WORKSHOP REPORT

Resolution unique tool to examine slope failure

Contributed by Lincoln Pratson, Carlos Primez, and David Goldberg

A workshop on slope stability was convened in April 1995 to focus the scientific goals of a potential ODP drilling leg devoted to studying submarine slope failure. Submarine failures are one of the greatest hazards to marine installations (e.g., communications cables, offshore production infrastructure, and national defense facilities). In certain coastal settings, such failures threaten life and property through their potential to generate tsunamis (e.g., the 1979 Var River delta failure in Nice, France) and liquefy shorelines (e.g., the 1964 Seward earthquake in Alaska). Submarine failures are also a primary means of transporting sediment from the continental slope to the deep sea, and are thus a key agent in shaping continental margin morphology and stratigraphy.

The Slope Stability Workshop was jointly sponsored by JOI/USSAC and Lamont-Doherty Earth Observatory, and was held at LDEO in Palisades, NY, on April 30, 1995. It was attended by U.S. and Canadian scientists with expertise in a broad array of fields related to submarine slopes. Workshop participants agreed that advances in seafloor imaging have greatly improved our understanding of what slope failures look like. But they also agreed that important questions remain about the causes and consequences of this phenomenon. For example, it is known that numerous mechanisms can trigger slope failure, such as earthquakes, seafloor oversteepening, and gas expansion. However, our understanding of these controlling mechanisms remains poor. The frequency of slope failures, and the conditions that determine where, and to what extent, a submarine slope fails are also presently unknown.

The workshop identified three principal objectives that need to be met before submarine slope stability can be reliably gauged:

(1) Establish *why* particular slopes fail while adjacent slopes remain intact.
(2) Determine *how* such failures occur and what the conditions were prior to and during failure that lead to different styles of failure evolution.
(3) Resolve *when* slope failures occur, and how their timing relates to varying environmental conditions, such as sea-level change.

Lincoln Pratson is a no-nonsense associate research scientist at LDEO who claims he lacks a sense of humor (but has two kids).

Carlos Pirmez is a post-doctoral research scientist at LDEO. In his spare time Carlos raises bees, exports hydroponic equipment to Brazil, casts a fly-rod in the Catskills, and pretends to design efficient survey strategies.

David Goldberg is Choir Director at the LDEO Borehole Research Group. When he's not confusing the staff or blithering about sonic tools, he might be found playing the Banjo (sometimes in tune).

