Provenance and metamorphic conditions of very low-grade metasedimentary rocks of the Variscan accretionary prism of the Kaczawa Mts (SW Poland): Geochemical and mineralogical evidence

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The Kaczawa Complex in the West Sudetes (SW Poland) is interpreted as a fragment of a Variscan accretionary prism. Together with neighbouring basement units, it forms a structural mosaic of the Sudetes at the NE edge of the Bohemian Massif.

Some previous studies of the Kaczawa Complex aimed at determination of the provenance and metamorphic conditions of metasedimentary rocks of the complex. These questions have become particularly important since the 1970's when some of the rocks were classified as mélange, rather than fragments of coherent stratigraphic successions as previously thought. Their depositional age remains controversial, though scarce conodonts suggest a Devonian - Early Carboniferous age.

We present new results of mineralogical (microprobe, XRD) and bulk-rock chemical investigations of various metasedimentary rocks from different structural units of the Kaczawa Complex.

The provenance of metasedimetnary rocks of the Kaczawa Complex is assessed based on the Chemical Index of Alteration (CIA) and discrimination function analysis, using major-element and selected trace-element data (i.e. Eu/Eu^* , Zr/Sc, Th/Sc Th/U and Gd_N/Yb_N). The results point to an old continental crust as the likely main source for the sediments, with minor recycled sedimentary and trench-derived components.

Based on the white mica and chlorite chemistry, as well as on illite 'crystallinity' index, we provide further evidence that the mélange and some other metamudstones in the Kaczawa Complex were metamorposed under very low-grade conditions (T < 250°C) which is in line with the accretionary prism model.

Is there an extreme pressure dependence of sulphur solubility in hydrous silicate melts?

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The question of the dependence of the solubility of sulphur in hydrous silicate melts on the pressure still remains one of the most discussed and relevant. There are a lot of experimental works studying the SCSS in silicate melts, but there is no clear answer on the effect of pressure on it. We have proposed an alternative hypothesis about existence of extreme pressure dependence of sulphur solubility with a maximum at 1.5-2.0 GPa [1]. Since, the available literature data are quite extensive at P from 0.5 to 3 GPa [2-4], we decided to study experimentally peridotite-basalt-sulphide-H₂O system at P=0.1-0.5 GPa and T=1200-1300°C.

Experiments were carried out in an internal-heated pressure vessels by a quenching technique. We used Ptperidotite ampoules filled with powder of tholeiitic basalt and FeS as starting compositions in the ratio of 3:1. The total volatile (H_2O) in system were 5 wt.%. Fugacity of sulphur and oxygen buffered by Pt-PtS and WM buffers respectively. Duration of experiments was 24 hours. Products of experiments were studied by microprobe.

There was a positive dependence of the solubility of sulphur on the pressure after experiment. The concentration of sulphur in the water-containing silicate melt at T=1200°C was 0.2 ± 0.12 wt.% at P=0.1GPa; 0.35 ± 0.03 wt.% at P=0.3GPa; 0.42 ± 0.19 wt.% at P=0.5 GPa. The sulphur concentration at T=1300°C was 0.2 ± 0.12 wt.% at P=0.1GPa; 0.27 ± 0.06 wt.% at P=0.3GPa; 0.46 ± 0.12 wt.% at P=0.5GPa. These data confirm our previous assumption about extreme pressure dependence of sulphur solubility in hydrous sulphide-bearing silicate melts. Confirmation of this theory can be very useful for a better understanding of transport of sulphue sulphur and ore elements from the deep magmatic centres to the upper levels of the Earth crust where most of known sulphide ore deposits were discovered.

Supported by grant RFBR № 12-05-31113

[1] Gorbachev N.S. et al. (2005) Doklady Earth Science,
V.401, N.3, P.421-423 [2] Mavrogenes, O'Neill (1999)
Geochim. Cosmochim. Acta. 63, 1173-1180. [3] Mysen, Popp (1980) Amer. J.Sci. 280, 78-92. [4] Wendlandt (1982) Amer.
Mineral. 67, 877-885.

www.minersoc.org DOI:10.1180/minmag.2013.077.5.11