Sediment diagenesis modelling in a AMD contaminated reservoir

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The Sancho water reservoir is located in the Odiel Basin, Huelva (SW Spain) in the Iberian Pyrite Belt. The Basin has been mined intensively during the last century. While the mines are now abandoned, the Basin is still heavily contaminated by acid mine drainage (AMD).

The reservoir has a pH of ~4, with high SO_4 (200 ppm) and heavy metal concentrations in the water column. A monomictic behaviour forces the reservoir to mix in winter, which oxigenates the bottom waters. Solid and aqueous phases analyses show that the sediment acts as a sink of trace elements (e.g. As, Cd, Pb) during oxic conditions and as a source for them during anoxic conditions at the bottom.

Quantitative transport-reaction modelling of sediment diagenesis has been performed by improving on the apporoach outlined in Couture *et al*. [1]. The model has been modified by including: $FeCO_3$ as a new phase, pH and porosity functions with depth, and two organic matter (OM) pools. Due to the monomictic behaviour of the reservoir non-steady-state boundary conditions were imposed as a function of time for O_2, as an error function, and for the Fe $(OH)_3$ (s) flux, because of its dependence on the O_2 concentration. The reaction network includes three primary reactions discribing the degradation of OM via oxic respiration, iron and SO_4 reduction. The secondary reactions considered are the oxidation of pore water Fe(II) by O_2, and of H_2S by O_2 and Fe $(OH)_3$ (s).

The Fe $(OH)_3$ (s) and SO_4 are reduced in the upper few cm, releasing Fe^{2+} and H_2S which precipitate as FeS and pyrite. Excess of Fe^{2+} precipitates as $FeCO_3$. Under anoxic conditions solute concentrations on sediment pore water increase due to the absence of oxygen. Owing to the time-dependent O_2 function implemented in the model, we obtain a periodic response for the years simulated which allow us to reproduce the complex features of the measured sedimentary profiles.

[1] Couture *et al*. (2010) *Env. Sc. Tech*. **44(1)** 197–203.

Hydrogeochemical analysis of the Sahl-Abad playa brines (East of Iran)

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The Iranian playas are one of the important playa zones in the world. The study area is located in the North of Birjand in the East of Iran. From hydrogeochemical point of view, the brines of this playa is of the Na- Ca- Mg- K-Cl- SO4 series, with the PH ranging from neutral to slightly alkaline. The concentration of some the above ions are very high in these brines, which is due to the composition of parent rocks in the surrounded area. The evaporate minerals within the brines are NaCl and CaSO4. On the basis of chemical composition of the brines especially their trace element (concentration of Br less than 27ml and ratio of Cl to Br which is more than 290) and concentration of Gypsum and Halite in sediments, a meteoric origin (meteoric water of first order of neutral group) is suggested for these brines.

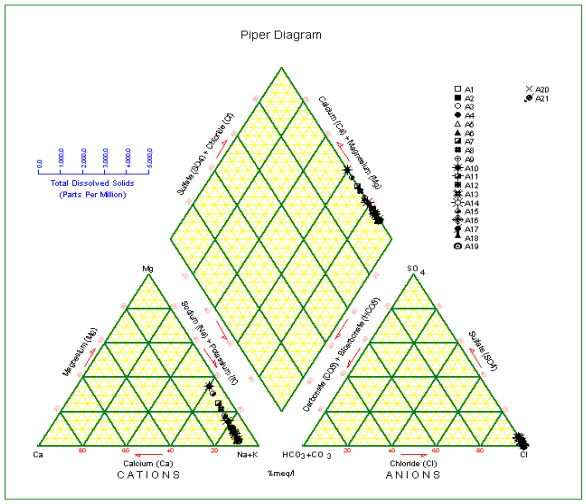

Figure 1: Piper diagram of the Sahl Abad playa brines