Fluid inclusion and trace element of the Hong-Che fault calcite cement, the northwestern Junggar Basin

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The roughly North-South-trending Hong-Che fault is located in the northwestern Junggar Basin (NW China). Oil and gas accumulations have been found in the area from Carboniferous to Cretaceous age. Core observations indicated that calcite cements were widely occurred in fractures of Carboniferous-Permian volcanic rocks and Triassic-Cretaceous sandstones and conglomerates. In this study, the calcites were investigated by fluid inclusion and trace element analyses to provide insights into fluid histories.

Petrographic observations show a common dissolution of calcites and associated feldspars. Combined with presence of petroleum inclusions, it is suggested that the reservoir fluid is intimately associated with hydrocarbons. This subsequently implies that the fault is good conduit for petroleum and fluid migration. In addition, cross-cutting calcite cements indicate a multi-stage fluid history, and zoned-texture of the calcites suggests the fluid activity here is episodic.

Abundance of petroleum inclusion in the main fault sample reaches up to 25-30%, which is much higher than the data in the wall rocks (generally less than 20%). Two Th populations around 60-90 ºC and 90-130 ºC from the fault core and hanging wall samples indicate that petroleum charged here mainly in two episodes. In comparison, only one fluid charge history is suggested by the data of the footwall samples. The composition of fluid inclusions from the fault core and hanging wall samples show similarities, including the salinities (generally greater than 6 wt.%), and laser raman compositions ($CO_2/\sum C$=0.31-5.09, C_1/C_{2+}=0.71-3.29). However, the data are different in the footwall (salinities generally less than 3 wt.%; $CO_2/\sum C$<0.5, C_1/C_{2+}<1.0). Trace-element content of the calcites show that those from the fault core and hanging wall have a higher proportion of Mn relative to Mg and Fe, indicative of deep-sourced petroleum fluid. In contrast, the footwall calcite is relatively enriched in magnesium, implying a more active primary formation water influence. These indicate that the hanging wall, compared to the footwall, has a similar fluid condition to the main fault, and thus might be a preferable path for petroleum fluid migration along the fault.

This work is financially supported by the National Natural Science Foundation of China (Grant No. 40602014)

Disperse Alkaline Substrate passive remediation at Mina Esperanza (Iberian Pyrite Belt, SW Spain)

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In order to overcome the frequent problems of clogging presented by common passive treatment system when exposed to high metal concentration Acid Mine Drainage (AMD), we have developed a novel Dispersed Alkaline Substrate (DAS) based system consisting on a mixture of fine-grained limestone (reactive material) and wood chips (coarse inert matrix).

Mina Esperanza is located in the northern part of the Iberian Pyrite Belt. It is an underground sulfide mine that was in operation during the first half of the last century. After closure, the mine was flooded and there is a polluted creek coming out of the main adit. AMD from this creek flows into the Odiel River producing an important impact on water quality.

A full scale passive treatment system was constructed at the site. It comprises an open channel connecting the adit to the DAS reactive pool (15m*8m*4m length*width*depth) followed by aeration cascades and a sedimentation pond (10m*3m*2 m).

AMD at the exit of the adit has a pH of 2.66-2.95, net acidity of 2200-2800 mg/L as $CaCO_3$, 750-950 mg/L Fe (95% Fe^{2+}), 3500-4200 mg/l SO_4^{2-}, 125-160 mg/L Al, 15-20 mg/L Zn, Cu, 0.1-1 mg/L As, Pb, Co, Cd and V. At the outflow of the system the pH is raised to 5.9-6.3 and net acidity is decreased to 750-900 mg/L as $CaCO_3$. The system has been working for a period of 11 months, treating a mean inflow of 0,5 l/s with an acidity load of 900 g/m^2•day as $CaCO_3$. This loading rate is much higher than that recommended for conventional passive treatment systems such as Reducing and Alkalinity Producing Systems (RAPS). Therefore, high acidity AMD can be treated on a relatively small area. The system eliminates a net acidity of 1500 mg/L as $CaCO_3$ from the inflow water and removes 100% Al, Cu, Pb, Cd, V, 90-100% As, Cr, 75-90% Zn, 45% Fe and 20% SO_4^{2-}.