Mechanisms of mercury dispersion in the Idrija mercury mine surroundings through history

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Abstract: There were many different mechanisms of mercury dispersion in Idrija and its surroundings through history. The most important mercury sources at the time of ore processing were atmospheric emissions. Other sources were ore roasting in the woods of the neighbouring hills in 16th and 17th century, poor ore and smelting residue dumps, dumping of roasted ore residues into the Idrijca riverbed, accumulation of mercury in overbank sediments and outcrops of mineralised rocks.

Key words: mining, Idrija, mercury, atmospheric emissions, tailings, floodplains

INTRODUCTION

Mining and processing of mercury ore in one of the largest mercury deposits in the world – the Idrija mercury mine – left behind serious pollution in different environmental compartments.

RESULTS AND DISCUSSION

Before mining activities in Idrija had started, were mercury levels in the environment of Idrija hightened as a consequence of natural, geogenic conditions. The outcrop is very small (Fig. 1). Natural migration of mercury into the wider surroundings of the deposit is limited owing to impermeable Carboniferous clastites and tectonic zones filled with clay (ČAR, 1998).

The production of mercury in Idrija started in 1492 and was soon moved to the neighbouring forests. Because enormous quantities of timber were required by the mining works, forests in the nearby surroundings of Idrija soon disappeared. Consequently, the miners had to transport relatively small quantities of rich ore to various places in the surroundings of Idrija that were suitable for ore roasting. This way, mercury was brought far into the Idrija surrounding areas and later misled ore prospectors who accidentally found traces of mercury in creeks. Up to the middle of the 17th century, ore was roasted on the neighbouring hills (Pront, Pringl) and in more distant localities (Čekovnik, Kanomlja) (Fig. 2).

Figure 1. Outcrops of mineralized rocks

It should be stressed that the ignition of ore in piles gave a very poor yield and resulted in considerable losses. Because of high temperatures usually a third of retorts cracked during burning and mercury escaped from the vessels. Large quantities of broken pottery (up to 0.5 m) can be found at the localities where old smelters used to stand. The concentrations of Hg at those places are, of course, very high (up to 4000 mg/kg).

Figure 2. Ore roasting in the woods of the neighbouring hills in 16th and 17th century

Another sources of mercury pollution were mineralized rock dumps and especially smelting residues that still contain rather high amounts of mercury. Since 1652, when the first smelter in Idrija was built, the mercury rich side products of smelting have been deposited along the river (Fig. 3). The main reason for complex spatial distribution of roasting tailings in Idrija and its surroundings are changes in combustion technology over the centuries, continuously growing quantities of processed ore accompanied by decreasing mercury content and various methods of further treatment of ore residues.

From the environmental protection point of view, depositories of poor quality ore and remains from smelters, which contain large quantities of mercury, are equally important. In time, less and less mercury rich ore was excavated. In order to maintain mercury production on the same level larger and larger quantities of ore had to be excavated and larger smelter was needed. In 1867, a modern smelter was built on the right bank of the Idrijca River. New dumps of roasted ore occurred also on the right banks of the Idrijca River (ČAR, 1998).

Figure 3. Ore and smelting residue dumps

Figure 4. Atmospheric emissions impact

Through atmospheric emissions of the new big smelter chimney mercury was brought far into the Idrija surrounding areas. Smelting process produced gaseous and particulate matter emissions, which were the major cause of creating huge geochemical halo around the Idrija mercury mine (GOSAR & ŠAJN, 2003) (Fig. 4).

From 1868 to 1977 most roasting remains were dumped directly into the Idrijca River, which carried the material to the Soča River

and Adriatic Sea. For this reason, the river sediments have high mercury contents (GOSAR ET AL., 1997; BIESTER ET AL., 2000, GOSAR, 2003). During high waters, mercury rich material was deposited on the floodplains in the lower part of the Idrijca and Soča River valleys (Fig. 5). These sediments represent a large accumulation of mercury enriched sediments.

There was no decrease in mercury concentration in river sediments determined during the last 12 years (GOSAR, 2003), although the mercury production in Idrija stopped in 1995. That is most probably due to the presence of an unknown amount of tailings material containing high concentration of mercury that is deposited along the banks of the river. Significant amounts of that material are being transported downstream during every high water event.

Figure 5. Accumulation of mercury in overbank sediments

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