Kolloquium:

Abiotic hydrocarbons on Earth: controversial theories, serpentinization, and new perspectives from subduction zones

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Hydrocarbons in the Universe are widespread and abiotic in origin, i.e. produced without the contribution of biology. Then, zooming in on Earth, this becomes paradoxical as global hydrocarbon budgets rely on biotic processes only. Beside the uniqueness of biology on our planet (?), the reason for that is that the geological processes generating abiotic hydrocarbons and their distribution on Earth are still largely under appreciated. The “Deep gas theory”, conversely, considers that hydrocarbon reservoirs on Earth may abiotic in origin and reflect a cosmic origin inheritance. The theory proposes that most deep hydrocarbons form through abiotic processes in the mantle and migrate towards shallower reservoirs in the crust (the “Deep hot biosphere”). The theory remains highly controversial, yet quite fascinating. Nevertheless, a series of geological processes producing abiotic light hydrocarbons such as methane are indeed documented, and some of them have gathered great international effort over the last decades. This talk will introduce these concepts and then focus on the most intriguing natural process associated with abiotic methane production, i.e. serpentinization of ultramafic rocks. I will introduce the process of serpentinization at shallow terrestrial conditions based on literature data and original images from the South-Western Indian Ridge, and then move to its potential significance in the deeper Earth in subduction zones, which has been the focused of my research activity over the last years. Additional topics, such as the role of serpentinization on energy production, life, and planetary exploration will be also introduced.