

Ecole Doctorale des Sciences Fondamentales

Title of the thesis: New biogenicity criteria identification based on the study of fossil stromatolites.

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Project Summary:

Identify early traces of life recorded in the geological record is one of the major challenge of the scientific community. This task is complicated because of the small size of the life forms (microorganisms) and post depositional processes that often alter them. Benthic laminated deposits also called stromatolites can record microbial activities in the sedimentary archives. These stromatolites are present during all the history of the Earth and are currently formed by important microbial consortium, which actively participate to the carbonate mineralization. The identification of stromatolites in the Precambrian record is based mostly on morphological criteria, which are highly debated in the scientific community. Indeed, abiotic processes can also produce laminated deposits.

The aim of this PhD project is to define new biogenicity criteria by studying different stromatolite samples from the Archean (Pongola, South Africa), the Trias (Western USA basin) and the Oligocene of Limagne (France). Field missions will be realized to collect the samples and to perform sedimentological analyses. High-resolution study of these different samples will be realized by combining sedimentology, mineralogy and geochemistry tools and will provide information about their depositional environment and their diagenetic history. In situ analyses of S, Fe and C isotope compositions will bring constrains about the presence and the influence of key microbial metabolisms (sulphate reduction, photosynthesis, iron reduction...). The comparison between different environments and times will bring constrains about the post depositional processes. This project will allow a better understanding of the mineralization processes as well as on the influence of microbial metabolisms.