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Serpentinization of the oceanic lithosphere: Geological aspects and environmental impact

Serpentinization is a low-temperature hydrothermal alteration process of peridotites or olivine-rich rocks, which originated in the Earth's upper mantle and lower crust. It typically occurs at certain geological settings of the oceanic lithosphere, including fracture zones, rift zones, subduction zones, and uplifted massifs near mid-oceanic ridges, where intensive interaction between rocks and seawater takes place. Serpentinization commonly involves the production of hydrogen, which provides vital energy for chemosynthetic biological communities and produces abiotic methane or other hydrocarbons. Serpentine-hosted hydrothermal vent fields that discharge fluids with hydrogen have been widely noticed as a possible environment for the generation of life on the early Earth and other terrestrial planets. Petrological studies have revealed that magnetite formation by oxidation of iron in olivine is the most effective process for the hydrogen production and is mainly controlled by temperature, silica activity, and water/rock ratio during serpentinization. Recent studies of geological structures of oceanic crust, mineralogical compositions of rocks recovered by seafloor drilling, and chemical compositions of vent fluids from hydrothermal fields suggest that serpentinization and alteration of lower crustal gabbros, as well as upper mantle peridotites, have significant effects on hydrothermal activities and oceanic environment.

Keywords: serpentinization, peridotite, gabbro, oceanic lithosphere

Biography

Dr. Subir Kumar Nag is a graduate in Agriculture and Post-Graduate in Agricultural Chemistry & Soil Science. He is Ph. D. in Agricultural Chemicals from ICAR-IARI, New Delhi. Dr. Nag has more than 29 years experience in working as ARS Scientist under the ICAR. His research areas include monitoring and risk assessment of xenobiotics, ecotoxicology, carbon sequestration and GHG emission from wetlands etc. Dr. Nag has authored more than 80 research papers, edited book, several book chapters, other publications. He is a Pos-Doc from Australia and recipient of many fellowships, awards and recognitions. Dr. Nag has guided three Ph.D. students.