Earth engineering technology learnt from low temperature present-day-serpentinization

Tsutomu Sato[1]

[1] Graduate School of Eng.
Hokkaido Univ.

http://geology5-er.eng.hokudai.ac.jp/

Serpentinization has unambiguously been recognized as important geo- physical and chemical processes in mantle wedge and oceanic lithosphere. Serpentinized peridotite generally forms at reaction temperatures of 100-500 degree centigrade 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 (40-75 degree centigrade). 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 hyper alkaline, metal-poor hydrothermal fluids with high concentrations of dissolved H_2 and CH_4.

Not only in Earth sciences but also in engineering reserch fields, hyper alkaline chemistry is the argent issue to solve many industrial problems. The extensive use of alkaline materials such as cement, slag and fly ash is envisaged in geological repositories of waste for encapsulation, backfilling, and grouting purposes. Degradation of such alkaline materials in the repositories can produce a high pore fluid pH initially ranging from pH above 12. However, an understanding of the processes at such an extreme hyper alkaline condition is not enough for safety assessment of the waste disposals. In addition to this, many engineering chemists and biologists are also interested in the hyper alkaline processes for safety CO_2 geological storage, application of Fisher-Tropsch type reaction to a natural system, metabolic mechanism of fishes living in hyper alkaline spring, and so on. Therefore, there are many contents to make lessons and be learnt from such a low temperature present-day serpentinization.

In this context, the previous studies on low temperature present-day serpentinization will be reviewed from the engineering points of view in this presentation with introduction of our studies conducted at Oman ophiolite