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Measurements of mechanical parameters on sediment cores collected in the Matakaoa avalanches system, South Kermadec subduction, New Zealand

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Continental slopes of active margins are subject to large submarine instabilities and mass failures. Multibeam bathymetry, seismic-reflection data and sediment cores were collected in the Matakaoa avalanche system (North Island, New Zealand) during the Tan 0314 cruise conducted by the NIWA in 2003. The data show that the Matakaoa morphological re-entrant is associated with a large failure scar, figuring the headwall of a complex system of debris flows and debris avalanches that extend northward over more than 200 km.

Triaxial tests have been conducted on sediment cores collected at three sites between 600 and 1500 m depth, on both east and west side of the Matakaoa re-entrant. The tests allowed to quantify the mechanical parameters and the variability of the sediment rheology, according to the specific morphology, sediment structure and nature of each coring zone. The main parameter investigated is the shearing resistance of materials (Mohr-Coulomb criteria). The knowledge of shear resistance enables to determine stability models, fixing the boundary conditions of the sediments rheology (i.e. limiting axial stress and strain at the rupture).

In the core sections analyzed, four shear tests have been run under isotropic consoli-

dation stresses varying from 300 to 2000 kPa, and under axial stresses reaching 3500 kPa (simulating water depths to 350 m). All the tests were conducted under conditions of saturation and hydrostatic pressures similar to the initial state of sediment deposits. The shear tests are therefore of "consolidated undrained" type, with fluid pore pressure measurements.

Using axial strain and stress deviator measured during the shear tests, it is possible, by Mohr-Coulomb's method, to obtain important rheological parameters such as: **Cu**, undrained cohesion (kPa); **C'**, effective cohesion (kPa); ϕ_{Cu}, internal friction angle (°) and ϕ**'**, effective internal friction angle (°). It is then possible to determine the theoretical limit between stability and rupture domains. The first results of the tests give internal friction angles from 14 to 18°, and undrained cohesion values from 10 to 60 kPa.

Additional experiments will allow to verify whether the shear stress (stress for which the rupture occurs) varies as a linear function of the consolidation stress or whether the rupture limit becomes independent of it for greater depths. Indeed, it is difficult to know precisely the mechanical parameters involved in shear resistance, taking into account differences between coring conditions and consolidation stresses generated during the tests. Reducing the number of unknown mechanical parameters in the final stability equation (finite elements modelling and Mohr-Coulomb rupture criteria) will allow to understand the role of external triggering parameters (sea-level changes, seismic accelerations during earthquakes, lithostatic overload...) during the Matakaoa landslide paroxysmal phase.

The main goal of these experiences is the modelling of submarine slope instabilities according to rheological parameters directly related to the nature of the sediment, and to external parameters.