Geological and geochemical investigations below the sea floor in Taiheiyo coal mine, southeastern Hokkaido

Eiji Nakata[1], Takahiro Oyama[1], Yasunori Mahara[1], Yoshitomo Watanabe[1], Tosifumi Igarashi[2], kazuhiro Tanaka[3], Hiroyuki Matsumoto[4], Yoshihisa Ichihara[4]

[1] CRIEPI, [2] Hokkaido Univ, [3] Geol. Dep., CRIEPI, [4] Kushiro coal mine

http://criepi.denken.or.jp

To investigate the properties of sedimentary rock and the behavior of rock mass, we have studied rock properties around tunnel and regional groundwater chemistry below the sea floor at Taiheiyo coal mining (Kushiro coal mine) co., Ltd. This coal mine is excavated deep ground below the Pacific Ocean floor, where about 8km from shore line. Maximum excavated depth is about 800m under the sea level (the depth of water is about 50m). This mine was a precious site to be able to collect non-weathering rocks, several type of groundwater, and to perform the verification of geophysical survey data and to develop new examination, in Japan.

Our study consists of five themes at present, as follow:

(1) Geological and rock properties survey

Kushiro coal field is distributed around the east coast of Hokkaido and below the Pacific Ocean around there. This study area is 4.5km southeast of central Kushiro town. The formation in tunnel mainly consists of the alternation of mudstone, muddy sandstone, sandstone and coal in Paleogene age. These beds strike E-W and dips 6 to 7 degrees southward (toward ocean).

Uniaxial compressive strength of most rocks is about 50MPa. Porosity is between 7 and 17vol% (ave. 12vol%). Rocks, in which the mineral content ratio of kaolinite/smectite is less than 2.5, were easily disintegrated to soak in distilled water at a few minute. On the other hand, these rocks almost have stabilized in the sea water, KCL4% solution, and ethanol. And furthermore, calcite rich rocks and exposed rocks on shore have also stabilized in the distilled water.

(2) Groundwater chemistry survey

For safety mining, drainage around tunnel by non-core perpendicular boring (the basis water hole; about L=300m from bottom of tunnel) is performed from tunnel. We collected 52 tunnel water and deeper groundwater from eight basis water holes. The groundwater can be classified into four types (sea water, fresh water, tunnel water, basis water), based upon chemical composition, oxygen and hydrogen isotope ratio, and groundwater dating.

(3) Distribution of unsaturated zone

We performed two horizontal core drillings, and air permeability test and evaporation test to investigate the migration of groundwater around the GL-285m tunnel below the sea floor.

Water content of core fragments suggests that the unsaturated zone is distributed from the surface of wall to 1m depths.

(4) Recovery velocity of water level

We began to measure recovery velocity of water level in tunnel between 3.1km and 6.5km from the seashore on closing the mine at 2002/1/30. The recovery time estimated by the mining staffs is 8 years at 3.1km point in tunnel.

(5) Biological survey

To investigate existence of microorganism under the deep ground, we collected groundwater from the basis water hole (GL-985m) and the fresh core sample (L=12m from surface of wall; GL-285m) from the tunnel.