FIELD AND REMOTE SENSING INVESTIGATIONS OF VOLCANIC EMBAYMENT RELATIONSHIPS IN TERRESTRIAL ANALOGUES FOR APPLICATION TO MARS. S. P. Scheidt[1,3,4], D. A. Crown[1], S. W. Ruff[3], J. W., Rice[1], and F. C. Chuang[1]. [1]Planetary Science Institute, Tucson, Arizona 85719, [2]Arizona State University, Tempe, AZ 85287, [3]Howard University, Washington, DC 20059 (stephen.scheidt@howard.edu), [4]Center for Research & Exploration in Space Science and Technology, Greenbelt, MD 20771.

Introduction: The interpretation of contact relationships using remote sensing data can be challenging due to geologic complexities combined with modification by surfaces processes. We are integrating multi-faceted analyses of volcanic embayment relationships in terrestrial settings to aid in the interpretation of embayment relationships on Mars.

This project will generate a detailed geologic map of Gusev crater using GIS and a combination of THEMIS, CTX, and HiRISE data. Detailed field investigations of volcanic embayment and contact relationships at sites in western North America, including the Zuni-Bandera (New Mexico), Craters of the Moon (Idaho), and Coso (California) volcanic fields, will inform our interpretations of Mars' surfaces and the geologic record preserved in Gusev crater.

Background: The geological history of Gusev crater is complex, with features attributed to a variety of geologic processes. It was described initially from orbital data and then by in situ exploration by the MER Spirit rover [1]. There are vastly different interpretations of Gusev crater floor materials [e.g., 2-5], and parts of the floor deposits have been defined as plains basaltic units [e.g., 6-8] that surround older features of astrobiological significance, such as the Columbia Hills and outcrops of sedimentary and altered rocks [9,10]. Fundamental uncertainties remain regarding the nature, magnitudes, and ages of these areas. Preexisting landforms associated with embayment are prominent elsewhere on Mars, including Jezero Crater, where NASA's Perseverance rover and small uncrewed aerial system (sUAS) Ingenuity missions are currently operating.

Fieldwork and Analysis: We are addressing a series of questions using the topographic, morphologic, textural, and compositional signatures at terrestrial analogue sites. What information regarding the styles and stratigraphic sequences of volcanism is evident at embayment contacts? What properties of lava flow margins along embayment contacts are diagnostic of a volcanic origin and what are their scale-dependencies? How do volcanic embayment signatures change with degradation as a function of surface process?

Our team will document observations in the field and collect high-resolution aerial image data using sUAS to produce digital terrain models that are 6 times the resolution of comparable data from HiIRSE (Figure 2) [11]. The mineralogy of field samples will be characterized in the laboratory using thermal infrared [12] and visible and near infrared spectroscopy, which will aid in classifying geological units and the mineralogical interaction at contacts. The detailed compilation of topographic, morphologic, textural, and compositional characteristics will provide ground truth for aerial and orbital observations and reveal scale-dependencies of key embayment signatures and the effects of degradation of geologic contacts.

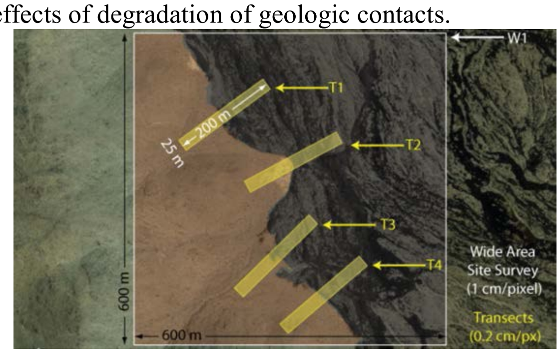

Figure 1. sUAS image collection strategy for lava embayment contacts, with wide area 4 cm/pix and high resolution nested transects (T1-T4, < 2cm/px).

Expected Significance: Our analyses of contacts between lava flows and pre-existing terrain, states of degradation, scale dependencies relevant to contact relationships on Mars, and the types of compositional exchange across contacts will provide a robust foundation that can be applied to Martian observations.

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