AN ECONOMIC-ENVIRONMENTAL APPROACH TO THE CLAY MINING ACTIVITIES IN THE SANTA GERTRUDES CERAMIC POLE–SP, BRAZIL

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The Sector of ceramic tiles, in Brazil, had in 2003 a revenue of R $3,9 billion. 53% of this total is made through the dry route process. The evolution of the Brazilian Production of Ceramic Tiles, according to ANFACER, had an increment of 27,4% between 2000 and 2005, passing from 536,7 million square metres to 683,8 million square metres. It should be emphasized that the export of ceramic covering in this same period increased 149% (from 56,7 million square metres to 141,5 million m^2), indicating a gradual and successful incursion in a competitive market that demands better quality of the raw material, higher price levels, fully compensating the investments.

The Santa Gertrudes Pole has 42 plants, producing BIIb tiles, dry route, of red base, regular size, produced by fast single-firing process; 2 plants wet route of BIIb tiles, of clearer base, of regular size, produced by fast single firing; 3 plants for special pieces for details, by wet route; 2 plants of tiles craft extruded pieces, AIII, cotto type and 1 dry route plant that produces, in an intermittent way, ceramic tiles type BIa (porcellanato).

All the raw material (clay) that composes the base of the ceramic tiles originates from mines existing in the area, constituted of siltstones and shales of the Corumbataí Formation, of Upper Permian age. To supply the demand of mineral raw material, an increase was noticed in the measured reserves of clays for the ceramic industries at Santa Gertrudes Pole. From the year base of 1998 it increased from 30.772.691t to 46.260.945t in 1999, to 48.431.449t in 2000 and to 159.492.404t in 2001. This consumption has been pushing the search for new areas. According to the official data of the Brazilian National Department of Mineral Production (DNPM), in the year 2003 the Mining Register List presented 546 processes of Mineral Rights in the Santa Gertrudes Pole, 249 being for clay, 106 for refractory clay, 95 for sand, 34 for crushed stone, 30 for mineral water and 28 for limestones. For the mineral substance clay it was counted 28 Mining Concessions, 14, Application for Mining Concession, 142 of Research Authorizations, 43 Applications for Research and 12 Permits. This increment has not yet reached a definitive level. In the year 2004 the Santa Gertrudes industries of ceramic tiles used 4,5 million tons of clay.

Having in mind the advanced technology of ceramic tiles production and the short firing time, the ceramic mass that feeds the productive process should be uniform and of a constant quality. However, the clay production of the area has not yet achieved a stabilized mass as desired; therefore, although the exploitation is in frank expansion, investments have not been applied in the mining research and methods, occasioning serious environmental problems, susceptible of punishing by the competent Authorities.

The results obtained in two mines, analysed according to the Environmental Evaluation Matrix[5], are representative of the *modus operandi* of the mining companies operating in the area. The indexes demonstrate that the emission of particulates is the main pollutant effect in the mines, occurring in practically all the operations.

Of the stages of the mining production system for provisioning raw materials for the ceramic industry, the seasoning yard work used for drying and homogenization of the clay is to be noted, because it presents a great potential negative impact for the environment, mainly due to carrying solid material to the water bodies, provoking silting and turbidity problems. The loss of the soil from erosive processes includes the loss caused by the erosion of the pluvial waters, which develop furrows, as well as the wind erosion of those soils without vegetable covering.

The laminar hydric erosion, defined as homogeneous removal of a soil layer, is a form of common erosion in the seasoning yards. This erosion type is the most harmful, because it is less perceptible and, when it is noticed, the clay loss is already significant; it could cause additional costs to the production chain. The application of the Universal Equation of Loss of Soils has allowed an analysis of soil loss from erosion due to laminate, and has allowed estimating a loss of 862,4 t/ha.year of clay in the area.

In the case of the studied mines, the whole mined material is destined for the industrial process. The selection of the ore is made visually during the operation. The previous analysis of the available material at the mining fronts, as well as of the dust resulting from the drilling operations, would allow drawing up a better mining plan and, consequently, quantitative and qualitative gains. It would be possible to accomplish the mining plan in a more rational way, mixing, still in the mine, materials of different qualities to obtain a uniform blend. This could promote an increase in the life of the mines. In this sense, also the sequence of retreat of the ore should be considered. It is possible to optimize the operations and the time of permanence of the material on site. The formation of optimized homogeneous piles could contribute as an important control in the raw material characteristics and, as a consequence, reduce the constant modifications in the routine of the industrial operations, mainly in the maximum temperature of the kilns, which cause processing problems and losses.

Once a technically appropriate plan of actions has been made for the ores of the area, with, for instance, the implementation of mining procedures improvements, although just seeking the maintenance of the production of ceramic industries of the area, there will be improvements in the quality of the raw materials, as well as in the environment, providing the sustainable base for the development of the Pole, increasing its potential of competitiveness.

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