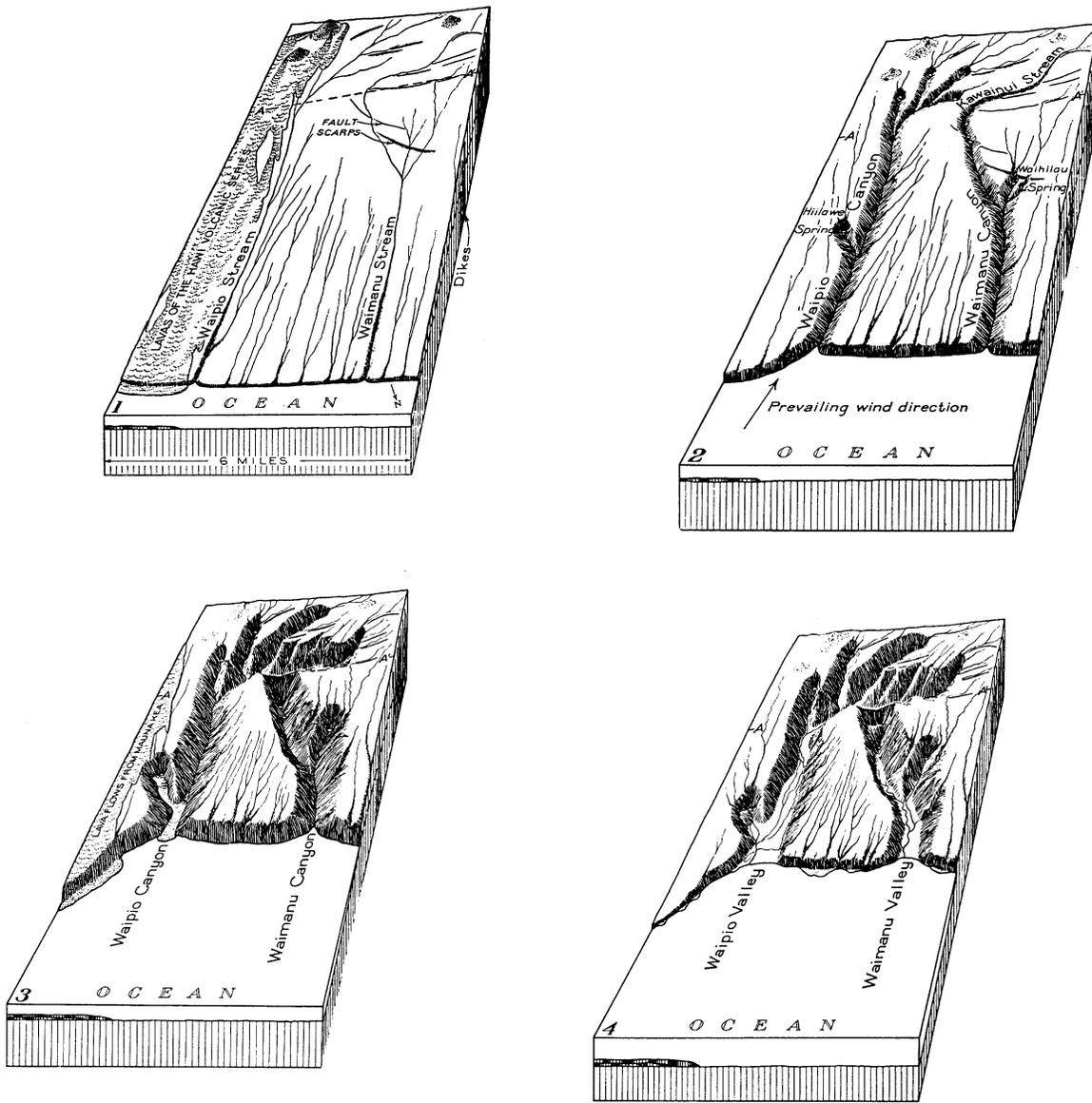


## Four Stages showing the development of Waipi'o and Waimanu Valley



Stage 1: Waipi'o stream flows along the margin of the heavy andesites (rocks that are harder to erode) of the Hawi volcanic series (left). The rest of the block consists of older, more easily eroded thin-bedded basalts of the Pololu volcanic series. The locations of the upper tributaries of Waipi'o and Waimanu streams are determined partly by fault scarp (steep cliff faces caused by rocks sliding off one another).

Stage 2: Waipi'o and Waimanu streams have cut deep canyons in the side of the mountain. Hiiilawe, Waimanu, and Waihilau streams tap water confined between a few stray dikes (wide, dense intrusive rocks that have the capacity to hold water) whereas the headwaters of Waipi'o Stream have tapped water confined in the main dike swarm which trends parallel to the line AA'. The sea has cut high cliffs along the shore. The spur on the left side of Waipi'o Canyon, being armored by thick andesites (rocks that are harder to erode), has resisted wave erosion better than the rest of the block consisting of basalt.

Stage 3: The large volume of spring water tapped in the main dike swarm by Waipiʻō stream has caused its tributaries to cut headward faster so that the ancestral Kawainui stream has been captured by Waipiʻō Stream. A lava flow from Mauna Kea has spilled into Hiilawe cove and flowed down Waipiʻō Valley. Others have spilled over the sea cliff left of Waipiʻō Canyon slowing down marine erosion in this sector. High cliffs have been cut by the sea on the weak basalts.

Stage 4: A submergence of the island by more than 1,200 feet has partly drowned the sea cliff and main canyons. Alluvium floor Waipiʻō and Waimanu valleys. Landslides are filling the head of Waimanu Valley as a result of the decrease in flow from loss of more ground water to Waipiʻō Stream.

Credit: Stearns, Harold T. 1966. The Geology of Hawaii. Pacific Books, Palo Alto. 266 pp.