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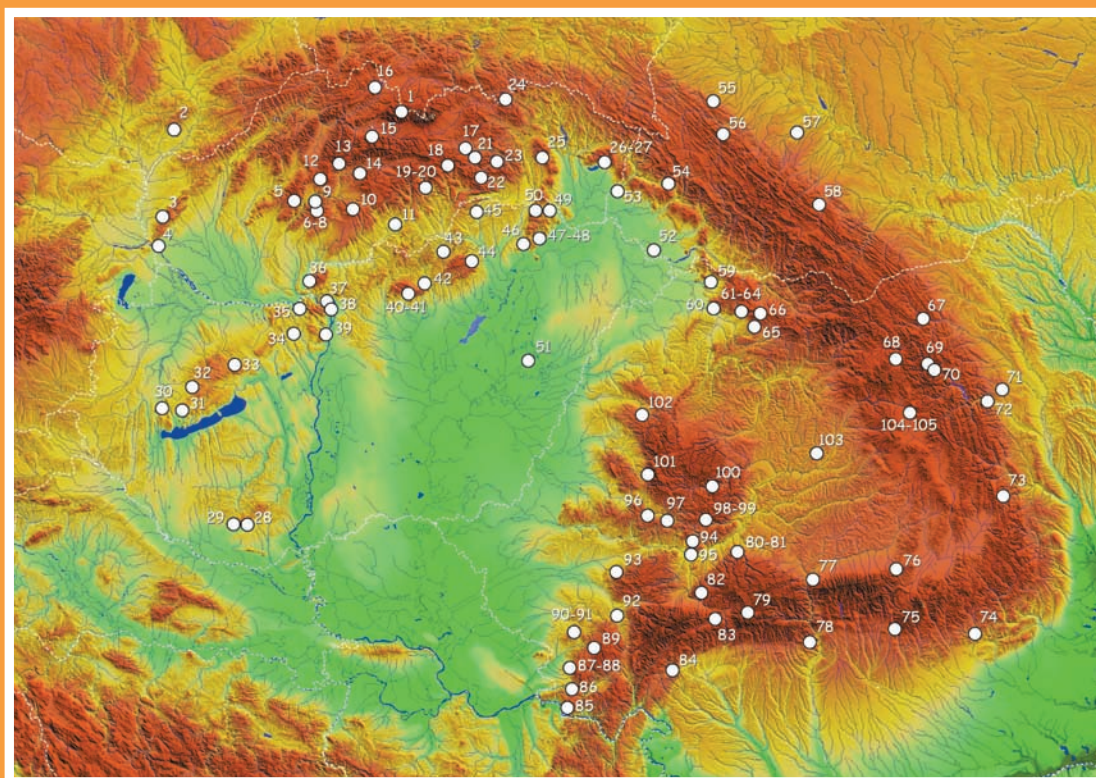
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REE arsenates in rare-metal greisens from the Sn-W deposit Verkhnee (Priamurie, Far East, Russia)

Korostelev, P.G.¹, Gorelikova, N.V.^{2*}, Semenyak, B.I.¹, Karabtsov, A.A.¹, Orekhov, A.A.¹ & Safronov, P.P.¹

¹Far East Geological Institute, RAS, Vladivostok, Russia

²Institute of Geology of Ore Deposits (IGEM), RAS, Moscow, Russia (*ngor@igem.ru)

REE arsenates and phosphoarsenates of variable composition have been found at the chimney body of Sn-W quartz-fluorite-topaz greisens from the Verkhnee deposit embedded in K₂ rhyolites. REE arsenates are associated with brown zones of zoned green fluorite crystals as replacement products of monazite and xenotime. They form small grains and grain aggregates of 0.1-0.3 mm in size. The mineral replacing monazite has a composition of gasparite-Ce [1], whereas one replacing xenotime is similar to chernovite [2].

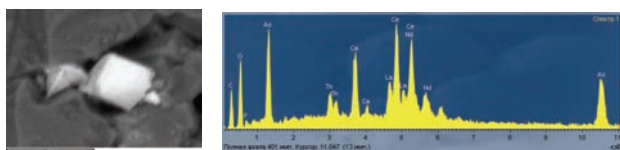


Fig. 1: Crystals of arsenates of La, Ce, Nd, Th in fluorite (SEM).

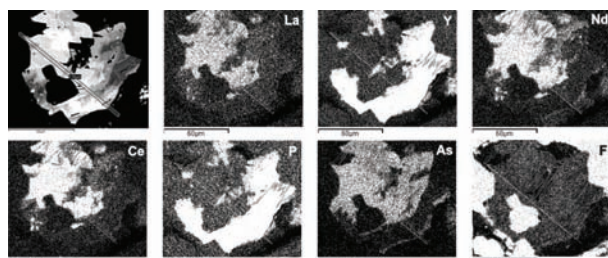


Fig. 2: The replacement of monazite and xenotime by REE arsenates (EMPA).

