

Mass Balance of Mercury in a Natural Forested Amazonian Watershed (Serra do Navio, Amapá State, Brazil)

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High Hg levels found in the Brazilian Amazon environment have been attributed mainly to gold mining activities (Nriagu, 1992; Hylander, 1994). Forest fires also have been identified as an important Hg source (Veiga, 1994). However, recently high Hg concentrations have been found in fish and human tissues in regions where there are no known anthropogenic Hg sources (Forsberg, 1994; Fostier, 1997). These facts suggest a large variation in Hg background concentrations in the Amazonian region, and/or a transport of Hg throughout the Brazilian Amazonian region.

In the Amazonian region, naturally acidic rain, high air humidity, high temperature and high rainfall rates can modify processes regulating Hg biogeochemistry, accelerating its residence time in the environment (Lacerda, 1990). At Amapá State (northeastern Brazilian Amazon) as well as in other Amazonian regions, new gold mining fields are being opened while some older ones are still operated. All of them extract gold manually (garimpos) from quartzite mineral deposits, using the Hg amalgamation process to concentrate gold. This process releases Hg to the atmosphere due to careless amalgam burning in open facilities. Resulting Hg emissions contaminate the atmosphere, soils, sediments and biota in the surrounding area and over distances of kilometers (Guimarães, 1997; Fostier, 1997). There are only scarce background measurements of Hg concentration available for the Amazonian Region (mainly soils and river sediments), and studies focused on Hg mass balance in undisturbed areas of the Amazonian environment are missing. Such studies are required for better understanding of the Hg behaviour in this environment and for evaluating contamination risks for the regional population.

The aim of this work is to determine background Hg levels in a small catchment located within an undisturbed rainforest. Also, the total Hg budget is calculated for this area. To achieve these objectives, the total Hg content was determined in monthly samples of rainwater, throughfall and stream water collected during the 1996 wet period. The total catchment area is 164 ha; the headwaters are covered with undisturbed natural rainforest (34 ha), the area close to the outlet (34 ha) has suffered some disturbance due to Mn ore mining activities. The catchment area is located 100 km

from the nearest "garimpo". The mean weighted Hg concentration value for the stream water draining the undisturbed subcatchment was 1.52 ± 2.21 ng (of Hg) L⁻¹; for the waters sampled at the outlet (waters with the Mn mining influence) the mean value is higher, 17.9 ± 20.6 ng L⁻¹. Precipitation concentrations averaged 18.5 ± 28.8 ng L⁻¹. For the undisturbed area of the catchment, the results showed a positive input/output budget, indicating either that the Hg, as well as the other chemical species, is being recycled within the forest, or it is being retained by the soil system. When the disturbed area of the catchment was included, the input/output budget was zero, indicating a release of Hg from the system. Furthermore, the elevated concentrations of Hg found in rainfall water indicate that Hg originating from long-range transport may be washed out by rainwater, which could represent one important process of Hg deposition. The low stream water Hg concentration represents well background value for this region.

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