

Evidence for Mass Transport Deposits at the IODP JFAST-Site in the Japan Trench

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Several studies indicate that the 2011 Tohoku-Oki earthquake (Mw 9.0) off the Pacific coast of Japan has induced slip to the trench and triggered landslides in the Japan Trench. A major effort in marine geosciences is currently to better understand these processes, including detailed mapping and coring landslides at the trench as well as Integrated Ocean Drilling Program (IODP) drilling (Japan Trench Fast Earthquake Drilling Project, JFAST) to recover the shallow fault zone.

Here we report sediment core data from the rapid response R/V SONNE cruise (SO219A) to the Japan Trench, evidencing mass transport deposits (MTD) in the uppermost section drilled at the IODP JFAST-site. A 8.7 meter long gravity core (GeoB16423-1) recovered from ~7000 meter water depth reveals a 8 m sequence of semi-consolidated mud clast breccias embedded in a distorted chaotic sediment matrix. The MTD is covered by a thin veneer of 50 cm hemipelagic, bioturbated diatomaceous mud. This stratigraphic boundary can be clearly distinguished by using physical properties data from Multi Sensor Core Logging and from fall-cone penetrometer shear strength measurements. The geochemical analysis of the pore-water shows undisturbed linear profiles measured from the seafloor downcore across the stratigraphic contact between overlying younger background-sediment and MTD below. This indicates that the MTD at the JFAST-site is older than the Tohoku-Oki event, and that the investigated section has not been affected by sediment destabilization triggered by the slip-to-the-toe Tohoku-Oki earthquake event. Instead, we report an older landslide which occurred in the relatively young geological past between 700 and 10,000 years ago, implying that submarine mass movements along the Japan Trench are frequent processes.

Keywords: Japan Trench, Mass Transport Deposit, Tohoku-Oki Earthquake, IODP-JFAST, geochemistry, physical property