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CHALLENGES AND SOLUTIONS

Evaluation of the Environmental Contamination in the Region of the Caldas Uranium Mine - MG Due to the Presence of U and Th in Sediments, Rocks, Mine Wastes and Fertilizers

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INTRODUCTION

- Environmental contamination began when men started using agriculture to ensure the survival of the human race. However, as time went by, agriculture took new proportions.

- Mineral exploring showed its major evidence during the First Industrial Revolution, as mass production intensified mineral extraction to supply the increasing industrial activities. Practically, mining activities imply in vegetation suppression or the impediment of its regeneration.

INTRODUCTION

- Phosphates rocks are the main prime matter used in the production of phosphates fertilizers. The preoccupation concerning environmental contamination is related to the fertilizer production process, where most part of the metals remain in them. In addition, Pb, U, Th concentrations, as well as, decaying products, can be significant in the fertilizers.

- The Study Area is located in the Poços de Caldas Plateau, in the Poços de Caldas municipality, surrounding an area of 102 kilometers squared, including part of the Mining Treatment Unit (UTM-Caldas) from INB.

INTRODUCTION

- The Poços de Caldas Mining-Industrial Complex (CIPC) has highly contributed to the Brazilian Nuclear Program, more specifically, to the development of the Nuclear Fuel Cycle for the generation of electrical energy. At present, it is undergoing a decommissioning process that is being carried out by the Nuclear Energy National Commission (CNEN) and by the Brazilian Environmental Institute (IBAMA).

- Concerning soil occupation, besides the UTM-Caldas, the interest area has fields and pastures, vegetable cultivation, commercial rosarium, native forest, and mainly, nowadays forestry. It is important mentioning that, in general, these types of cultivations, especially, forestry, use significant amounts of phosphates fertilizers and agricultural correctives.

OBJECTIVE

- The main objective of this article is the investigation of environmental contamination levels through the determination of Uranium and Thorium concentrations present in samples of fertilizers, sediments from the bottom of rivers, mining waste and non weathered rocks collected in the study area.

METHODOLOGY

- Twenty nine sediment samples were collected from the bottom of the Consulta Creek, the Soberbo Stream and from the Taquari River, ten mining waste samples, two weathered rock samples and seven types of fertilizers used by agricultures in the region.

- The determination of U and Th concentrations present in the samples, took place in the Nuclear Energy Development Center (CDTN/CNEN) through the technique of neutronic activation analysis, using the methods of retarded neutrons and *k0*-AAN, respectively.

