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SPOTLIGHT 3 | Lō'ihī Seamount

18°55.80'S, 155°15.00'W

By Hubert Staudigel, Craig L. Moyer, Michael O. Garcia, Alex Malahoff, David A. Clague, and Anthony A.P. Koppers

Lō'ihī Seamount defines the volcanically active, leading edge in the Hawaiian hotspot chain. It is located on the submarine flank of Mauna Loa, 30 km south of the island of Hawai'i. Lō'ihī's summit is at 975-m water depth (Pisces Peak), and the seamount has a pronounced southern rift that extends down to about 5000-m water depth (Figure 1). The summit displays three pit craters (Figure 1), including Pele's Pit (1350-m water depth), the most hydrothermally active crater, which was formed during an earthquake swarm in 1996 (Garcia et al., 2006). Lō'ihī was not recognized as an active volcano until a sampling expedition in 1978 that led to a detailed understanding of Lō'ihī as a juvenile oceanic intraplate volcano; it then became the de facto type location for the first stage in the development of a typical oceanic intraplate volcano (Figure 2; Moore et al., 1982; Staudigel et al., 1984; Koppers and Watts, 2010). Key characteristics of this "Lō'ihī Stage" of ocean island formation include: (1) a very small volume relative to the final completed volcano, (2) a diverse suite of rock types ranging from very alkalic to tholeiitic, and (3) heterogeneous mantle sources. Since then, Lō'ihī has been the focus of substantial scientific research, with numerous sampling expeditions, leading to a detailed understanding of its volcanic history, seismic activity,

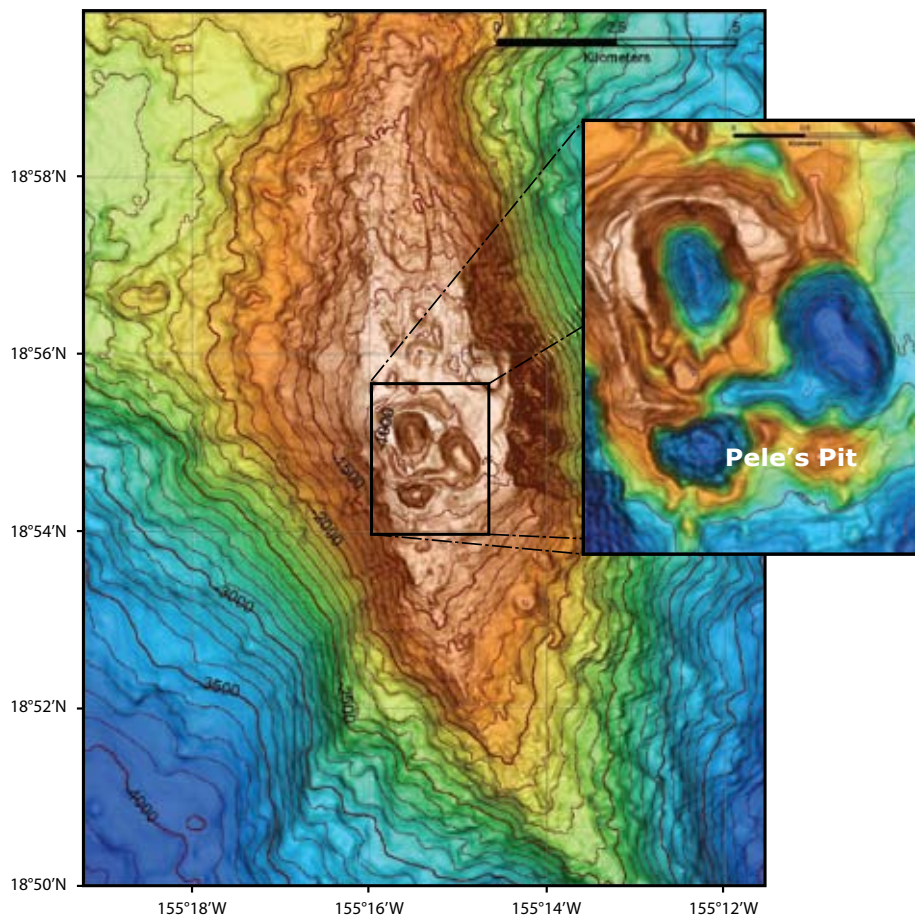


Figure 1. Map of the three pit craters on Lō'ihī's summit.

petrology, geochemistry, and microbiology (see review by Garcia et al., 2006; Emerson et al., 2007; http://en.wikipedia.org/wiki/Loihi_Seamount).

