X-ray luminescence study of REE behaviour in fluorites from gold-bearing metasomatites, SE Siberia

V.A. VEKLENKO, N.N. BOROZNOVSKAYA, P.A. TISHIN*, E.I. BIRYUKOV AND N.A. TSYRO

Tomsk State University, Lenin Avenue, 36, 634050, Tomsk, Russia (*correspondence: tishin_pa@mail.ru)

Epithermal fluorite-rich gold ores of the Siberian Craton are localized on the boundary of crystal basement and sedimentary cover. The metasomatic zonation of deposits can be reconstructed as a rhythmic reiteration of some mineral assemblages 'quartz+fluorite→quartz+fluorite+sericite→quartz+sericite'. The content of fluorite has fallen in the upper part of vertical cross section of ore bodies. The X-ray luminescence (XRL) is studied in 16 fluorite mineral separations from different parts of total ore column in the wave range from 280 to 760 nm. The XRL-spectrum was registered in primary conditions and after calcination about 500°C. Fluorites had completed XRL patterns according to owner's and TR^{3+} related crystal defects. The directly revealed peak of the Dy^{3+} luminescence shows an enrichment by HREE of studied samples and these stability to acid solutions. A ratio between the XRL-intensity of Tb^{3+} (420 nm) and own crystal defects (296 nm) I_{420}/I_{296} values allows to discriminate studied fluorites on three groups such as REE-poor (I_{420}/I_{296} < 0.25) and REE-bearing (I_{420}/I_{296} = 0.25-0.5) and REE-rich (I_{420}/I_{296} > 0.5) mineral associations. The positive correlation between a level of rock alteration and the TR^{3+}-type XRL and higher REE contents distinguish in lower parts of ore rhythms. XRL spectrums are changing after the calcination in air. Values of I_{420}/I_{296} was rise to 0.3-0.44 in REE-poor fluorites that reflect a possible transition $Tb^{2+} \rightarrow Tb^{3+}$. Hence we propose a variety of redox regime during the formation of metasomatic zonation.

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N and O isotope composition of nitrate in aquifers of the Naukluft Mountain region, Namibia

TORSTEN W. VENNEMANN[1]*, CAROLINE REYMOND[1], CLAUDE BERNHARD[1], KATHERINE NAUDE[2] AND JODIE MILLER[3]

[1]Institute of Mineralogy and Geochemistry, Anthropole, CH-1015 Lausanne (Torsten.vennemann@unil.ch)
[2]Department of Geological Sciences, University of Cape Town, South Africa (Katherine.Naude@uct.ac.za)
[3]Department of Geology, Geography and Environmental Studies, University of Stellenbosch, South Africa (jmiller@sun.ac.za)

The Naukluft Mountain region is dominated by fractured and karstified carbonates, shales, and evaporites, emplaced onto another sedimentary sequence in a nappe structure. The geographic location of the mountains close to the cold Atlantic sea and the geology suggest relatively good recharge potentials for the aquifers draining underneath the Namib desert sands, but little is known about the quality and quantity of the groundwaters. Increased tourist and agricultural activities coupled with extreme climatic conditions make the aquifers susceptible to contamination and over-abstraction. As part of a larger project to determine the hydrological potential, isotopic measurements on water as well as on the dissolved anions were made to help asses the water quality.

While the nitrate in 32 of the 41 boreholes and springs sampled has a range of between 5 to 46 mg/l, 9 of the boreholes exceed 50 mg/l, reaching values as high as 420 mg/l. Mean values were 25.5, median 22.6 mg/l during the summer campaign, contrasting with a mean of 59.3, median of 37.4 mg/l during the rainy season. Nitrate $\delta^{15}N$ values range from 3 to 22‰. The normal distribution with a mean of 10.3 and median of 9.5‰, is compatible with an origin from mammal waste and/or important denitrification within the recharge zones. $\delta^{18}O$ values of the nitrate range from -5.0 to +18.2‰, with a normal distribution averaging 7.8‰, values typical for nitrate-O sourced from a mixture of soil water and soil O_2. Lack of a correlation between nitrate concentrations and $\delta^{15}N$ argues against denitrification in a single recharge zone though. However, seasonal variations in nitrate concentrations and isotopic compositions, together with a wide range of H- and O-isotope composition of water (-56 to -30‰, -8.4 to -5.0‰, respectively) and of the C-isotope composition of DIC (-4.6 to -12.8‰), suggest the presence of a number of aquifers in the region, each likely with a localized recharge. This is also supported by the variable ^{14}C-ages of DIC of between modern to 12'950 years.