The role of dehydration of subducted serpentinites in the genesis of gold-rich magmatic-hydrothermal ore deposits

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We present a geochemical study of whole-rock concentrations of gold and other noble metals (Ir, Ru, Rh, Pt and Pd) in subducted serpentinites and their dehydration products, i.e. chlorite harzburgites, from Cerro del Almirez (southern Spain). The Cerro del Almirez massif exposes the arrested front of antigorite breakdown to olivine + orthopyroxene + chlorite in high-P subducted serpentinites, which is the most important reaction that generates fluids at intermediate depths in subduction zones. Hence, the concentrations of precious metals, including gold, in these rocks constitute a unique opportunity to evaluate the impact of serpentinization, subduction metamorphism and serpentinite dehydration on the metal budget of subducted mantle, and to constrain the role of serpentinite-derived fluids in the transfer of metals to the mantle wedge. We show that different Ca-S-Au correlations in the Almirez serpentinites are due to heterogeneous conditions of temperature and fO_2 during seafloor serpentinization. Platinum-group elements (PGE) were mostly immobile during serpentinization and reflect magmatic processes in the mantle (melting and melt-rock reaction) and sulfide incorporation from intercalated pyroxenites during subduction. Antigorite breakdown significantly partitioned gold into fluids, likely forming different complexes with sulfur able to travel to the mantle wedge. This provides a natural mechanism capable to endow gold in the mantle source of arc magmas. These relatively gold-rich magmas may be particularly appropriate to generate economic deposits of gold, such as epithermal deposits in southern Spain.