The sources of gold and associated elements in Carlin-type deposits, Northern Nevada, USA: Lithogeochemistry and mineral chemistry constraints

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Carlin-type deposits in northern Nevada, which provide ~ 9% of world gold production, are hosted mainly in hydrothermally altered Paleozoic impure carbonate rocks as well as in various types of Jurassic and Eocene intrusive rocks. The main auriferous event took place in the Eocene during the onset of the Basin and Range extension. Gold occurs in arsenian pyrite and is commonly associated with other elements such as Cu, Sb, Ni, Se, Hg, Tl, Ti, Zn, Ag, Co, Pb, and W. Despite the large gold endowment and more than 40 years of research, very little is known about the source of metals and fluids associated with Carlin-type gold deposits.

Our extensive lithogeochemistry and mineral chemistry investigation at the Goldstrike Property, which comprises the largest Carlin-type deposits, suggests that some of the sedimentary and intrusive rocks, and probably magmatic fluids exsolved from Eocene magmas, may have been sources for gold and some of the ore-related elements.

The Jurassic phlogopite lamprophyre dikes are interpreted to be one of the possible local sources of gold as their freshest samples have gold contents up to 40 ppb and comprise magmatic As-poor, Co-rich pyrite containing up to 100 ppm Au. Gold was neither detected in igneous pyrite in any of the other intrusive rocks, nor in pre-ore pyrite in the sedimentary rocks. Intriguingly, the magmatic pyrite in the Eocene porphyritic dikes is very poor in elements associated with the Carlin-ore when compared with data obtained from other units. These data, and the fact that these Eocene dikes are temporally and spatially associated with gold mineralization and emplaced at shallow levels, favor the hypothesis that gold and some elements associated with Carlin-ore were scavenged from the magma by magmatic fluids that exsolved during its early stage of crystallization. This process would have prevented the incoroporation of these ore-related elements in the magmatic sulfides. Furthermore, the sedimentary units, in particular those enriched in carbonic matter, are probably the most important local sources of Mo, Zn, Ni and Se and to a lesser extent of As, Cu, Hg and Sb, as their unaltered samples are commonly enriched in these elements.

EarthKin: An online geochemical kinetics database

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EarthKin is an online database designed as a repository for geochemical kinetics data. *EarthKin* is the only database of environmental kinetics that is currently online. The database was synthesized from the literature by personnel at the Center for Environmental Kinetics Analysis (CEKA) at Penn State University. The database is currently accessed and facilitated within *Chem$_X$Seer* (http://chemxseer.ist.psu.edu/), an online cyberinfrastructure that enables the use of chemical data online.

We envision that *EarthKin* will provide permanent global access to environmental kinetics data. *Chem$_X$Seer* will provide tools and utilities to invite researchers to both add and compare new this data to existing data. Currently, *EarthKin* contains primarily mineral dissolution kinetics data that has been compiled from papers in the literature, although we hope to add data for the rate of heterogeneous mineral-water reactions including cation exchange, precipitation, and bioreaction. We hope to continue to compile legacy data for inclusion in *EarthKin*, but we also hope to encourage scientists who are not currently affiliated with *EarthKin* to add new data to the database.