Evidence for the Toarcian oceanic anoxic event in the Southern hemisphere (Los Molles Formation, Neuquèn Basin, Argentina)

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The Early Jurassic, Toarcian, Oceanic Anoxic Event (~180 m.a.) was characterized by emplacement of a large igneous province, (e.g. Karroo Ferar) high sea-surface temperatures (~6°C warmer than present), mass extinction, and the deposition of sediments rich in organic carbon thought to be associated with a global oceanic anoxic event. Most chemostratigraphic studies of the event have focused on the northern hemisphere, leading some researchers to question its global nature. Here we report results from a combined sedimentological, biostratigraphic and geochemical study of a southern hemisphere Pliensbachian-Toarcian black-shale succession, the Los Molles Formation of the Neuquén Basin, Argentina, in order to assess the global extent of the Oceanic Anoxic Event. Preliminary results show a negative -7‰ carbon isotope excursion, as well as a ~2% relative enrichment in TOC over the OAE interval. These new data have been compared with those from Lower Toarcian sections in southern Europe, and show a strictly comparable step-wise negative carbon-isotope excursion. The preliminary results support the hypothesis that Toarcian oceanic anoxia and the attendant carbon-cycle perturbation was a phenomenon of global significance.

Geochemical processes in carbonate and silicate-dominated reservoirs of deep geothermal systems: Insights from coupled thermal-hydraulic-chemical modeling

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We use reactive-transport models patterned after the geothermal systems at Bad Blumau, Austria, and Basel, Switzerland to track the fate of fluids that originate from a carbonate and a silicate-dominated geothermal reservoir, respectively, on their passage through the geothermal system. We explore 1) mineral scaling and the rate at which it occurs, 2) borehole corrosion and geochemical fingerprints indicating incipient corrosion, 3) chemical and hydrological implications of reinjecting the fluid into the deep aquifer. P-T changes of the circulating fluid and the extraction of heat modify the chemical state of the fluid and induce the precipitation of mineral phases. The latter are primarily dictacted by the composition of the reservoir fluid. The distribution of minerals is a function of the flow and reaction rates, as well as of the temperature dependence of solubilities. We use our model to explore the effect of corrosion on the fluid composition and on mineral precipitation to identify chemical fingerprints that could be used as corrosion indicators. Thus, incipient corrosion could be detected early on during regular chemical monitoring. Any modification of the fluid composition caused by mineral precipitation means that the reinjected fluid is no longer in equilibrium with the aquifer rock. Thus, rock-water interaction and fluid mixing at the base of the injection well drive chemical reactions that cause changes in porosity and permeability of the aquifer, potentially compromising the efficiency of the geothermal system.