

The purpose of this program is to carry out comprehensive research projects on representative ecosystems as well as on relevant human activity in the region in order to determine basic conditions required to harmonize environment and development.

The two main difficulties to obtain long term hydrogeochemical data in the Amazon Region are: 1) the lack of access to the sites to be studied and 2) infrastructure (Forti and Neal, 1992). These two difficulties were partially surpassed in a monitoring program that is being conducted in Northeastern Amazonia, 200 km north of the Amazon River mouth, Serra do Navio, State of Amapá (Fig. 1).

The objective of this program is an integrated study of the effects of mining activities on the chemical composition of the drainage waters and on the biogeochemical cycles. Within this program there are two projects going on, at the moment. The first one is studying the water chemistry in a controlled area of 164 ha where part of the area was altered due to Manganese ore exploitation. The main objective of this project is to study the recovery capacity of the area by comparing the hydrogeochemical processes in the natural area with those processes occurring within the altered area. The mined area is going to be recovered through a program of soil treatment, drainage normalization and reforestation. The second project, to be established in 1994, is going to study mainly the mercury cycling in areas of gold exploitation. The main objective is to measure the effects of this activity on humans and on different compartments (water, atmosphere, soil, plants, animals, etc) of a tropical rainforest environment.

These projects are being conducted as a collaborative research among the University of São Paulo State (Institute of Astronomy and Geophysics/ Nucleus for Research in Geochemistry and Geophysics of the Lithosphere) - IAG/NUPEGEL-USP, National Institute for Space Research (INPE) and Regional Institute for the Amapá Development (IRDA).

Preliminary results of the first project (one month during the wet season - April/1993), show that the waters are slightly acidic (pH between 5.4 and 6.9) and that alkalinity is being generated within the soil-soil water system. For this period a budget was done within the catchment and the results indicated that the input of chemical species was smaller than the output, therefore, indicating that the system was losing all considered species but chlorine, which was in equilibrium for this period (Fig. 2). The presence of Carbonates in these waters are neutralizing the Hydrogen ion; the mobile anions Nitrate and Sulphate, are carrying with them the cations through the soil waters. The weathering within this region have occurred upon Sulphide minerals in the manganese protore (Valarelli, 1967) which may explain the high content of sulphate in these drainage waters. But the sulphate is not acidifying these waters since the acidification is not a result of the Sulphur species oxidation. The species in solution are being originated mainly in the mined area of the basin, where, besides the mechanical erosion and normal losses due to the weathering and soil leaching, has not yet enough vegetation to prevent these losses. In the higher part of the basin the results indicate that most of the species are being retained by the forest system. This behaviour has been described extensively in the literature for other Amazon regions as a closed and tight nutrient cycle (Bruijzeel, 1990). A loss of Nitrate is observed in the natural forest area, probably because during the wet season it may not be totally absorbed by the vegetation; this Nitrate could be mobilizing the Magnesium that is also being lost by the forest. The output of the major cations can be attributed to two main factors: 1) within the mined area, where the vegetation is sparse and still not fixed, these species are being lost throughout the soil solution and 2) the high concentration of Sulphate and Nitrate in the soil solution, is mobilizing an equivalent amount of cations to maintain the electroneutrality.

