IDENTIFICATION OF VOLCANIC RIDGE IN NORTHERN SYRIA PLANUM, MARS: CONSTRAINT ON GEOLOGIC HISTORY OF SYRIA. J.A. Richardson[1], J.E. Bleacher[2], and A.R. Baptista[3], [1]Department of Geography and Geology, Eastern Michigan University, Ypsilanti, MI 48197 USA (jricha13@emich.edu), [2]Planetary Geodynamics Laboratory, Code 698, NASA Goddard Space Flight Center, Greenbelt, MD, 20771, [3]Center for Earth and Planetary Studies, Smithsonian Institution, PO Box 37012, National Air and Space Museum MRC 315, Washington, D.C. 20013-7012.

Introduction: The acquisition of post-*Viking* data enable for the first time detailed cataloging and morphologic descriptions of the wide range of small volcanic vents in the Tharsis province. This ability represents a critical step forward in the scientific understanding of martian magma production and eruption. An effort is currently underway to catalog small vents in the Tharsis region of Mars including the application of nearest neighbor and 2 point azimuth statistical analyses to quantify the spacing and alignment relationships within and between volcanic fields [1]. Here we report on an aspect of this project involving mapping the location of small volcanic vents in Syria Planum.

Study Area: Syria Planum is found between 8°-20°S and 110°-95°W. It is bound by Noctis Labyrinthus to the north and to the south by Claritas Fossae and Solis Planum**.** Syria has long been acknowledged as a volcanic and tectonic center within the Tharsis province [2-5]. Data from Mars Orbiter Laser Altimeter (MOLA) showed that the plateau is composed of dozens of small, coalesced shield volcanoes.

Recently a geologic history was proposed for Syria including multiple volcanic and tectonic events. Baptista et al. [6] developed a geologic history of Syria Planum including tectonic and volcanic events identified in the Plateau. First, Northwest trending Noachian aged graben formed in the existing basement rock. These were embayed by Hesperian lavas from Syria Mons, located near the center of the plateau. Syria Mons is >6700m above MOLA datum. The lavas from the volcano flowed up to 1000 km to the southeast, covering a very large aerial extent. Sparse northeast trending faults later altered the volcano. To the east of Syria Mons, a second volcanic episode produced dozens of Hesperian aged volcanic vents whose flows coalesced to form a monogenetic volcanic field. Each shield covers an aerial extent of <1500 km^2. These volcanoes are unembayed to the southwest where some of their lava flows embayed the older flows of Syria Mons to the west. Finally, possibly during the opening of Noctis Labyrinthus, large scale (10s of kilometers in length) collapse features with a wide range of orientations formed within both volcanic units [6]. Here we report on the latest mapping of volcanic vents within Syria Planum and provide new insight into the geologic history of the region.

Approach: Images from the Thermal Emission Imaging System (THEMIS), the Context Imager (CTX), and the High Resolution Imaging Science Experiment (HiRISE) as well as MOLA altimetry data were used to identify locations where lava erupted onto the surface of Syria Planum, forming small (up to 10s km in diameter) volcanic vents. We identify a feature with the following characteristics as a volcanic vent: 1) a topographically positive landform with closed contours, which 2) displays a depression at its apex and 3) has observable radiating flow patterns from its summit. We also identify landforms with the following characteristics as likely volcanic vents: 1) a topographically positive landform, which 2) has a height of 10s to 100s of meters but displays no collapsed depression at its summit. Two-dimensional data points are plotted at the center of the collapsed depression, if present, or otherwise at the topographic peak of the landform. We assume that this point most closely marks the location along which magma ascended through the crust to form this vent.

Results: At least 163 volcanic vents are identified within Syria Planum. Baptista et al. previously identified two magmatic events in Syria: 1) Syria Mons with large scale flows (100s km in length) and 2) an episode that formed a coalesced field of monogenetic shield volcanoes [6]. Our catalog agrees with the description of these episodes by Baptista et al.

We identify a third episode of volcanism to the north of the two volcanic terrains. This event emplaced lavas and produced small vents that also coalesced, together forming a northeast trending ridge that occupies the highest topographic point in Syria Planum. Here, we refer to this feature as the North Syria Ridge. This ridge is 7400-8080 m above datum, approximately 160 km in length along strike, and is oriented N35E. We identify 17 volcanic vents within the North Syria Ridge. Flows related to the development of this feature radiate up to >400 km from the central peak of the ridge to cover an estimated area of 45,000 km^2.

