# Mechanisms of Re enrichment in subduction related magmas

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Recent studies have suggested that high Re concentrations (~2 ppb) combined with low Yb/Re in undegassed arc-type magmas, including submarine volcanic glasses and olivine-hosted primitive melt inclusions from several locations in the southwest Pacific [1,2], reflect high mantle to crust Re transfer, and furthermore may indicate high Re in the continental crust. Previously published low Re (<0.5 ppb) in subaerially erupted arc rocks is likely due to volatility related Re loss. The mechanisms of Re enrichment in arc magmas however, remain unclear.

The chemistry of basaltic rocks from the Lau Basin changes systematically from MORB-type in the Lau Spreading Centers, to arc-type in the Valu Fa Ridge [3]. The Valu Fa Ridge is surrounded by seamounts on both sides. The east seamount is closer to the arc and with diagnostic trace element ratios close to the global arc averages, indicating addition of considerable amounts of subduction released fluids [3]. In contrast, the west seamount and the Lau Spreading Centers show a smaller influence from subduction fluids. Correspondingly, the arc-like east seamount samples have higher Re and lower Yb/Re. When the Lau Basin sample suite is plotted together with MORBs, Yb/Re is positively correlated with Ce/Pb and Nb/U, and negatively correlated with Ba/Nb. Ba and U are similarly incompatible as Nb, as is Ce to Pb, such that Ba/Nb, Ce/Pb and Nb/U ratios remain constant during mantle melting. However, Ba, U and Pb are among the most mobile elements during the dehydration of subducted slabs, with Ce much less mobile and Nb one of the least mobile elements. Therefore high Ba/Nb, and low Nb/U and Ce/Pb are diagnostic indicators for addition of subduction released fluids. As Re is similarly incompatible as Yb, there is no major fractionation between Yb and Re during mantle melting. Thus the correlations of Yb/Re with Ce/Pb, Nb/U and Ba/Nb indicate that Re is much more mobile than Yb during subduction, and furthermore that Re enrichment in arc magmas is specifically due to addition of subduction released fluids.

## References

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# Trace gaseous compositions in fluid inclusions as indicators of ore-forming fluid sources and processes: a case study on Songxi large-scale Ag(Sb) deposit, China

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Songxi is a newly discovered large-scale Ag (Sb) deposit. There exist two major opinions on its genesis: submarine basic volcanic exhalation and epithermal low-medium temperature volcanic hydrothermal fluid filling. In this study, we analysed the trace gaseous phases and $^3He/^4He$ compositions in fluid inclusions of Songxi by using a high vacuum quadrupole and an inert gas mass spectrometers. The results show that: 1. Nearly all of the samples are plotted in the field of basinal brine or crustal fluid in $N_2$-Ar-He and $CO_2/CH_4$-$N_2$/Ar diagrams, suggesting the basinal brine may be the predominant source of ore-forming fluid; 2. R/Ra of all the samples are less than 1 (0.0579 to 0.4464, n=6), showing the ratio of mantle-derived magmatic water in the fluid inclusions is lower than 5%; 3. Nine light hydrocarbons recognized in the fluid inclusions are mainly composed of $C_1$-$C_4$ saturated alkanes, while the contents of $C_2$-$C_4$ unsaturated alkenes and aromatic hydrocarbons are very low, suggesting that the metallogenic processes seem not to have been affected by magmatic activities; 4. Thermodynamic calculation shows the hydrocarbons are mixture of organic gases generated by microorganism activity and thermal cracking of type _kerogens (kukersite), and the former constitutes more than two-third, implying microorganism might have played an important role in the metallogenesis; 5. The equilibrium temperature of the light hydrocarbons in the fluid inclusions is estimated to be about 300°C, which is much higher than geothermal temperature at the estimated depth of metallogenesis of Songxi, suggesting the hydrocarbons were probably originated in the deep part of the sedimentary basins and then migrated through a long distance to shallow position of the basin; 6. Based on the composition of trace gases in fluid inclusions, the Songxi is inferred to be a sedimentary brine transformed deposit.

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