METHODOLOGY

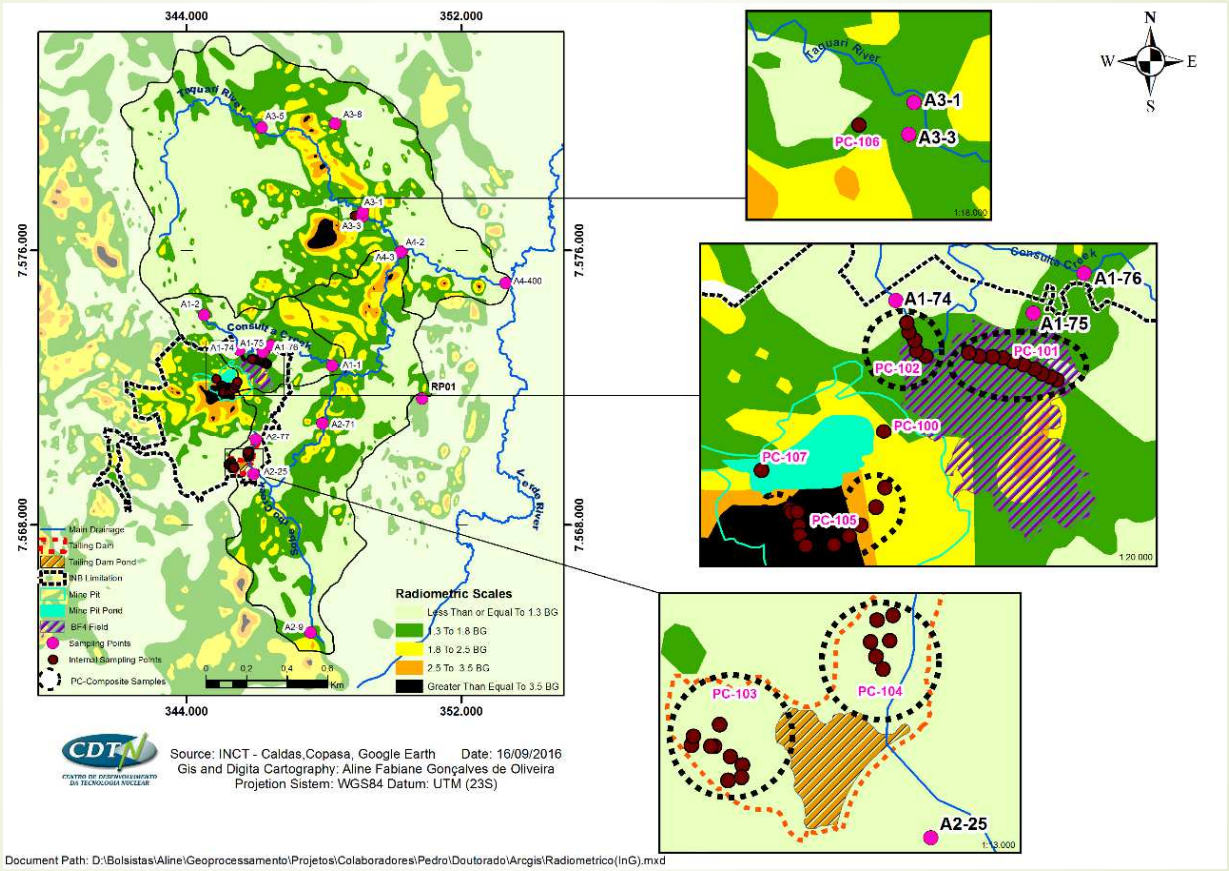

FIG1. Shows the location of the sediment and mining waste sampling points, as well as, the radioactive anomalies found in the region.

DISCUSSION

- By result analysis, it is possible to verify the presence of high Uranium concentrations in one of the mining waste samples (SCEXT08), which is a gneiss originated from the mining waste treatment process.

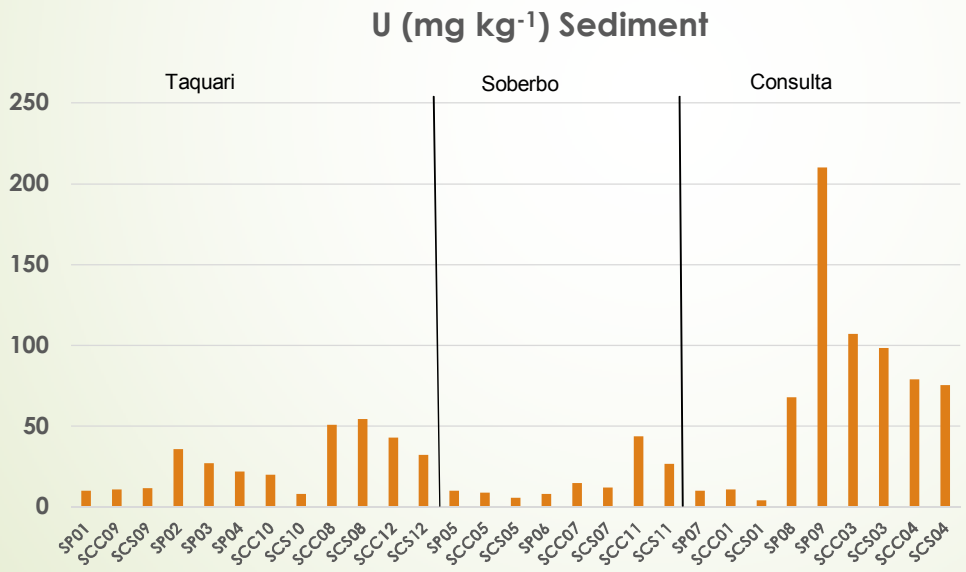

FIG. 2. U concentration in sediments.

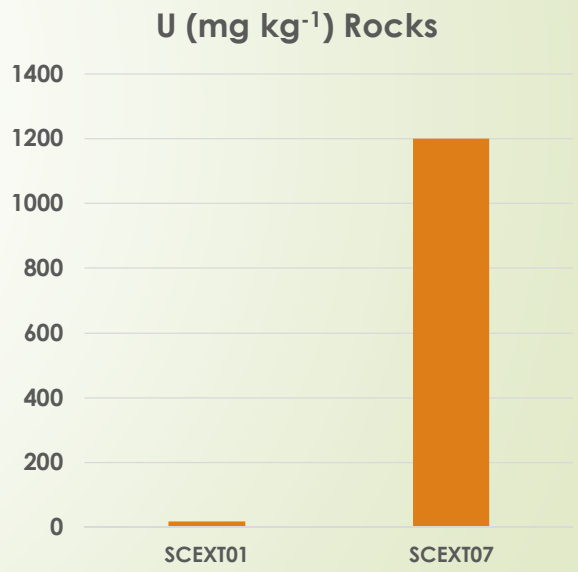

FIG. 3. U concentration in rocks.

