# Experiments on the wetting properties of precious metal-rich sulfosalt melts against MSS

ANDREW G. TOMKINS

School of Geosciences, Monash University, Clayton 3800 Victoria, Australia (andy.tomkins@monsh.edu)

In a significant proportion of magmatic sulfide ore deposits, Pt, Pd, Au and Ag (precious metals), correlate strongly with As, Bi, Sb and Te. In these deposits, the majority of the precious metals can be locked in platinum-group minerals (PGM). The majority of these PGM consist of Pt and Pd complexed with one or more of the semi-metals As, Sb, Bi and Te. In addition, domains rich in non-PGM sulfarsenides, such as gersdorffite and nickeline, with very high precious metal concentrations are found within some ores. These observations imply that these semi-metals play a critical role in controlling the distribution of precious metals in some deposits.

Piston cylinder experiments have been used to study the wetting behavior of As-rich sulfosalt melts against monosulfide solid solution (MSS). This is important information because the wetting propoerties of a melt against its solid crystal framework control melt migration processes; a wetting melt requires about an order of magnitude less volume than a non-wetting melt to form an interconnected permeable melt network, which allows melt migration.

Experiments show that range of As-rich melt compositions wet MSS, including those that contain significant proportions (1 – 45%) of precious metals. Interestingly, sulfosalt melts that are extremely Au-rich or Pt-rich (> ~40% Au; > ~ 50% Pt + 5% Au) do not wet MSS. These results imply that if a late stage As-rich sulfosalt melt is able to form either through magma contamination with something like carbonaceous shale (which tend to be As-rich), or simply through fractionation of the sulfide melt (many sulfosalt minerals crystallise at lower temperatures than MSS) it should preferentially partition incompatible Bi, Sb, Te, Pt, Pd, Au and Ag. Furthermore, where the proportion of As-rich sulfosalt melt exceeds ~ 0.2% of the rock volume, an interconnected melt drainage network will be able to form along MSS crystal triple junctions. Because sulfarsenide melt is significantly more dense than MSS, it would then be able to drain downwards, further scavenging precious metals. The greater the length of this melt migration pathway, the more effective the enrichment in precious metals. Ultimately, very precious metal rich sulfosalt melt accumulations can form by this mechanism. When such a sulfosalt melt fractionates as it migrates, a spectrum of PGM would result.

# Noble gases in the sediment pore water as proxies for physical transport processes and past environmental conditions in Lake Van?

Y. TOMONAGA[1]*, M.S. BRENNWALD[1] AND R. KIPFER[1,2]

[1]Eawag, Swiss Federal Institute of Aquatic Science and Technology, CH-8600 Dübendorf, Switzerland (*correspondence: tomonaga@eawag.ch)

[2]Institute of Geochemistry and Petrology, Swiss Federal Institute of Technology (ETH), CH-8092 Zurich, Switzerland

Since many decades unconsolidated sediments in lakes and oceans have been proposed as a potential archive for noble-gas records to reconstruct past environmental conditions in lakes and oceans. In addition, the accumulation of non-atmospheric noble-gas isotopes allows tracing the geochemical origin and transport processes of the pore fluids. For instance, the abundance of terrigenic He isotopes reflects the residence time and transport dynamics of the pore fluids in the sediment. The $^3He/^4He$ ratio of terrigenic He can be used to constrain the geochemical origin of the pore fluids. However, methods for reliable noble-gas analysis in sediment pore water have been developed only recently.

Lake Van (Turkey) is one of the largest terminal lakes and the largest soda lake on Earth. The physical conditions of the lake are known to react sensitively to changes in the hydrological cycle and the environmental conditions of the lake catchment. Therefore the noble-gas records in the sediments of Lake Van have a great potential as an archive for palaeoenvironmental research. Also, the basin of Lake Van is situated in a tectonically active region characterized by the presence of major faults and volcanos. The lake is known to accumulate mantle fluids. Noble-gas isotopes are therefore useful to study the origin and transport processes of terrigenic fluids in the sediment pore space and their release into the water body.

In this study we present noble-gas data measured in the pore water of sediment samples collected in Lake Van. On the one hand, data from short cores taken at different sites throughout the lake basin will be discussed. Furthermore, we intend to present first results from the noble-gas samples taken from a 220 m long core during the 2010 ICDP drilling operations of the PALEOVAN project.