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The golden finger points to the arc

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Many Cu-Au ore deposits are closely associated with high fO_2 magmas at convergent margins (1,2). The genetic mechanisms, however, have been hard to track. Many models favoured addition of Au to the arc magmas either due to that additional sulphide is dissolved in the form of sulphate from the mantle into the magmas by high oxygen fugacity (fO_2) melts and fluids released from subducted slabs, or that gold is mobile and thus transferred from the subducting slab to the overlaying mantle wedge and subsequently to the magmas.

We show here, in contrast to Re, the Au/Yb ratios are roughly the same for two suits of arc-type volcanic glasses and melt inclusion from Valu Fa Ridge with different subduction effects (3,4), suggesting that Au is not significantly mobile during subduction. Detailed studies on a cogenetic fractionation series of submarine, subduction-related volcanic glasses from the eastern Manus Basin, Papua New Guinea, show abrupt decreases of Au and Cu abundances, coupled with a switch in behaviour of Ti and Fe from concentration increases to decreases as SiO_2rises at the commencement of titanomagnetite crystallisation. No obviously coupled changes between Cl and Au (Cu) were observed. Given the studied samples are sulfide undersaturated, all the above observations can be plausibly interpreted by that the abrupt depletion in Au and Cu results from concurrent sulphur reduction ($SO_4^{2-} \rightarrow S^{2-}$) as a result of fO_2 buffering, causing enhanced formation of Cu-Au

hydrosulphide complexes that become scavenged from crystallising melts into cogenetic magmatic aqueous fluids (2). The reduction of sulphate to sulphide also implies that this process is particularly efficient in oxidised arc magmas with substantial sulphate, which conceivably explains the relation between high fO_2 and Cu-Au ore mineralizations (2).

References:

.1. Mungall, J. E. *Geology* **30**, 915-918 (2002).

2. Sun, W. D., Arculus, R. J., Kamenetsky, V. S. & Binns, R. A. *Nature*, **431**, 975-978 (2004).

3. Kamenetsky, V. S., Crawford, A. J., Eggins, S. M. & Muehe, R. *EPSL* **151**, 205-223 (1997).

4. Sun, W. D., Bennett, V. C. & Kamenetsky, V. S. *EPSL*. **222**, 101-114 (2004).