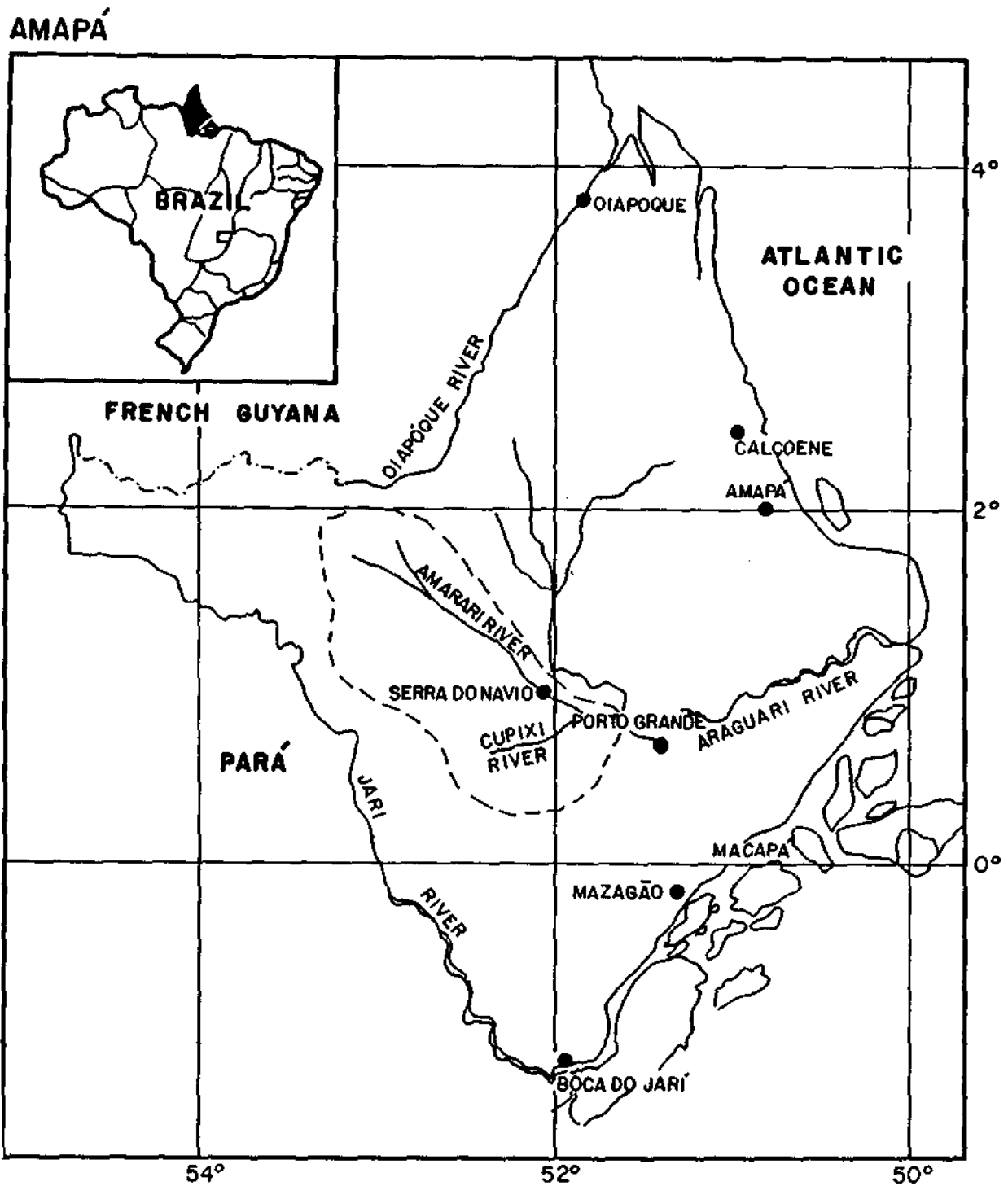


Figure 1. Location of measurement site in the State of Amapá.

Localização da estação de medidas no Estado do Amapá.

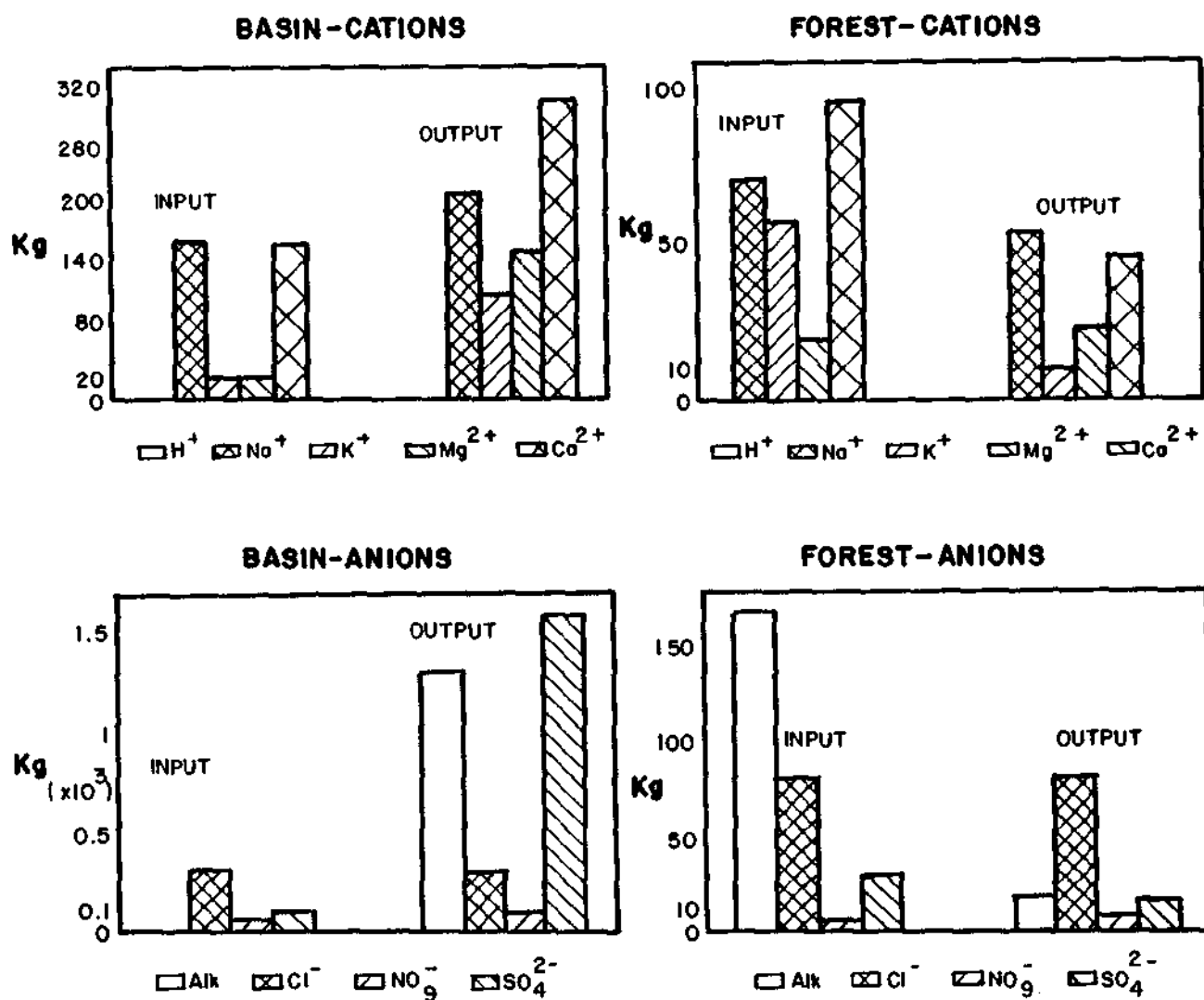


Figure 2. Major input and output of ions (in kg) for Pedra Preta basin, April 1993.

Entrada e saída de íons, em kg, para a bacia da Pedra Preta, abril de 1993.

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HYDROGEOCHEMISTRY STUDIES IN NORTHEASTERN AMAZONIA

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