RELATIONSHIPS BETWEEN INTERCRATER AND INTRACRATER PLAINS IN TYRRHENA TERRA, MARS: A CASE STUDY A. R. Boyd[1,2], K. D. Seelos[2], F. P. Seelos[2], [1]University of Maryland, College Park, 3017A Washington, 4928 Lehigh Road, College Park, MD 20742 (aroyab@terpmail.umd.edu), [2]JHU Applied Physics Laboratory, Laurel, MD 20723.

Introduction: The Noachian highland cratered landscape is particularly well-exposed and exemplified in the Tyrrhena Terra region of Mars, bracketed between Isidis and Hellas Basins as well as the Syrtis Major and Hesperia volcanic provinces [**Fig 1**]. A complex interplay of geologic processes has shaped this terrain, ranging from fluvial to volcanic and aeolian, but also over 4 Ga years of impact cratering. Mineral and compositional information has revealed the Noachian crust in this region to consist of mafic to ultramafic materials that experienced widespread, near subsurface aqueous alteration resulting in localized deposits of phyllosilicates, carbonates, and salts [1].

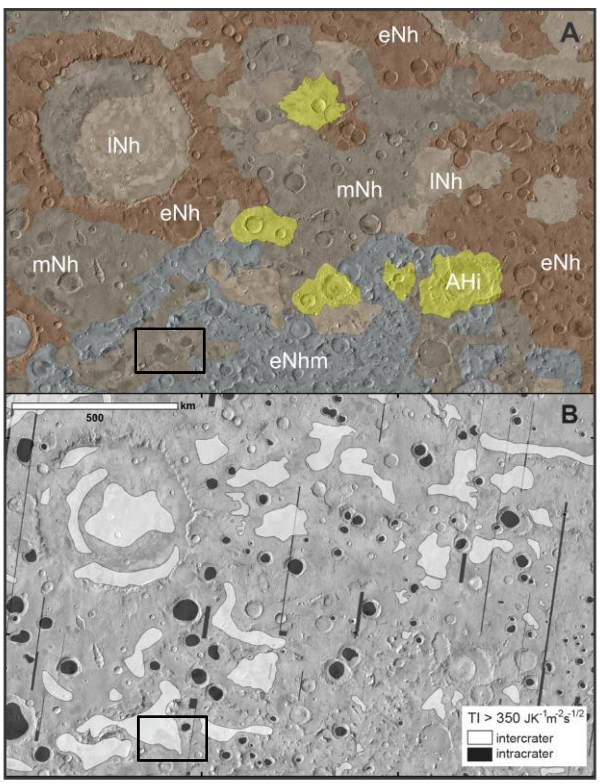

Figure 1. *Regional context with study area and location of Fig. 2. indicated. (A) Geologic units from [2] over THEMIS daytime IR: early, middle, and late Noachian highland units (eNh, mNh, lNh), early Noachian highland massif unit (eNhm), and Amazonian Hesperian impact unit (AHi). (B) Map from [3] showing intercrater and intracrater plains deposits with elevated thermal inertia (> 350 $JK^{-1}m^{-2}s^{-1/2}$).*

Overlain on these impact-churned materials are slightly younger plains deposits that fill lower elevation areas both between craters ("intercrater") and inside craters ("intracrater"). Remotely-sensed properties of these plains deposits suggest a relatively consolidated basaltic material, as evidenced by elevated thermal inertia values [4] and enhanced olivine and pyroxene spectral signatures [5, 6, 7]. However, exactly how these plains were emplaced remains unresolved. In some places, morphologic evidence suggests a volcanic origin (e.g., dikes and wrinkle ridges [8], while in others, particularly within craters, a decompression melting [9] or lacustrine origin has been proposed [10]. Moreover, it is not clear that the intercrater and intracrater plains share the same emplacement mechanism despite their similar thermophysical characteristics.

This project aims to investigate an unusually clear-cut example of a conjoined intra- and inter-crater plains deposit to establish any relationship that might shed light on the origin of similar deposits throughout the Noachian highlands. The crater is unnamed and located in the northwest rim region of Hellas Basin (**Fig. 1**). In general, the region is characterized by a heavily eroded appearance, with channels, mountainous terrain and craters throughout. The floor of the crater of interest is filled with smooth plains material that overlies the western rim and extends out and down into the surrounding region. Here, we utilize multiple datasets to map the morphology and mineralogy of this feature to discern how the feature formed, and thus inform the evolution and geologic history of the martian crust.

