Ore Mineralization Processes in the Greater Caucasus Kakheti Segment, Georgia

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The Greater Caucasus represents a Phanerozoic collisional orogen which is formed along the Euro-Asian continent South margin and is expended over 1200 km between the Black and Caspian Seas. The Kakheti segment is located on the eastern part of the Greater Caucasus southern slope and is mainly formed of folded Lower Jurassic clay-shales and basic volcanic-sedimentary formations, which according to geophysical data, are located on oceanic or transitional crust (Morariu, Nouval, 2009). The complex of these rocks is intersected by Middle-Upper Jurassic gabbroic, dioritic, quartz- dioritic and felsitic intrusions which caused intensive hydrothermal silicification, sericitization and ore mineralization of the fractioned host rocks (Okrostsvaridze *et al*., 2012).

The above mentioned ore mineralization was studied by supported of Georgian National Science Foundation grant (#GNSF/ST09-1071-5-150). Metals chemical analyses more than 300 ore samples were carried out in the laboratory of ACMELABS (Canada, Vancouver), using ICP-MS, by 3B, 14B, F5 and 1F15 methods.

Our research showed that ore mineralization processes genetically are related to postmagmatic events of Middle-Upper Jurassic intrusive magmatism in the Caucasus Kakheti segment. Two mineralization zones - the Northern and the Southern are distinguished here. The Northern one is mainly distinguished by pyrite-polymetallic mineralization, where content of Pb and Zn sometimes is >10000 g/t, Co - varies between 40-295 g/t, and Ag – 5-95 g/t intervals. Au doesn't have an industrial concentration (0.01-0.05g/t) in this zone. The Southern mineralized zone is represented by copper-pyrrhotitic ores, where Cu concentration sometimes is >10000 g/t, and Au reaches industrial concentrations (0.1-3.1 g/t). At the last stage of ore mineralization, at some areas of the South mineralized zone Th and Bi concentrations are detected, which genetically should be related to carbonate hydrotherms. In these rocks Th content varies from 40 to 120 g/t, and Bi – from 200 to 800 g/t, but near the Gelia ore zone concentration of Th reaches 3842 g/t, and Bi - 4806 g/t (Okrostsvaridze *et al*., 2011).

Sr stable isotopic anomalies in primitive meteorites and chondrules

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Chondrules are one of the main constituents of chondrites (CC: 15-60 vol.%, OC: 60-80 vol.%, EC: 60-80 vol.%). The identification of chondrule formation mechanism is an important clue to understand how Solar System precursor solids formed, were transported, and mixed in the nebula. Interpritations of chondrules' origins are still controversial, however, particularly because chondrule bulk compositions have a large variation in their chemical composition. In this study, we tackle this issue by analyzing highly precise Sr isotope compositions in chondrules with a variety of chemical compositions that were separarted from multiple chondrites.

Chondrules were separated by a freeze-thaw method or sampled from sliced specimens by using a micro milling system (Geomill 326, Izumo) [1]. We followed the sample digestion procedure of [2]. Sr isotopic measurements were carried out by TIMS (Triton plus at Tokyo Tech). The $^{84}Sr/^{86}Sr$ ratios are reported in $\mu^{84}Sr$ units, which are 10^6 relative deviations from the average of NIST 987 Sr.

The $\mu^{84}Sr$ values in two Allende (CV3.6) chondrules (+140 ppm, +130 ppm) are greater than those of bulk Allende (+70 ppm). This result suggests that the matrix components have $\mu^{84}Sr$ values lower than bulk Allende, because CAIs also have $\mu^{84}Sr$ values greater than the bulk. This is supported by a previous study [3] reporting that Allende acid leachate #1, where matrix component is dominant, had a $\mu^{84}Sr$ value lower than the bulk Allende (+35 ppm). Our new data would suggest that Allende chondrules are also isotopically distinctive carriers for Sr along with presolar grains and CAIs. This strongly argues against the genetic linkage between chondrules and matrix components in a single meteorite. On the contrary, $\mu^{84}Sr$ values in chondrules from Sahara 97072 (EH3) and Sahara 98175 (LL3.5) are not resolvable from those in the bulk rock of their host meteorite.

For Allende, we propose that X-wind model is one of the conceivable processes to concurrently induce large scale migration of chondrules and Sr isotopic anomalies between chondrules and matrix. In contrast, chondrules from ordinary and enstatite chondrites have formed locally and did not undergo large scale migration in the solar nebula before they formed parent body with matrix.

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