Researchers estimate anthropogenic mercury emissions from 1500 to 1900

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Element mercury (Hg), liquid form. Credit: Wikipedia.

Mercury, toxic to humans, is the only known metallic element that is liquid at standard Earth temperature and pressure and therefore comprises a hazard to children because it is so cool. But many historic human activities have involved the use of mercury, including gold and silver mining, the production of the red pigment vermilion, felt production, and manufacture of mechanical pressure gauges, thermometers and other devices. One guy even made a mercury fountain for the Spanish Pavilion at the 1937 World Exhibition in Paris, now on display at the Fundació Joan Miró in Barcelona.

So much mercury has been used industrially for centuries that researchers have sought to account for legacy mercury, as the element can endure essentially forever in the environment, presenting a toxic hazard to humans and other life. Saul Guerrero and Larissa Schneider of the Australian National University have now constructed a comprehensive, country-by-country historical dataset on the pre-1900 global trade and production of mercury. Their study is published in the *Proceedings of the National Academy of Sciences*.

As primary sources, the authors raided records archived by governments, documents from local trade associations, cargoes by ship reported in newspapers, and other sources. They compiled data for the mercury market for each country as equivalent to the net import/export balance, including the fraction of domestically produced mercury that was not exported. The researchers compiled all of this data into what they call a "mercury source pool" that accounts for the total historic anthropogenic mercury within and outside the global mercury biogeochemical cycle. The result, say the authors, is a chronological and regional report with unprecedented detail that establishes boundaries on the environmental magnitude of legacy mercury.

The use of mercury evolved from 1500 to 1900, from a monopoly by silver refiners in the New World to a vast global market that

encompassed the western world, China and India. The authors note that a substantial amount of anthropogenic mercury before 1900 was removed from the global mercury biogeochemical cycle via chemical sequestration, either in industrial products like felt and vermilion or as an industrial byproduct in the form of calomel, a solid mercury chloride mineral, buried within a mineral matrix.

China alone accounts for 20% of the global mercury market in the 19th century, as both a consumer and exporter, which means that "a significant amount of mercury… was chemically sequestered as vermilion and thus would not be a part of the global mercury biogeochemical cycle." The authors argue that gold rushes, previously believed to be a major contributor to anthropogenic mercury deposits, do not account for a significant percentage, citing the unexpectedly low use of mercury by gold miners in Australia.

"Together with the fact that chemically sequestered mercury played a major role in the mass balance of pre-1900 anthropogenic mercury, it explains the absence of supporting evidence from natural archives for major pulses of mercury emissions in the late 19th century," they write.

They argue that previous overestimates of mercury emission from gold and silver mining failed to account for sequestered mercury in the form of calomel, and also conflated the processes for mining gold and silver, which differ. Additionally, previous models failed to account for major exports from California and China.

The authors note that more accurate future studies will require data for all alternate mercury global hotspots unrelated to precious metal mining and a better documented historical estimate of mercury losses at production sites.

More information: Saul Guerrero et al, The global roots of pre-1900

legacy mercury, *Proceedings of the National Academy of Sciences* (2023). DOI: 10.1073/pnas.2304059120