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Geo- and bio-resource science and technology learnt from the interaction between ultrabasic rock and groundwater

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For sustainable development, engineering technology in 21st century should be in Safe, low-cost and environmentally friendly. In such technology, not rare earth and platinum group elements but rather ubiquitous elements such as Si, Al, Mg, Fe should be used. Natural process is a physical, chemical and biological process existing in or produced by nature without the intent of human beings. Therefore, products and technology learnt from natural processes are available with low-cost and safe. Not only civil and geological engineers but also engineering chemists and biologists are interested in natural processes for sustainable engineering technology. Especially, chemical processes at extreme environments such as hyperalkaline conditions have been attracted their attention for sustainable management of waste disposal used huge amount of concrete, recycling of alkaline materials such as cement, slag and fly ash, and so on. However, an understanding of the processes at such an extreme hyperalkaline condition is not enough for safety assessment of the waste disposals and the recycling. In addition to this, many engineering chemists and biologists are also interested in the hyperalkaline processes for safety CO_2geological storage, application of Fisher-Tropsch type reaction to natural system, and so on. Therefore, there are many contents to make lessons and be learnt from natural processes at hyperalkaline conditions. Fortunately, we can have the lessons at hyperalkaline fluids produced from the interaction between ultrabasic rock and groundwater, i.e., low temperature present-day serpentinization.
Serpentinization has unambiguously been recognized as important geological physical and chemical processes in mantle wedge and oceanic lithosphere. Serpentinized peridotite generally forms at reaction temperatures of 100-500 C as indicated by chemical, mineralogical and isotopic data. On the other hand, temperatures of present-day serpentinization observed at Lost City vent fluids are considerably lower (40-90 C). This is in strong contrast to other known serpentinization systems. Thus, the temperature variability expressed by vent fluids from ultramafic-hosted hydrothermal systems on or slightly removed from mid-ocean ridge, is not altogether surprising. The low temperature hydrothermal field is characterized by a combination of extreme conditions never before seen in the marine environment. These conditions include venting of hyperalkaline, metal-poor hydrothermal fluids with high concentrations of dissolved H_2, CH_4.
In this context, the previous studies on low temperature present-day serpentinization will be reviewed from the engineering points of view in this paper with introduction of our lesson at hyperalkaline spring in Oman and Philipine.

Keywords: CO2 geological storage, Fisher-Tropsch type reaction, Hyperalkaline, Serpentinization