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IODP Expedition 344 コスタリカ沖の堆積物物性と間隙水圧
Distribution of physical properties and pore pressure of sediments off Costa Rica: IODP Expedition 344

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Evolution of physical properties in subduction zone is a key to understand lithification processes, location of decollement, stress distribution. In this study, we examined the physical properties of sediments using on-board data and laboratory experimental data on sediments obtained off Costa Rica margin to understand the distribution of compaction states.

Target sites are in the Integrate Ocean Drilling Program (IODP) Expedition 344 off Costa Rica, including reference sites (U1381 and U1414), frontal prism site (U1412), mid-slope site (U1380) and upper-slope site (U1413).

Laboratory experiments for velocity and porosity measurements were conducted with variation of effective pressure.

Porosity ranges from about 80% to about 53% during experiments. P-wave velocity ranges from about 1.4 to about 1.7 km/s. S-wave velocity ranges from about 0.75 to 0.93 km/s. Vp/Vs ranges from about 1.73 to 2.04. bulk modulus ranges 1.7 to 2.7. shear modulus ranges from about 0.8 to 1.4. Vp-porosity relationships from on-board data and from laboratory experiments are comparable nicely. This comparable trend in Vp-porosity relationship suggests that the relationship between porosity and effective pressure can be applied to most of sediments.

The porosity-effective pressure curves under isotropic condition were converted to the curves under uniaxial condition (Teeuw, 1971). Using the normal consolidation curves under isotropic and uniaxial stress conditions, we converted the on-board porosity to effective pressure and fluid pressure.

In balk modulus-shear modulus graph, bulk modulus is not seen much change, but shear modulus there are variations.

For U1381 Unit I, hydrostatic fluid pressure was estimated as expected as a reference site.

For U1414 in another reference site, hydrostatic pressure was observed in Unit I, but lower fluid pressure than hydrostatic pressure was estimated in the upper part of Unit II. Below that, the pore pressure returned along hydrostatic pressure. This boundary can be weakened by higher fluid pressure below the boundary, suggesting that this boundary is likely a precursor of decollement.

For Unit 1412 in frontal prism, pore fluid pressure is lower than hydrostatic pressure, suggesting that they have lower porosity possibly caused by tectonic stress.

For 1380 in mid-slope andU1413 in upper slope, very low fluid pressure is observed. Because there is almost no age difference at the boundary, the extremely low porosity can be caused by rapid sedimentation and erosion on the seafloor or tectonic stress enhanced-dehydration.

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