INTERACTION OF MANTLE MAFIC MELTS AND ULTRAMAFIC RESTITES AS A KEY TO UNDERSTANDING THE GENESIS OF MAFIC-ULTRAMAFIC COMPLEXES OF OPHIOLITE ASSOCIATIONS

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The genesis of ophiolite associations, their internal structure, relationship between individual components, as well as mineralogical and geochemical features and formation conditions of participating rocks continue to be the subject of detailed study. Of topical significance is the issue of the time-dimensional relations between ultramafites and gabbroid rocks that compose such massifs. The "stratified" model of the ophiolite association structure was proclaimed at the Penrose Conference in 1972, and then adopted by many geologists. In accordance with the R. Coleman's pattern created on its basis, "the following rock types are represented from bottom to top in the complete ophiolite series: ultramafic complex; gabbroid complex, the complex of parallel dikes of the basic composition, the main volcanic complex [1]. Initially, it was supposed that the above complexes had formed in the same sequence; however, Coleman had to admit that "when studying the sequence of events that resulted in the formation of an ophiolite association…, it is necessary to proceed from polygeneticity rather than from cogeneticity of the rocks…"

Representative data obtained so far on the structure and composition of many ophiolite mafic-ultramafic massifs being abundant within multi-aged fold structures of Asian Russia and other regions, give evidence to the fact that such "stratified" model of the structure and formation of ophiolite associations should be adjusted.

The above data demonstrate that the bodies of ultramafic restites included in ophiolite massifs, are subvertical or, more rarely, gently sloping protrusions that are intruded by spatially contiguous gabbroid bodies. Such time-dimensional relationship between ultramafites and mafites have been found in numerous massifs of Chukotka, Koriakia, Kamchatka, Sakhalin Island, Tuva, Urals Region, Mongolia [2-4]. Thus, D. Shteinberg concludes that "in the Urals ophiolite associations magmatic gabbroids do not obligatorily rest on ultrabasites, but break through them, thus being in normal intrusive relations with them and metamorphizing them. At the same time, gabbros can occur not only above ultrabasites, but can also underlie them". These particular relations were observed in Kempirsay ophiolite association [5]. Dimensional location of gabbroid intrusives was determined by the permeability degree of fissures bounding ultramafic protrusions, along which mafic melts were traveling. In contact zones with ultramafic protrusions in gabbroids quite often one can find xenoliths of ultramafic rhestites transformed in certain manner under the influence of mafic melts and their fluids. Within ultramafic protrusions one can often find intersecting gabbroid bodies varying in thickness and length – apophyses of gabbroid intrusives along which the processes of pyroxenization and feldspatisation of ultramafic rhestites took place. Zones of contact between gabbroid intrusives and ultramafic protrusions normally have inhomogeneous structure stipulated by the irregular alternation of stripe- and lens-like bodies of varying petrographic composition (wehrlite, pyroxenite, troctolite, melanocratic olivine gabbro). In accordance with R. Coleman's pattern, the rocks of such "striped complexes" have cumulative origin. However, multiple observations reveal that all those rocks are hybrid or "paramagmatic" formations being the result of complex magmatic and metasomatic interaction between ultramafic rhestites and the injected mafic melts, and the resulting fluids. The thickness of such "striped complexes" which actually are contact-reaction zones, vary from the first dozens of meters to many hundred and more meters. Depending on the formation conditions of such complexes, the following rock varieties in different combinations and quantitative ratios can be found in the contact-reaction zones: impregnated rhestites (plagiolherzolite, plagioharzburgite, plagiodunite); wehrlite and plagiowehrlite; websterite and plagiowebsterite olivine-bearing ones included; clinopyroxenite and plagioclinopyroxenite olivine-bearing ones included; troctolite and olivine gabbro of varying melanocrativity. Contact-reaction zone rocks are characterized by inhomogeneous textures, structures, quantitative and mineral compositions; quite often they have porphyroblastic and nest-like isolations of olivine, plagioclase and pyroxenes. Such associations of spatially close but genetically heterogeneous protrusions of ultramafic rhestites, gabbroid intrusives breaking through them, and contact-reaction zones, are proposed to be isolated as polygenic mafic-ultramafic massifs (plutons).

Quantitative ratios between petrographic varieties of ultramafic and mafic rocks observed in polygenic mafic-ultramafic plutons are quite often used for the purpose of their typization and calculation of chemical composition of the model melts. This, however, is not quite correct since those ratios, in fact, are very irregular and, normally, are pre-determined by the differences in the levels of erosion sections of (varying in size and morphology) bodies of ultramafic rhestites, gabbroids and hybrid formations. It is proposed to isolate in polygenic mafic-ultramafic plutons the following substance-genetic rock associations: a) orthomagmatic (rhestitogenic) ultramafites (lherzolites, harzburgites, dunites, and products of their serpentinization); b) orthomagmatic gabbroids (gabbros, gabbronorites, rarely norites proper, certain olivine-bearing gabbros, anorthosites); c) paramagmatic ultramafites (pyroxenized and feldspatized lherzolite, harzburgites, dunites, plagioclase-less and plagioclase-bearing wehrlites, ortho- and clinopyroxenite, websterite); d) paramagmatic gabbroids (Type A) (olivine gabbro, gabbronorite, and troctolite of varying melanocrativity, rarely anorthosites); e) paramagmatic gabbroids (Type B) (amphibol-, biotite- and quartz-bearing gabbros, gabbro-diorites, diorites). All the paramagmatic gabbroid rocks that compose polygenic mafic-ultramafic plutons, are the products of crystallization of the hybrid mafic melts. Varying in intensity, the processes of interaction between ultramafic restites and intruding through them mantle mafic melts, occurring at various depths and under varying conditions including the differences in the concentration of volatile components (sulphur included) and stimulating the formation of contact-reaction zones within polygenic mafic-ultramafic plutons of ophiolite associations, deserve further, more detailed study, experimental techniques included as the above processes are quite often accompanied by redistribution and concentration of sulphide Cu-Ni- and PGE-mineralization.

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