CONSTRAINTS ON THE AGE OF CORINTO CRATER FROM MAPPING SECONDARIES IN ELYSIUM PLANITIA ON MARS. M. Golombek[1], C. Bloom[1,2], N. Wigton[1,3] and N. Warner[1], [1]Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109, [2]Occidental College, Los Angeles, CA 90041, [3]University of Tennessee, Knoxville, TN 37996

Introduction: Corinto crater is a 13.9 km diameter fresh rayed impact crater in Elysium Planitia on Mars. Corinto crater is elliptical and has asymmetric lobate ejecta suggesting an oblique impact from the northeast (Fig. 1). Fresh rayed craters on Mars were discovered by their distinctive rays in thermal images that can extend for more than 1000 km [1]. Examination of the rays showed them to be a combination of high and low thermal inertia units with extensive secondary craters and are believed to be among the youngest geomorphic features on Mars [2]. The best known is Zunil, a 10 km diameter crater that impacted in Elysium Planitia [1], spewed $7x10^7$ secondary craters >15 m in diameter [3], and is credited with ejecting some of the Shegotite meteorites [2]. Most rayed craters show evidence for oblique impacts and they are found dominantly in Tharsis and Elysium young volcanic terrains (about 8 have been found) suggesting that the generation of secondary craters is strongly influenced by the target material [2]. Even though Corinto has extensive rays, they have not been described previously. This abstract describes the rays surrounding Corinto and provides tighter constraints on its age by mapping of secondary craters to the south.

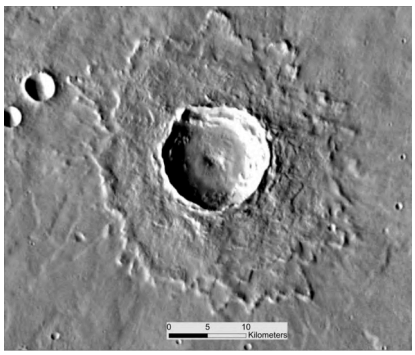

Fig. 1. Corinto crater located at 16.95°N, 141.7°E in THEMIS mosaic.

Data: We surveyed secondary craters from Corinto using daytime and nighttime thermal infrared images from the Thermal Emission Imaging System (THEMIS) and georeferenced images from the High Resolution Imaging Science Experiment (HiRISE) and the Context camera (CTX).

Crater Rays: Distinct dark elongate ray-like forms are observed radiating ~1400 km south from Corinto in nighttime thermal but are not readily visible in daytime images (Fig. 2). Although a number of fresh rayed craters are present in the region, rays radial to Corinto dominate the broad region to the south. Most of these rays are dark in nighttime thermal mosaics indicating very low thermal inertia, suggesting somehow that dust is sintered in the ejecta [1,2]. The well developed rays to the south and the less extensive rays to the north suggests that Corinto was an oblique impact from the north. Corinto impacted surface material similar to other Martian rayed craters in terms of albedo, thermal inertia, and dust cover [2].

Examination of HiRISE and CTX images over the dark rays, shows that they are all composed of dense swarms of secondary craters. Three facies of rays were found with increasing distance from Corinto.

The first facies, consists of rays of secondary craters up to 5 km wide that begin at the edge of the ejecta blanket and extend to ~9 diameters to the south (~120 km) and 4 diameters to the north (~60 km). Unlike most rayed craters, this facies is not bright (high thermal inertia) in nighttime thermal imaging [2] (Fig. 2). These secondary crater rays can be identified in CTX, but do not show up in thermal images. This facies was also observed 120 km west of and radial to Zunil crater [3]. The density of rays and secondaries decreases away from the crater and are densely concentrated in each ray with few independent secondaries in the surrounding area. Secondary crater diameter varies between 50 m and 350 m and generally increases with distance from the crater.

