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THE METASOMATIC CONTACT AUREOLE BETWEEN THE CARBONATITE AND DUNITE COMPLEX OF THE GULI MASSIF, TAIMYR PROVINCE, NORTHERN SIBIRIA, RUSSIA

by

Gernot Ch. Loidl

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Department of Applied Geosciences and Geophysics, Mineralogy and Petrology

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Abstract

This thesis presents results of microscopic, micro-analytic and geochemical investigations of the metasomatic contact aureole between the carbonatite and dunite - complex of the Guli Massif, located in the Maimecha Kotui province in the northern part of the Siberian Platform. The massif represents a multiphase zoned alkaline - ultramafic and carbonatitic complex, which is surrounded by Early Triassic volcanics. It is oval shaped with an extension of 35 x 45 km, occupying an area of 1500 to 1600 km^2. The aims of this study were to classify the occurring rocks on the basis of their mineralogy, mineral chemistry, and their whole rock geochemistry, to investigate degree of metasomatic influence on the rock suites under consideration, and to investigate the ore mineral assemblage with particular emphasis on native gold, Au- and platinum group element (Os, Ir, Ru, Rh, Pd, Pt) containing mineral phases.

The investigated rock sequence is considered typical for zoned alkali-ultramafic complexes and consists of lithologies such as dunite, clinopyroxenite, olivine melanephelinite and jacupirangite. Jacupirangites intruded are supposed to represent the last member within the zoned alkali-ultramafic sequence. All of the investigated rock samples, except those of dunite composition, show alkali geochemical characteristics and a tholeiitic as well as komatiitic to komatiitic - basaltic trend. All samples are characterized by weak enrichment in elements such as Ti, Al, Ca and K in the vicinity to the carbonatite intrusion. Temperature estimation on the basis of the single clinopyroxene thermometer resulted in almost identical solvus temperatures throughout all samples ranging between 1180 and 1260°C. The whole rock sequence is furthermore characterized by a strong enrichment trend in LILE, HFSE and REE towards the carbonatite stock suggesting a pronounced metasomatic influence caused by the carbonatite intrusion, which has affected even the most distal parts of the rock suite investigated, namely the dunite complex.

Significant changes in compositional characteristics of amphibole and phlogopite in addition to the appearance of perovskite, baddeleyite, thorionite, monazite and mineral phases highly enriched in Ce and La (probably bastnasite or calkinsite) reinforces the argument for metasomatic influences. The mineralogical results are supported by very high oxygen fugacities in the range of +2 to +4 (according to the FMQ buffer) and non-magmatic temperatures in the range of 650 down to 100°C, on the basis of olivine - spinel equilibria. The PGE and Au concentrations provide an additional support for metasomatism. Local enrichment of PPGE and Au as well as the Pd/Ir and the Pt/Ir ratios indicate remobilisation of the PGE, most probably during metasomatism.

As a consequence, two possible explanations for the genesis of the Guli alkali-ultramafic rock sequence investigated in this study can be suggested: The results of this study could imply I) that the fluid rich carbonatitic melt significantly metasomatized the existing rock sequences during its emplacement, or II) that metasomatism occurred already at the very early stage of carbonatite melt origin. In the latter case it is suggested, that the rock sequence investigated, derived from already highly metasomatized mantle material. It seems likely, that both processes operated together. This suggests that the rock suite investigated is characterized by multiple metasomatic events, which probably started in the upper mantle and continued during the final intrusive emplacement of the carbonatite stock.