Assessing abundance and relevance of bacterial endospores in the marine subsurface

LARS WÖRMER[1], TATSUHIKO HOSHINO[2], BERNHARD VIEHWEGER[1], TRAVIS MEADOR[1], NIROSHAN GAJENDRA[1], BIRK STERN[1], FUMIO INAGAKI[2], KAI-UWE HINRICHS[1]

[1] MARUM & Department of Geosciences, University of Bremen, 28359 Bremen, Germany.

[2] Kochi Institute for Core Sample Research, Japan Agency for Marine-Earth Science and Technology (JAMSTEC), Nankoku, Kochi 783-8502, Japan.

Scientific drilling has evidenced the abundance of Earth's deep microbial biosphere. However, a major question remains how these communities deal with progressive burial and the associated gradual energy starvation, i.e. how they achieve long-term survival on geological time scale.

Bacterial endospores are metabolically inactive, dormant cells that are structurally different from vegetative cells and have the ability to monitor the habitat to resume active growth when the conditions become favorable. Sporulation can be triggered by a variety of stimuli, the main one being prolonged starvation. Endospore formation is exclusive to the phylum *Firmicutes* and widespread among its different physiological groups. *Firmicutes* are considered as one of the major contributors to the subseafloor microbial community. Consequently, in the deep biosphere exposed to progressive burial and energy starvation, endospores may constitute a critical long-term survival strategy.

While endospores have been poorly accounted for in previous subseafloor microbiological surverys, we have now implemented accurate, biomarker-based methods to unravel their abundance and ecological relevance. Our study is two-pronged: (i) a selection of 48 samples (maximum depth of 6.3 m below seafloor) from eight sites in the Mediterranean, Black and Marmara Seas have been extensively studied by molecular, geochemical, and sedimentological methods. This serves as a test case to investigate mechanistic factors controlling endospore abundance; (ii) a global view of endospore distribution and abundance in deep drilling sites is currently being established on the basis of several locations worldwide in order to further define whether endospore abundance gradually increases with depth compared to vegetative cells. Thereby we assess the potential of endospores to persist on geological time scales and to act as an inoculum in deep, hardly accessible layers of transient cell stimulation, where they would contribute to extend the limits of life in the marine subsurface.