The second and third facies of rays (with increasing distance from the crater) are similar to the low thermal

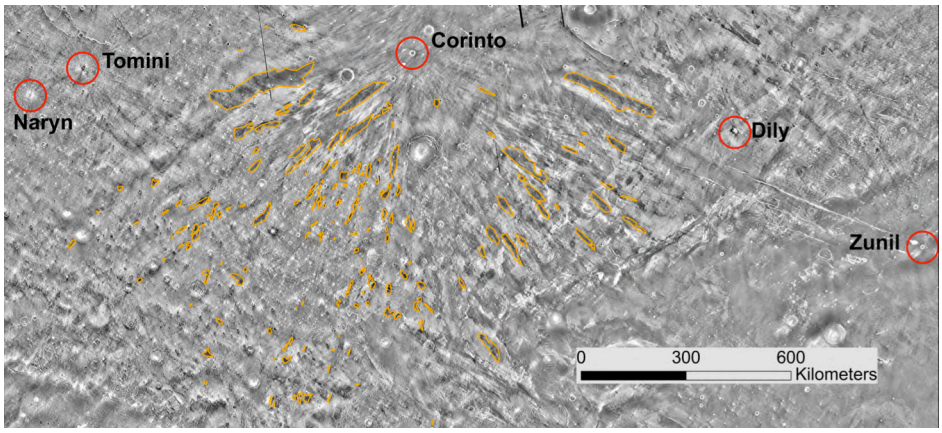

Fig. 2. Fresh rayed craters (circled in red) in and around Elysium Planitia in THEMIS nighttime mosaic. Low thermal inertia (dark) secondary crater rays radial to Corinto that have been verified in CTX and HiRISE images are outlined in yellow.

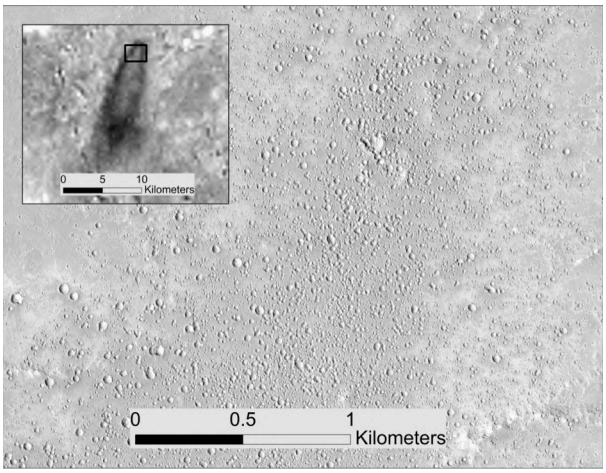

Fig. 3. Corinto ray (second facies) in THEMIS nighttime (inset) and HiRISE.

inertia rays previously identified around rayed craters, appearing dark in THEMIS nighttime images [2,3] (Fig. 3). The second facies is composed of dense groupings of secondaries in large elongate lobes that are up to 50 km wide and 100-300 km in length, extending south of Corinto from 9 (~125 km) to 22 diameters (~310 km). The diameter of secondary craters in this facies exceeds 350 m and so they are resolved by CTX images (Fig. 4).

The third and most distant facies of rays appear the darkest in nighttime THEMIS images indicating they have the lowest thermal inertia. These rays extend radially from 21 (~300 km) to 100 diameters (~1400 km) to the south of Corinto. Individual rays are the narrowest of the facies (up to 14 km wide) and are several km to over 100 km in length. In CTX images the rays have a light tone, even though the craters are ~7-15 m in diameter and resolvable in HiRISE. Secondary craters in this facies have characteristic light toned ejecta blankets (Fig. 5) and their appearance (and

