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Morphology, sedimentology, and possible causes of submarine landslides on the northeastern margin of Korean Peninsula in the East Sea

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Submarine landslides are common geomorphological features of the continental margins and may be associated with destructive tsunamis that threaten large population centers along these coasts. In this study, we investigate submarine landslides from a newly collected dataset constituted by multibeam bathymetry, subbottom chirp, reflection seismic, and piston cores in the northeastern margin of the Korean peninsula in the East Sea. At least four submarine landslides and corresponding mass-transport deposits (i.e. slides/slumps, debris flow deposits) are documented in multibeam bathymetry and high-resolution seismic reflection data. These landslides initiate at water depths of 400-600 m and left very clear scarps (ca. 100 m high) on the seafloor. Piston cores taken below the headwall scarps confirm the presence of landslide deposits that are represented by inclined- and deformed-beds and mud clasts with variable size and shape. Two landslide-wall cores show sharp boundary surfaces at depths of 2.7–4.0 m below the present-day seafloor that are interpreted to represent slide planes. These boundary surfaces are identified by a sharp color-change boundary; large increases in sediment stiffness; and slight decreases in water content and porosities. Ages of landslides are being determined, but the preliminary analyses suggest they are older than ca. 15 ka. Individual landslides comprise volumes in the range of 2.5 –10 km3, cover 450 km2 on the seafloor and have run out distances of up to 50 km from the source. We suggest that the preferential occurrence of major failures adjacent to the major faults on the lower slope may ultimately be tectonic-controlled although other factors may have contributed as well. Stability analyses based on geotechnical properties of slope sediments indicate that all areas are stable under static and seismic loading. This finding points to some additional factor or factors must predispose certain areas, such as the slide zone, at the times of slide emplacement. Our work shows that gas is abundant in the shallow subsurface and may be important in reducing the strength of the sediment and allowing failure to occur. Piston cores further show higher-permeability units (weak layers) that would focus fluid flow and could act as slip planes for slope failure. Finally, if a large slope failure with a volume of up to 10 km3 were to occur today on the northeastern Korean Margin, a tsunami would probably result and its negative economic and societal impact would likely be severe and significant.