Fault zones and hot springs, Da Qaidam hot springs (W-China)

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Continental hot springs represent a geochemical window to deep parts of the fractured brittle upper crust. Continental hot springs are related to deep groundwater circulation systems and occur worldwide in mountain ranges, including the Alps, the Himalayas, the Rocky Mountains and the Black forest. The composition of the hot water arriving at the surface reflects the end result of a complex series of transport and chemical reaction processes. Meteoric recharge may reach deep (several 1000 m) in correspondingly warm regions of the upper crust if the necessary pressure gradients provide the driving force for water (fluid) circulation. Flow and upwelling are normally directed by predominantly steep to vertically dipping fault zones at depth. The ascent path is generally related to the highly permeable damage zone of steep faults.

Here we present hydrochemical data from the hot springs of Da Qaidam in the Qilian Mountains of western China along with rock-leaching data, rock and mineral composition data from the presumed reservoir rocks, and mineral data from deposits at the hot springs. Hot water flows from springs along the border fault system at the SW rim of the Qilian mountains near the city of Da Qaidam (Qinghai Province, Western China). The outflow temperature is close to 72 ˚C. The water contains about 1.4 g/kg total dissolved solids, predominantly Na and Cl, significant and equal amounts of hydrogen carbonate and sulfate, and 42 mg/l boron. The water originates from a fractured granite reservoir at about 5 km depth suggested by the estimated Qtz- and Na-K equilibrium temperatures of 130 – 150 ˚C. The solutes derive from the interaction of the deep ground water with the solids of the fractured granite. The high Cl/Br mass ratio of about 550 in the deep water and the composition of surface runoff nearby suggest the presence of an evaporite component of aeolian halite and gypsum deposits from the salt flats and deserts of the Qaidam basin.