



## The Almadén district (Spain): Anatomy of one of the world's largest Hg-contaminated sites

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### Abstract

We present data from an early reconnaissance survey (stream sediments, soil, and water Hg chemistry; plants and water crustaceans Hg intake) of the Almadén district (central Spain), that was carried out to establish the potential environmental hazards derived from the anomalous mercury concentrations measured in this realm. The Almadén mercury district (~300 km<sup>2</sup>) can be regarded as the largest geochemical anomaly of mercury on Earth. The district includes a series of mercury mineral deposits, having in common a simple mineralogy (dominant cinnabar: HgS, and minor pyrite: FeS<sub>2</sub>). The ore deposits have been mined for more than 2000 years, and the main mine of the district (Almadén), has been active from Roman times to present day with almost no interruptions. The mercury distribution in soils of the district reveals the existence of high, and extremely high mercury values (up to 8889 µg g<sup>-1</sup>), whereas concentrations in stream sediments and waters reach exceptional values of up to 16,000 µg g<sup>-1</sup> and 11,200 ng l<sup>-1</sup> respectively. On the other hand, very high concentrations of methylmercury (MeHg) have been detected in calcines (up to 3100 ng g<sup>-1</sup>), sediments (0.32–82 ng g<sup>-1</sup>), and waters (0.040–30 ng l<sup>-1</sup>). Mercury gets incorporated to edible river crustaceans and plants. The red swamp crayfish *Procambarus clarkii*, has Hg concentrations of up to 9060 ng g<sup>-1</sup> (muscle) and 26,150 ng g<sup>-1</sup> (hepatopancreas). Regarding plants, the local wild asparagus (*Asparagus acutifolius*) yields values of up to 298 µg g<sup>-1</sup> Hg. Mercury also escapes to the atmosphere, and mineral deposits, together with metallurgical activities, generate strong anomalies of atmospheric Hg. The most important concentrations relate to the emissions from the Almadén metallurgical roaster, in the order of 14,000 ng Hg m<sup>-3</sup>. Additionally, large open pit operations also contribute to the district atmospheric pool of mercury, with high

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