Datasets and Methodology: The area's morphologic characteristics were examined and delineated using data from the 100 m/pixel daytime and nighttime controlled mosaics from the Thermal Emission Imaging System (THEMIS) [11], and 6 m/pixel broadband visible data from the Context Camera (CTX) [12]. Locally, 0.5 m/pixel visible information from the High Resolution Imaging Science Experiment (HiRISE) was used to understand the detailed morphologic properties and relationships.

Morphologic Units: The result of the morphologic mapping is presented in **Fig. 2**. The smooth plains unit is characterized by lower albedo and higher thermal inertia, as inferred from daytime and nighttime THEMIS data. Wrinkle ridges and patchy terrain are superposed, while the surrounding undivided, fluvially dissected terrains and rough, knobby terrains are stratigraphically beneath. Relationships between the smooth plains unit and the other morphologic units are detailed in **Figures 3A-C**.

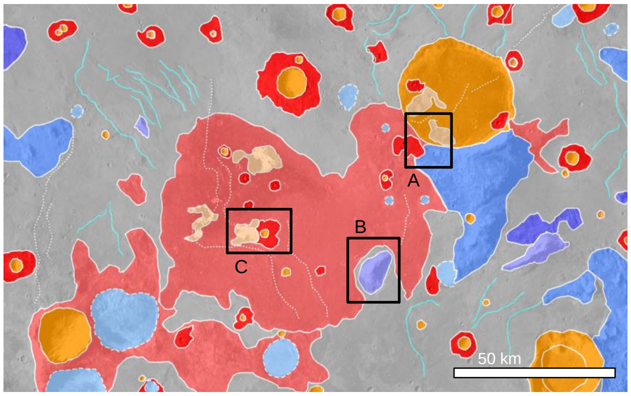

Figure 2. *Color-coded morphologic map of the study region overlain on THEMIS daytime IR. The locations of Figures 3A-C are outlined in black.*

Table 1: *Map Legend*

	Patchy Terrain		Buried Crater Rim
	Wrinkle Ridge		Etched Terrain
	Smooth Terrain		Undivided Terrain
	Eroded Channels		Massif
	Crater		Rough Terrain
	Ejecta		

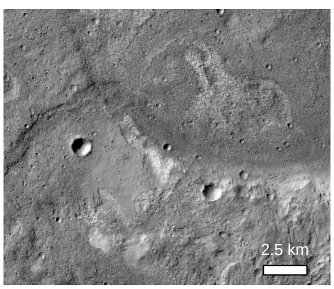

Figure 3A*: The area where the intra- and inter-crater smooth plains intersect with of the rim of the hosting crater and the superposed older, rough terrain. The smooth plains material appears to have flowed around the rim and rough terrain before expanding west.*

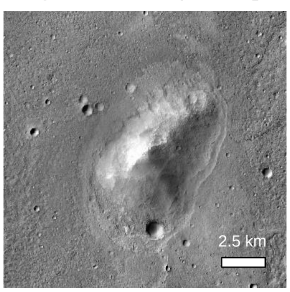

Figure 3B*: Relationship between the smooth plains and an isolated massif. The smooth plains encircles the knob, which is slightly depressed at the base like a moat. This is an embayment relationship wherein the younger unit (plains) overlaps the older unit (massif). The older massif has a texture similar to that of the nearby rough terrain.*

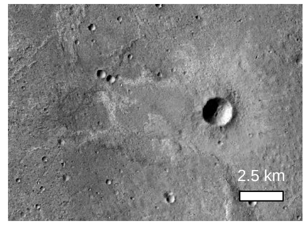

Figure 3C: *Relationship between the smooth plains unit, a superposed crater and ejecta, and some patchy terrain that seems to be overlying both. A neighboring wrinkle ridge is also partially covered by patchy terrain. Patchy terrain is observed elsewhere on the smooth plains unit but does not appear on the undivided or rough terrain units.*

Summary and Future Directions: This region and outcrop of higher thermal inertia, smooth plains material presents a unique opportunity to assess the morphologic features and geologic relationships between the intercrater and intracrater plains deposits located throughout in Terra Tyrrhena. Our next step will involve analyzing the mineralogic information derived from 180 m/pixel mapping and 20 m/pix targeted data from the Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) [13]. We will then assess the mineralogic relationships between the morphology-based units presented here. We expect that this comparison can be extrapolated to the surrounding region and help to explain the formation of similar features and thus gain insight into the formation and evolution of Mars' surface over time.

Acknowledgments: All data used in this study are publicly available on the NASA Planetary Data System (PDS) and were accessed and examined through the ASU/JMARS interface [14]. The research was funded by the MRO project.

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