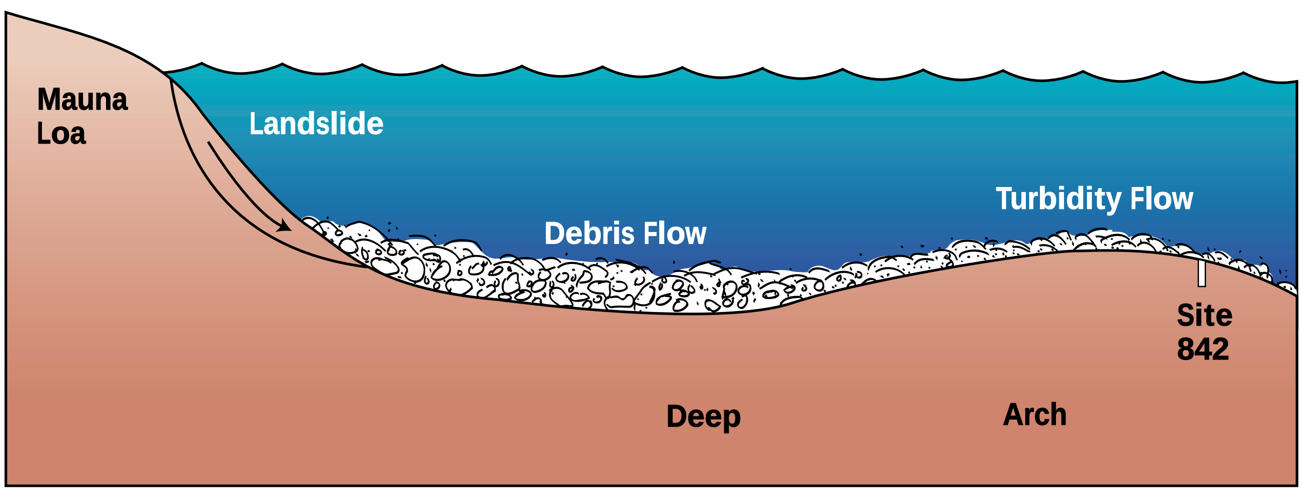
New evidence for massive landslides from the Hawaiian Islands

Michael O. Garcia, University of Hawaii

Hot-spot produced oceanic islands are built rapidly (~1 MA), which causes them to be gravitationally unstable and to generate giant landslides from their flanks. The history of Hawaiian giant landslides is recorded in the sediments surrounding the Hawaiian Islands. During ODP Leg 136, cores were taken 320 km west of the island of Hawaii on the outer side of the arch that surrounds the Hawaiian chain. The cores from Site 842 contain Pleistocene to late Oligocene graded volcanic sand layers with glass (or its alteration products) and mixed assemblages of Pleistocene to Eocene radiolarians or Eocene and Cretaceous ichtholiths (fish teeth). The age (based on paleomagnetic and fossil evidence) and the glass compositions were used to relate some of these sands to specific Hawaiian volcanoes. The low sulfur content of the glasses (<0.02 wt%) indicates that they were erupted under shallow marine to subaerial conditions.

In our model (shown below), the sands were deposited by turbidity currents that were produced by giant landslides that originate near sea level and descend 4 to 5 km down the flanks of several Hawaiian volcanoes. The debris flows generated by the landslides scoured the sedimentary section outboard from the Hawaiian Islands. Along their 270 to 320 km trip to Site 842, the turbidity currents form the debris flows ran over the ~500-m-high Hawaiian Arch, which indicates that the currents were at least 325 m thick. Similar turbidite deposits are located 930 km south of the Hawaiian Islands. Thus, landslides from Hawaiian volcanoes (and probably from many other oceanic islands) can generate enormous turbidity currents that transport sediments long distances from their source (1000+ km). This phenomenon is an alternative explanation to Antarctic bottom waters for creating mixed assemblages of Pleistocene and Eocene radiolarians in deep-sea sediment.



This simple model for the origin of the turbidite layers at ODP Site 842 combines the observed landslide scars and debris flows around the Hawaiian Islands (e.g., [*Moore et al.,* 1989]) and the presence of turbidite layers in the Site 842 cores. Given the relief of ~500 m between the Hawaiian Deep and Arch, the turbidity currents that deposited the sands layers must have been at least 325 m thick when they crossed the crest of the Arch, based on the models of upslope flow for turbidity currents by Muck and Underwood [1990].