Geophysical Research Abstracts
Vol. 16, EGU2014-4834-4, 2014
EGU General Assembly 2014

Seeking the mantle contribution for the formation of giant ore deposits: Contemporaneous alkaline lamproites and carbonatites in the Kalmakyr and Muruntau ore districts, Tienshan, Uzbekistan

Reimar Seltmann (1) and Flavien Choulet (2)

(1) CERCAMS, Department of Earth Sciences, Natural History Museum, London, UK, (2) UMR6249 – Chrono-Environnement, CNRS/Université de Franche-Comté, France

The decline in discoveries of ore deposits contrasted by the rising demand for e-tech metals requires the global mining industry to continuously seek innovation in exploration. Unravelling the source of metals is among the crucial questions in exploration targeting and geologists have often had to recourse to indirect determinations based on the nature of the magma conveying the metals. The relative contributions of mantle and crust in metallogenic processes and the origin of the magmas from either shallow or deep mantle are not fully understood in the current models of ore genesis. To help to resolve this dilemma, research must establish the link between anorogenic (within-plate) and orogenic processes by using a holistic approach featuring crustal processes, mantle dynamics and crust-mantle interactions that may contribute to the magma fertilization. To achieve this, our study focuses on indicators for the involvement of deep-mantle intrusions (lamproites, lamprophyres, etc.), which have the potential to encapsulate pristine samples of the mantle (xenoliths) during magma ascent [1,2].
The Tienshan belt hosting many giant ore deposits is quite exemplary for understanding mantle-crust interactions and identifying the nature of mantle contribution to ore systems. Sr-Nd-Hf-Pb isotope systematics on granitoids [3] showed a variation of crustal to mixed signatures, indicating involvement of both older crustal sources and mantle-derived material, but the mantle source is not clearly assessed. As objects for our case study in Uzbekistan we choose the Kalmakyr Cu-Au porphyry deposit ($\sim$ 315 Ma; Chatkal-Kurama continental arc of Middle Tienshan) and the Muruntau orogenic Au deposit ($\sim$290 Ma, Turkestan-Alai / Kyzylkum accretionary complex of South Tienshan) to investigate the impact of associated alkaline magmas on the ore-bearing intrusions and mineralization. Field observations and geochronological data shed light on the spatial and temporal relationships between the various geological objects involved in both giant mineral systems. Upper Carboniferous lamproitic pipes have been recognized around the Kalmakyr ore deposit [1]; diamond-bearing lamproites occur near the Muruntau ore deposit and are contemporaneous to the Murun granite [2]. Indicator minerals of deep crustal and mantle origin have been identified within xenoliths hosted by the ore-bearing intrusions and the dikes and pipes spatially and temporally associated to the giants. SEM and CT scanning observations allow for revealing the shape and internal texture of indicator minerals and their relations (inclusion, interstitial or bulk minerals). Microanalysis (EPMA and LA-ICPMS) of indicator minerals is used to estimate the physico-chemical conditions of their formation and track the mantle involvement in magma fertilization. Results permit clues on the mantle contribution in ore formation during the late collisional to post-collisional stages of the Tienshan, and, based on complementary comparisons with other ore systems, to refine exploration models.

References:
[1] Yusupov, R.G.; Stanley, C.J.; Welch, M.D.; Spratt, J.; Cressey, G.; Rumsey, M.S.; Seltmann, R.; Igamberdiev, E., 2009: Mavlyanovite, Mn5Si3: a new mineral species from a lamproite diatreme, Chatkal Ridge, Uzbekistan. Mineralogical Magazine 73, 43-50.
[2] Golovko, A. V.; Divaev, F. K., 2010: Ore mineralisation of the Karashokho diatreme, western Uzbekistan. Applied Earth Science 119.2: 100.
[3] Dolgopolova, A.; Seltmann, R.; Armstrong, R.; Belousova, E.; Pankhurst, R.; Konopelko, D.; Koneev, R., 2013: Sr-Nd-Hf-Pb Isotope Mapping of Tien Shan in Uzbekistan. Mineralogical Magazine 77.5: 1001.