The dormant deep biosphere: Assessing global abundance of bacterial endospores and their response to burial and aging in the marine subseafloor

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The microbial deep biosphere is unexpectedly large, pointing to unique mechanisms to overcome the physiological stresses inherently associated with burial and limitation of metabolic energy. Among such mechanisms, the role of dormancy, generally considered to be an important microbial survival strategy, has only been poorly constrained.

Through the quantification of the diagnostic biomarker dipicolinic acid, we determined bacterial endospore concentration in more than 300 marine sediments samples from 48 sites. The samples represent diverse depositional settings and geographical origins and thus provide a global assessment of endospores in the marine deep biosphere. Relative abundance of endospores, compared to vegetative cells, steadily increases with depth. Our data also suggest that (i) areas of high productivity or terrestrial input provide large endospore concentrations in surface sediments and (ii) burial and aging consistently select for a more resistant endospore subpopulation.

Three independent modeling approaches effectively narrow down estimates of the size of the global marine subseafloor endospore population and confirm that endospore biomass surpasses that of vegetative cells. The potential presence of resistance forms different from endospores could tip the balance even further towards dormancy. This large community of dormant cells may serve as seed bank for the colonization of new habitats and contribute to the activity of the deep biosphere by sporadic germination.