SULPHUR CONCENTRATION AND METAMORPHISM DEGREE EFFECT ON THE FORMATION OF PLATINUM AND PALLADIUM SULPHIDES

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A sample from the ore-bearing horizon, leucocratic gabbro (pl-cpx-cumm-act-horn-bi-chl-czo-ep), has been analyzed by the microprobe technique. The analysis has shown that the rock is greatly metamorphosed, that is manifested in amphibolization, biotitization, clinozoisitization, and epidotization. The sample demonstrates relic primary magmatic (clinopyroxene) and autometamorphic (cummingtonite) minerals. The superimposed transformations of the clinopyroxene are reduced to the subsequent development of pale-coloured amphibole of the actinolite-tremolite series and green hornblende.

The distinguished mineral assemblages of the sample analyzed and their chemical composition have been employed for estimating the thermodynamic conditions (parameters) of the metamorphism by the TWQ method [1]. The research results suggest that the P-T parameters cover the temperature interval from the autometamorphic rock transformations with pyroxene-cummingtonite assemblages (T=504^{o}C, P=5.6 kbar) to the early metamorphic transformations with early plagioclase-actinolite (T=390^{o}C, P=2.2 kbar) and later plagioclase-hornblende assemblages (T=450^{o}C, P=5.7 kbar).

In order to carry out the thermodynamic modelling, the input thermodynamic data for the mineral phases, gas components, elements and sulphides have been taken from the reference books and from our earlier investigations [2-4]. The thermodynamic modelling of the complex natural system has been performed using the program package Selector [5] that allowed considering different factors during the investigation. The examination of the sulphur concentration effect (0.015-0.075 mole/kg) on the content of Pt, Pd, and their sulphides, as well as investigation of the fluid regime, Cu, Ni, Fe sulphides and silicate phase have been accomplished at the given P-T parameters for the different metamorphism facies. The results obtained indicate a fundamentally different sulphur (and PGE's) behaviour at the various metamorphism stages. It has been established that the PGEs can exist only as elements at the autometamorphic stage, when the sulphur content is about 0.03 mole/kg. Such sulphides as PtS, PtS_2, PdS, and PdS_2 can exist only at the high sulphur content in the system. At the greenschist facies the elementary form of PGEs is traced even at the higher sulphur concentration in the system (0.06 mole/kg). The sulphur concentration in the systems increasing subsequently, the Pt and Pd content diminishes abruptly, forming the appropriate sulphides. At the epidote-amphibolite facies the PGEs can exist as elements at the relatively low sulphur concentration (0.015 mole/kg). However, even a negligible increase in the sulphur concentration (up to 0.017 mole/kg) provokes an abrupt fall in Pt and Pd contents and intense development of the PGE sulphides.

The results obtained allow assuming that the conditions, when platinum occurs as an element, are a) relatively low metamorphism degree (greenschist facies) at the sulphur content in the natural system within 0.06 mole/kg; b) formation of Pt and Pd sulphides does not disclose a clear dependence on the sulphur concentration at different metamorphism facies; c) PGE concentration is caused by the factor of the sulphur concentration at the metamorphic substitution of the ore horizon.

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