東オーストラリア沖ロードハウライズ地域で採取された浅部コアの物性・強度試験結果：将来のロードハウライズライザー掘削に向けて
Results of geotechnical tests on shallow sediment cores recovered from Lord Howe Rise, off eastern Australia: Implications for future Lord Howe Rise riser drilling

*杉原 孝充[1]、青池 寛[1]、斎藤 実篤[2]、村山 達也[1]、武田 研太郎[1]、小野寺 拓也[3]、澄川 あゆみ[3]、木戸 ゆかり[1]、真田 佳典[1]
*Takamitsu Sugihara[1], Kan Aoike[1], Saneatsu Saito[2], Tatsuya Murayama[1], Kentaro Takeda[1], Takuya Onodera[3], Ayumi Sumikawa[3], Yukari Kido[1], Yoshinori Sanada[1]

1. 海洋研究開発機構　地球深部探査センター、2. 海洋研究開発機構　海洋掘削科学研究開発センター、3. 日本海洋事業
1. Center for deep earth exploration, Japan Agency for Marine-Science and Technology, 2. Research and development center for ocean drilling science, Japan Agency for Marine-Science and Technology, 3. Nippon Marine Enterprises, Ltd.

Lord Howe Rise (LHR) Drilling Project (871-CPP2) is an accepted IODP drilling proposal to reconstruct Cretaceous tectonic history of northern Zealandia, designated as a Chikyu riser drilling project. In order to plan a riser drilling operation, it is important to evaluate mechanical strength and physical properties of shallow sediment (0 to 100 or 200 meters below sea floor, mbsf) for setting Blow-out Prevention (BOP) system and riser with heavy weight on the seafloor. Geotechnical core test (e.g., triaxial compressive test and consolidation test) is an essential work to directly measure rock strength and physical properties of geological materials. Therefore, the geotechnical core tests are usually conducted for the surface sediment to evaluate their mechanical and physical properties. In the LHR region, calcareous sediment is broadly and predominantly distributed, and clayey sediment is not observed in shallow sediments. In general, deep seafloor is composed of clayey sediment, and their mechanical and physical properties are well understood. However, mechanical and physical properties of calcareous sediment in both ambient and confined pressure conditions are not well known.

In this study, results of geotechnical test for shallow cores taken in the LHR region are presented, and characteristics of mechanical and physical properties (especially shear strength and permeability) are discussed.

Shallow cores for geotechnical test were taken by R/V Kairei with a gravity piston corer in KR17-15C and by D/V JOIDES Resolution with a rotary core barrel (RCB) in Expedition 371. The gravity piston coring by R/V Kairei was conducted at the proposed riser drilling sites DLHR-5A and -3A, and two cores with approximately 7 m length were taken at each site. The RCB coring by D/V JOIDES Resolution was conducted at Site U1506 in Expedition 371. A whole-round sample with 40 cm length was taken from U1506A-13R for our investigation, and depth of the whole-round sample is 116.5 mbsf. In order to measure physical and mechanical properties for the core samples, geotechnical tests of Penetrometer test, Bulk density, Grain density, Liquid limit, Plastic limit, Grain size distribution, Constant rate of strain consolidation test (CRSC test), and Triaxial compressive strength test with pore pressure measurement (Consolidated-Undrained conditions) were carried out.

Most of the tests except penetrometer test were carried out by OYO Co. Procedures of those

measurements and tests were based on the regulations established by Japanese Geotechnical Society (JGS) and Japanese Industrial Standards (JIS). Those are almost the same as their regulations in the ASTM.

All of core samples are composed of calcareous ooze, and grain size distribution of the core samples shows clay size fraction (less than 5 micro meters) is dominant (more than 80 %).

Based on the bulk density data, overburden stresses were calculated and consolidation pressures corresponding to depth of 10 to 240 mbsf for the triaxial test were estimated assuming k0 compaction (k0 factor = 0.5). The result of the triaxial test show shear strength profile gradually increases with depth and is almost identical to those of clayey sediment from Kumano Basin and Nankai Trough. However, the result of the penetrometer test indicates that shear strength of calcareous ooze under ambient condition is quite lower than those of clayey sediment. This observation suggests mechanical strength of calcareous ooze is easily released with depressurizing of sediment.

Based on the result of the CRSC test, it is indicated that calcareous ooze shows no obvious preconsolidation stress, and this result is in good agreement with the result of the triaxial test mentioned above. Permeability of calcareous ooze calculated from the CRSC test results is similar to sandy sediment and the results indicate calcareous ooze is more permeable as compared with clayey sediment.

Those results will be dedicated to analysis for the riser operation in the LHR area.

キーワード：ロードハウライズ、ライザー掘削、岩石強度試験、剪断強度、透水率
Keywords: Lord Howe Rise, Riser drilling, Rock strength test, Shear strength, Permeability

