

## Distribution of Rhenium in fresh and altered rocks from porphyry Cu-Mo deposits (Siberia and Mongolia)

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To investigate rhenium behavior during alteration and mineralisation a suite of rocks from porphyry copper-molybdenum deposits of Southern Siberia (Russia) and Mongolia have been analysed for their whole rock Re contents. Re contents have been measured using inversion voltammetry at the Geological Analytic Centre "Zoloto-Platina" (Tomsk Polytechnic University, Russia) with a detection limit of 1 ppb. The samples analyzed include: (1) relatively unaltered rocks representing the major phases of batholiths, hosting porphyry ore-bearing intrusions, (2) samples from the least mineralised and altered parts of porphyry suite, and (3) variably altered samples. The average Re content in the studied porphyry suite samples is high compared with average crustal values and probably can be explained by the influence of hydrothermal processes. Within the group of relatively fresh rocks, the porphyry ore-bearing suite typically shows higher Re content compared to hosting them plutonic rocks. On the average, altered and mineralized rocks are enriched in Re compared to unaltered and unmineralized rocks. In summary, the alteration shows variable changes in Re relative to fresh rocks. Altered and mineralized samples exhibit highly heterogeneous Re distribution, ranging from <1 to 500 ppb, higher Re concentrations are associated with higher Mo grades. Mo contents in the samples varied from below detection limit (1 ppm) to 1.2%; Cu contents ranged from 6 ppm to 0.9%. Some significantly altered unmineralized samples show lower Re contents than fresh rocks. Variable Re contents within highly altered rock samples may be explained by selective remobilization and redistribution of metal during alteration processes. Probably, some portion of Re could be extracted from rocks during alteration and then redeposited with sulfides. Within the group of altered rocks, the Re content tends to increase from the potassic to propylitic zone at copper-rich porphyry deposits (Aksug and Erdenetiin Ovoo). Molybdenum-rich deposits (Zhireken and Shakhtama) typically show higher average Re content in potassic zone.

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## Deep UV native fluorescence and resonance Raman spectroscopy for life-detection

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For life-detection on this planet or elsewhere, it is necessary to use a non-earth centric approach that includes both detection of carbon as well as nitrogen-containing compounds [1]. There is no need for these to be in structures that we find on Earth (DNA, RNA, proteins), instead, detection of bonds such as CN, CH, NH<sub>x</sub>, C=O, C=C, and NO<sub>x</sub> and aromatic compounds can be used to suggest that life was a contributing factor. Our current non-contact, non-destructive deep UV (<250) fluorescence and Raman analyzers utilize this strategy for life detection. This combined methodology is only possible with excitation <250nm where the fluorescence and Raman spectral regions are separate [2]. Simultaneous acquisition of both regions coupled with chemometric analysis enables detection and characterization of carbon containing organics, biological materials, bacteria (cells/spores), and a variety of chemical precipitates with both exquisite sensitivity (1 cell) and a high degree of specificity [3]. For microbial cells and spores the sequences of DNA or proteins are not used, rather the separation is associated to the unique combinatorial signature of aromatic and non-aromatic compounds. Nitrogen as well as sulfur containing functional groups or heterocycles can also be differentiated because of their unique effect on the spectral response using deep UV excitation. In addition this methodology enables detection of mineral by-products as indicators of microbial activity such as nitrates, carbonates, sulfates, and phosphates [4, 5, 6, 7]. This detection methodology is being used for surface detection as well as for detection in aqueous phases (i.e. post sample processing).

[1] Capone *et al.* (2006) *Science* **312**, 708-709. [2] Frosh *et al.* (2007) *Anal. Chem.* **79**, 1101-1108 [3] Bhartia *et al.* (2008) *Appl. Spec* under review. [4] Nelson *et al.* (1992) *Appl. Spec Rev.* **27**, 67-124. [5] Sparrow *et al.* (2001) *Appl. Spec* **55**, 66-70. [6] Storrie-Lombarid *et al.* (2001) *Rev Sci Inst.* **72**, 4452-4459. [7] Ianoul *et al.* (2002) *Anal. Chem.* **74**, 1458-1461.