REGIONAL VARIABILITY OF FACTORS THAT INFLUENCE OFFSHORE SLOPE STABILITY, SYNTHESIS WITHIN A GIS

By Homa J. Lee, Jacques Locat, Peter Dartnell, Diane Minasian, and Florence Wong

Submarine slope failures occur when the environmental forces that tend to move sediment downslope as a mass exceed the ability of the sediment to resist these forces. These forces are typically derived from earthquakes, waves, or gravity. Over the long term, both the environmental forces and the sediment resistance vary in a systematic regional way. As a result, the occurrence and character of mass movements vary regionally and reflect variations of sedimentological and environmental conditions. This situation lends itself well to the application of a Geographic Information System (GIS) toward predicting regional variations in slope failure susceptibility.

Regional studies were conducted in two areas off the coast of California: the Eel margin, near Eureka, and Santa Monica Bay, near Los Angeles. For each environment, detailed multibeam bathymetric maps were recently obtained, and extensive sediment coring programs were conducted. Each area represents a seismically active continental margin with significant sediment accumulation rates. The bathymetric maps show few obvious shallow-seated landslides with the exception of a steep slope south of the Palos Verdes Peninsula near Los Angeles. Extensive shallow-seated landslides and at least one deep-seated landslide cover most of the Palos Verdes slope. A simplified regional slope stability analysis was applied to both the Eel margin and Santa Monica Bay areas. The analysis uses an algorithm relating cyclic shear strength to surface sediment density that was derived from over 100 cyclic triaxial tests. Sediment strengths predicted using this algorithm were combined with slope steepness calculations from swath bathymetry and estimates of expected seismic shaking to calculate a measure of regional relative stability with respect to shallow-seated failure. All calculations and presentations were conducted within the structure of a geographic information system (GIS). Preliminary results show that the area of observed landslides on the Palos Verdes slope is associated with relatively low values of slope stability factors. Other, apparently more stable areas are associated with higher values of the stability factors.