**THE CAPE VERDE ARCHIPELAGO PRIMARY MELTS: PETROLOGICAL SYSTEMATICS**

***N.A. Migdisova, L.N. Kogarko***

*Vernadsky Institute of Geochemistry and Analytical Chemistry of RAS, Moscow*

*kogarko@geokhi.ru**, migdisova@geokhi.ru*

The representative collection of samples was obtained during the complex geological expeditions of the Geological Institute of the Academy of Sciences of the USSR and the 9th cruise of Akademician Boris Petrov (GEOKHI RAS) on the islands of the Cape Verde during the three field seasons (1982-1986) within the framework of the national project "Lithos" and the "World Ocean" program.

The collection of primary magmas from the islands of Sal, Santiago, San Vicente, Boavista, Fogu, Mayu and San Nicolau consists of 39 samples. X-ray fluorescent, microprobe, and ICP studies were conducted in the Geokhy RAS.

In the work contemporary GeoRock and PetDB databases were used. The dataset on the Cape Verde rocks from the databases was compiled of 1100 individual analyzes. Thorough work according to the databases and this study individual analysis was performed to select the primary magmas samples that are suitable for comparison. Sampling frame consists only of volcanic rocks with available chemical analyzes for all major and rare (including rare-earth) elements.

In our study, we have focused on primitive high-magnesian magmas produced by partial melting of the mantle, which have not undergone profound differentiation and have not been affected by secondary processes.

Primary melts are characterized by high magnesian numbers, significant nickel content, and they are in equilibrium with mantle olivine [Green & Ringwood, 1967]. Systematization of the data revealed the range for high-magnesia rock compositions of the Cape-Verde and Canary Islands within Mg # from 44 to 78 interval (roughly corresponding to a MgO content in the range of 6.8 to 24% by weight). Melts with increased magnesia (more than 24 wt.% MgO) were not used in this work, due to their likely origin of heterogeneous olivine-melt systems resulting in olivine cumulates, imprinting the fact that the melts of increased alkalinity have the very wide olivine crystallization field, as it was demonstrated in the experimental works of Green & Ringwood [1967].

The systematic of primary melts of the Cape Verde Islands was carried out using TAS diagram. For the petrochemical classification, compositions from the primary magma sample were plotted on the diagram with the sum of alkali-silica (Figure 1), first proposed by LeBa and Streckeisen, 1991.

The compositions of alkaline magmas of the Cape Verde Islands fall into four fields: foidites, picrobasalts - picrites, tephrites - basanites and basalts (Fig. 1). Basaltic field, in turn, we subdivide into two zones - the field of subalkaline basalts and basalts of normal alkalinity (tholeiite). This division was proposed by McDonald [1974], the section line is known as the McDonald-Katsura line. Thus, the primary melts of the Cape Verde form five petrochemical types:

1. Foidites (27%) are low-silica (below 41 wt% SiO2) rocks, usually with a high content of alkalis and normative nepheline (up to 15%). Among this group there are rocks with normative larnite and modal melelite. For most volcanics the content of alkali is higher than 4%. The group is characterized by the elevated MgO content and the presence of feldspathoids.

2. Picrobasalts (ankaramites) (28%) - along with a high content of MgO are characterized by low values ​​of normative nepheline (about 5%).

3. Bazanite-tephrites (39%) - the most representative group; differs from the previous two in terms of the level of content of alkalis - about 6-8%. Along with a high content of MgO high concentrations of normative nepheline are characteristic. Modal nepheline or other feldspathoids are often present. In this group the contents of alkalis and magnesium oxide vary greatly with a relatively narrow range of SiO2 contents (41-45% by weight). Figure 1. Typification of primary lavas of the Cape Verde Islands.

4. Alkaline basalts (5%) contain normative nepheline. The group is characterized by a fairly weak dispersion in respect of petrogenic elements.

5. Basalts of normal alkalinity - tholeiites (1%). These rocks have tholeiitic composition, they are quartz-normative or with exceptionally low content of normative nepheline. However, these rocks cannot be attributed to the typical tholeiites (MORB) of the ocean floor according to Hofmann [2003], because their geochemical and isotopic characteristics are similar to alkaline basalts. It can be concluded that basanitic-tephritic magma types prevail among the rocks of the Cape Verde Islands, amounting to 39%. The subsequent Cape Verde rocks types are foidite and picrite, 27% and 28%, respectively. Basalts constitute the very small group (total 6%), in which alkaline basalts have a significantly higher prevalence (5% versus 1% of tholeiites). Thus, the alkaline magmatism of the Cape Verde Islands is mainly constituted by basanits, while the foidite and picritic rock types play a second role, being represented in equal parts. The basalts obviously have a subordinate character (Fig. 1).

The distribution of magmatic rock types in the Atlantic Ocean islands (OIB) is an interesting and contemporary issue. Earlier was shown [Kogarko et al., 2002] that the primary high alkaline associations of the foidite and basanitic types compose more than 40% of the total number of primary magmas in the OIB, the most common rocks are tholeiites, amounting to 47%. Then follow the basanites (23%) and alkaline basalts (18%), foidites and picrits have the lowest prevalence (8% and 4%, respectively).



In general the Cape Verde magmatism is more alkaline in compare to the other Atlantic OIB. It can be concluded that the Cape Verde alkaline magmatism has a large depth origin combined with the high pressures of volatile components in the primary melts. Such conditions are typical for the alkaline magmatism parental to the carbonatite manifestations, which are rare on the Islands of the Atlantic.

**References:**

Green DH, Ringwood AE (1967) The genesis of basaltic magmas. Contrib. Mineral. Petrol 15:103-190.

Hofmann AW (2003) Sampling mantle heterogeneity through oceanic basalts: isotopes and trace elements. Treatise on Geochemistry. 2:61–101.

Le Bas MJ & Streckeisen AL (1991) The IUGS systematics of igneous rocks. J. Geol. Soc. London. 148: 825-833.

MacDonald R (1974) Nomenclature and petrochemistry of the peralkaline oversaturated extrusive rocks. Bulletin Volcanologique. 38:498-516.

Classification of igneous rocks and the glossary of terms. Recommendations of the subcommission on the taxonomy of igneous rocks of the International Union of Geological Sciences. (1997) Nedra, Moscow, 248 p.

Kogarko LN, Asavin AM, Ryakhovsky VI (2002) Typification of primary melts and petrochemical zoning of intraplate alkaline magmatism of the Atlantic // Reports of the Academy of Sciences. 385(1):1-4.