



REDUCTIVE DISSOLUTION OF IRON MINERALS IN THE SEDIMENTS OF PARAOPEBA RIVER – ROLES OF ORGANIC MATTER AND INDIGENOUS MICROORGANISMS

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On January 2019, Paraopeba River was subject to a major environmental disaster after the failing of a tailings dam in Córrego do Feijão Mine (Brumadinho, MG, Brazil). The tailings covered the bottom sediments, and increased the concentrations of Fe, Mn and other potentially toxic elements (PTEs) in the water. To access the roles of indigenous microorganisms and organic matter on the release of Fe and PTEs from minerals in bottom sediments, we assembled anoxic microcosms with sediments and water from Paraopeba River and amended them with Na acetate 6.8 and 34g.L⁻¹, glucose 3 and 15g.L⁻¹, or yeast extract 4 and 20g.L⁻¹. Control microcosms contained no amendments (living controls), or were amended with glucose but were sterilized. All microcosms except the sterile ones showed increase in Fe(II) concentrations with time. Microcosms with Na acetate were similar to the living controls, whereas those with yeast extract and specially those with glucose showed marked increases in Fe(II) concentrations as compared to the controls. The higher the concentrations of yeast extract and glucose added to the microcosms, the higher the concentrations of Fe and trace elements in the water. After 28 days, Fe(II) concentrations were 1765-2798mg.L⁻¹ in the microcosms amended with glucose 15g.L⁻¹, whereas the Mn concentrations were 72-125mg.L⁻¹, Ba 7.37-11.7mg.L⁻¹, Al 1.47-2.61mg.L⁻¹, Zn 0.71-2.68mg.L⁻¹, Co 0.67-0.84mg.L⁻¹, and Ni 0.23-0.51mg.L⁻¹. All of these metal concentrations were much higher than those considered suitable by Brazilian regulations. These results point to the role of anaerobic, heterotrophic microorganisms indigenous from river sediments in the reduction of Fe(III) to Fe(II), leading to mineral dissolution and release of Fe(II) and PTEs. Organic matter fuel these microorganisms, implying and the need to control the inputs of organic matter to Paraopeba River. This work provides a mechanism for the release of Fe and PTEs from Fe minerals in river sediments.



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