Generation of adakite: Melting of eclogite during exhumation of UHPM terrane

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Adakite magmas are generally thought to be produced by partial melting of subducting young oceanic crust [1]. However, thermal models predict that hydrated ocean crust in most modern subduction-zones at depths beneath volcanic arcs [2] is mostly old and too cold to melt. A number of models have therefore been proposed to explain the petrogenesis of adakite magmas.

The North Qaidam UHPM belt at the northern edge of the Tibetan Plateau is an Early Paleozoic continental-type subduction zone between the Qaidam block to the south and Qilian block to the north [3,4]. In the south Dulan sub-belt, the eclogite has been strongly overprinted by high-pressure granulite facies metamorphism at conditions of P = 1.86−2.0 GPa and T = 870-930°C [5]. The latter is characterzied by three kinds of veins and veinlets: (1) garnetite, (2) garnet-bearing felsic veins and (3) garnet-free felsic veins. A tonalite pluton is also exposed in the study area. The petrology and geochemistry shows that these felsic veins/veinlets and the tonalite pluton exhibit typical features of adakite. The garnetite and garnet-rich layers are most likely of cumulate origin from adakitic melts at a high pressure (1.8-2.0 GPa) and have excess abundances of Ti, Nb and Ta. Zircon SHRIMP U-Pb dating reveals that partial melting of the eclogite took place at 409-404 Ma, younger than the peak UHP metamorphic ages (~ 423-430 Ma). Slab break-off induced exhumation and partial melting of the eclogite at HP granulite facies is a plausible tectonic model for adakitic magma genesis.

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XAFS study of gold adsorption to *Bacillus subtilis* bacterial cells

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Bioaccumulation of gold by bacteria occurs in a range of natural environments. Therefore, it is important to investigate the adsorption reactions between bacteria and gold in order to understand the controls on gold distributions in geologic systems. Although a number of laboratory studies have investigated interactions between gold and metabolizing bacteria, no systematic study of the sorption of gold to non-metabolizing bacteria has been undertaken.

Batch adsorption experiments show almost completely irreversible uptake of gold from gold (III)-chloride solution by non-metabolizing gram-positive *Bacillus subtilis* bacterial cells. The extent of adsorption is greatest at low pH, and decreases with increasing pH. In order to determine the binding mechanisms, X-ray absorption fine structure (XAFS) experiments were conducted on two sets of gold - *B. subtilis* biomass samples with a fixed gold (III) concentration of 5 ppm: 1) samples with a bacterial concentration of 1.0 g/L (wet mass) at pH 2.98, 4.33, 5.22, and 5.90; and 2) samples with the same gold concentration, and a higher bacterial concentration of 7.0g/L (wet mass) at pH 4.56, 5.54, 6.14, and 6.55. The samples were quick-frozen with liquid nitrogen and kept frozen during XAFS measurement to minimize radiation damage from the beam.

Both XANES and EXAFS data indicate that more than 80% of the gold (III) atoms on the bacterial cell wall were reduced to gold (I) atoms. However, in contrast to what has been observed for Au (III) interaction with metabolizing cells, no gold (0) or Au-Au nearest neighbors were observed in our experimental systems. The EXAFS data suggest that although $[Au(Cl/OH)_4]^-$ complexes dominate the speciation of gold in solution, Au on the *B. subtilis* cell wall is characterized predominantly by binding of Au atoms to a mixture of amine/carboxyl and sulfhydryl functional groups, and the relative importance of the sulfhydryl groups increases with increasing pH values. The XAFS data provide a framework for interpreting the bulk adsorption experiments, and enhance our ability to account for the behavior of gold in bacteria-bearing geologic systems.