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Slipping and Sliding: Capturing the Earth in Motion by Scientific Ocean Drilling

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Since the beginning of ocean drilling, sampling and dating reflection-seismically imaged tectono-stratigraphic sections and recovering sediments and rocks from marine convergent plate-boundary systems has advanced our understanding of subduction zone structures and evolution. It further evidenced the dynamic nature of deformation, fluid flow and mass fluxes within such systems. With the advancement in developing borehole observatories, monitoring data is increasingly becoming available to analyze and quantify the dynamic processes, such as those leading to and resulting from earthquakes, slides and tsunamis. Short instrumental records, however, limit our perspective of maximum magnitude and recurrence of such submarine geohazard processes. Examining past events expressed as sedimentary or geochemical perturbations preserved in the marine record provides IODP the key to address this challenge on relevant time scales.

This talk summarizes recent efforts by IODP and related method-developments to unravel the marine-geological record for advancing our understanding on past earthquake occurrences and resulting dynamic responses of deep-water seafloor and sub-seafloor environments. In particular, I highlight the role of earthquakes on event-triggered sediment mass transfer and carbon cycling in deep sea trenches, such as those around the Pacific rim of fire and representing the deepest parts of our world′s ocean.