

## Forming catalysts: a basic principle of deep chemistry, life chemistry and life

Initiative: "Leben?" - Ein neuer Blick der Naturwissenschaften auf die grundlegenden Prinzipien des Lebens  
(beendet)

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The most fundamental unifying properties of life are i) that life harnesses environmental energy to promote chemical reactions, ii) that those chemical reactions are carbon-based and iii) that the reactions of life are promoted by catalysts, which merely accelerate reactions that occur anyway. There has to be a natural tendency for the molecules central to life to form spontaneously and to organize towards higher complexity under the right conditions. Those conditions must have existed on the early Earth. The search for those conditions is the search for catalysts. The geochemical process of serpentinization harbors well-known similarity to life processes but also has striking similarity to both Fischer-Tropsch (FT) reactions and the Haber-Bosch (HB) processes for hydrocarbon fuels and ammonia synthesis, respectively. Serpentinization converts  $\text{Fe}^{2+}$  silicates and water into  $\text{Fe}_3\text{O}_4$  and  $\text{H}_2$ , the starting material for FT and HB catalysts. Serpentinization, FT and HB generate native metals, which induce the backbone of exergonic carbon metabolism in autotrophic microbes to unfold from  $\text{CO}_2$  in laboratory experiments. This project proposes to investigate metals and carbon metal bonds in early Earth chemistry for converting  $\text{CO}_2$ ,  $\text{H}_2$ , and  $\text{N}_2$  into the central molecules of life. The consortium will synthesize and characterize reduced metal catalysts and identify catalyst bound intermediates. This will illuminate a fundamental principle about life: Life is a chemical reaction; its primordial catalysts harbor the mechanism of its genesis.

### Projektbeteiligte

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