DISCUSSION

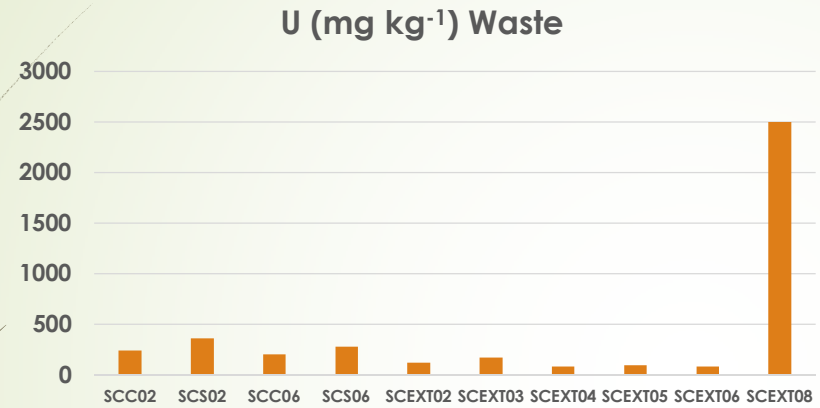

FIG. 4. U concentration in mining waste.

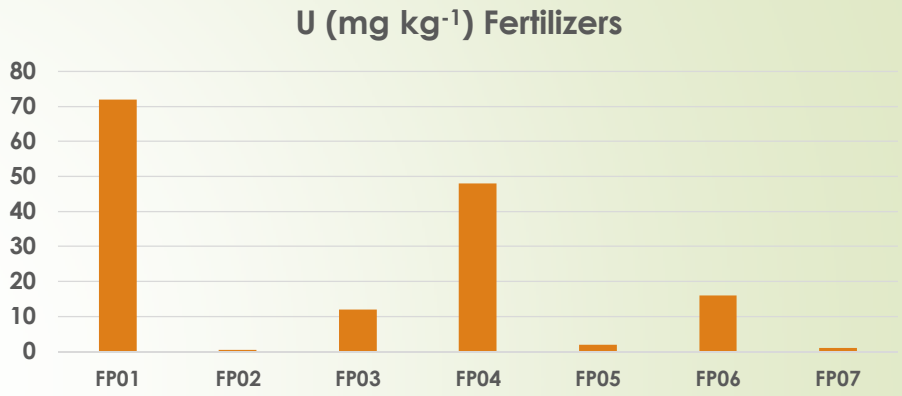

FIG. 5. U concentration in Fertilizers

- In sediments, it was observed, a higher U concentration in the samples collected in the right margin of the Consulta Creek (sample SP09), more specifically, within the UTM-Caldas facility. This result may be explained by the geological anomaly that originated the opening of the first Uranium Mine in Brazil, or even by the Uranium opening and extraction operation.
- The other points (SCC03, SCS03, SCC04 e CSS04), located just downstream the effluents discharge point of the Consulta Creek presented inferior results. Even though, they were much higher than the ones seen in other water bodies that did not suffer direct influence from the mine.

DISCUSSION

- However, it can be observed that the samples collected in the Nestor Figueiredo basin (SCS02/SCC02) were the ones that showed higher concentrations. It is worth noting, that this basin was constructed in order to retain waters that come from the mine's pile of steriles.

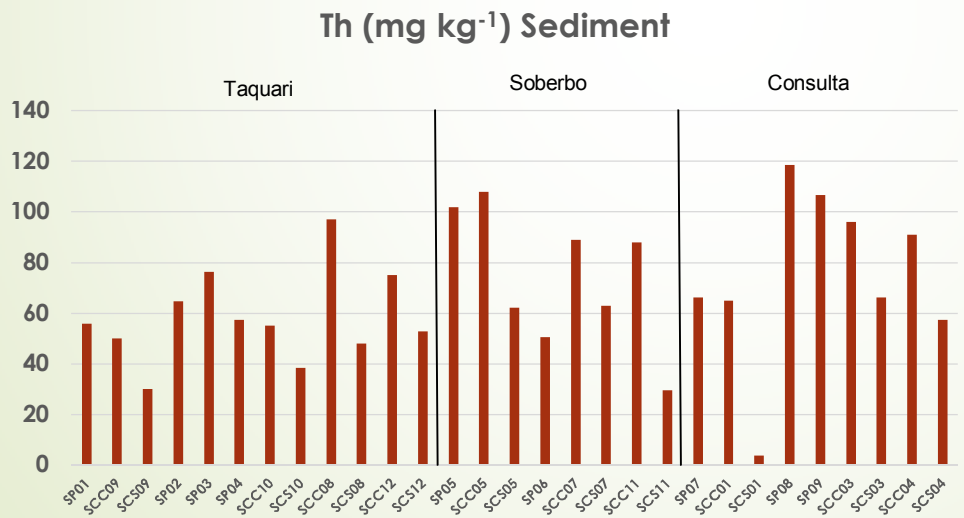

FIG. 6. Th concentration in sediments.

