Geophysical Research Abstracts
Vol. 21, EGU2019-14481, 2019
EGU General Assembly 2019

Assessing of arsenic controlling factors in the alluvial aquifer nearby Venice lagoon (NE, Italy)

Nico Dalla Libera (1), Daniele Pedretti (2), Paolo Fabbri (1), Fabio Tateo (3), Leonardo Mason (4), and Leonardo Piccinini (1)

(1) University of Padua, Geosciences, Padua, Italy (nico.dallalibera@phd.unipd.it), (2) University of Milan, Earth Sciences, Milan, Italy, (3) Institute of Geosciences and Earth Resources, National Research Council (CNR) of Italy, Padua, Italy, (4) Regional Environmental Protection Agency (ARPAV), Venice, Italy

Excess of arsenic in groundwater is a worldwide problem threatening the health of the millions of people directly exposed to As-rich water intake. The problem is particularly acute in naturally occurring unconsolidated aquifers where As-rich groundwater is an easily accessible resource of drinking water, such as in India, Bangladesh and Vietnam. Naturally occurring high concentrations of As in groundwater also notoriously mark the Venetian Alluvial Plain (VAP) in Italy, affecting in particular the shallower aquifers. The VAP is characterized by a patchy As distribution with variable extensions and concentrations. Although empirical evidences exist about the relationship between As occurrence and other factors, several aspects regarding the physical and geochemical processes controlling As in the VAP aquifers remain unclear. This study aims to elucidate the geochemical conditions that control As mobilization in the VAP, in order to improve the knowledge about As-controlling processes in the study area and use them as a proxy to evaluate occurrence of As in other world regions characterized by a similar hydrogeological and geochemical settings, such as the Bengal Delta Plain. To this end, we focused in detail on an agricultural zone nearby the Venice lagoon, affected by As contamination (called "Aree Agricole West", AAW). The available data, collected by several hydrogeological surveys, show a spatial and temporal variability of As concentration, which can be associated to a variety of hydro-geochemical processes such as redox variations, sorption or reductive dissolution of As-rich iron oxy-hydroxides. In order to point out the consistency and the importance of these processes, we combined an advance exploration analysis with a PHREEQC 0D reactive model. The former part, performed by mean of Self-Organized Maps (SOM) algorithm, allows for identification of the main geochemical relationships within the study aquifer and the associated geochemical processes. The latter, instead, allows us for testing whether the supposed processes are able to fit the geochemical conditions of the study system. The results highlighted a strong effect of oxy-reductive potential on arsenic mobility, and it seems to be strictly correlated to organic matter degradation. The uprising of reduced condition, then, affects other mechanism such as reductive dissolution of iron hydroxides, ion exchange and sorption processes, causing arsenic mobilization. Moreover, this study shaded light on the existence of oxygen ingress as function of local water recharge events, which seems to be responsible of space/time redox variation. Thanks to the 0D model, it was possible to explain, in a semi-quantitative way, the effect of the oxygen ingress on the redox aquifer condition, and so to explain the arsenic variation. This study has to be intended as a first step toward a more detailed study, which will account for a 2D/3D reactive transport model aiming at elucidating arsenic mobility, including influence of recharge due to agricultural activities.