

**Total mercury distribution in the Bolivian tributaries of the Madeira River.
Importance of the biomagnification process in the aquatic food-chain**

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Mercury contamination from amalgamation of gold in small scale gold mining is an environmental problem of increasing concern, particularly in tropical regions like Amazon, where a new boom of such gold mining started in the 1970s. Results on the mercury concentration in two abiotic compartments (water and sediments) and two biotic compartments (fish and human hair) from the gold-mining areas of the Bolivian Amazon basin, are presented. Total mercury concentration range measured in surface waters of the upper Beni river basin vary from 2.24 - 2.57 ng l⁻¹ in glacial waters of the Zongo river, to 7.22 - 8.22 ng l⁻¹, in the Beni River at the end of the Andean piedmont. The highest mercury concentrations were not found in the rivers where the mining activities take place but at the outlet of the Andean sub-basins exploited for their alluvial gold.

Total mercury concentrations measured in sediments vary from 0.012 in the Beni river downstream to 0.244 µg Hg g⁻¹ in the Mapiri river. The quite low concentration of Hg in the sediments indicate a low sedimentary contamination due to the high particulate transport in the Beni river, especially in its Andean tributaries.

The mercury concentrations found in carnivorous fishes vary in the Beni River from 0.8 to 1.8 µg Hg g⁻¹, in the Mamore River, from 0.4 to 2.1 µg Hg g⁻¹, and in the Madeira River at its formation from 0.3 to 5.2 µg Hg g⁻¹. This results indicate, on one hand, that each of the carnivorous fishes collected is contaminated and on the other hand, that high mercury concentrations can nearly exceed 10 times the WHO (1976) safety limit. Although main gold-mining activities take place in the headwaters of the Beni river and at the confluence of the Mamore and Beni rivers, the Mamore ecosystem in the flood plain is also contaminated. This means that vapour mercury released in atmosphere during burning operations may be easily reoxidised, due to the high humidity, and deposited again by wet or dry precipitation in the plain. The mercury accumulated by carnivorous fishes is mainly present on its organic form ; methylmercury represents 70 to 100% of the total mercury analysed, confirming the methylation and the accumulation of Hg in the food chain. Thirty persons have been studied in all the Bolivian Amazonian basin ; seven of them present elevated levels (> 6 µg g⁻¹ ww, limit WHO for beginning poisoning). Our results show that the major health impact caused by mercury affects people who are not working directly in gold cooperatives but who have a regular fish diet.

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