

## Formation of reduced Carbon compounds using natural catalysts in hydrothermal experiments

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The alteration of peridotites (the serpentinization reaction), leads to the production of H<sub>2</sub> and thus propagates low oxygen fugacity conditions in the fluids which may in turn favor the reduction of CO<sub>2</sub>. This reduction reaction is invoked for the production of methane and other reduced carbon molecules (e.g. carboxylic acids, formic acid, methanol) observed in hydrothermal fluids circulating through the oceanic lithosphere. These reactions are usually interpreted in terms of Fischer-Tropsch type (FTT) processes and have been experimentally studied for natural systems leading to contradictory results. In particular, even though it is admitted that they are promoted by some catalysts, those catalysts have not been clearly identified yet among the mineral phases present in such environments. Hence, we have studied the catalytic properties of some spinel-structure phases (magnetite, chromite) and sulfides (Fe, Cu-sulfides) which are suspected to play some role in these FTT processes in aqueous phase. Hydrothermal batch experiments were first performed on nano-magnetite powder under elevated fugacities: PH<sub>2</sub>=40 bars, PCO<sub>2</sub>=40 bars and T=180°C. After 3 days of reaction some methanol was detected by GC in the gas phase whereas only CO<sub>2</sub> was present in a blank experiment run without any solid. This result shows that, under these conditions, CO<sub>2</sub> can react with hydrogen in an aqueous phase. Analyses of both the fluid phases and the solid after reactions are still in progress. In a second part of this work, the potential catalysts (spinel, sulfides) were added in relatively small amounts to nano-olivine and run in gold capsule at P=200 bars–T=200°C, closer to natural systems, under more realistic H<sub>2</sub> fugacity and CO<sub>2</sub> being present as a bicarbonate solution. We show that relatively small amounts of added “geocatalysts” modify profoundly the carbon speciation in the solid products. For instance, large amounts of condensed reduced carbon phases are formed in presence of pyrite (FeS<sub>2</sub>) whereas numerous large magnesites with euhedral shapes and phyllosilicates with very specific microstructures are induced by chalcocite (Cu<sub>2</sub>S).