FORMATION OF AN AS-RICH FERRIHYDRITE DEPOSIT. IMPLICATION OF NATURAL WEATHERING FOR A LOCAL RIVER (SW FRANCE).

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ferrihydrite arsenic crystal chemistry gold mining

Numerous studies have investigated the behavior of heavy metal contaminants in soils and sediments of industrial, agricultural and mining areas. Usually, Fe oxy-hydroxides, present in these contexts, show a strong affinity with trace elements (TE) and the potential dissolution of these materials by weathering and/or chemical variations may release high amounts of TE into waters. The studied area is located in the flood plain area of the Manaurie river (St-Yrieix auriferous District, France), downstream of an open pit along the Bourneix gold bearing quartz vein (54000 tons of ore mined from 1986 to 1990). Mining activities favored groundwater circulation leaching of pyrite and arsenopyrite deposits remaining in the quartz vein. A freshly precipitated ochreous deposit covers the area of resurgent groundwater seepage (averaged dissolved O_2 23.6±2.7%, pH 5.9±0.3, n = 37, with sulfate-Ca composition and dissolved As concentrations ranging between 1.0 to 6.1 µM). Crystallization and stability conditions and release of TE bearing phases in the Manaurie river by natural weathering are the aim of the present work. Characterization (X-Ray diffraction and Mössbauer spectroscopy) of the superficial ochreous deposits shows only one phase as ferrihydrite (Fh). A very poorly crystallized phase “proto-Fh” is identified in the upstream part of the area and a better defined 6-line Fh downstream. The reasons of this mineralogical spatial evolution are not fully understood at this time (Fh ageing, different groundwater composition, T° variations…). However, the chemical data also pointed out a spatial gradient of As concentrations in the deposits : the proto-Fh deposit contains up to 9% of As and the better cristallinity the lower As concentration (less than 1% of As) is observed downstream. Submitted to rainfall weathering and to river floods, this area may be a major source of TE by solid exportation and/or dissolution of the enriched deposits. Therefore, the material stability is tested with selective extractions and batch-reactor experiments to determine if As is fixed temporarily and which hydrological/chemical conditions are favorable to TE release. Rainfall weathering simulation is investigated with column tests on sediment cores to forecast and to quantify potential TE release to the Manaurie river. A mapping of TE distribution with core sampling will allow us to evaluate the potential quantities of leachable As.