Geophysical Research Abstracts
Vol. 18, EGU2016-2078, 2016
EGU General Assembly 2016

Submarine creeping landslide deformation controlled by the presence of gas hydrates: The Tuaheni Landslide Complex, New Zealand

Felix Gross (1), Joshu Mountjoy (2), Garethy Crutchle (3), Stephanie Koch (4), Jörg Bialas (4), Ingo Pecher (5), Susi Woelz (2), Anke Dannowski (4), Jon Carey (3), Aaron Micallef (6), Christoph Böttner (1), Katrin Huhn (7), and Sebastian Krastel (1)

(1) Christian-Albrechts-Universität zu Kiel, Institute of Geosciences, Geophysics, Kiel, Germany (fgross@geophysik.uni-kiel.de), (2) NIWA, Wellington, New Zealand, (3) GNS Science, Lower Hutt, New Zealand, (4) GEOMAR Helmholtz Centre for Ocean Research, Kiel, Germany, (5) University of Auckland, Faculty of Science, Auckland, (6) University of Malta, Msida, Malta, (7) Marum, Bremen, Germany

Methane hydrate occurrence is bound to a finite pressure/temperature window on continental slopes, known as the gas hydrate stability zone (GHSZ). Hydrates within sediment pore spaces and fractures are recognized to act like a cement, increasing shear strength and stabilizing slopes.
However, recent studies show that over longer strain periods methane hydrates can undergo ductile deformation. This combination of short term strengthening and longer term ductile behavior is implicated in the development of slow creeping submarine landforms within the GHSZ.
In order to study this phenomenon, a new high-resolution seismic 3D volume was acquired at the Tuaheni Landslide Complex (TLC) at the Hikurangi margin offshore the North Island of New Zealand. Parts of TLC have been interpreted as a slow moving landslide controlled by the gas hydrate system. Two hypotheses for its slow deformation related to the presence of methane hydrates have been proposed: i) Hydrofracturing, driven by gas pressure at the base of the GHSZ, allows pressurized fluids to ascend toward the seafloor, thereby weakening the shallow debris and promoting failure. ii) The mixture of methane hydrates and sediment results in a rheology that behaves in a ductile way under sustained loading, resulting in slow deformation comparable to that of terrestrial and extra-terrestrial rock glaciers.
The 3D dataset reveals the distribution of gas and the extend of gas hydrate stability within the deformed debris, as well as deformation fabrics like tectonic-style faulting and a prominent basal décollement, known to be a critical element of terrestrial earth-flows and rock glaciers. Observations from 3D data indicate that the TLC represents the type example of a new submarine landform – an active creeping submarine landslide – which is influenced by the presence of gas hydrates. The morphology, internal structure and deformation of the landslide are comparable with terrestrial- and extra-terrestrial earth flows and rock-glaciers.