PTX properties of a natural Au-bearing hydrothermal fluid from a multidisciplinary study of fluid inclusions (Sigma deposit - Canada)

P. GAROFALO [1,2], C. A. HEINRICH [2], D. GÜNTHER [3], AND T. PETTKE [2]

[1] Institut für Geowissenschaften -Peter Tunner Strasse 8700 Leoben –Austria (garofalo@unileoben.ac.at)
[2] Institut für Isotopengeologie und Mineralische Rohstoffe – ETH Zentrum – 8092 Zurich – Switzerland (heinrich@erdw.ethz.ch; pettke@erdw.ethz.ch)
[3] *Laboratory of Inorganic Chemistry* - ETH Hönggerberg, – 8092 Zurich – Switzerland (guenther@inorg.chem.ethz.ch)

Studied samples and methods

The Sigma deposit is a large network of quartz-tourmaline-Au veins of the Archean Abitibi greenstone belt. We reconstructed the physical and chemical properties of its Au-bearing fluid using petrographically discriminated trails of fluid inclusions showing clear relations with vein quartz, tourmaline and gold. Samples were studied using microthermometry and Raman spectroscopy to determine bulk properties and identify the species in the vapour phase. Laser Ablation-ICP-Mass Spectrometry was used, for the first time for this type of deposits, to determine the concentrations of Na, K, B, and Au in the ore fluid.

Fluid inclusion data

The collected data show that ore fluid belongs to the system H_2O-NaCl-CO_2-B-Au±CH_4. Two fluids, one belonging to the system H_2O-NaCl-CO_2-Au±CH_4 and another to H_2O-NaCl-B-Au, were separately trapped within the veins as heterogeneous mixtures of liquid and vapour phases at 380-400 °C and ca. 300 bar. This pressure is significantly lower than that previously estimated for the deposit (e.g. ROBERT and KELLY, 1987). In both fluids, Au ranges between 0.5 and. 5 ppm. In the liquid phase, Na is between 3900 and 31000 ppm, and K from 380 to 9500 ppm. B ranges from about 78 to 1300 ppm. We compare our results with previous data on the deposit, and propose that Au precipitated from a boiling Au-rich parent fluid.

References

Robert F. and Kelly W. C. (1987) Ore-forming fluids in Archean gold-bearing quartz veins at the Sigma mine, Abitibi Greenstone belt, Quebec, Canada. *Economic Geology* **82**, 1464-1482.

Clinopyroxene geothermobarometer for eclogites

J.G.GARTVICH[1] AND N.V. SURKOV[2]

[1] Institute Mineralogy and Petrography, SB RAS, Novosibirsk, Russia (julia@uiggm.nsc.ru)
[2] Institute Mineralogy and Petrography, SB RAS, Novosibirsk, Russia (diagrams@uiggm.nsc.ru)

Introduction

The system CaO-MgO-Al_2O_3-SiO_2 is a suitable object for the modeling. The Cpx-Gr association in the system is not divariant, and the composition of coexisting phases depends not only on temperature and pressure, but also on bulk composition of a system. The simplest geobarometer for eclogite paragenesis must consist of two equations with three parameters: the En and the CaTs contents in Cpx, and the Gross content in garnet. The experiments of coexisting Cpx and Gr in the magnesium part of system kbar were performed on the high-pressure apparatus "piston - cylinder"at T~1200 to 1585 °C, P~15 to 30 kbar.

Discussion of results

The En and CaTs content in Cpx increase with increasing pressure. The En content increases with increasing temperature but no notable changes in the CaTs content were detected. The garnet becomes more magnesium with increasing pressure and temperature. Using these data, the coefficients of two polynomials ($F=f_1+f_2x+f_3y+f_4z+f_5x^2+f_6y^2+f_7z^2+f_8xy+f_9xz+f_{10}yz$; **x** is the content of Gross in Gr (mol. %), **y** is the content of En in Cpx, **z** is the content of CaTs in Cpx (mol. %)) fitting the experimental composition of coexisting Cpx and Gr as a function of T and P (Table 1).

Table 1: Coefficients of polynomials.

	Temperature	Pressure
f_1	1794.9028	97.372239
f_2	-805.4903	-64.51706
f_3	-1809.595	15.310452
f_4	-774.2796	-248.6717
f_5	3424.7345	157.20992
f_6	-2679.645	25.737019
f_7	-4839.156	242.51907
f_8	1827.7546	31.650826
f_9	5943.542	-403.9175
f_{10}	3367.0297	173.69664
N	39	39

Conclusions

The data may be recommended for geothermobarometry of eclogites and eclogite-like rocks.

References

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