Gold deposition onto arsenian pyrite

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Arsenian pyrite is widely known for its dual role as an important host for "invisible" gold in ore deposits, and a major source of arsenic and heavy metal environmental pollution. Despite recent studies to characterize the structural position of nanoscopic gold [1] within arsenian pyrite, little is known about the atomic scale mechanisms that are responsible for uptake of Au and/or the associated release of As from the mineral.

Solution deposition of Au onto fine-grained arsenian pyrite surfaces has been investigated using *in situ* atomic force microscopy and X-ray photoelectron spectroscopy. The spatial distribution of Au correlates with As-enriched domains on the surface, similar to the positive correlations between Au and As content in pyrite grains [2].

Ab initio quantum mechanical methods were employed to describe possible reaction paths for the adsorption and reduction of Au^{3+} on arsenian pyrite surfaces, and for Au^{+1} substitution for $(Fe\text{-}S)^{+1}$ vacancies within pyrite and arsenian pyrite structures. Au incorporation energies were shown to be >1 eV more favorable for Au substitution into arsenian pyrite versus pure pyrite, depending on the As-Au atomic distance.

These results can be used to improve the understanding of how surface reactions contribute to the formation of precious metal ore deposits and control iron sulfide surface reactivity.

[1] Reich *et al.* (2005) *Geochimica et Cosmochimica Acta* **69**, 2781-2796. [2] Fleet, M. E. & Mumin, A. H., (1997) *American Mineralogist* **82**, 182-193.

Vegetation and climate variability in the Galapagos Islands over the last 2000 years: A high-resolution pollen record

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A fossil pollen record from El Junco Crater Lake on the island of San Cristobal within the Galapagos Islands, provides the first continuous high-resolution terrestrial paleoclimate record from within the El Nino-3 region. The record provides a c. 3-8 year resolution record of vegetation change around the crater. The limited flora of the Galapagos allows many pollen and spore types to be identified to genus or species level, e.g. *Scalesia, Darwiniothamnus, Alternanthera, Acalypha, Bursera graveolens,* and *Cyathea wetherbyana*. Some taxa such as Poaceae and *Psidium* show responses highly characteristic of human landuse, and may be taken as indicators of human activity. Also evident are pollen that have undoubtedly blown in from the Andes, e.g. Alnus, Podocarpus, and Hedyosmum; an influx that provides an index of trade-wind activity.

Major shifts in the fossil pollen record correspond to the onset (c. 1340 AD) of the Little Ice Age and also a dry period at the peak of that event (c. 1610-1690 AD). A turning point toward warmer and wetter climates is evident at c. 1800 in both the fossil pollen and diatom data sets recovered from these sediments. Strong changes associated with land clearance are evident from 1930 onwards. An intensification of warm, wet conditions is suggested by the expansion of *Bursera graveolens* after 1970. Wavelet analyses and time series analyses of pollen representation relative to sea-surface temperature are used to develop a chronology of ENSO variability since mediaeval times.