The microbial compelling attraction for hydrogarnets in the oceanic crust

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Microbial life appears to develop deep in the oceanic crust, taking advantage of the redox gradients locally generated during hydrothermal alteration of the crystalline rocks. Nonetheless everything does not seem to be everywhere and habitats are proving to be highly specific, mineralogically[1] speaking. Notably, hydrogarnets were recently shown to represent microbial niches hosted in serpentinized mantle-derived rocks from the Mid-Atlantic ridge. These hydroandraditic garnets ($Ca_3Fe_2^{3+}(SiO_4)_{3-x}(OH)_{4x}$ with trace amounts of Al, Ti, Cr) serve as metabolic substrates likely providing oxidized iron and calcium to the attached microbial community[2]. Far from being anecdotic, such occurences can be found in other geographically-distant locations along the ridge system as for example in the South Western-Indian ridge, likely signing an extensive process. In addition, the extent does not appear to be limited to the peridotitic portion of the oceanic crust. We present here results obtained on hydroschorlomite, a Ti-, Ca-, Fe-rich andraditic garnet hosted in altered basalts drilled in Hole 1256D during ODP Leg 206 (Equatorial East Pacific)[2]. In situ characterizaton of the organic carbon speciation at the microscale reveals the presence of microbiologically-derived material in close association with the hydrogarnets found in the deepest cores of basalts (661–749 mbsf). The specificity of these microhabitats will be discussed and compared in terms of chemical and mineralogical characteristics, inferred hosted metabolisms along with their potential as shaping low temperature alteration processes.

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Protolith and tectonic implications of the Changhai metamorphic supracrustal sequence in southeast Liaoning Province, NE China: Constraints from zircon U–Pb and Lu–Hf isotopic and whole-rock geochemical evidences

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The Changhai metamorphic supracrustal rocks, located in the eastern–central part of the Jiao–Li–Ji Belt in the North China Craton, are mainly composed of various types of garnet–mica schists, along with minor quartzites and marbles. Geochemical results indicate that the source rocks were mainly granitoids with a possible minor contribution from clastic sediments with an active continental margin signature. Detrital zircons have U–Pb age peaks at approximately 1887, 2174, 2552, 2765, and 3212 Ma, εHf values of –11.1 to +13.0, and three major time windows of average continent crustal model ages (T_{DM}) of 2.04–2.33, 2.48–2.56, and 2.72–2.93 Ga. These results suggest that sediments of the Changhai metamorphic supracrustal rocks were mainly sourced from nearby basement granitoid rocks and, to a lesser extent, from Paleoproterozoic metamorphosed strata such as the North and South Liaohe groups. Furthermore, the source rocks of the magmatic zircons analyzed in this study appear to have originated from interaction between old continental crust and juvenile material. The youngest concordant zircon age peak at 1879 Ma coincides with the timing of formation of regionally widespread granitoids, mafic igneous rocks, and metamorphism of the South Liaohe and Ji'an groups in the Jiao–Liao–Ji Belt, and requires the sedimentary protoliths of the Changhai metamorphic supracrustal rocks to have been deposited after this time. The results regarding lithostratigraphy, provenance, and depositional age indicate that the Archean Northern Liaoning–Southern Jilin Complex in the north, and the southern Liaoning–Nangrim Complex in the south were already a single continental block by 1887 Ma, and that the Changhai metamorphic supracrustal rocks was deposited at an active continental margin.

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