Subject offered for a contract starting October 2017

SUBJECT TITTLE: The fate of endogenic condensed carbonaceous matter of hydrothermal origin during the subduction of the oceanic lithosphere and its implications for diamond formation

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Host lab/ Team : **IPGP- Teams Géomicrobiology/Cosmochemistry, Astrophysics, Experimental Geophysics – UMR7154**

Financing: Doctoral contract with or without teaching assignment

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Presentation of the subject: (1 or 2 pages)

Deriving from recent progress in thermodynamic modelling, it has been recently shown that small organic acids can be the dominant dissolved carbon species in the aqueous fluids encountered in subduction zones that drive melting and degassing up to the atmosphere. This has profound implications for the subduction factory, in particular for the formation of diamonds as acid-base reactions can hence be invoked instead of redox reactions as the driving force. Beyond the dissolved organic compounds, condensed organic carbon phases were now found to be widespread in the subducting plate, being either formed by carbonates destabilization or inherited from hydrothermal circulation at oceanic ridges. We hence hypothesized that this O- and N- bearing carbonaceous matter can constitute relevant starting material at the origin of diamond nucleation and formation at depth, as also suggested by the recent description of nanodiamonds in mantle xenolithes associated with carbonaceous components. To assess the fate of the condensed organic phases of hydrothermal origin during subduction and their potential link with diamond occurrences, the PhD student will run high pressure and high temperature (HP-HT) experiments using multi-anvil press. Those will involve natural samples from the oceanic crust that contain proven occurrences of condensed phases of reduced carbon. The student will then characterized at the microscale the nature and structure of the organic content trapped in the experimental products using a suites of spectroscopic techniques (SEM-EDS; SEM-FIB; TEM; Raman, nanoSIMS) and propose a model of diamond formation based on mineralogical and petrological constrains. The implications for the deep carbon cycle and the recycling of carbon in the mantle will also be an important aspect of the project.