

Effects of lithology on the mechanical properties of the input materials at the Hikurangi margin

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Subduction zones are known to produce large, damaging earthquakes, but they can also experience slow-slip events which cannot be felt by humans. Understanding the mechanisms that influence this variation in slip rate is crucial for better assessing how the subduction zones will act in the future. While the seafloor sediments make up a small portion of the subducting oceanic plate, they can have a noticeable impact on its ability to produce both large earthquakes and slow-slip events. Here, we report the mechanical properties of sediments and rocks that are subducting in the Hikurangi Margin. The International Ocean Discovery Program (IODP) Expedition 375 recovered input sediments and basement rocks at Sites U1520 and U1526. We compared shipboard physical properties with the chemical composition determined using the X-ray fluorescence (XRF) scanner at the Gulf Coast Repository. We also analyzed drilling data and conducted deformation experiments on volcanoclastic materials from Site U1520. By integrating the XRF data with porosity, p-wave velocity, and drilling parameters, as well as lab tests to determine the strength of these rocks, we can evaluate how the composition of the sediments affects their physical and mechanical properties. The preliminary results show a strong correlation between calcium content, porosity, and p-wave velocity for the volcanoclastic cores. There is also evidence to suggest that the torque on bit during drilling is an indication of rock strength as it increases sharply when the calciferous-volcanoclastic boundary is reached. Triaxial compression tests in the lab should confirm and quantify the rock strength of the volcanoclastic materials. This investigation into the subducting sediments properties builds onto pre-existing studies into the effects of seamounts on subduction and the factors that influence the slip rate at subduction zones.

Keywords: Subduction zones, Hikurangi Margin, laboratory experiments