Keynote Address

Social and Economic Impacts of Applied Mineralogy

Prof. Tsutomu Sato
Division of Sustainable Resources Engineering,
Hokkaido University
Japan

Most of us use the products of modern technology without fully appreciating which minerals are required to make a cell phone, a modern internal combustion engine, an aluminum can, ceramics and the concrete used in buildings. For example, in Japan, all students in junior high school should learn “what are minerals” and “what is the definition of minerals” with some examples from rock-forming minerals such as quartz, feldspar, mica, and so on, although the author does not know the situation of minerals in education at other countries. I suppose that the situation is not so different in different countries. However, as stated in the special issue of Elements on “Social and economic impact of geochemistry”, minerals are definitely central not only to our natural and technological environments but also to our social and economic environments. Environmental mineralogy is a fast-growing multidisciplinary field, addressing major societal concerns about the impact of anthropogenic activities on the global ecosystem. However, mineralogists are still not very good at communicating the social and economic impacts of mineralogy to the public. Of course, minerals may sometimes inspire us to design new materials for advanced technologies. Minerals and mineralogical processes such as adsorption, sorption, and precipitation may play an important role to solve problems in negative legacy such as pollution, health effect, and waste disposal.

Invited Speech

Geological Disposal of High-Level Radioactive Waste in Japan and the Role of Rock Engineering

Prof. Yoshiaki Fujii
Division of Sustainable Resources Engineering,
Hokkaido University
Japan

High level nuclear wastes are produced during the nuclear cycle of ordinary light water reactors and fast breeder reactors. Japanese government does not encourage the development of fast breeder reactors. Only a few light water reactors are functional since the Magnitude 9 Tohoku 2011 earthquake. The devastating tsunami due Tohoku earthquake destroyed Fukushima Daiichi Nuclear Power Plant and consequently more than half of Japanese are objecting the existence of nuclear power plants. However, there are already huge amount of high level nuclear wastes in Japan and they should be safely stored. Geological disposal of high level nuclear wastes is one of the methods; the nuclear wastes are mixed with glass and filled in stainless canisters to make vitrified radioactive wastes. The canisters are stored for 30 to 50 years for cooling prior to geological disposal. Later on when then they dispose, the canisters are covered by over packs which are made of carbon steel and are buried in underground caverns via Bentonite sealing materials. The geological disposal cavern for high level nuclear wastes should be tight by keeping the low permeability of the surrounding rock mass. The caverns will be constructed more than 300 m deep by Japanese regulations so that the rock stress is enough to create the excavation disturbed zones (EdZ), and the excavation damaged zones (EDZ) in the surrounding rock mass. In geological disposal, the thermal stress due to temperature gradient by the decay heat and chemical reactions should be considered. The sealability of the caverns will significantly control by permeability of rock mass which will change deformation, temperature and chemical reactions.