The North Syria Ridge and lavas emplaced by its formation represent the uppermost stratigraphic unit of Syria Planum as evidenced by the southern margin of its flows. Faults that cross-cut the coalesced shields to the south are filled by the North Syria Ridge lava flows, which themselves are not cut by this population of faults. Furthermore, where we observe a distinct margin

between the North Syria Ridge and the coalesced field to the south, the northern ridge flows always embay their southern counterparts. Beyond the ridge's flow margin to the northeast and southwest, faults and collapse features of several kilometers in length are found trending in the same direction as the ridge.

Discussion/Conclusion: We newly identify a volcanic region in northern Syria Planum that is characterized by lava flows of large areal extent (45,000 km^2), forming a northeast trending ridge at the summit of the plateau. This volcanic region is interpreted to be the youngest episode of volcanism in Syria Planum. Superposition relationships indicate that the North Syria Ridge was emplaced after the formation of the coalesced shields to the south which are embayed by the ridge volcanism. Further, because the lavas from the ridge are superimposed over all faulting in the coalesced shields, we suggest that a period of regional extension separates the two magma generation events.

The identification of the North Syria Ridge suggests a more complex history of Syria Planum including the following geologic events: 1) formation of a dense field of NW-SE graben in a Noachian aged basement; 2) formation of Syria Mons at 13.85°'S 104.15°W that emplaces flows covering many of the graben to the southeast; 3) NE-SW faulting observed within the volcano; 4) a coalesced shield field forms to the east of the large volcano; 5) faulting occurs forming collapse features that cross-cut all older units; 6) volcanic eruptions produce the North Syria Ridge, which covers northern Syria Planum and embays all younger units to the south.

The source of the magma that formed the ridge, with relation to the older volcanism, is unknown. Two scenarios might explain these observations: 1) a migration of volcanic activity from the south to the north, in which case the North Syria Ridge represents an evolution and migration of activity of the same eruptive expisode that emplaced the coalesced shield field to the south, or 2) a younger, unique magma generation event beneath Syria Planum.

The northeast alignment of the ridge is possibly due in part to previous faulting in the basement rock of Syria Planum. Massive faulting in a similar orientation to the ridge can be observed along the strike of the ridge to the northeast of Noctis Labyrinthus. The ascending magma might have followed these faults as the easiest pathways to the surface, thereby creating the elongated regional topographic rise.

To test these hypotheses spatial statistical analysis will be conducted on all vents located within Syria Planum, vents found within the North Syria Ridge, and vents found within the southern coalesced shields to quantify vent alignments possibly related to different episodes of magmatism in Syria Planum. Crater counting will also be implemented to further understand age constraints of the emplacement of the North Syria Ridge as related to the rest of the plateau.

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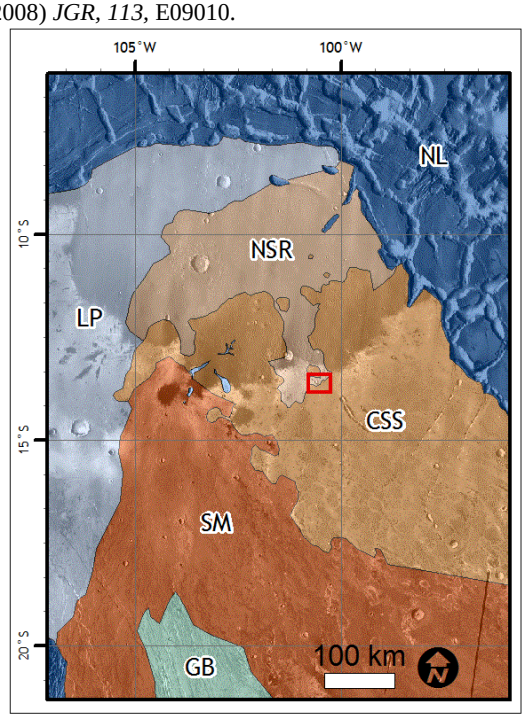

Fig. 1. Geologic map of Syria Planum. Units: GB; Noachian graben, VA; Syria Mons and flows, CSS; coalesced small shields, NSR; North Syria Ridge, NL; Noctis Labyrinthus, LP; low plains surrounding Syria. Box in the center shows location of Fig 2.

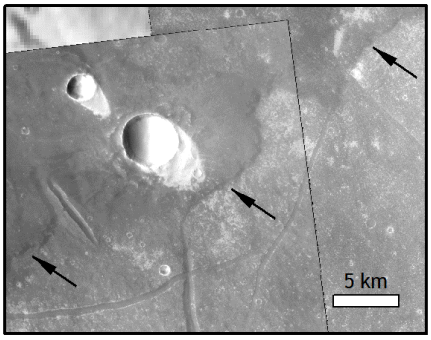

Fig. 2. CTX imagery where North Syria Ridge lava flows meet coalesced shields to the south. Lava can be seen filling three graben and embaying a NW oriented linear vent. Black arrows point at the margin.