Assessment of groundwater isotopic variations in a uranium mining site

V. P., de Araújo[1], G. A. N., Sobrinho[2], L. D., Freitas[2], M. R., Franklin[2]
e-mail: valeska@ien.gov.br , mariza@ird.gov.br

[1] *SETMQ, IEN*
[2] *DIRAD, IRD*

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This report presents an assessment on the stable isotopes (Deuterium (^{2}H) and Oxygen-18 (^{18}O)) variation of in groundwater to investigate its dynamics and mixing of water sources as part of initial efforts to characterize the hydrogeology of a basin under a uranium mining influence, for future contamination and recharge studies.
The Caetité Experimental Basin (CEB), located in the semi-arid region of Northeastern Brazil (Figure 1), faces not only the challenges associated with water scarcity but also the potential contamination processes due to mining activity. The only active uranium production center in Brazil (URA) is located in this watershed [1] and the sustainability of mining and milling operations, as well as the survival of the local community, is highly dependent on the availability of groundwater resources. Measurements of δ^2H and δ^{18}O were carried out in water samples from 27 wells. A total of 98 groundwater samples were analyzed during the dry and wet seasons from 2012 to 2014.

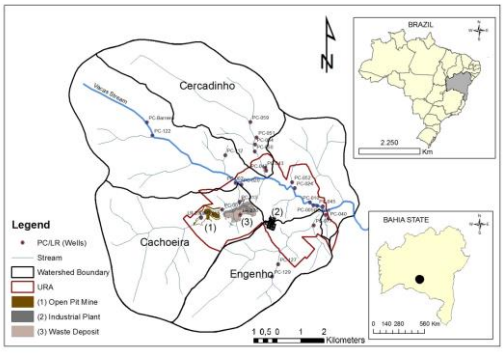

Figure 1. Location of the Caetité Experimental Basin (CEB), showing the groundwater sampling points and the main source terms of the installation (open-pit mine, waste deposit, and the industrial plant).

Figure 4 shows the comparison made between the data obtained for δ^2H and δ^{18}O in the groundwater samples with the Global (GMWL) and Brasilia (BMWL) Meteoric Water Lines.

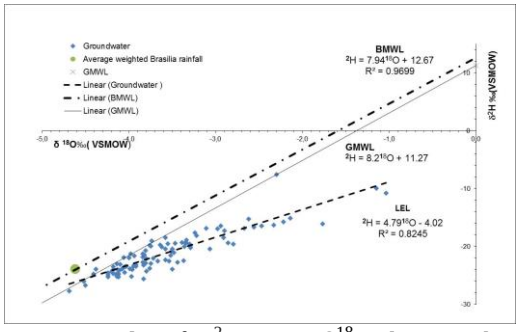

Figure 2. Plot of δ^2H versus δ^{18}O showing the groundwater samples, compared to the BMWL and GMWL.

All the groundwater samples plotted below the local meteoric line toward more enriched δ^{18}O values, an indicative of evaporation process. ^{2}H and ^{18}O data suggests that the main source of groundwater recharge is local precipitation and there is no mixing of infiltrating rainwater with older groundwater. These results provide evidence that the aquifer system in the CEB has a relatively fast turnover time, which contribute to the vulnerability of the aquifer to contamination. These findings are corroborated by the low TDS and EC values indicative of short time in water-rock interaction [2].

References

[1] GOMIERO, L. A.; MATOS, E. C.; RODRIGUEZ, P. C. Produção de concentrado de urânio em Caetité e BA. In: ENCONTRO NACIONAL DE TRATAMENTO DE MINÉRIOS E METALURGIA EXTRATIVA, 20., 2004, Florianópolis. **Anais...** Santa Catarina: UNESC, 2004. p. 399-406,

[2] ARAÚJO, V. P. et. al. Groundwater isotopic variations in a uranium mining site: subsidies for contamination studies. **Brazilian Journal of radiation Sciences**, Rio de Janeiro, v.5, n. 2, p. 1-23, 2017.