THE THICKNESS AND MORPHOLOGY OF A YOUNG PYROCLASITIC DEPOSIT IN CERBERUS PALUS, MARS: IMPLICATIONS FOR THE FORMATION SEQUENCE. D. G. Horvath¹ and J. C. Andrews-Hanna¹, ¹Lunar and Planetary Laboratory, University of Arizona, Tucson, AZ, dhorvath@lpl.arizona.edu.

Introduction: The Cerberus Palus region south of Elysium Mons contains some of the youngest volcanism on Mars. Effusive lava flows emanating from long sub-parallel fissures and shield volcanoes in the region have crater retention ages younger than 250 Ma and possibly as young as 2 Ma [1]. Here we report on a potential recent pyroclastic eruption, first reported [2] as a low albedo, high thermal inertia deposit approximately symmetric around one of the Cerberus Fossae fissures near Zunil crater (7.9°N, 165.8°E). The high thermal inertia in both the day and night infrared is consistent with partial welding of an ash tuff and CRISM spectra of the unit indicates the presence of pyroxene proximal to the fissure. Furthermore, the deposit is smooth relative to the textures of the lava flows in the surrounding volcanic plains. The interpretation that the deposit buried and obscured these underlying flow textures, and also mantles Zunil secondary craters suggests that this deposit is younger than surrounding volcanic plains (<250 Ma) [1] and the Zunil impact (<5 Ma) [3]. Here we expand on the geomorphology, age, and thickness of this deposit (here in referred to as the Cerberus mantling unit, CMU) using HiRISE imagery and suggest a formation sequence for the CMU.

Observations: In addition to the observed albedo differences between the main deposit and the surrounding volcanic plains, HiRISE imagery and CRISM spectra reveal albedo and spectral variations on the deposit itself. The most obvious internal albedo and spectral variation are noted at the deposit proximal to the fissure (here in referred to as CMUp) and the surrounding more distal deposit (here in referred to as CM Ud, Fig. 1a).

CM Ud is dark and smooth relative to the lava flow texture of the surrounding dusty volcanic plains (Fig. 1c). A band of low thermal inertia and bright albedo exposed at the edge of the deposit suggests that the CMU as a whole is mantling an underlying dust layer that was deposited across the region at an earlier time [4], also preserved in the bright ejecta blankets surrounding Zunil secondary craters outside of the CMU [3]. Bright ejecta primary craters observed on the CM Ud suggest that these craters on the deposit excavated through the deposit into the underlying dust layer (Fig. 1d). The excavation depths of these craters indicate that the CM Ud deposit is substantially less than 1 m in thickness (Fig. 2), consistent with a distal ash fallout and minor welding.

In contrast, the CMUp is dark relative to the distal portions of the deposit, while CRISM spectra indicate a higher pyroxene content proximal to the fissure [2]. Texturally this deposit is characterized by sinuous troughs and ridges 10s of meters across and approximately perpendicular to the fissure (Figure 1b). A relative dearth of bright ejecta craters on the dark CMUp indicates that the deposit closer to the fissure is thicker and/or stronger than distal portions of the deposit (Fig. 2). Along with a higher pyroxene content observed on the CMUp, the apparent strength is consistent with welded tuff ring deposits observed around explosive volcanic centers on Earth.

Fig. 1. A) HiRISE imagery of a portion of the Cerberus mantling unit delineating the proximal textured unit and smooth distal unit. The proximal unit B) contains the majority of the sinuous troughs and ridges observed on the deposit in contrast to the relatively smooth deposit C) further from the fissures where bright ejecta craters are observed D).

Formation sequence: Based on HiRISE observations of the morphology and albedo variations on the deposit, a depositional scenario and formation sequence is proposed. Evidence for shallow ground-ice in this region [5] suggests that magma interaction with a layer of ground-ice or an underlying aquifer may have initiated the pyroclastic eruption that deposited the CMU. We propose that the initial interaction of intrusive magma with a ground-ice layer or aquifer resulted in a Strombolian to plinian style eruption, dispersing fine ash and pumice fallout to form the main CM Ud unit (Fig. 3a). This is supported by the thinness of the CM Ud and the slight asymmetry of the deposit, likely due to wind direction during eruption of the ash plume. Gas pressure buildup in the magma column close to the surface [6]
then initiated either a single or sporadic explosive eruptions and deposition of the CMU compared to the current Martian production function. The young age of the deposit is consistent with its stratigraphic age being younger than Zunil and the surrounding volcanic plains [1]. This age also makes this deposit the youngest eruption product and thus the most recent volcanic eruption yet documented on Mars.

**Conclusions:** We have detailed the youngest known volcanic eruption on Mars and hypothesize an eruptive sequence in which a dike intrusion interacts with a subsurface volatile reservoir resulting in an initial ash plume eruption followed by explosive volcanism. Variations in spectra and albedo suggest that this deposit is two distinct units, one proximal to the eruptive source with a high pyroxene content and surge textures (CMU) and a broadly distributed thin, smooth distal unit (CMUd), consistent with our proposed eruptive scenario. While young volcanism is observed in the Elysium region, the very young age of this deposit indicates that intrusive magmatism may be active today, which may be detectable with the upcoming InSight mission.