. The two-feldspar geothermometer indicates a decrease in crystallization temperature from the central parts of the ovoids (720-780^{0}C) to the marginal parts (580-600^{0}C) and to the groundmass (520-540^{0}C).

The data provide evidence that the magmatic differentiation had a special importance during formation of the ovoids. In the initial period, the cores of ovoids crystallized, while in the terminal period, the crystallization of the: marginal parts of the ovoids and of the groundmass was realized. However, the complexity of ovoid composition and structure, abundance of different types of inclusions in the ovoids, and presence of several generations of rock-forming minerals in the groundmass indicate the lengthy and heterogeneous crystallization history of rapakivi granites. The process of formation of ovoids consists of rhythmically repeated stages of crystallization (potash feldspar plagioclase - quartz - hornblende - biotite) which were caused by fluctuation of thermodynamic parameters and variations in melt composition. The prolonged, repeated stages of crystallization of minerals in rapakivi granites resulted in the formation of rounded, coarse potash feldspar ovoids with the zonal internal structure in which abundant mineral inclusions occur. The peculiarities of rapakivi granite formation are connected with the specific geological situation characterized by the transition from the orogenic regime to the stage cratonization.