Enhancing the accuracy of the environmental monitoring systems in mining areas

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Mining operations generally have a significant impact on the environment. Traditional monitoring by periodically performing field measurements, sampling, and lab analyses is laborious, costly, and not always reproducible and reliable. Abundant series of monitoring data may be obtained by installing continuous measuring devices in selected points. In most of the mining areas, the number of such monitoring points is rather limited. The data series provided by such systems are usually interpreted as averages of the measured parameters for a certain area. Very often, this is not the case, either due to the limited representativity of the selected points, or because of the high dynamic of the environmental parameters. The environmental issues related to mining have become an ever increasing concern all over the world, with a direct impact on the prices of commodities, as opening a new mine is getting more and more difficult. A cost-effective and precise monitoring system is essential in the management of the environmental problems. Providing accurate monitoring data may also increase the confidence and acceptance of the communities and other stakeholders towards the mining activity. New methods and tools are needed for accomplishing this goal.

The EU-funded project ImpactMin (www.impactmin.eu) develops a combination of satellite remote sensing and aerial lightweight measurements for obtaining new methods of environmental monitoring in mining areas. Four test-sites were selected for calibrating and demonstrating the new toolset. Rosia Montana test-site (Romania) has a particular position in this context, as the cumulated impact of almost 2,000 years of gold mining can be observed. Currently the mine is inactive, the operations ceased in 2006 due to economic reasons. A new mining project is proposed on the same location, intending to implement a large scale open pit operation. The newly developed monitoring methods may represent an important contribution to the proper definition of the environmental baseline conditions, should the mining operations re-start.

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Distribution of rare elements in mineral-forming environments of rare-metal granites

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The composition of melt and its evolution in space and time is traced at formation of ore-bearing Li-F granites and them sub-effusive analogs (ongonites, rhyolites, felsit-porphyries) from Orlovka, Etyka and Sherlovaja Gora in Transbaikalia (Russia) on the basis of melt inclusions study in quartz [1]. It is established that process of fractional crystallization is not the unique mechanism of concentration of LILE (Li, Rb, Cs) and HFSE (Nb, Ta, Zr, REE, W, Sn). A role of various mechanisms of concentration (fractionation, liquid immiscibility, metasomatism) estimate by calculation of distribution coefficients and saturation degree of melt for ore minerals. Contrast behavior of various rare elements is established at different stages of melt evolution [1]. High concentration of Li, B, Ta, Zn are found out in hydrosaline and fluid inclusions of Orlovka [2]. High concentration of some rare elements are found out in fluid inclusions (FI) in quartz from Sn-bearing rhyolites of Sherlovaya Gora by LA-ICP-MS. So, the Sn concentration varies from 1864 to 5879 ppm that explains formation of large tin deposit with finely dispersed cassiterite at a hydrothermal stage. High concentration of Zr in a fluid (to 1,5 wt %) from ultrapotassic felsite-porphyriy explains the formation here saturation zones of fine crystalline zircon in a topaz from famous a topaz-aquamarine greisen of Sherlovaya Gora and confirms probability of its crystallization at a hydrothermal stage. High uranium concentration in melt of rhyolites (up to 42 ppm U) exceed those in rhyolites of a Streltsovsky deposit. Sharp increase of U in FI up to 116 ppm unequivocally testifies to a potential role of rhyolites in genesis of uranium deposits of Transbaikalia that closes discussion about a source of uranium for them.

[1] Badanina *et al.* (2010) *Petrology*. **18**. 139-167. [2] Thomas *et al.* (2009) *Min Petrol*. **96**. 129-140.