

THE GIANT MERCURY DEPOSIT OF THE ALMADÉN SYNCLINE

SPAIN



UNESCO World Heritage Site

Cinnabar crystals on quartz from Almadén. (Photo: Luis Carcavilla Urquí).

THE LARGEST KNOWN MERCURY DEPOSIT IN THE EARTH AND WITH A LONGEST PRODUCTIVE HISTORY DATING BACK TO THE 3RD CENTURY BCE.

The exceptionality of this ore deposit lies in the unique geological characteristics that led to the high concentrations and large accumulations of mercury, which constitutes its own metallogenetic model (Saupé, 1990; Ortega Gironés and Hernández Sobrino, 1992; Palero-Fernández *et al.*, 2015). The mining and metallurgical complex, together with part of the rest of the mu-

seum facilities, currently constitute the Almadén Mining Park, which is open to the public since 2008. The park includes a Visitor Center, the Mining Interpretation Center, and the Mercury Museum. It offers tours in real tunnels in the 16th-century inner mine. Almadén is included into the World Heritage List.

SITE 076

GEOLOGICAL PERIOD	Upper Ordovician - Lower Silurian
LOCATION	Castilla-La Mancha, Spain. 38° 46' 30" N 004° 50' 30" W
MAIN GEOLOGICAL INTEREST	Mineralogy History of geosciences



General view of the town of Almadén, Spain, in the foreground are the mercury mining facilities located to the west of the town and in which the main shaft and their metallurgical fence stand out.

Geological Description

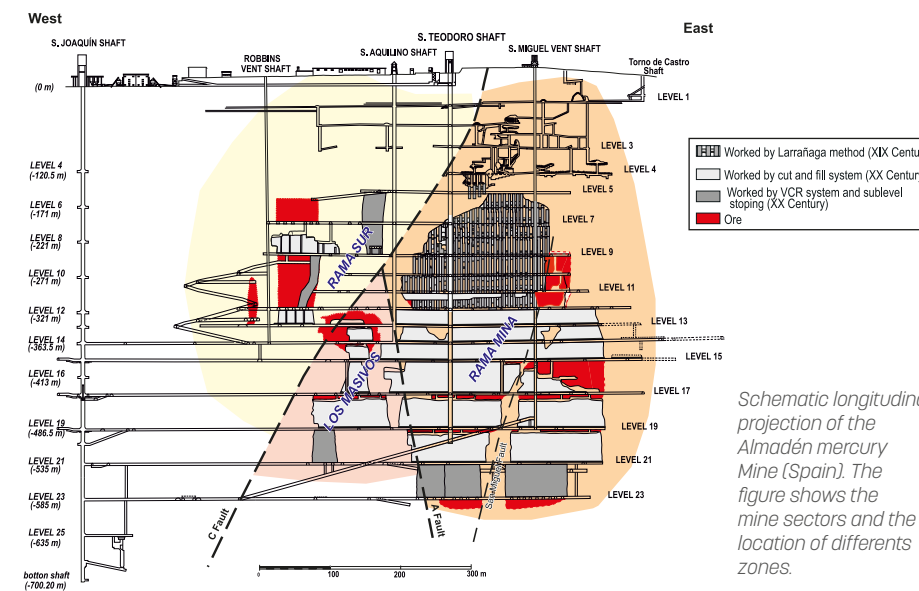
The giant Almadén mercury deposit is hosted in the Lower Silurian Criadero Quartzite; in turn this ore-bearing rock unit is cross-cut by the so-called Frailesca unit, a diatreme body of basaltic composition. The Almadén district is the largest mercury geochemical cluster on Earth, having produced one third of the total world mercury. It is a stratabound mineral deposit and is composed of three mineralized

levels in the "Cuarcita del Criadero". Formation that correlates with the Upper Ordovician to lower Silurian. The Silurian intraplate alkaline volcanism developed in submarine conditions, which triggered widespread hydrothermal activity resulting in Hg ore formation and pervasive alteration to carbonates.

The deposit consists of impregnated and in-filled joints with cinnabar in siliceous sand-

stone beds. It appears to be linked to the presence of explosive volcanic tuffs (Roca Frailesca). It is located on the southern limb of the Almadén syncline where it appears in a vertical position and with an E-W strike. In addition, the good outcrops of the mine tunnels allow excellent observations of the sedimentology, volcanic petrology, and Variscan tectonic structures, and are classic sites for fossil occurrences, particularly Silurian graptolites.

The Almadén deposit has mined out about 7,000,000 flasks (= 241.500 Tm) with an average grade of 3.5% Hg. This is about a third part of all the mercury consumed by humanity.



Schematic longitudinal projection of the Almadén mercury Mine (Spain). The figure shows the mine sectors and the location of different zones.

Scientific research and tradition

There are many studies of the Almadén ore deposit dating back in time. The mining history began some 2000 years ago when Romans use cinnabar as a vermilion red pigment (Hernández *et al.*, 1999). When the arabs invaded, they gave this locality its name of Almadén. However, the 'modern' history of Almadén and mercury begins in 1555 when Bartolomé de Medina discovered the use of mercury in silver processing (Higuera *et al.*, 2013).