EFFECTS OF URANIUM MINE EFFLUENTS (CALDAS, SOUTHEASTERN BRAZIL) ON THE AQUATIC BIOTA: STUDY ON THE PHYTOPLANKTON COMMUNITY

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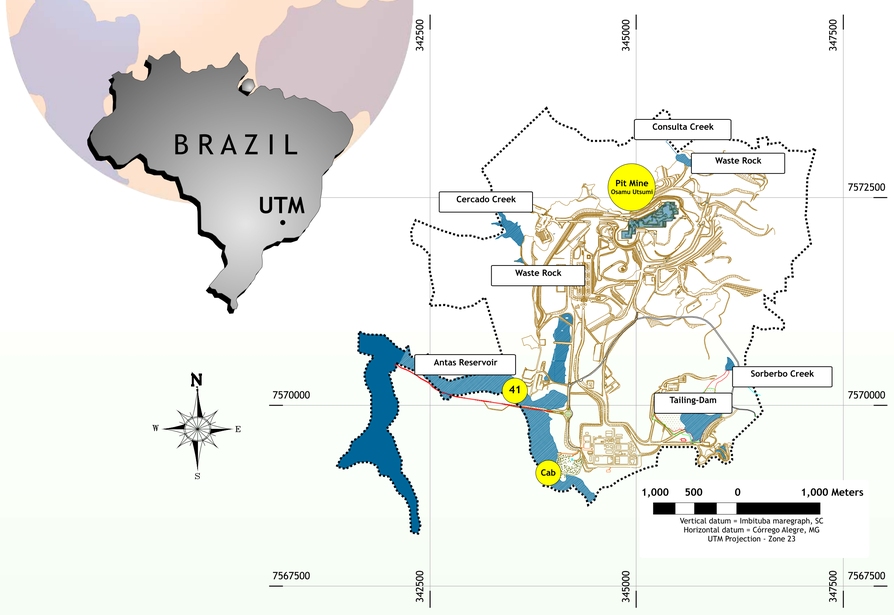
INTRODUCTION

The Osamu Utsumi uranium mine is located in the Poços de Caldas Plateu (state of Minas Gerais, Brazil). It is the first mine to extract uranium ore from Brazil, within the area of the Ore Processing Unit – Brazilian Nuclear Industries (UTM/INB). The Antas dam, located in the Plateau hydrographic network, in addition to supply of water for industrial processes, also receives treated effluent from the UTM/INB, from acidic drainage generated in the piles of mine tailings (waste rock) from low content uranium ore.

This study evaluated the composition and density of the phytoplankton community and physico-chemical variables in an area located within the facilities of the Ore Treatment Unit and also the Antas dam suffers influence from this nuclear installation.

METHODOLOGY



Sample Points - CM, Cab and 41

October, 2008, and January, 2009

Physical, Chemical and Biological Measurements

- Chlorophyll a
- Dissolved oxygen
- Electrical conductivity
- Hardness
- Oxi-reduction potential
- pH
- Sulphate
- Temperature
- Thorium
- Total organic nitrogen
- Total phosphorus
- Uranium

PHYTOPLANKTON

- Phytoplankton density
- Phytoplankton taxa

RESULTS

Phytoplanktonic taxa found in water from sampling points in this study

Class	Taxon	Point CM	Point Cab	Point 41
Cyanophyceae	*Chroococcus* sp			X
	Chroococcus minimus	X		
	Geitlerinema unigranulatum		X	X
	Limnothrix sp	X	X	X
	Células livres de *Microcystis*	X	X	X
	Microcystis	X		X
	Pseudanabaena spp.			X
Chlorophyceae	*Crucigenia tetrapedia*			X
	Golenkinia radiata		X	X
	Chlamydomonas sp.			X
	Cylindrocystis sp.	X		
	Desmodesmus sp		X	
	Dictyosphaerium pulchellum	X		
	Monoraphidium irregulare			X
	Scenedesmus opoliensis			X
Euglenophyceae	*Trachelomonas volvocina*	X	X	X
	Trachelomonas sp.	X	X	X
Bacillariophyceae	*Euglena* sp.	X		
	Eunotia sp.	X	X	X
	Fragilaria spp.		X	X
	Navicula spp.	X	X	X
	Pinnularia sp	X		
Zygnematophyceae	*Closterium* sp.	X	X	X
	Cosmarium sp.		X	
	Mougeotia sp.	X	X	X
	Spondylosium sp.		X	
	Staurastrum sp.			X
	Staurodesmus sp.		X	X
	Sphaerozosma sp.			X
	Staurodesmus sp.		X	
Chrysophyceae	*Dynobryon sertularia*			X
	Mallomonas sp.		X	
Dinophyceae	*Peridinium* sp.		X	X
Cryptophyceae	*Cryptomonas* sp.	X	X	X
TOTAL		15	19	24

Average values and standard deviation of physical, chemical and biological variables analyzed in water samples from the UTM/INB, Caldas, MG

Variables	Point CM	Point Cab	Point 41
pH	3.9 ± 0.28	6.65 ± 0.07	6.95 ± 0.35
Temperature (^oC)	24 ± 1.34	23.4 ± 2.05	23.6 ± 2.33
Dissolved oxygen ($mg.L^{-1}$)	6.95 ± 0.21	7.15 ± 0.07	7.10 ± 0.14
Oxi-reduction potential (mV)	475.75 ± 57	285.8 ± 2	224.75 ± 58
Conductivity ($\mu S.cm^{-1}$)	2415 ± 261	269.65 ± 321	422.25 ± 484
Hardness ($mg.L^{-1}$)	1309.40 ± 126	115.75 ± 107.55	163.20 ± 210
Sulfate ($mg.L^{-1}$)	1743 ± 127	110.11 ± 152.45	165.67 ± 197
Uranium ($mg.L^{-1}$)	3.71 ± 0.76	<0.05	<0.05
Thorium ($mg.L^{-1}$)	0.10 ± 0.01	<0.05	<0.05
Total organic nitrogen ($\mu g.L^{-1}$)	725 ± 49	875 ± 149	770 ± 99
Total phosphorus ($\mu g.L^{-1}$)	7.98 ± 3.36	7.70 ± 9.48	6.70 ± 6.36
Chlorophyll a ($\mu g.L^{-1}$)	5 ± 7.03	0.63 ± 0.46	0.47 ± 0.16

Average value of phytoplankton densities

CONCLUSION

In samples from the point Cab high values of density were verified for most phytoplanktonic classes identified, and the lowest values of hardness, sulfate, and conductivity. Moreover, in point CM, the environmental conditions found (low pH, high concentrations of sulfate, uranium and thorium) were not in favor of maintaining the high density of individuals of the phytoplankton community. Discharge of the treated mining effluent in point 41 could be contributing to the lowest values of density of phytoplanktonic organisms in that location compared to the results obtained in point Cab.

SUPPORT

FAPEMIG Fundação de Amparo à Pesquisa do Estado de Minas Gerais
CNEN Comissão Nacional de Energia Nuclear

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