Lithological variation of massive serpentinites in marginal zone of serpentinite body in Kamuikotan belt, Hokkaido, Japan: Analysis of advanced-boring cores for tunnel construction

*Shusaku Yamazaki[1], Kenji Okazaki[1], Toshiyuki Kurahashi[1]

1. Civil Engineering Research Institute for Cold Region, Public Works Research Institute, National Research and Development Agancy

Serpentinite body associated with high-pressure metamorphic rocks such as Kamuikotan belt in Hokkaido is very important as a key to understand a deep subduction process in subduction zone. In the field of marine geology, recent advances of sampling and analytical techniques contribute to understand of serpentinization process of abyssal peridotites. On the other hand, terrestrial serpentinite body still remain a lot of unexplained processes such as variation of serpentinization, uplifting mechanism and formation of internal structure, because of poor sampling by its fragile and fragmented rock conditions on earth surface conditions. There are over 30 tunnel construction cases drilling into a serpentinite body in Japan. Geoengineering investigation including description of tunnel drilling face, measurement of physical properties and making cross section of the tunnel route were operated in each tunnel. However, a detailed geological information such as types of source rock and degree and aspect of serpentinization has been less understood from the construction records. In addition, even in recent yeses with developed drilling technology, excavation of serpentinites often encounters serious trouble such as tunnel collapse. It indicates that more detailed classification of serpentinites for tunnel construction is necessary using recent geological insights and technique.

The authors focus on reconstruction of the tunnel geological section and the detailed classification of serpentinites of a tunnel with 1241 m into Takadomari serpentinite body of Horokanai area in Kamuikotan belt in Hokkaido, Japan. In this study, massive serpentinites, which were sampled from advanced-boring core at 50 to 100 m intervals along tunnel route, were conduct to description of core and thin section and XRD analysis to investigate lithological variation around the marginal zone of the serpentinite body contact with Kamuikotan metamorphic rocks.

The research by Igarashi et al. (1985) revealed that serpentinites of the Takadomari body were classified into massive, foliated and clay serpentinites and their source rocks were mostly harzburgite and partly dunite as band in harzburgite. There are large number of “micordiorite” and micro gabbro dikes in the body. As a result of this study, advanced-boring cores from the tunnel also have same variation of massive, foliated and clay serpentinites. The source rock types of massive serpentinites from the marginal zone are also mainly harzburgite with minor band of dunite. All samples were completely serpentinized and only Cr-spinel is survived as primary mineral. Original texture of the massive serpentinite is classified into dunitic texture without pyroxenes, harzburgitic texture with orthopyroxene, cumulate texture with euhedral orthopyroxene and foliation of spinel allay. Serpentine types in the massive serpentinites are antigorite that replaced olivine and orthopyroxene and lately formed asbestos chrysotile vein. Minor amount of brucite also appears through the tunnel. As a notable feature in the marginal zone of the body, three zones of difference serpentinization were observed. In the center of the tunnel, the serpentinites well remain the original harzburgitic and dunitic texture. In the west side with amphibolites, the massive serpentinites contain magnesite veins and patches as metasomatism. In the east side with the contact to greenschists, the original texture is completely disappeared with greenish large antigorite and massive of

grains of magnetite with brucite. The difference of texture and mineralogy of the serpentinites in this tunnel could possibly be explained that the serpentinization process in subduction zone is difference in the both sides of marginal zone in the association with the types of the Kamuikotan metamorphic rocks.

Keywords: Serpentinite, Kamuikotan belt, Boring core

