# New Perspectives on the Exploration for Deep Life

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Collectively, basic and applied research strategies have boosted our knowledge of the extent and controls of life in Earth's subsurface. Microbes survive in and respond to numerous geological processes, and hypothetically, there are many more Earth processes that control the chemical and physical properties of the subsurface but for which still we lack sound evidence of microbial response. Advances in the methods used to collect samples, sense the subsurface, and speed the analysis of microbial communities move our science towards a better description of the entwinement of Earth and microbial systems. An example is our increasing knowledge of the involvement of microbes in Earth's methane cycle. We understand much about methanogenesis and methanotrophy, and how these two metabolic strategies offset each other in the production and consumption of this compound that is critical in the carbon cycle. However, we are still learning about the range of environments that are suitable for methane cycling including crucial deep biogenic methane production and consumption, how this process behaves across different lithologies, and how microbial communities reflect the biogeochemical signatures and rates of methane flux. The integration of these findings – and others like them - across spatial scales relevant to continents and ocean basins and temporal scales relevant to long, dynamic Earth cycles will inform us of the constraints on life at planetary dimensions. In addition to the anticipated discovery of new ways that the living and non-living are interdependent in the subsurface we may also learn how to more effectively control deep biogeochemical processes and remotely track the progress of natural and biogeoengineered systems.