Electron-microprobe analyses in different points of monazite and xenotime grains provided the following composition (in wt.%): Y 9.58-15.09, Ce 3.17-22.82, La 8.53, Nd 1.19-6.95, Sm 0.95-3.88, Gd 1.25-4.85, Dy 3.33-4.99, Yb 0.92-1.76, Th 0.57-37.87, As 9.87-23.15, P 0.55-3.52, Ca 1.09-2.41, O 16.05-19.09, F 0.98-6.39.

In addition to REE arsenates, phosphoarsenates of Y, REE, Th and a britholite-like mineral have been observed in marginal zones of monazite.

REE arsenates and phosphoarsenates formed at the high redox-potential under conditions of the S deficiency and a higher alkalinity. At these conditions, As exists as As⁴⁺ and shows more covalent properties than in sulphides and sulphosalts, which promotes replacement of P by As in REE minerals. Owing to its variable valence, As reflects redox conditions of the mineral formation [3].

[1] Graeser, S. & Swander, H. (1987) *Schweiz. Mineral. Petrogr. Mitt.*, **67**, 103-113. [2] Goldin, B.A., Yushkin, N.P. & Fishman, M.V. (1967) *Zap. VMO*, 1967, 699-704. [3] Grigoriev, D.P. (1965) in *Geochemical Processes*. Moscow, Nauka.

Rare Mg-hydrocarbonates in mineral assemblage of fissures in serpentinite at Hrubšice, Moldanubian zone, western Moravia

Kovář, O.¹, Losos, Z.^{1*}, Houzar, S.² & Zeman, J.¹

¹Institute of Geological Sciences, Masaryk University, Brno, Czech Republic (*losos@sci.muni.cz)

²Dept. of Mineralogy and Petrography, Moravian Museum, Brno, Czech Republic

The unique low-temperature Mg- (Mg-Fe) hydrocarbonate mineralization was found in the Hrubšice serpentinite, Moravian Moldanubicum. It is linked to the fissure system in serpentinite in the active quarry „U Pustého mlýna“ and it consists of rare minerals (hydromagnesite, artinite, brugnatellite, coalingite), followed by aragonite, brucite, dolomite and calcite. Artinite [1], brugnatellite and coalingite are mineral phases found for the first time in Czech Republic.

Hydrocarbonate mineralization occurs as small veins few mm thick or druses in the fissures in serpentinite. Thicker small veins provided outstanding examples of artinite and partly also magnesite. Remaining described minerals were found only locally in microscopic size. From geochemical viewpoint the minerals belong to the Mg-CO₂-H₂O system, locally with Ca-, Fe- a Mn-, and two latter elements are present only in the oldest mineralization stage. In the system, Al is completely missing.

Based on the carbonate assemblage study, three temporal crystallization stages have been recognized: (1) the oldest stage comprising higher Fe- (Mn-) activity: brugnatellite, coalingite and Fe-bearing brucite, i.e. minerals with high Fe content and locally also with slightly increased Mn content occur. (2) Younger stage is represented by hydromagnesite. Simultaneously, there are separate occurrences of chemically pure artinite in fissures, rarely present with hydromagnesite. There is a rare common occurrence of artinite with hydromagnesite, when younger hydromagnesite grows on artinite. Similarly hydromagnesite is surrounding older Mg-Fe-hydrocarbonates (brugnatellite, coalingite). (3) The youngest fill of fissures is formed by calcite and druses of prismatic aragonite crystals. Even younger, but only with respect to hydromagnesite, is huntite, which probably forms pseudomorphoses after hydromagnesite [2].

The mineralization of described Mg-hydrocarbonates probably precipitated from low temperature solutions rich in Mg²⁺, at pH ~ 9, low activity of CO₂ and at temperatures less than 44°C. The presence of brugnatellite and coalingite with associated Fe-hydroxide (i.e. phase comprising Fe³⁺) indicates at least locally oxidizing conditions during the precipitation of the phases. Source of Mg and of Fe were the processes of serpentinite alteration by aqueous solutions of local circulation.

From genetic viewpoint, the spatial distribution of Mg-carbonates in the Hrubšice serpentinite body is remarkable. Described Mg-, Mg-Fe-hydrocarbonates and huntite represent a typomorph association in fissures only in the southern part of the body. Their genesis may be related to the manifestation of young or even sub-recent re-activation of faults, which was documented at Biskoupy close to the study site [3].

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[1] Kovář, O. & Losos, Z. (2005) *Bull. mineral.-petrolog. Odd. Nár. Muz. (Praha)*, **13**, 137-139. [2] Jirásek, J. (2007) *Ac. Mus. Moraviae (Brno), Sci. geol.*, **92**, 103-109. [3] Leichmann, J. & Hejl, E. (1996) *Geol. Mag.*, **133**(1), 103-105.