VOLCANO INSTABILITY ON THE SUBMARINE SOUTH FLANK OF HAWAII ISLAND

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ABSTRACT

Marine geophysical data, including SEA BEAM bathymetry, HAWAII MR1 sidescan, seismic reflection profiles, and magnetic anomaly data were acquired over the offshore continuation of the unstable Kilauea volcano south flank. This slope, comprised of the three active hot spot volcanoes Mauna Loa, Kilauea, and Loihi seamount, is the locus of the Hawaiian hot spot and is the site of frequent low intensity seismicity as well as episodic large magnitude earthquakes. Its subaerial portion is reported to creep seaward at approximately 10 cm/yr. The Hilina slump is the only large submarine landslide in the Hawaiian Archipelago thought to be active, and this study is the first to more highly resolve a particular slide feature. The overall picture gained from these data sets is one of mass wasting of the neovolcanic terrain as it builds upward and seaward, though reinforcement by young and pre-Hawaii seamounts adjacent to the pedestal is apparent. Extensive lava delta deposits are formed by hyaloclastites and detritus from recent lava flows into the sea. These deposits dominate the upper submarine slope offshore of Kilauea. Along the lower flanks of submarine volcanic rift zones are patches of hummocky topography suggesting failure by avalanching or more frequent sloughing off of material. The larger and more intact Hilina slump block is classified into four distinct zones from nearshore to the island's base. Estimates of size based on these data indicate a slumped area of 2100 km² and a volume of 10,000-12,000 km³ equivalent to about 10% of the entire island edifice. Thus, volcano building on the leading edge of the Hawaiian hot spot is a "two steps up, one step down" process where several scales of flank degradation are apparent. The slope instabilities on the southeast flank of Hawaii Island suggest a complex interplay of neotectonic and neovolcanic activity in a
mid-plate setting, and provide an active model for interpreting the processes causing structural collapse in the form of extensive submarine landslides within the EEZ's of oceanic islands and seamounts throughout the world ocean.