

The Environmental Legacy of California's Gold Rush: Arsenic and Mercury Contamination from Historic Mining

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California's mid-19th century gold (Au) rush produced incredible wealth and left a rich historical legacy. The contamination of water, sediment, and biota by Arsenic (As) and mercury (Hg) is part of the environmental legacy associated with historic mining in California.

Cinnabar (HgS) deposits were mined in the Coast Ranges. The Hg(0) produced on site was transported to the Sierra Nevada and used to extract Au by amalgamation. Hg(0) was lost from sluices and undercurrents at placer Au deposits mined by hydraulic and dredging methods and from stamp mills at low-sulfide Au-quartz deposits mined primarily by underground methods. Methylmercury, formed by microbial methylation of Hg(II), is a potent neurotoxin that biomagnifies up the food chain, creating health risks for consumers of high-trophic level fish.

Environmental As contamination in the Sierra Nevada is related primarily to mining of low-sulfide, Au-quartz vein deposits, which include arsenian pyrite and arsenopyrite. Oxidation of these phases produces inorganic As(III) and As(V), both known carcinogens. Pathways of human As exposure include ingestion through ground water and soil, and inhalation of As-rich particles from soils and mine wastes.

Synchrotron-based spectroscopic techniques have been vital in the study of the aforementioned environmental impacts. They have enabled *in situ*, trace-level identification of the chemical forms of Hg and As in diverse solids (e.g., mine wastes, fish tissue, human fingernails).

The environmental legacy of California's gold rush presents challenges to economic and social development in certain areas. Similar legacies exist worldwide, especially in areas of historic and modern artisanal Au and Hg mining.