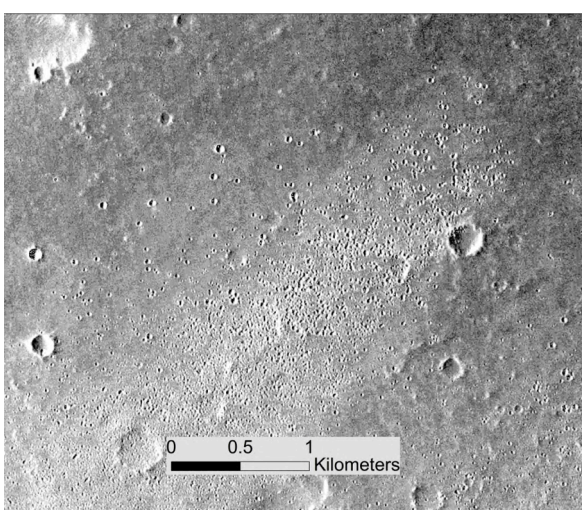

Fig. 4. Corinto second facies secondary crater ray in CTX image.

detectability) can vary on different terrains suggesting target effects are important [7].

Age of Corinto: Although Corinto is a fresh crater and it has extensive secondary rays that are considered to be very young, estimating its age is difficult. Hartmann et al. [4] placed constraints on 8 of the freshest rayed craters by estimating the recurrence interval for craters of its size and counting small superposed craters on the floors and ejecta blankets. For Corinto (referred to as "Unnamed crater, SW flank of Elysium Mons"), Hartmann et al. [4] determined 3 and 2 Ma recurrence intervals for different production functions for craters of this size. They also counted small craters on the ejecta blanket and determined a model crater age of 5-9 Ma by comparing to Hartmann isochrons.

Mapping of Corinto secondaries about 1000 km

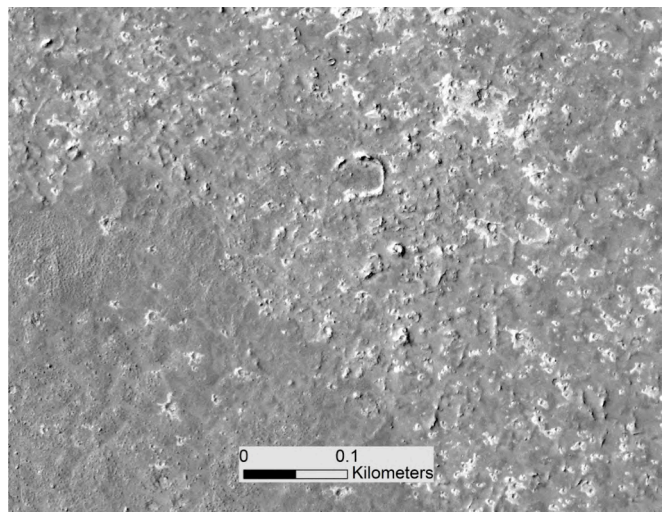

Fig. 5. Corinto secondaries superposed on young Cerberus lava in southern Elysium Planitia.

south, in the region being considered for landing the InSight mission [5], more tightly constrains the age of Corinto crater to between 0.1-1 Ma and 2.8±0.5 Ma. Corinto secondaries are observed superposed on young Cerberus lavas in the Western Lava Basin (Fig. 5) dated to be 2.5±0.5 Ma [6]. Further, a ray of secondary craters that is radial to Zunil crater produces smaller craters without obvious ejecta that are superposed on the characteristic light-toned ejecta of Corinto secondaries. Zunil crater is estimated to be 0.1-1 Ma [4], which constrains Corinto to be older than Zunil, but younger that the Western Lava Basin lavas.

References: [1] McEwen A. et al. (2005) *Icarus 176*, 351–381. [2] Tornabene L. et al. (2006) *JGR 111*, E10006. [3] Preblich B. et al. (2007) *JGR* 112, E05006. [4] Hartmann W. et al. (2005) *Icarus 208*, 621–635. [5] Golombek M. et al. (2013) *LPSC* #1691; (2014) this issue. [6] Vaucher J. (2009) *Icarus 204*, 418-442. [7] McEwen et al. (2010) *Icarus 205*, 2-37.