

Preliminary results of lithostratigraphy in IODP Expedition 375: Hikurangi subduction margin coring and observatories

*橋本 善孝¹、Oliveira Christie⁷、Kutterolf Steffen¹³、Meneghini Francesca¹⁷、野田 篤¹⁹、Rabinowitz Hannah²⁰、Underwood Michael²²、Saffer Demian²、Wallace Laura³、Petronotis Katerina⁴、Barnes Philip⁵、Bell Rebecca⁶、Crundwell Martin³、Fagereng Ake⁸、Fulton Patrick⁴、Greve Annika⁹、Harris Robert¹⁰、Hüpers Andre¹¹、Ikari Matt¹¹、伊藤 喜宏¹²、北島 弘子⁴、Lee Hikweon¹⁵、Li Xuesen¹⁴、Luo Min²⁵、Malie Pierre¹⁶、Morgan Julia¹⁸、Savage Heather²⁰、Shepherd Claire³、Shreedharan Srisharan²、Solomon Evan²¹、Wang Maomao²³、Woodhouse Adam²⁴

*Yoshitaka Hashimoto¹、Christie Oliveira⁷、Steffen Kutterolf¹³、Francesca Meneghini¹⁷、Atsushi Noda¹⁹、Hannah Rabinowitz²⁰、Michael Underwood²²、Demian M Saffer²、Laura Wallace³、Katerina Petronotis⁴、Philip Barnes⁵、Rebecca Bell⁶、Martin Crundwell³、Ake Fagereng⁸、Patrick Fulton⁴、Annika Greve⁹、Robert Harris¹⁰、Andre Hüpers¹¹、Matt Ikari¹¹、Yoshihiro Ito¹²、Hiroko Kitajima⁴、Hikweon Lee¹⁵、Xuesen Li¹⁴、Min Luo²⁵、Pierre Malie¹⁶、Julia Morgan¹⁸、Heather Savage²⁰、Claire Shepherd³、Srisharan Shreedharan²、Evan Solomon²¹、Maomao Wang²³、Adam Woodhouse²⁴

1. 高知大学、2. ペンシルバニア州立大学、3. GNSサイエンス、4. テキサスA&M大学、5. NIWA、6. インペリアルカレッジ ロンドン、7. UNISINOS、8. カーディフ大学、9. JAMSTEC、10. オレゴン州立大学、11. ブレーメン大学、12. 京都大学、13. GEOMAR、14. 桂林工学院、15. KIGAM、16. UniLaSalle、17. ピサ大学、18. ライス大学、19. AIST、20. コロンビア大学、21. ワシントン大学、22. ニューメキシコ工科大学、23. 河海大学、24. リーズ大学、25. 上海海洋大学

1. Kochi University, 2. Pennsylvania State University, 3. GNS Science, 4. Texas A&M University, 5. National Institute of Water and Atmospheric Research, 6. Imperial College London, 7. Universidade do Vale do Rio dos Sinos, 8. Cardiff University, 9. JAMSTEC, 10. Oregon State University, 11. University of Bremen, 12. Kyoto University, 13. GEOMAR, 14. Guilin University of Technology, 15. KIGAM, 16. UniLaSalle Terre & Sciences, 17. Università degli Studi di Pisa, 18. Rice University, 19. AIST, 20. Columbia University, 21. University of Washington, 22. New Mexico Institute of Mining and Technology, 23. Hohai University, 24. University of Leeds, 25. Shanghai Ocean University

Slow slip events (SSEs) are common phenomena in subduction zones and are observed as transient aseismic slip on a fault for weeks to months and are faster than plate convergence rate and slower than the slip rate for regular earthquakes. SSEs at the northern Hikurangi subduction zone are the best-documented ones in the world. Recent geophysical studies have revealed that the SSEs occur at shallow plate boundary where one can reach the materials by drilling, and the SSEs recur every 2 years systematically. These characteristics of SSEs at the northern Hikurangi margin provide a good opportunity to core sediments and install observatories to understand the nature and mechanisms of SSEs.

In International Ocean Discovery Program (IODP) Expedition 375, three scientific objectives have been targeted: 1) Characterization of materials (lithology, structure, frictional and soil-mechanical properties, and so on) associated with SSEs area, 2) Characterization of conditions (temperature, stress, and so on) in the upper plate above SSEs source area, and 3) Monitoring of deformation, hydrogeology and chemistry via borehole observatories. These scientific objects are linked to test the hypotheses: 1) SSEs propagate to the trench, 2) Pore fluid pressure is elevated in the source region, 3) SSEs occur in regions of conditional frictional stability, 4) There is a continuum of SSEs, and 5) Slow slip events drive fluid flow along faults.

The transect for the cruise is located in the region where the Pacific Plate subducts westward beneath the North Island of New Zealand along the Hikurangi Trough at a convergence rate of 4.5-5.5 cm/y. To achieve the scientific objectives, four drill sites are chosen for the cruise: 1) Upper slope site, 2) frontal thrust site and 3) two subduction input sites (thick sedimentary input close to a front of Hikurangi Trough and thin sedimentary input above a seamount). Coring will be conducted in all sites and observatories will be installed in the sites except for the input site above a seamount. Logging while drilling (LWD) was conducted also at the sites except for the site above a seamount in IODP Expedition 372, which was operated at the same sites previously.

On the basis of regional and seismic interpretations, the upper slope site includes ~440 m of Quaternary deposits with muds, sand and ash, and sandy and muddy turbidites underlying that. In the frontal thrust site, Pleistocene trench-fill sediments of sand and mud turbidites with ash is expected. At the thick sedimentary input site a succession of clastic trench turbidites will additionally overlie the older pelagic and volcanic sediments observed at the thin sedimentary input site. To achieve the objectives we will firstly achieve the lithostratigraphic information by drilling to understand basic circumstances for the Hikurangi subduction zone.

In this presentation, we mainly focus on the preliminary results of lithostratigraphic work from the onboard descriptions that is just after the end of cruise.

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