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## Geochemical modelling of arsenic release into the crystalline aquifers: preliminary study

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Arsenic (As) is a toxic element present in different natural systems. The aqueous As species and their concentrations in natural waters depend on a variety of parameters, including the presence of natural source and the local geochemical conditions. The primary source of As in natural waters is the oxidation of mineral sulphides like arsenopyrite (FeAsS) and As-rich pyrite (FeS<sub>2</sub>) [1]. The trivalent iron (Fe<sup>3+</sup>) can act as oxidant for pyrite oxidative dissolution together with dissolved oxygen. In this work the attention is focused in As-contaminated area of the Calabria Region (Southern Italy). The high arsenic concentration is a peculiar characteristic of the shallow groundwaters circulating in a limited area of the Calabria region, which represents an unexplored mineralized area. Indeed, although pyrite is widely present in the crystalline rocks, its spatial distribution is highly variable and not predictable [2]. Generally, the As content of the studied granite rocks is within the normal global range but the presence of not-surfacing, hydrothermally-altered granites, could be the cause of As contamination in limited areas. In order to explain the As-rich groundwaters occurring into crystalline aquifer, a reaction path modelling of granite dissolution was performed by using EQ3/6 software package version 8a. The dissolving granite was considered to be constituted by quartz, two types of plagioclase (representing the rim and the core of the mineral), K-feldspar, biotite, muscovite, chlorite, epidote, fluorapatite and pyrite. The considered value of pyrite content and its As concentration fall within the global estimations [3]. Two simulations were performed allowing the precipitation of moganite, gibbsite, kaolinite, illite-py and the calcite-rich solid solution of trigonal carbonate. Moreover, two oxy-hydroxide solid solutions composed of amorphous Fe(OH)<sub>3</sub> - amorphous ferric arsenate and 2 lines-ferrihydrite - scorodite were precipitated in two separate runs to evaluate their effects on dissolved As. Nine water samples were used to fix the boundary conditions as well as to validate the outcomes of geochemical modeling. The arsenic concentration detected ranging from 25 to 435 µg/L. The theoretical trend involving the precipitation of amorphous Fe(OH)<sub>3</sub> is in agreement with the groundwaters richest in As, because a higher amount of pyrite is dissolved due to a greater availability of trivalent Fe in the aqueous solution, which is caused by the higher solubility of amorphous Fe(OH)<sub>3</sub> compared to 2-line ferrihydrite. The analytical data of the As-rich groundwaters, as a whole, are well explained by the performed simulations, suggesting that these processes control the release and fate of arsenic during the water-rock interaction.

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