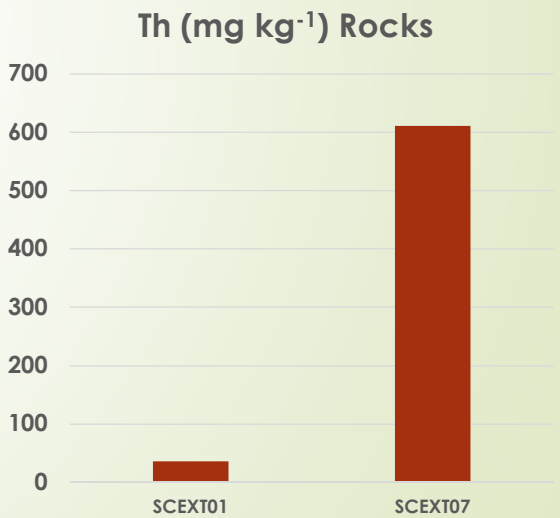

FIG. 7. Th concentration in rocks.

DISCUSSION

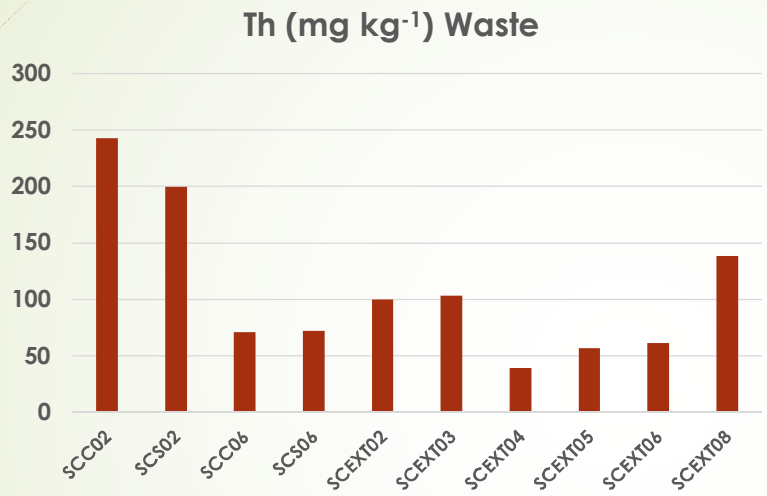

FIG. 8. Th concentration in mining waste.

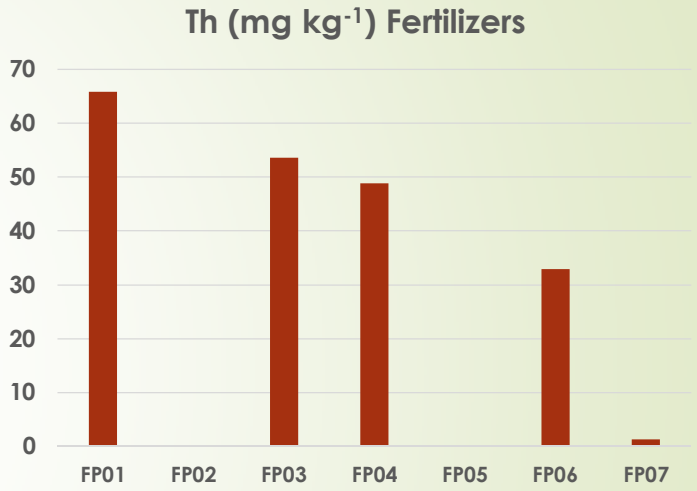

FIG. 9. Th concentration in fertilizers.

- Visually, the result analysis determined U and Th concentration present in the mining waste and fertilizer samples in order to correlate them with the ones found in the sediment samples. However, through this specific analysis, a concrete statement concerning Thorium behavior, was not possible, since this element, differently from Uranium, doesn't practically move in aqueous environments.

CONCLUSION

- The observed results indicated the presence of high U concentrations in the samples of sediments collected in the basin of the Consulta Creek, especially within the mine facility and just downstream of the effluent discharge points, demonstrating the influence of mining activities.

- Conclusive results were not found concerning the possible contamination potentials caused by Th sources, either anthropogenic or natural. Additional studies, using techniques for the determination of isotopic ratio Pb/Pb have been performed in order to obtain a more detailed knowledge about the geochemical behavior of these elements of the contamination source origin in the area.

THANKS!


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