Mercury in mineral deposits in Poland

The Quicksilver Quandary

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The problem of mercury pollution in the environment has been a major area of interest for several decades, mainly due to the harmful effects caused by increased levels of Hg in the biosphere

Mercury and its compounds behave differently in the environment than other heavy metals: they are easily transported over long distances in the atmosphere, they are able to transform into more toxic methylmercury compounds, and they exhibit bioaccumulation in water trophic levels.

Environmental contamination

Anthropogenic sources of mercury in the environment include industrial processes that use the element or its compounds, as well as various Hg-containing products (such as anti-fouling paints, fluorescent lights, and mercury lamps). Mercury is predominantly released into the environment by industrial plants where raw or waste materials containing mercury are subjected to processing at high temperatures. One of the most important anthropogenic sources is the mass combustion of hard coal and lignite in electrical power stations, in other industrial plants, and for municipal purposes. Another factor currently contributing to environmental pollution with mercury is the use of amalgamation technology by large numbers of small-scale gold and silver prospectors in the southern hemisphere and China.

Mercury is a rare chalcophilic element extensively dispersed in the lithosphere, occurring in low quantities in rocks, usually falling in the 20-60 μg/kg range and rarely exceeding 100 μg/kg. It occurs in the lithosphere as oxides, sulfides, chlorides, organometallic compounds, and as a native metal. Of the over 60 known mercury ores, the most common is the bright-red cinnabar (HgS). Mercury is frequently present as admixtures in sulfides of other metals, such as sphalerite. In sphalerites that crystallize at low temperatures, mercury content may reach tenths of a percent.

Energy raw materials

In Poland's hard coal deposits, mercury occurs at levels ranging from a few to over 1000 μg/kg. Average mercury content in coal from the Lublin Coal Basin and the Upper Silesian Coal Basin is 105 μg/kg and 60 μg/kg respectively. The values are comparable with the average content in coal deposits found around the globe: 130-310 μg/kg for Brazilian coal, 30-330 μg/kg for US coal, and 30-490 μg/kg for Chinese coal. Mercury found in hard coal is mainly bound in the form of sulfides, although it may also be present as chlorides and calcite. Lignite is characterized by a higher mercury content – the average Hg content in Poland's lignite deposits is 322 μg/kg, four times greater than the average content in hard coal. The highest Hg content has been found in coal from Poland's Bełchatów deposits, reaching levels over 400 μg/kg. Similar mercury levels have been found in lignite deposits in the US (80-1120 μg/kg) and Greece (140-1210 μg/kg). Mercury is usually present in lignite as an admixture of iron sulfides.

Metal ores

In ore-bearing dolomites from the zinc and lead deposits in Pomorzany and Trzebionka, mercury is present in levels from a few to a few hundred μg/kg. Its average levels in the rocks of both deposits are 260 and 50 μg/kg respectively.

Grzegorz Barczyk

The rocks extracted from the Pomorzany zinc and lead ore mine have a mercury content of 260 micrograms per kilogram

Grzegorz Barczyk

Raw materials extracted in Poland in 2008 – such as from the huge Bełchatów Lignite Mine, pictured here – contained a grand total of 25.77 metric tons of mercury

This variation is due to the zoning of ore minerals. In ore-bearing dolomites, mercury is bound to sphalerites, galena and marcasite. In copper-bearing rocks, mercury content varies across a very wide range, from under a hundred μg/kg to tens of thousands μg/kg; in copper-bearing shale, its average content is 4615 μg/kg, in sandstones it reaches 255 μg/kg, while in dolomites it is as low as 173 μg/kg. In copper-bearing formations, mercury occurs as amalgams of silver or as admixtures, mainly in tennantite, chalcopyrite, sphalerite, and organic compounds.

Rock raw materials

Clay raw materials used in the production of building ceramics contain from a few to over 100 μg/kg of mercury, with average levels of 46 μg/kg. Tertiary clay formations (Miocene-Pliocene clays from Poznań, Krakowiec Miocene clays of marine origins, and Oligocene septarian clays) are marked by relatively high mercury levels. They are characterized by the presence of at times high content of iron minerals – pyrite, marcasite, hematite, goethite, and occasionally siderite – which are likely to bind mercury. In carbonate rocks, mercury occurs at levels up to several tens of μg/kg, although its average content in carbonate raw materials is very low at 7 μg/kg.

Poland's mercury balance

The mineral raw materials extracted in Poland in 2008 – hard coal, lignite, copper ores, lead and zinc ores, clays, and limestone – contained a total of approx. 25.77 metric tons of mercury, after adjusting the calculations for their average geometric content in individual types of materials. The largest share of extracted Hg was contained in lignite (67%), followed by copper ores (17%). Hard coal contributed around 10%, lead-zinc ores approx. 3%, while the total share of clay and carbonate raw materials was around 2%. ■

Further reading:

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