

Optical microscopy and heating-freezing studies of fluid inclusions in quartz and schelite revealed the presence of four kinds of fluid inclusions: type A ($\text{CO}_2\text{-H}_2\text{O}$; CO_2 , 3-12 mole%), type B ($\text{CO}_2\text{-H}_2\text{O}$; CO_2 , 20-45 mole%), type C (pure CO_2) and type D (pure aqueous inclusions). Type A, B and C inclusions are primary and/or pseudosecondary, and are considered contemporaneous, whereas type D are secondary inclusions.

The four types of inclusions have the following physicochemical characteristics; type A: temperature of partial homogenization of liquid and gaseous CO_2 (final phase, liquid CO_2), 18.4 - 28°C; melting temperature of CO_2 hydrate, 6.8-10°C; total homogenization temperature (final phase, liquid), 230-325°C; salinities and bulk densities range from 0-6.10 equiv. wt% NaCl, and 0.81-0.99 g/cm^3 respectively; type B: temperature of partial homogenization of liquid and gaseous CO_2 (final phase, liquid CO_2), 10-24°C; melting temperature of CO_2 hydrate 5.5-10°C; total homogenization temperature (final phase, «gas»), 220-331°C; salinities and bulk densities range from 0 to 8.3 equiv. wt% NaCl, and 0.81-0.92 g/cm^3 respectively; type C: temperature of partial homogenization of liquid and gaseous CO_2 (final phase, liquid), 6.5-23.9°C; bulk densities range from 0.75 to 0.88 g/cm^3 ; and type D: final homogenization temperature (final phase, liquid), 110-135°C. The temperature of melting of CO_2 indicates that the noncondensable gas in all the inclusions is pure CO_2 with traces of CH_4 .

Isochoric path calculations, combined with the total homogenization of type A and B inclusions which produce different phases in a similar temperature range (220-330°C), indicate that these inclusions were entrapped from boiling, CO_2 -bearing, saline hydrothermal solutions, at temperatures of 250-400°C and pressures between 1 and 2 kbars during retrograde greenschist facies metamorphism. Progressive CO_2 loss from the hydrothermal fluid by immiscibility may have shifted the solution pH to higher values thus causing tungsten deposition. CO_2 plays an important role in the transport and deposition of tungsten.

EVOLUTION OF EASTERN VARNOUNTAS PLUTONITE (NW, MACEDONIA): MAJOR AND TRACE ELEMENT FRACTIONAL CRYSTALLIZATION MODELS

A. Koroneos, G. Christofides, G. Eleftheriadis

Aristotle University of Thessaloniki, School of Geology, Dept. of
Mineralogy - Petrology - Economic Geology, 54006 Thessaloniki, Greece

The Eastern Varnountas plutonite occurs in the Pelagonian zone north of Florina, intruding the metamorphic basement with which it forms contact metamorphism phenomena (formation of various types of hornfelses).

It comprises Hb-Bi-monzodiorites, Hb-Bi-quartz monzonites, Bi-quartz monzonites, Bi-granites, leucogranites and aplitic veins. The main rock type is Hb-Bi-quartz monzonite. Augen and spotted gneisses, considered to have genetical relations with the plutonic rocks are also examined. Lastly, xenoliths of monzonitic composition, enclosed both in the plutonic and the gneissic rocks, were found.

The geological relations between the various rock types of the plutonite support a frac-

tional crystallization process for the evolution of the plutonite. Fractional crystallization is also supported by the trace element behaviour. The large variation of compatible elements (Ba, Sr) and the small variation of incompatible elements (Rb) is consistent with such a process.

The geochemical behaviour of the rocks investigated, indicates that fractional crystallization is mainly controlled by plagioclase, hornblende, biotite and K-feldspar, followed by zircon, apatite and sphene.

Petrographic major element models, used to calculate the crystal cumulates and determine their modal compositions, require 52% crystal fractionation of the parental magma (Hb-Bi-monzodiorite) for the formation of the Hb-Bi-quartz monzonite, 5% of Hb-Bi-quartz monzonite to give Bi-quartz monzonite, 47% of Bi-quartz monzonite to give Bi-granite, 21% Bi-granite to give leucogranite and 30% of the later to give aplite.

The results of the major element models are tested by trace element (Rb, Ba, Sr) models. Compatible/incompatible element diagrams (Rb/Ba vs Ba, Rb/Sr vs Sr) were used. Based on the major element models, the concentrations of these elements were calculated and the theoretical differentiation trends were constructed. The distribution of the calculated concentrations of these elements matches very well the real distribution of them.

The distribution of Rb, Ba and Sr of the gneissic rocks follows the calculated differentiation trends of the plutonite for these elements, thus suggesting a similar evolution.

THE DISTRIBUTION OF TRACE ELEMENTS IN CHROMITITE ORES AND BASIC-ULTRABASIC ROCKS OF THE VOURINOS OPHIOLITE COMPLEX, W. MACEDONIA

G. Konstadopoulou

IGME, Mesoghion 70, 11527 Athens, Greece

The distribution of Ti, V, Mn, Ni, Cu, Co, Zn and As in chromitite ores and basic-ultrabasic rocks of the Vourinos ophiolite complex, is discussed. Based on the trace element distribution, three geotectonic units may be distinguished: a) south Vourinos, b) north Vourinos and c) Kissavos. The distinction is based on the concentration and variability of trace elements in the afore mentioned units, whereas a correlation to the composition of the chromitite ores with respect to major elements and PGE concentrations is being made. The ultrabasic block of Rodiani, east of Vourinos, seems to be an independent geotectonic unit. Any systematic differentiation of trace elements within every and each particular unit, indicating a distinct stratigraphic upsection in the mantle sequence of the ophiolite, is not documented from the present study. The distribution of trace elements in the Vourinos ophiolite complex may be explained by the geochemical behavior during the partial melting and fractional crystallization processes.