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Investigation of repeated reactivation behaviour of the Tuaheni Landslide Complex (TLC) in the Hikurangi Margin, New Zealand: insights from XCT-scans on cores from the IODP Expedition 372

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The IODP Expedition 372 “Creeping Gas Hydrate Slides and LWD for Hikurangi Subduction Margin” occurred from 26th November 2017 to 4th January 2018. Among the different scientific objectives, the IODP Expedition 372 aimed to investigate the relationship between gas hydrate processes and the kinematics of Tuaheni Landslide Complex (TLC). Key drilling, downhole logging and coring data were gathered within the landslide at site U1517-C. First results support the hypothesis of a slow-motion, repeated reactivation behaviour of the TLC slid masses. However, key role of gas hydrate dissociation processes could not be confirmed with first preliminary results. Therefore, we aim to study the micro-textures/structures, particularly the nature and timing of micro-deformations of the slid masses based on XCT-scans. These scans allow to see features which cannot be observed from direct, naked-eye observations on sediment cores. Together with the IODP Expedition 372 dataset, we will test the different hypotheses (gas hydrates versus liquefaction), as well as to gain a better understanding of this uncommon slow-motion and repeated reactivation behaviour of the TLC that is poorly documented in submarine systems.
To do so, we plan: (I) To characterize, localize and understand formation mechanisms of microstructures occurring within the reactivated part of the landslide, based on XCT scans analyses (resolution: 350 μm). Integration and correlation of the IODP Expedition 372 dataset (sedimentology, geotechnical testing, etc.) will contribute to identify and to select specific sections of interest all along the U1517-C cores. These sections will be then sampled (cm-scale) for the second part of the project. (II) To provide mechanical and timing constraints on slow and repeated reactivation processes experimenting micro-XCT scanning and 4D (Time-resolved) XCT scanning (resolution: 3 μm to 50 μm) . This method allows to visualize microstructures with 3D-higher-resolution images, but especially to scan while experiencing in-situ deformation and/or failure mechanisms.This new and innovative method is a great opportunity to have access to deformation mechanisms in real time. Timing is a key component in submarine landslides dynamics. This project will bring new and essential elements to the understanding of a specific poorly documented submarine mass movement process, not only in terms of fundamental mechanisms of landslides, but also in the associated geohazards assessment.