Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

SIT38-08 Room:511 Time:April 30 11:00-11:15

Porosity and permeability under effective pressure for the Quaternary Kazusa Group siltstones

MARUMO, Haruna[1*] ; UEHARA, Shin-ichi[1] ; TAMURA, Yukie[2] ; MITSUHASHI, Shunsuke[2]

[1]Graduate School of Science, Toho University, [2]Faculty of Science, Toho University

The Kazusa group is a geological formation of the middle Pleistocene - Pliocene marine, and widely distributes in middle and northern part of the Boso Peninsula. Mudstones of the Kazusa Group is in the first stage of consolidation (viscous compaction stage), and porosity is 37.9 - 55.5% [1]. In mudstone formations of the Kazusa Group, high porosity anomaly is observed, of which location is consistent with that of natural gas deposits. This high porosity anomaly is suggested to have been generated by an abnormally excess pore pressure. The development process of the high pore pressure is still unknown. Previous studies have discussed the mechanism in connection with production of natural gas, but sufficiently quantitative analyses have not been performed. H igh pore pressure zone may affect many properties and processes in underground, such as porosity and permeability development in accretionary wedge or sedimentary basins during accretion and depositional process, ground water flows or petroleum migrations in underground, and fault mechanisms. Thus, to elucidate the mechanism of developing the high pore pressure zone is important. We are therefore planning to investigate the mechanism of the high pore pressure zone development by using the 1D model of Tanikawa et al. [2], which include simple deposition and compaction processes. In this study, as the first step of this project, the effective pressure dependences of porosity and permeability were determined for laboratory experiments for siltstone of the Kazusa Group, which are necessary for the modeling.

The measurements were performed using an intra-vessel deformation fluid-flow apparatus at Toho University. The rock samples used in the experiments were collected from outcrops at Umegase Formation, Ota-dai Formation, Kiwada Formation, Ohara Formation and Katsuura Formation of the Kazusa group. The collected samples were shaped into a cylindrical shape about 40 mm in diameter and about 30 mm in height. Distilled water was used for pore fluid and confining pressure was applied by using oil. Permeability and porosity of siltstones were measured at room temperature and under effective pressures from 0 MPa to 35 MPa. To obtain porosity under effective pressure, we measured a volume of water discharged from the specimen when confining pressure was applied. We measured permeability by monitoring flow rate through the specimen under the condition that pore pressure differences at the both side of the specimen is kept constant.

Permeability and porosity ranged from 10^{-17} - 10^{-18} m^2 and to 34 - 42 %, respectively. Permeability and porosity both decreased with increasing effective pressure, and this pressure dependence varies.Based on the results of the experiment, porosity and permeability was expressed in relation to the effective pressure. We have examined the relationship between permeability and porosity.

References
[1] Inami, K., Bull. Geol. Surv. Japan 34, 207-216 (1983)
[2] Tanikawa, W., J. Geophys.Res.,113,B12403 (2008)

Keywords: Kazusa group, porosity, permeability, laboratory experiment