Inorganic dioxide carbon and organic hydrocarbon charge history in Wuerxun Depression, Hailaer Basin, NE China

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A number of inorganic carbon dioxide and organic hydrocarbon are contained in Wuerxun Depression, Hailaer Basin, NE China, displaying a complex history of fluids migration. At present, hydrocarbon charge history can be constrained by fluid inclusions study and illite K/Ar dating. Thus, the key problem to solve is how to establish the timing of inorganic CO_2 charging in the reservoirs. It is worth noticing that abundant dawsonite cement is found in the CO_2 and petroleum reservoir sandstones. Detailed petrography and isotopic geochemistry data show that the dawsonite can be used as a tracer for inorganic CO_2 migration. Therefore, dawsonite-bearing sandstones provide a new clue for inorganic CO_2 and organic hydrocarbon charge history.

Paragenetic sequence of the dawsonite-bearing sandstone show that dawsonite formed later than quartz overgrowth; petroleum began to charge during quartz overgrowing. Therefore, CO_2 charged later than petroleum. Furthermore, petroleum inclusions are also found in dawsonite cement, indicating earlier hydrocarbon was displaced by CO_2. This point has been supported by the petroleum-CO_2-water distribution relationship in reservoir profiles.

According to the fluid inclusions and illite K/Ar dating, the organic hydrocarbon charge began at about 120 Ma, reached climax during 90-105 Ma and went on till 63 Ma or later. So the CO_2 charge could be after 90-105Ma during the charging peak. Stable isotopic data of dawsonite and CO_2 gas show mantle magmatic carbon feature. Considering multiple stages igneous activities in Hailaer Basin, CO_2 may be related to igneous activity. In fact, the reported igneous ages are between 145-120 Ma, so these igneous rocks may be possible CO_2 source as in general magma degasification is posterior 10-20 Ma to magma activity. In addition, most of zircon grains from allgovite sample in core have $^{206}Pb/^{238}U$ weighted average ages of 46.2±2.1Ma. According to the fact that dawsonite is the authigenic mineral forming at latest in sandstone, CO_2 charging was relatively late, possibly 46.2±2.1Ma or later.

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Hydrothermal fluids from 5°S, MAR: Evidence for a different heat flow regime in slow-spreading crust?

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At 5ºS on the Mid-Atlantic Ridge (MAR) three active vent fields with black smokers and areas of diffuse venting exist at water depths around 3000m within very young lava flows. Whilst one cluster of 4 chimneys - Red Lion - emanates non-phase separated fluids with temperatures of max. 370 °C, chimneys at the other two sites only 2 km apart - Turtle Pits and Comfortless Cove - show vigorous venting of vapor-type fluids with T > 407 °C that have undergone phase separation at p,T conditions well above the critical curve of seawater. Constant temperatures and fluid compositional data at all sites were collected in 2005, 2006, and January 2008 after the assumed trigger eruption in 2002.

The chlorinity-depleted fluids of the superhot vents are characterized by very high Fe concentrations up to 4.2 mM. Cu is highly variable in different fluid samples (between 9 and 280 μM) indicating different Cu speciation in hot single-phase fluids than in cooler fluids venting from the same chimney. REE composition of the hot fluids is, to our knowledge, unique so far.

The 5°S MAR fluids appear to vent for an unusually long period at extremely high temperature when compared to "young post-eruptive stage" high-temperature fluids on the East Pacific Rise (EPR). This has important implications for both heat-flow models and estimates of mass fluxes for hydrothermal systems at slow-spreading settings like the S-MAR. As "supercritical" phase separation might be more common than previously thought the 5°S MAR hydrothermal fields can serve as a model system to investigate processes that likely operate within many other hydrothermal systems occurring at greater water depth below the seafloor, but in which the processes become overprinted during cooling and/or dilution before the fluids can be sampled at the seafloor.