Mining Pollution: the Case of the Baguio Mining District, the Philippines

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ABSTRACT / Environmental problems caused by improper mine tailings disposal in the Baguio district include pollution of the Lower Agno River system and its watershed and siltation of irrigation canals in the Pangasinan plains. Direct economic losses are from reduced agricultural production due to siltation of irrigation works and farmlands. To check the adverse ecological effects of improper mine tailings disposal, government regulations have been imposed on mining firms. Several disposal schemes have been proposed, including the use of the reservoir of a multipurpose project to be sited in the watershed where the mines are located. Because of siltation problems, however, trapping the tailings in the reservoir will diminish the economic benefits that can be derived from the project.

The Philippines is considered one of the world's highly mineralized countries in terms of minerals per unit area of land. For example, the country has the world's largest deposits of chromite and one of the richest nickel reserves. The total mineral reserves of the Philippines is estimated at 36.2 billion metric tons (MT), 66% of which is accounted for by nonmetallic ore reserves and the remaining 34% by metallic reserves (NEEP 1983). At present, most of the mining activities are concentrated in Luzon's Baguio Mining District, where metallic reserves such as gold, silver, and copper are the largest in the nation.

The mining industry has always been a major contributor to national economic growth and development. Its significance lies in its contribution to employment, capital accumulation, and foreign exchange earnings. For a developing Philippine economy, the mining sector is an indispensable source of funds to improve the country's balance of payments. Although it accounted for less than 2% of the net domestic product, the annual contribution of mining as a source of foreign exchange earnings was about 18% of the total receipts for the period of 1971–1984 (NEDA 1985). The majority of the Philippine mining share is derived from the exports of copper concentrates, gold, iron ore, and chrome ore.

While the industry has brought economic benefits, it has also taken its toll on the environment. In 1977, there were 39 mining firms dispersed along the major river basins of the Philippines. Of these, 24 mines were active mineral-producing firms generating 220,000 MT of raw ore daily. About 140,000 MT of mine tailings were being discharged daily into eight rivers, consequently damaging about 190,000 ha of farmlands (Villavicencio 1977). As the tailings are transported down the streams and rivers, the beds become shallower, leading to overflowing with consequent flooding of the outlying areas. The tailings accumulate at lower elevations and clog irrigation canals, ricefields, and reservoirs.

It has been recognized that pollution and siltation of main river systems within the immediate vicinity of mine sites of Baguio Mining District is due to improper disposal of mine tailings. This article discusses the problems and economic implications of mining pollution in the highly mineralized area in Baguio, the Philippines. Alternative mine waste disposal methods, including the use of the proposed reservoir of the San Roque Multipurpose Project as a dumping site, are also presented.

The Baguio Mining District

In an area of a few kilometers southeast of Baguio City in Luzon is a mining site which is drained by the Twin River, a tributary of the big Agno River. It lies in a mountainous region characterized by sharp edges and steep slopes. This area is collectively designated as the Baguio Mining District, which is considered as the most important and productive mining area in the Philippines (Figures 1–3). Several active mines and mine prospects are clustered along a north–south trending belt with an approximate area of 260 km².

The most common problems of the mines in the district is how to dispose of the mine tailings properly. After ore milling and concentration, the mines discharge the tailings into neighboring creeks; thus, downstream of the mines all streams are polluted to varying degrees. The total daily tonnage of discharged...
mine tailings is approximately 50,000 MT and is expected to increase in the coming years. This quantity, which flows into the Agno River and other nearby creeks, has caused a considerable amount of damage to the agricultural system and aquatic resources. Mine pollution in the area affects four river systems and hundreds of thousands of hectares of farms in the lowland areas of the provinces of Pangasinan, La Union, and Ilocos Sur (Table 1).

Philex Mines, the largest company operating in the district, started operation in 1958 and by 1983 had 3000 employees. The mine, which uses the block-caving mining method, has a remaining lifespan of 40 years. The tailings produced by this mine represent 90% of the total tailings volume produced within the Lower Agno River watershed and nearly 80% of the overall ore or tailing volume mined in the Baguio District. At present, Philex Mines' tailings are impounded in two company-constructed tailing dams that are being gradually built up on a right bank tributary of