

Cone penetration tests at shallow gas hydrate exploration sites in 2015

*Takao Ebinuma¹, Syu Kyouno², Yoshitaka Kakuwa³, Ryo Matsumoto³

1.Methane Hydrate Science Course, Department of Management of Social Systems and Civil Engineering, Graduate School of Engineering, Tottori University, 2.OYO Corporation, 3.Gas Hydrate Research Laboratory, Organization for the Strategic Coordination of Research and Intellectual Properties, Meiji University

To develop a production method for natural gas from shallow gas hydrate accumulations, the mechanical strength of shallow sedimentary layers should be investigated. During shallow gas hydrate exploration in 2015, cone penetration tests were conducted at test sites off Joetsu, Japan. The cone penetration resistance, sleeve friction, and pore pressure were measured by using a piezocone penetrometer testing (PCPT) apparatus supplied by Geoquip Marine. The effective section of the cone was 10 cm². The penetration rate and the stroke of the PCPT were 2 cm/s and 3 m, respectively. The cone penetration resistance was less than 100 MPa. The data measured by the penetrating cone were transmitted to an onboard display and a recording device in real time. An undisturbed specimen 1 m long was also sampled immediately above and below the PCPT trial zones, and vane shear and undrained triaxial tests were performed. Because test wells for PCPT were drilled at sites near coring wells, the PCPT results were compared with descriptions of the core specimens. The comparisons confirmed that the PCPT responded sensitively to thin sandy layers, granular gas hydrates, and carbonates in a muddy zone. Undrained shear strengths was also estimated from the PCPT results by using a relational expression for subsurface exploration on land. The estimated values of undrained shear strength were similar to those of the undrained shear strengths measured by the triaxial tests on the undisturbed specimen sampled near the PCPT trial zones. By using the estimated undrained shear strength values, the depth profiles were compared. This study was conducted as part of the shallow methane hydrate exploration project of the Ministry of Economy, Trade and Industry (METI), Japan.

Keywords: Shallow gas hydrate, Piezocone penetrometer testing, Undrained shear strength