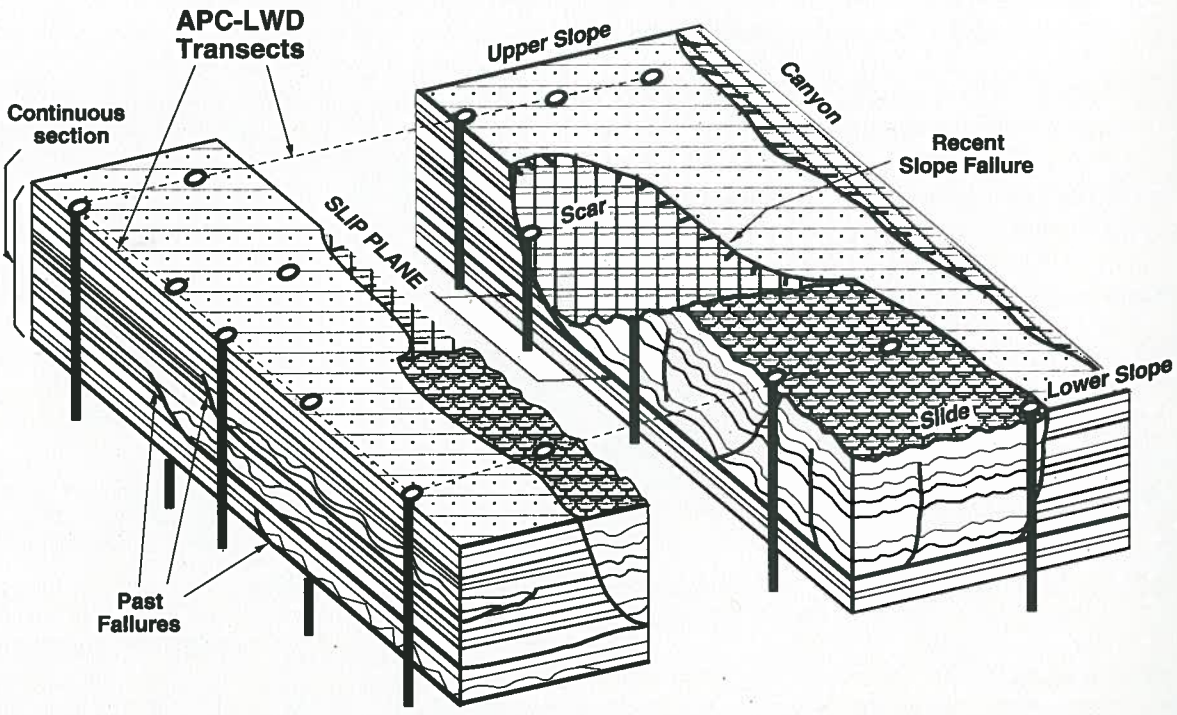


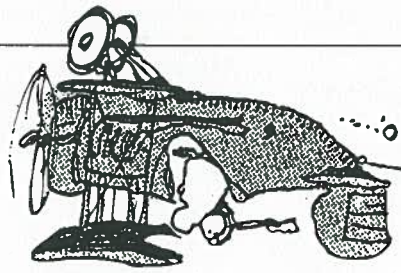
Fig. 1: APC-LWD drilling-transect strategy of recent and past slope failures and undisturbed stratigraphic sections surrounding the failures.

Workshop participants recognized that *JOIDES Resolution* is a unique tool capable of addressing these objectives. Specifically, the Advanced Piston Corer (APC) and Logging-While-Drilling (LWD) capabilities of the drillship can be used to rapidly collect transects of cores and logs from seafloor slopes. Transects across seafloor slopes, from failed to unfailed regions, will enable detailed sampling of failure surfaces from their exposure in failure scars to where they lie intact beneath adjacent unfailed sediments. In the latter regions, failure slip planes are generally buried tens of meters below the seafloor, beyond the reach of conventional piston coring (Figure 1). Multiple APC and LWD transects will yield new and detailed information on the spatial (lateral and vertical) variability in the mechanical, physical, chemical and sedimentological properties of slope strata, and how these properties relate to slope stability.

Since much still needs to be learned about submarine slope stability, the Workshop recommended that the first areas drilled should be geologically simple so that the causative mechanisms for slope failure can be resolved. Ideally, the study areas should also be small (~100 km^2) and well-surveyed. The extensive drilling and logging approaches discussed can then be used to thoroughly document the spatial variability of slope properties in failed and unfailed seafloor regions, and in the transition zones between them (Figure 1).

Target sites along continental margins throughout the world were nominated during the workshop as areas for conducting the first slope-stability drilling legs. Drilling the continental rise and abyssal plain promises to provide critical information on the dynamics of failure transport. However, workshop participants agreed that the recovered sedimentary record would likely be difficult to date and may possibly preclude the reconstruction of slope failure frequency. The middle Pleistocene record recovered from an intercanyon area on the upper New Jersey continental slope during ODP Leg 150 suggests that similar continental slope sites may harbor long, datable records of sedimentation. If Pleistocene chronologies can be developed for these records, they will identify the timing of past slope failures in other areas of the continental slope during a period in which sea level variations are well constrained. Participants concluded that the recovery of such records would provide critical information for gauging when, why, and how submarine slopes failed in the past and present, and where slope failure may occur in the future.

Workshop participants were: Clark Alexander, Peter DeMenocal, John Diebold, Neal Driscoll, Dave Goldberg, Richard Hiscott, Anne Jennings, Homa Lee, Jacques Locat, Ulisses Mello, Greg Mountain, Lisa Osterman, Charlie Paull, Carlos Pirmez, Lincoln Pratson, and Bill Ryan.



Change of JOI Personnel

Mary Reagan, Program Associate, left JOI at the beginning of the year to join the Borehole Research Group at LDEO as Program Manager. You may now find Mary with her nose to the grind stone and "logging" it. They say the Diet Coke sales at Lamont have risen sharply.

After working as a postdoc at Brown University and spending two years at the University of British Columbia, John Farrell has joined JOI as Assistant Program Director for ODP. John has already discovered some of the wonders of Washington, DC summers, but says he's going to stay, anyway.