TERRESTRIAL BASALTIC COUNTERPARTS FOR THE VENUS STEEP-SIDED OR "PANCAKE" DOMES; *S. E. H. Sakimoto,* Department of Earth and Planetary Sciences, The Johns Hopkins University, Baltimore, MD 21218-2681.

The Magellan Images of Venus have revealed a number of intriguing volcanic and tectonic features, including the steep-sided or "pancake" domes. These volcanic domes or flows have morphologies that suggest formation by a single continuous emplacement of magma with a higher viscosity than that of the surrounding basaltic plains. Since the majority of studied terrestrial volcanic domes are silicic, numerous investigators have compared the domes to terrestrial silicic volcanic domes and suggested that such high viscosity is due to high silica content, leading to the conclusion that the domes are evidence of evolved magmatic products on Venus. However, the majority of volcanic features on Earth are basaltic seafloor features, and thus little studied and not often used for interplanetary volcanologic comparisons. Nevertheless, the Venus domes may have a greater resemblance to terrestrial basaltic submarine domes than to the terrestrial silicic subarial domes.

Modeling of Venus volcanic dome formation indicates that it is probably feasible to produce the steep-sided domes from a variety of compositions—including basalt—and thus their morphology is not necessarily an unambiguous indication of their composition [1, 2]. Several studies comparing their morphology to terrestrial features have been made [3, 4, 5], however, the overwhelming majority of terrestrial features selected for comparison to the Venus pancake domes are silicic, small, and subarial. Since the Venus domes are usually at least one magnitude larger in both diameter and in volume than the terrestrial subarial features, and possibly made of basaltic material similar to that of the plains [2, 6], it seems reasonable to compare Venus domes to terrestrial seafloor volcanic features; specifically, seamounts. While the terrestrial seafloor has many features comparable to Venus volcanic features such as extensive basaltic plains, shield-like small edifices, and large volcanic constructs, seamounts such as those recently described by [7] seem the most promising analogs of the Venus pancake domes. Three particularly interesting seamounts (figure 1), as imaged in the SEABEAM 2000 data of [7], are approximately 5 km across and 1 km high, basaltic, with flat to bowl-shaped tops. The Venus steep-sided domes, as characterized by Pavri et al. [3], generally have steep sides, relatively flat tops, and radial symmetry. Individual dome morphologies range from low shield-like shapes with flat tops to steep-sided "pancakes" with concave tops. Thus, the Venus domes and the seamounts are morphologically very similar as well as having the low aspect ratios and high volumes in common. Possible differences include seamount flanks that are somewhat less steep than those of the Venus domes due to talus slope formation, which appears to be generally less prevalent on Venus than on Earth. Also, sediment cover obscures the tops of the terrestrial seamounts and precludes observations of a presence or lack of the concentric and radial fracturing patterns observed on some of the Venusian domes. Due to resolution limitations in both the Magellan Venus data and the terrestrial bathymetric data, it is not possible to absolutely determine if either feature type is composed of individual flows or a single flow. However, Pavri et al. [3] considered the smooth margins, radial symmetry, and lack of evidence for multiple flows indications that the Venus domes were the result of a single eruptive episode.

The similarities between the Venus domes and the seamounts may be the result of similarities between Venus and oceanic thermal lithosphere conditions. Generally, the probability of transport and/or eruption of a magma of a particular crystallinity is a function of the time it spends at that crystallinity during the cooling process [12]. If the heat flux out of a magma is reduced and the cooling process lengthened, the time a magma has to erupt or be transported before it is too crystalline to move (approximately 60% crystals [12]), is correspondingly longer also. Probability of transport and/or eruption for a given magma is enhanced on Venus relative to Earth [11] as the result of a reduced heat flux out of the magma caused by the higher surface temperature and higher near-surface thermal gradient [8, 9, 10, 11] in the Venus thermal lithosphere relative to terrestrial oceanic thermal lithosphere

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conditions. A similar but smaller magnitude effect may exist for terrestrial oceanic lithosphere conditions in comparison to terrestrial continental lithosphere conditions. In both cases, this effect would increase the probability of eruption of all magmas, as well as the probability of eruption of higher crystallinity (20-50%) basalts. These basalts could then either spread as a single unit [1, 2, 13] or as a series of units [14] and form steep-sided basaltic domes instead of the more common basaltic shields. If this is the case, than the terrestrial seafloor is probably a more appropriate region than the continents for Venus comparative planetary volcanology studies of the steep-sided or "pancake" domes as well as other features.

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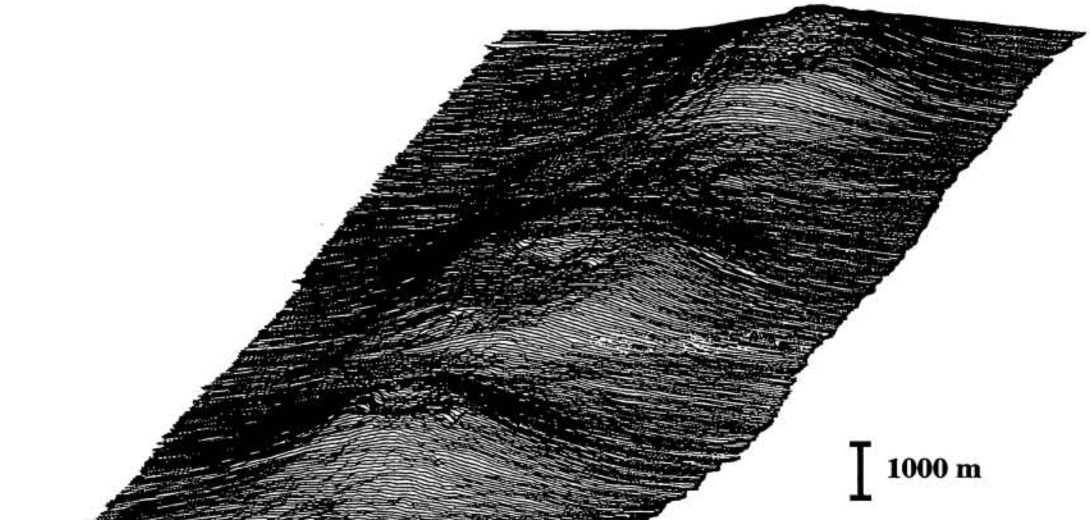

Figure 1. Topography of the "Three Wisemen" seamounts at latitude -18 17.2 and longitude -114 44.2 near the northern East Pacific Rise. No vertical exaggeration (figure after [7]). See text for discussion.