

The Environmental Legacy of Gold, Mercury, and Asbestos Mining in California, USA: Evaluation of the Long-Term Impacts and How They Can be Mitigated

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Mining of the precious metal gold in California began shortly after Jan. 24, 1848, when James Marshall discovered gold flakes in the Southern Fork of the American River at Sutter's Mill in Coloma, CA. This discovery had a profound effect on the history of California and the US as a whole and resulted in an increase in the non-native population of the California territory from less than 1,000 to almost 300,000 by the end of 1849. During the estimated 7,000 years that gold has been mined on Earth, roughly 5,000,000,000 troy ounces of gold have been produced, with the western US state of Nevada responsible for about 3% of this total. The history of gold and mercury mining in California is intimately intertwined because of the use of liquid mercury to extract fine-grained gold from placer deposits. The geological origins of chrysotile asbestos and mercury are also related. I will briefly discuss the origins and mining history of gold, mercury, and chrysotile asbestos deposits in California and the environmental impacts of mining the gold and mercury deposits since the early 1850's and of the chrysotile asbestos deposits since 1917. A major focus will be on the environmental impacts of toxic elements such as arsenic, which is closely associated with the gold deposits, as well as the impacts of mercury and chrysotile asbestos on local ecosystems in the California Bay Area as well as on the global ecosystem. The global impact of mercury and chrysotile is caused by their atmospheric transport from point sources in California and other areas, which started long before the beginnings of civilization. I will also discuss molecular-level investigations my group and others have carried out on the speciation of mercury, the effects of molecular-level speciation on mercury transport and human health, the association of gold with metal sulfides, and characterization of chrysotile asbestos deposits in Central California, focusing on the possible presence of amphibole asbestos in these deposits and human health implications. In addition, I will discuss parallels between gold deposits in California and Nevada and that of the Paracatu Gold Mine in Minas Gerais, Brazil. Gold in these deposits is often intimately associated with arsenious pyrites and arsenopyrite, which helps explain the presence of harmful levels of arsenic in mine tailings and soils in gold mining areas. Finally, I will discuss measures currently being taken in California and Brazil to mitigate the environmental impacts of gold mining as well as the legacy mercury pollution in California associated with historic placer gold mining.