Introduction of IODP Exp. 399 Building Blocks of Life, Atlantis Massif -Hole U1309D deepening

*Natsue Abe^{1,2}, Andrew McCaig³, Susan Lang⁴, Donna Blackman⁵, Benoit Ildefonse⁶, Yasuhiko Ohara^{7,8}, Beth Orcutt⁹, Benedicte Menez¹⁰, Marvin Lilley¹¹, Geoffery Wheaet¹², Johan Lissenberg ¹³, Frieder Klein¹⁴, William Seyfried¹⁵, Muriel Andreani¹⁶, Barbara John¹⁷, Marguerite Godard⁶, Antony Morris¹⁸, Esther Schwarzenbach¹⁹, Christopher MacLeod¹³, Ivan Savov³, Alistair Harding ²⁰, Gretchen Früh-Green²¹

 Mantle Drilling Promotion Office, MarE3, Japan Agency for Marine-Earth Science and Technology , 2. Graduate School of Natural Science & Technology, Kanazawa University, 3. University of Leeds, 4. University of South California, 5. UC Santa Cruz, 6. University of Montpellier, 7. Graduate School of Environmental Studies, Nagoya University, 8. IMG, Japan Agency for Marine-Earth Science and Technology, 9. Bigelow Laboratory for Ocean Sciences, 10. IPGP Paris, 11. University of Washington, 12. University of Alaska, Fairbanks, 13. Cardiff University, 14. Woods Hole Oceanographic Institute, 15. University of Minnesota, 16. University of Lyon, 17. University of Wyoming, 18. University of Plymouth, 19. Free University Berlin, 20. UC San Diego, 21. ETH, Zürich

The Atlantis Massif in the North Atlantic Ocean is one of the most studied Oceanic Core Complex (OCC) in the world, along with the Atlantis Bank at the Southwest Indian Ocean Ridge, with conducting four drilling expeditions (Exp. 304, 305, 340T and 357) and surveys. The famous Lost City Hydrothermal Field (LCHF) is located on the south side of the massif. It has been the site of many studies of the ocean floor hydrothermal circulation and the subsurface biosphere. In Exp. 304/305, we successfully drilled down to 1415 mbsf (Hole U1309D) with a core recovery rate of over 78%. In addition, the most primary gabbro in the history of ocean drilling, "Olivine-rich troctolite," considered a reaction product of mantle peridotite (harzburgite) and MORB, was also obtained for the first time in drilling. The Hole U1309D will be used for deepening to 2100 mbsf, where a temperature of 220C is expected, and shallow serpentinite drilling and fluid sampling near the Lost City hydrothermal circulation field (IODP Exp. 399) from April to June 2023. There are 3 objectives for this expedition;

Objective 1: The life cycle of an oceanic core complex: Links between igneous, metamorphic, structural, and fluid flow processes, and testing of geophysical and hydrothermal models. This objective addresses Science Plan Challenges 9, 10, and 14.

Objective 2: Accessing the chemical kitchen preceding the appearance of life on Earth: formation of organic molecules of prebiotic interest at high and low temperatures in the Atlantis Massif. This objective addresses Science Plan challenge 10, 13, and 14, and will also be of great interest to the Astrobiology Community.

Objective 3: Deep biosphere and limits for life in the Atlantis Massif: controls of the lithological substrate, porosity and permeability, temperature, fluid chemistry, and reactive gradients on microbiology. This objective concerns Science Plan Challenges 5 and 6.

In this presentation, we will introduce the objectives and prospects of the Exp. 399, focusing on the integrated analysis of rock properties, rock description, and in-hole measurement data obtained from previous drilling and subsequent studies in Hole U1309D.

Keywords: Atlantis Massif, Hole U1309D, Oceanic Core Complex, gabbro, melt-rock reaction, IODP