Most recent attention has been focused on the interaction between Lō'ihī's hydrothermal activity and

microbiological processes. Hydrothermal activity at Lō'ihī has been monitored over several decades through numerous submersible visits, establishing that Lō'ihī's vents are very rich in ^3He and CO_2 and contain substantial fluxes of Fe (review by Malahoff et al., 2006). Lō'ihī's

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distinct He isotope compositions allowed Lupton (1996) to trace its hydrothermal plumes over 2,000 km toward the east, demonstrating the use of hydrothermal plumes as tracers for mid-water-depth ocean circulation. The Fe-hydroxide-rich nature of the Lō`ihi hydrothermal vents led to detailed studies of novel microbial communities thriving on Fe-oxidation and the discovery of a new genus of Proteobacteria, *Mariprofundus ferrooxydans* (Emerson et al., 2007). Lō`ihi Seamount is now recognized for its potential value to observatory-based science, including the (short-lived) fiber-optic-linked HUGO geophysical

observatory in 1997 (<http://www.soest.hawaii.edu/HUGO/hugo.html>) and the FeMO microbial observatory for Fe-oxidizing microbes in 2006 (<http://earthref.org/FEMO>).

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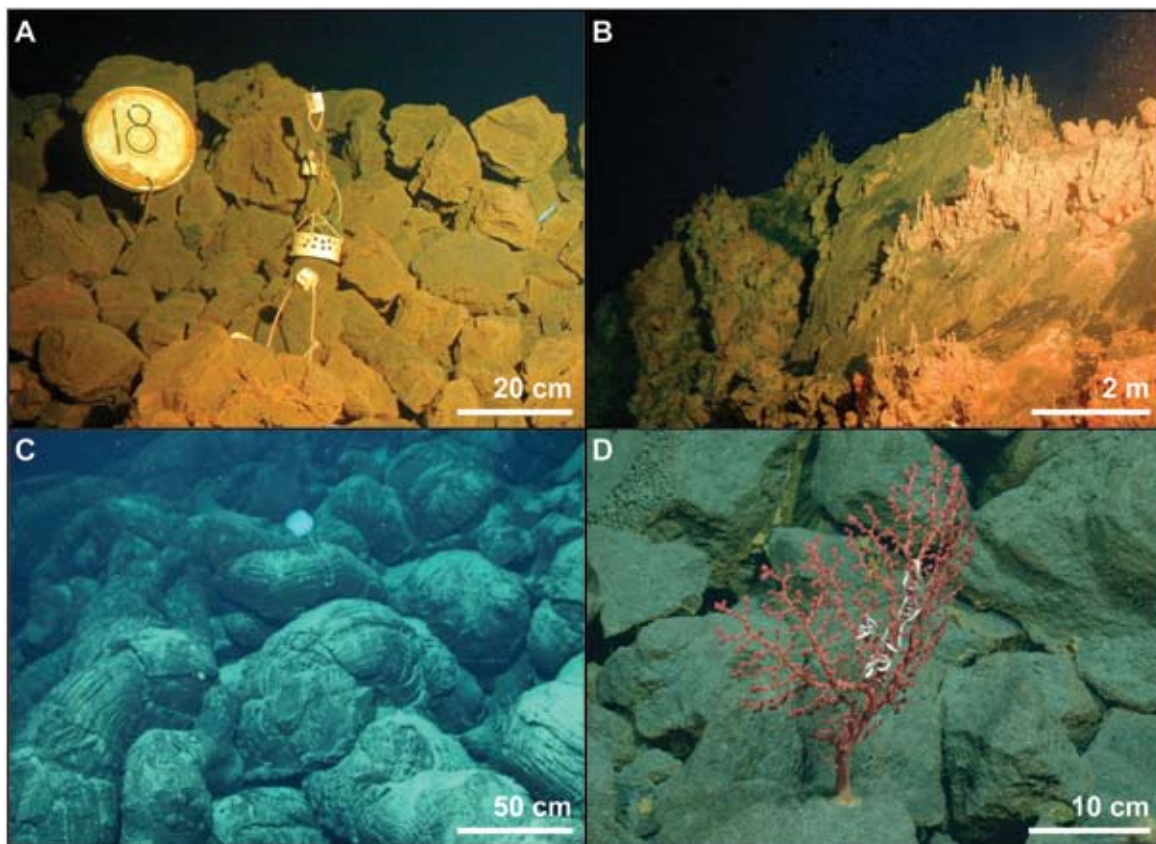


Figure 2. Seafloor images from Lō`ihi Seamount. (a) Pillow fragment breccia near Marker 18 on the western end of Pele's Pit, the location of a microbial exposure experiment; the breccia fragments are coated with Fe-oxide stain. (b) Fe-oxide chimneys in Pele's Pit. (c) Pillow lavas and (d) pillow breccia on the south rift as a substrate for the growth of a coral with a brittle star.