BASALTIC ERUPTIVE FISSURES ON EARTH AS ANALOGS TO VOLCANIC PROCESSES ON THE MOON AND MARS. S.S. Hughes[1], W.B. Garry[2], S.E. Kobs Nawotniak[1], A. Sehlke[3,4], D.W.G. Sears[3,4], E.H. Christiansen[5], R.C. Elphic[3], D.S.S. Lim[3,4] and J.L. Heldmann[3]. [1]Idaho State University, Pocatello, ID; [2]NASA Goddard Space Flight Center, Greenbelt, MD; [3]NASA Ames Research Center, Moffett Field, CA; [4]Bay Area Environmental Research Institute, Petaluma, CA; [5]Brigham Young University, Provo, UT.

Introduction: Linear or curvilinear eruptive fissure vents are the dominant sources of basaltic lava on planetary surfaces. To better understand the association of fissure vents with volcanic terrains, we evaluate fresh terrestrial features of the Great Rift and surroundings on the eastern Snake River Plain (ESRP) of Idaho, USA, as well as Hawai`i, Iceland and Ethiopia.

We use geomorphology and physiography to categorize fissure vents on Earth and the Moon. Volcanic features on Mars have been extensively studied previously, but we focus on the fossae near Alba Mons and low shields in the Tharsis region. Lunar features are examined using the Lunar Reconnaissance Orbiter Camera (LROC) in Quickmap, while the study of volcanic features on Mars uses MRO Context Camera (CTX) imagery. This study represents a component of the SSERVI program FINESSE (Field Investigations to Enable Solar System Science and Exploration), Dr. Jennifer Heldmann, PI.

Basaltic Fissure Vents on Earth: Lava fields on the ESRP reveal three types of basaltic fissure vents: (1) monogenetic, simple short-lived eruption, at least one visible fissure vent (e.g., Kings Bowl); (2) monogenetic, low-shield or pyroclastic cone obscures fissure (e.g., Wapi lava field); and (3) polygenetic, intermittent eruptions, multiple vents and cones over an extended time period (e.g., The Great Rift). Collectively they represent, especially types 1 and 2, the progenitors of plains-style volcanism, typified by the ESRP as a major contributor to the landscapes of terrestrial planets. Many other examples exist on Earth.

A fourth type of fissure system, not apparent on the ESRP, is represented by networks of dikes and vents in major volcanic rift zones. These systems are characterized by dike swarms with aligned fissures and graben and extensive lava flows (e.g., Lakagigar, Iceland).

Fissure Vents on the Moon: Fissure vents on the Moon are mainly represented by dark pyroclastic deposits in two terrains: floor-fractured craters (FFCs) in highlands and smooth plains within or near mare basins. Nearly all in FFC settings are type 1 simple systems and a few are type 2, where vents are obscured by pyroclastic deposits. We find no evidence of types 3 or 4 in FFCs, and only two vents are considered to be type 2, Airy and Hell, which are cones that dominate the interiors of their host craters. Most vents associated with maria are also type 1 and a few are considered type 4; however, many mare vents likely were covered by lava. Some type 1 mare vents lie on complex rille networks (rimae) where multiple vents are likely. We suggest that most mare vents, like flood basalt fissures, may actually be considered type 4.

A plot of lunar fissure vent dimensions (Fig. 1) illustrates a near linear trend of crater depth vs. width represented by mare vents with FFC vents closely associated. Several postulated vents fall significantly off that trend, having much greater relative widths, which may represent the existence of lunar calderas.

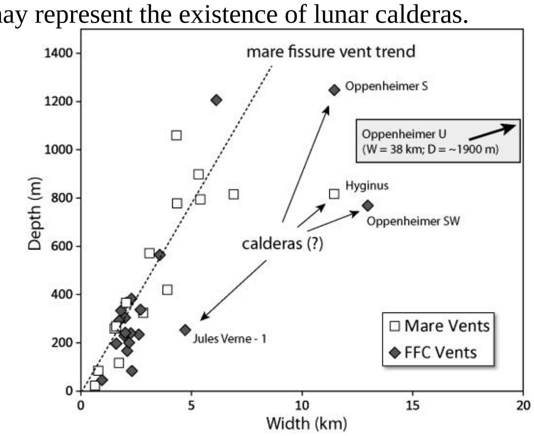

Figure 1. Plot of depth vs. width of lunar vents, measured rim-to-floor and rim-to-rim using Quickmap.

Fissure Vents on Mars: Fissure vents on Mars unsurprisingly depict many structures of plains volcanism found on the ESRP analog terrain. Fossae vents are dominantly type 1 well-exposed fissures with few visibly connected lava flows; however, most lie on vast lava flow fields so many earlier vents are likely buried. By contrast, type 2 fissure vents on low shields reveal more direct association with outflow lava lobes that cover the flanks. Although many reveal elongate craters, only a few portray a direct association (type 1) to a linear fissure. Types 3 or 4 fissure vents may have existed in Mars' geologic history, but additional exploration is necessary to reveal geologic associations.

Conclusions: The preponderance of type 1 fissure vents in FFCs suggests relatively small, local networks of magmatic reservoirs compared to much more extensive type 4 dike swarms depicted by mare volcanism. Type 1 fissure vents also suggest late-stage, low-volume volcanism in fossae on Mars, while type 2 vents are mostly associated with low shields. Extensive older lava fields on the flanks of large Tharsis shields may indicate type 4 dike swarms; however, that association will require more detailed exploration.