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Who to blame for groundwater fluoride anomaly in São Paulo, Brazil? Hydrogeochemistry and isotopic evidence

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ABSTRACT

Fluoride concentrations up to 10 $mg.L^{-1}$ have been described in the groundwater of the biggest South American City, São Paulo, Brazil. Possible suspects were minerals in crystalline or sedimentary rocks, or industrial activities. Hydrochemistry tools pointed that the fluoride occurrence has positive correlation with Na and HCO_3^- concentrations and negative correlation with Ca^{2+}. The saturation index are negative for fluorite in all samples, but samples with high fluoride content have calcite saturation index close to zero, indicating the precipitation of calcite maybe a mechanism that is taking out the Ca^{+2} and enhancing fluorite dissolution. Samples with fluoride concentrations >1.5 $mg.L^{-1}$ are related to samples more depleted in H and O heavier isotopes and deeper groundwater flow with higher temperature. This anomaly is probably associated with fluorite dissolution, present in a fault system with an ancient hydrothermal activity, with deep circulation of groundwater flows in the crystalline basement rocks.

Keywords: fluoride, stable isotopes, crystalline rocks, deep groundwater systems, fractured aquifer

1 INTRODUCTION