MERCURY DEGASSING RATE FROM MINERALIZED AREAS IN THE MEDITERRANEAN BASIN

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Abstract. Knowledge of the natural emissions of mercury in the Mediterranean basin, which has large cinnabar anomalies, has particular weight as these deposits could be an important source of atmospheric mercury. Data on the degassing rate of mercury from soils sampled both in mineralized areas (Mt. Amiata, Italy and Almaden, Spain) and rural areas are reported. Measurements were carried out ‘in situ’ using a transparent flux chamber and collecting the gaseous mercury on gold collectors. The highest values were observed in Almaden over the roasted cinnabar banks (up to 100 μg/m²/h) from past and present mining activity. In Italian rural areas the values of the volatilization rate of mercury are on the order of few ng/m²·h. The degassing rate was observed to be strongly dependent on the ambient temperature and not only seasonal but also daily variations were measured in all the studied areas.

Key words: Mercury, Atmosphere, Mine, Lidar

1. Introduction

The Mediterranean basin is characterized by the presence of a geological anomaly of large cinnabar deposits which are part of a mercury-containing belt that encircles the earth, passing through Turkey, Italy, Spain and Mexico (Figure 1). Approximately 65% of the world’s mercury resources are contained in the Mediterranean basin (Bernhard and Buffoni, 1982), which is a semi-closed sea. Some researchers consider the higher mercury levels observed in the pelagic fishes of the Mediterranean with respect to those of the Atlantic (Bernhard and Renzoni, 1977) a reflection of these mercury deposits.

Many papers (Bargagli et al., 1988; Edner et al., 1992; Ferrara et al., 1989; Fowler, 1986) describe the mercury concentration in the different abiotic and biotic compartments of the Mediterranean basin, but there is little data available on the mercury fluxes between compartments.

Several years ago we began a research project on the natural sources of atmospheric mercury in the Mediterranean, considering emissions from active volcanoes, geothermal areas and the soil degassing rate. The preliminary results, obtained by means of the Lidar technique developed by Lund University (Sweden) (Edner et al., 1987), estimated that mercury fluxes from some active volcanoes in the Mediterranean (Vulcano and Stromboli) are less than 2.5 kg/day and less than 24 kg/day, respectively.

The contribution of Etna (the largest volcano in the Mediterranean), based on an Hg/SO$_2$ ratio of $10^{-5}$ (Varekamp and Buseck, 1981), has been estimated at about 54 kg/day (Ferrara et al., 1990). These values, considerably lower than those observed for Hawaiian volcanoes (Siegel and Siegel, 1984), demonstrate that volcanic emissions in the Mediterranean do not represent an important source of atmospheric mercury.

Mercury fluxes linked to geothermal activity used for electric power production, measured in the Larderello area (one of the two known deposits of dry steam in the world) and in the mineralized area of Monte Amiata, constitute an important atmospheric mercury source only at the local level. The amount of mercury emitted into the atmosphere from a 20 MW power plant is about 0.5 kg/day (Edner et al., 1992).

The present research evaluated the mercury degassing rates over the soils of some particular areas (Spain – cinnabar deposits at Almaden; Italy – cinnabar deposits at Mt. Amiata and rural areas near Pisa) in order to establish the importance of this source of atmospheric mercury in the Mediterranean basin.

2. Experimental Procedures

Vapor-phase atmospheric mercury species were collected on gold traps, made with a quartz tube (length 15 cm, internal diameter 0.3 cm) containing a twisted strip of pure gold (0.8 g). Air was sucked through the trap at a flow rate of 0.5–1 L/min by means of a membrane pump, for a period of time ranging between 10 and 30 min. depending on the sampling site. The flow rate was regulated by a flow meter. The electrothermally desorbed mercury was determined with a