# Origin, mobility, and temporal evolution of arsenic from a low-contaminated catchment in Alpine crystalline rocks

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**Introduction**

The reduction of the limit for As concentration in drinking water from 50 to 10 µg/l led many resource manager to deal with expensive treatments. In the case of arsenic levels around the limit, knowing its origin and temporal evolution is of great importance. Here, a study case from an alpine basin is presented.

**Results**

Arsenic speciation, isotopic compositions of pyrites, sulfate and water, and major and trace element concentrations indicate a geogenic source of arsenic due to the dissolution of pyrite. New tools are provided to study As in water: $\delta^{34}S_{SO4}$ and [As] are negatively correlated, $\delta^{18}O_{SO4}$ and $[As^{V}]/[As^{III}]$ are correlated. A monthly monitoring of [As] in some springs started in 2005 and shows an increase of [As] compared with scattered data from 1998-2002. A 3-year monitoring at high resolution demonstrated that drought conditions enhance pyrite dissolution. The 2003 summer heat wawe had a major effect. The increase in [As] between years 1998-2002 and 2005-2011 may result from the effects of droughts.

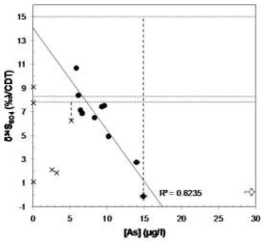

**Figure 1 :** Arsenic concentrations correlate negatively with $\delta^{34}S$ of dissolved sulfates. Larger As mobilization is linked with larger S-isotope fractionation resulting from larger pyrite dissolution.

**Conclusions**

$As^{V}$ is the major arsenic species in the form $HAsO_4^{2-}$ but As originates in a more reducing environment than measured. The increase of fractionation factors leads to a negative correlation between $\delta^{34}S_{SO4}$ versus [As] and oxygen isotopes show that pyrite dissolution appears in anaerobic conditions.Temporal evolution shows that pyrite dissolution is enhanced by droughts.

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# The Itaju do Colônia Sodalite Litchfieldite Stock, NE Brazil

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## General Aspects

The Itaju do Colônia sodalite litchfieldite stock is located in the South Bahia Alkaline Province (SBAP) in the São Francisco Craton, NE Brazil. It is an approximatelly 3 km$^2$ ellipsoidal intrusive body that cuts the Archean–Paleoproterozoic granulitic basement of the Itabuna Belt. SBAP is the unique Brazilian source of the blue sodalitites, and Itaju do Colônia is the most important of them.

## Lithogeochemical and Isotopic Data

The crystallization age for these rocks is 732 ± 8 Ma (U–Pb titanite). Diverse types of syenites with variable amounts of blue sodalite constitute this massif. The contacts between syenites and granulitic rocks are sharp, and dykes and pegmatites of syenitic composition are common in those areas. In the Eastern area, a layer of massive blue sodalite (sodalitite) 6-8 m wide occurs. Nearby, the transition between sodalite–nepheline syenites and granulites show interrelated metric apophises of calcite, phlogopitite and carbonatite, in which xenoliths of blue sodalite are common. Flux structures and contact relationship suggest the coexistence of three (3) distinct magmas, that seem to be coeval in this stock: (i) Cl-rich phonolitic, (ii) thomsonite-bearing carbonatitic, and (iii) ultrafemic-ultrapotassic (calcite phlogopititic). The blue syenites show a wide range of textures and sodalite contents. They consist of sodalite, perthitic alkali feldspar, aegirine, nepheline, albite, cancrinite, annite and paragonite; the accessory minerals include calcite, zircon, titanite, apatite, and magnetite. Late fractures are filled with white minerals identified by X-ray diffractometry as natrolite, ferrihydrite, manganosite, halite, gonnardite, halloysite and "chloromagnesite". Lithogeochemical data show that these syenites are strongly fractionated ($53 < SiO_2 < 61$), have high contents of alkalis ($14 < Na_2O+K_2O < 20$); $1.5 < Na_2O/K_2O < 4.2$; and $19 < Al_2O_3 < 25$. These are peralkaline rocks with elevated amounts of chloride (Cl up to 3%), Zr (up to 20,000 ppm), Nb (up to 160 ppm), Y (up to 70 ppm), Th (up to 50 ppm) and Pb (up to 18 ppm). The REE patterns are flat, 10 to 100 times richer than chondrites, and show a strong negative anomaly in Eu.

## Concluding Remarks

The new data show that the crystallization of the Itaju do Colônia syenites resulted from a magmatic system in which Cl-rich phonolitic, carbonatitic and ultrafemic-ultrapotassic magmas have developed late and bear complex relationships. *Acknowledgments: This work was supported by CNPq, CBPM and FAPITEC.*