Noble gas isotopes of tungsten-tin polymetallic deposits in South China: Constraints on origins of ores and related granites

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South China is rich in tungsten-tin polymetallic deposits, and has the world's largest tungsten resources. These deposits have ages of ca.150-160 Ma, and are spatially, temporally and genetically related to granites which were previously believed to be S-type granitoids. Previous studies have significantly advanced our understanding of the ore formation. However, it has been poorly constrained whether or not mantle components were involved in the genesis of the deposits.

This study provides He and Ar isotope data of fluid inclusions in pyrite and arsenopyrite from the Yaogangxian, Furong, Shizhuyuan, Dajishan, Xianghualing, Yanbei, and Xihuashan tungsten-tin polymetallic deposits in South China. $^{3}He/^{4}He$ ratios range from 0.1 to 3.0 Ra (where Ra is the $^{3}He/^{4}He$ ratio of air = 1.39×10^{-6}). Moreover, there are excellent correlations between He and Ar isotopic compositions. The results suggest that the ore-forming fluids of the deposits are a mixture between a crustal fluid and a fluid containing mantle components. The existence of mantle noble gases in fluids, exsolved from the ore-bearing granitic magma, provides new insights about the origin of the deposits and associated granites. The hosting granites, previously considered as S-type, were actually formed by crustal melting induced by heat and volatile release from the mantle.

New insights on the origin of unresolved complex mixtures

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Biodegradation results in the dissappearance of the dominant aliphatic and aromatic components of petroleum and in the development of an unresolved complex mixture(UCM), referred to as a big "hump" in GC. Many studies showed that UCM should result from the relative concentration of a complex mixture that is already present in crude oil, which arises from the removal of major resolved alkylated species by biodegradation[1-2]. However, the recent study on crude oil in Biyang depression, which carried out by 5A molecular sieve adduction and laboratory bacteria degraded experiment, suggested that UCM may be produced by biodegradation (Fig.1).

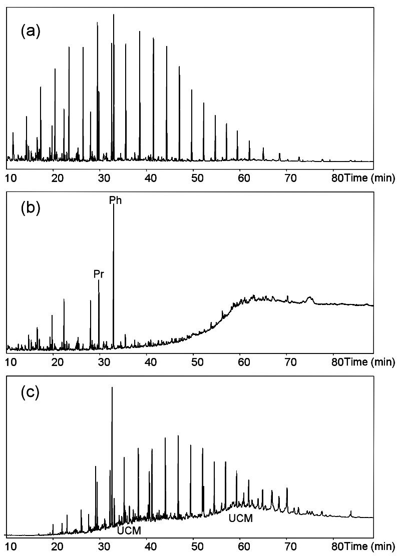

Figure 1 Gas chromatograms for : (a) SH1 crude oil; (b) non-adducted fractions for SH1 crude oil by 5A molecular sieve; (c) SH1 biodegraded oil after a 9-day laboratory experiment by a culture of aerobic bacteria isolated from a biodegraded oil in the field

[1] M.A. Gough (1990) *Nature* **334**, 648-650. [2] Ventura G T, (2008) *Org.Geo.* **39** (7),846-867.