Column experiments with orange Bangladesh sediments to quantify retardation in low As aquifers

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Deeper Pleistocene aquifers in Bangladesh are low in arsenic despite being anoxic. Because these aquifers are a potential long-term source of safe drinking water, it is important to assess the ability of their sediments to retard downward transport of As from shallower aquifers that might result from intense pumping or well failure. To quantify rates of As sorption and desorption, we present column experiments using aquifer sands naturally coated with ferric oxides that were collected in Araihazar, Bangladesh.

Three cores of orange sands were placed in N_2-flushed mylar bags right after collection and adapted in an anaerobic chamber in the laboratory to make three 10-cm columns within their original liners, without repacking or disturbing the sediment. Deoxygenated artificial groundwater with 200 μg/L As (III) was eluted through the columns for up to ~100 pore volumes (PV), followed by flushing with the same solution, but without As. The columns were reused for experiments at three elution velocities (~4, 16, and 48 PV per day) under low-O_2 conditions.

The initial rise in As concentrations was retarded by 10-30 PV with respect to bromide (conservative tracer) due to rapid initial sorption and slow desorption of As from column sands. The amount of sorbed As per PV depended on the elution velocity, indicating a kinetically limited process. Differences between the cores in the extent of As oxidation and Mn desorption were observed but did not seem to correlate with the amount of As sorption on the columns. Approximately 80% of the As loaded on the columns was displaced by a 1M phosphate solution, with the remainder evidently more strongly bound to the sediments. Equilibrium partitioning coefficients of As ranging from 5-20 L/kg were calculated from a reversible kinetic box-model that allows for As (III) oxidation.

We also expect to present estimates of As retardation based on the breakthrough measured by pumping high-As groundwater directly from a shallow well through columns of orange sands during a series of 12 field experiments conducted more recently in Bangladesh.

Re-Os age of a chalcopyrite sample from the Lubin Cu-Ag mine, Kupferschiefer, SW Poland

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The Lubin Cu-Ag deposit ranks as one of the largest in the world. The ore series occurs between the Lower Permian (*Rotliegendes*) terrestrial redbeds/volcanics and the Upper Permian (*Zechstein*) marine sequence. The Kupferschiefer is rich in organic matter with metal sulphide-containing deposits formed in reduced zones. A 240 ± 4 Ma Re-Os age for Cu-rich whole-rock samples has been reported from the Lubin mine [1]

We report a Re-Os model age for a single sample of chalcopyrite characteristic of laminated and veinlet types of Cu ores. The studied sample was collected from the underground workings of the Lubin mine at the -610 m level. In the dated sample, hosted in calcareous black shale of thickness *ca.* 5 cm, chalcopyrite is the dominant sulfide (*ca.* 4 wt.% Cu, with traces of Au and PGE). Chalcopyrite occurs in two forms - the first one is as dense disseminations along with shale laminations and the second one is as veinlets almost perpendicular to these laminations. The dated veinlet is 2-3 mm thick with very irregular margins which often penetrate laminae with the chalcopyrite grading into aggregates forming thin lamellae in the black shale. Microscopic studies show chalcopyrite as fine-grains (from 2 to 30 μm in diameter) and as aggregates (20-200 μm in length) disseminated along shale laminations. The sample also contains pyrite framboids and bornite which is locally replaced by chalcopyrite. Chalcopyrite veinlets may be sheared and transformed up to several cm along laminae, and younger cross-cutting calcite veinlets (up to 1 mm thick) may also be present. The analyzed chalcopyrite sample has a Re concentration of 11.35 ± 0.02 ppb, and an Os concentration of 0.046 ± 1 ppb. Ratios of ^{187}Re/^{188}Os and ^{187}Os/^{188}Os are 2673 ± 8 and 9.86 ± 4, respectively. The high ^{187}Re/^{188}Os permits calculation of a Re-Os model age of 217 ± 2 Ma which suggests a period of chalcopyrite deposition in the Late Triassic. Further work is needed to evaluate the local and larger geographic importance of a younger ore-forming event.

This work was financially supported by Polish Ministry of Science and Higher Education, Grant 4 T12B 029 30.

[1] Pasava *et al.* (2007) *GCA*, A763.