MAPPING THE RITCHEY CRATER CENTRAL UPLIFT, MARS. N. Ding[1, 2], V. J. Bray[2], A. S. McEwen[2], S. S. Mattson[2], M. Chojnacki[2], L. L. Tornabene[3, 4], C. H. Okubo[5], [1]Faculty of Earth Sciences, China University of Geosciences (Wuhan), Wuhan, Hubei 430074, China. [2]Lunar and Planetary Laboratory, University of Arizona, Tucson, Arizona, USA, [3]Dept. of Earth Sciences & Centre for Planetary Science and Exploration, Western University, London, ON N6A 5B7, Canada. [4]SETI Institute, Mountain View, CA 94043, USA. [5]U.S. Geological Survey, Flagstaff, Arizona, USA. (ningding@lpl.arizona.edu)

Introduction: The central uplifts of large impact craters can expose bedrock and ancient crust that are otherwise buried [1, 2]. One example is the central peak of the 79 km diameter Ritchey crater (28.8°S, 309°E). Ritchey Crater is near the boundary between Hesperian ridged plains and Noachian highland terrain units on Mars [3]. In Coprates Chasm ~ 700 km to the north of Ritchey Crater, the deepest exposed bedrock is rich in low-calcium pyroxene (LCP) intruded by olivine-rich dikes, and interpreted as primitive crust produced in a magma ocean, overlain by altered Noachian bedrock rich in phyllosilicates, then topped by Noachian and Hesperian lava flows [4]. The stratigraphy of Argyre basin ~ 700 km south of Ritchey has been interpreted as an olivine and LCP basal unit overlain by bedrock rich in high-calcium pyroxene (HCP), then capped by phyllosilicate-rich Noachian units [5].

The central uplift of Ritchey crater is ~20 km wide. High Resolution Imaging Science Experiment (HiRISE) images of the peak reveal fractured massive bedrock and megabreccia [c.f. 2] with large clasts that appear to have been raised from depth. The stratigraphic uplift in a crater of this size is ~7.7 km [6], comparable to the depth of exposures in Coprates Chasm. Compact Reconnaissance imaging Spectrometer for Mars (CRISM) spectral parameter maps [7] reveal LCP, HCP, olivine, and hydroxylated silicates.

Our goal is to map the 3-dimensional geology of the central uplift of Ritchey and reconstruct the pre-impact stratigraphy, to better understand the Noachian stratigraphy of Mars. We are also mapping impactite deposits on the central uplift to help us constrain the relationship between breccia, pre-existing megabreccia, and other rock units. We update our progress [8] in this abstract.

Results: *Units*: We mapped nine units on Ritchey central uplift: (1) exposed bedrock (BR); (2) large-scale megabrecia (MB); (3) a clast-rich deposit (C) where fractures are either absent or obscured; three units often covered by polygons (interpreted as impactites produced by the Ritchey impact by [2]), namely, (4) polygonal-spot (PS), (5) polygonal-bright (PB), (6) polygonal-dark (PD) terrains, two of which (PS and PD) appear to be draped; (7) unconsolidated aeolian deposits (S); and two bedrock/clast-rich units that are thinly draped by aeolian deposits and are therefore transitional between units (1-3) and unit S, namely (8) a transitional bedrock/megabreccia (TB) unit and (9) a transitional clast-rich deposit (TC). The center of the central uplift contains a cavity ~2 km across. Most of the MB unit appears outside this central cavity, and most of the BR unit lies at even greater distances from it, in the outermost third of the uplift structure. These two units are predominantly exposed on the eastern and southern sides of the uplift. CRISM data for this region shows that most bedrock (BR) exposures are LCP-rich but also contain a small amount of HCP-rich material. The C and TC units are mainly distributed in the outermost parts of the central uplift and extend to the crater floor. Our analysis of CRISM data shows that these units are mainly LCP-rich materials. PS, PB and PD are usually found in lower elevations or on flat terrain within the central uplift and are mainly distributed in the west and north areas of the central uplift. The S unit has a low albedo and recognizable aeolian bedforms (e.g., ripples) found across Mars. The ripples display a regular NW-SE orientation indicating the direction of the prevailing wind.

Structural geology: We find several outcrops of conjugated joints in the northern and southern regions of the central uplift; their directions of greatest principal stress (σ_1) are nearly NNW-SSE. One outcrop, located northwest of the central uplift, exhibits a fault cross-cutting veins or dikes with a left-lateral offset of ~20-25 m. Another region, in the southern part of the central uplift, contains tensional joints. Throughout the entire uplift, joints are primarily confined to the BD and/or TB units, and are interrupted by surrounding units. This phenomenon suggests that these joints formed during the cratering process.

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