COLD VENT FLUIDS IN THE LOWER CRUST OF JUVENTAE CHASMA, MARS. Muna Al-Samir, Freie Universität Berlin (Berlin, Germany; muna.al-samir@fu-berlin.de).

Introduction: The liquid state of water is by far the main responsible phase for the convective transport of heat and mass. Liquid water on Earths surface is an enormous reservoir of minerals and energy, exchanging continually in a source-sink system driven by chemical reactions and precipitation processes in a heat-controlled regime. Most of this "liquid component" is stored in oceans and lakes where energy and material exchanges. The resulting major fluxes of heat and mass between water an lithosphere are very complex and generally difficult to investigate, especially on Mars.

An attempt was made by fluid-geochemical experiments, including leaching processes and numerical modeling [1] [2], in oder to test if hydrothermal activity as we know it from fluid-rock interactions at mid-ocean ridges or back-arc spreading centers can be a possible source for precipitations we see in Juventae Chasma, Mars. And if not: Is ILD precipitation possibly the result of hydrothermal processes we commonly find in onshore hot-spring systems with thermal acid-sulfate waters?

Premise and discussion: High fluid-temperatures occur in hydrothermal systems (>400°C) or hot springs with temperatures >200°C [3] and [4]. The terrestrial oceanic crust is well known to be a sink of Mg due to the formation of Mg-smectite veins underneath vent fields, on-axis, and is usually not part in endmember hydrothermal vent fluids [3], [5], and [6].

Thus, such high-temperature fluids do not provide Mg in a sufficient quantity to form Mg-rich sulfates on the surface of Mars. This seems to exclude hydrothermal activity as described by [3] as a possible origin of the initial solution evaporated in Juventae Chasma.

According to [5], [6], and [7], the estimated maximum Mg uptake to the oceans from ultramafic rocks can be equivalent up to 85% of the yearly Mg flux from rivers. Nearly 20% along slow- and ultraslow-spreading ridges are ultramafic rocks, peridotites respectively [6]. Abyssal peridotites crop out in close vicinity of ridge discontinuities, associated with walls of rift valleys, which are present in transform faults and in fracture zones as well as in corners of ridge-offset intersections [6]. These ultramafic rocks are serpentinizied and weathered in a low-temperature hydrothermal environment. [7] discovered active mounds in the Lost City vent field, off-axis, at a location nearly 15 km away from spreading centers with 40°C to 75°C venting fluids with a Mg content of 9-19 mmol kg-1. Hence, relatively cold vent fluids (formerly known as epithermal fluids), driven by water-ultramafic rock interactions in the lower crust along slow- to ultraslow spreading centers is possibly a source for Mg-rich solutions.

Thermal acid-sulfate waters are well known in hot-spring systems in areas in the western United States, e.g. in the Yellowstone National Park [4] and spread all over the Earth's crust, often associated with volcanic activity. Several solutions with pH values of 1-5 were collected and classified by [4]:

1. meteoric water,
2. meteoric water, heated by high-temperature gases,
3. deep hydrothermal water, and
4. boiled, deep hydrothermal water that has been subsequently heated with H_2S-enriched gases, and
5. mixtures of all of these types.

But thermal acid-sulfate waters do have in common that their Mg concentration (between <0.007 and 21.9 mg/L; measured by [4]) is lower than the Mg uptake into the solution assumed and measured in [1] and [2]. Therefore, ILD-formation, as observed in Juventae Chasma, cannot easily be formed due to hydrothermal activity in hot-spring systems. Thus, it is most likely that hydrothermal processes, as we know them from slow- to ultraslow spreading centers in the lower crust are more likely an analogue for ILD-formation as observable in Juventae Chasma,

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