# High-pressure serpentinization, deep $H_2$ and abiotic methanogenesis

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Serprentinization is known to be an important source of $H_2$. When carbon is available in serpentinizing systems, abiotic hydrocarbons may form and play a key role in geo-biological processes on Earth and possibly beyond. A great international effort is currently made on the study of serpentinizig systems and the related abiotic hydrocarbons in shallow terrestrial environments within the biosphere, such as mid-ocean ridges and ophiolites. However, the P and T reagion at which serpentinization may occur extends to much greater depths reaching more than 100km under subduction zone thermal regimes. High-P serpentinization is widely documented by both natural observations and geophysial studies. Despite that, the role of this process on the generation of $H_2$ and abiotic hydrocarbons, most notably $CH_4$, is unknown. The recent discovery of natural high-P processes responsible for the generation of large amounts of $H_2$ and abiotic $CH_4$ in deep serpentinizing systems (Vitale Brovarone et al., 2017, Nature Communications) now calls for a reassessment of the role of high-P serpentinization as a reservoir of deep abiotic hydrocarbons. This presentation summarizes the field, microstructural and stable isotope results, as well as their implications and long-term perspectives. Our data suggest that $CH_4$ can form by different reactions sustained by deep, dry fluids that were not documented before in these settings, and that may lead to the precipitation of C particles characterized by signatures equivalent to diamonds. These mechanisms have the potential to also occur and sustain pre-biotic processes at lower pressurse within the biosphere. It is emphasized that deep serepntinization has the potential to produce $CH_4$ fluxes comparable to those estimated at mid-ocean ridges. This achievement represents an important means to better understand the relationships between biotic and abiotic processes in the biosphere, as well as for the detection and exploration of similar processes on other bodies of the solar system.