METER- TO DECAMETER-SCALE MORPHOLOGY OF MELT ROCKS, BRECCIAS, BEDROCK AND STRUCTURES IN CENTRAL UPLIFTS REVEALED BY THE MARS RECONNAISSANCE ORBITER.

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Introduction: High-resolution sub-meter (~25 cm/pixel) images from the High Resolution Imaging Science Experiment (HiRISE), the Context Camera (CTX; ~5-6 m/pixel) and other data from the Mars Reconnaisance Orbiter (MRO) are providing unprecedented and remarkable geologic detail of surface features [e.g., 1]. Observations elucidating various aspects of the impact process, particularly with respect to impact melt deposits and various impactites associated with central uplifts (CUs) in complex craters are summarized and presented here.

Crater-related pitted materials: Crater-related pitted materials have been observed within 205 fresh and well-preserved impact craters [1-4] on Mars (also associated with fresh craters on Vesta [5]). These craters span ~1–150 km in diameter and 53°S to 62°N with the majority occurring ~10–30° N and S, and fewer to a complete lack of these craters at or near the equator and high latitude, respectively. The pits are distinctive depressions with circular to polygonal shapes. Pits possess subtle topographic rims with no signs of apparent proximal ejecta materials. Pit size shows a relationships with their host deposits and host crater, particularly a strong relationship with crater diameter ($n = 9$; $r^2 = 0.985$) [3].

Pitted matertais occur in similar settings as melt-rich flows and deposits associated with well-preserved lunar craters. This includes within crater-fill and as ponds and flows on CUs, terraces and crater ejecta. Non-dusty and well-exposed sections of the pits show that they consist of lighter-toned decameter-sized clasts enclosed in a darker-toned matrix. These and other PM observations (see [3-5]) are generally consistent with an impactite interpretation, likely consisting of a mixture of impact melt, and mineral and lithic fragments. The pits are specifically thought to be the result of interactions between hot, highly shocked materials with volatile-rich phases or water-ice derived directly from the target materials. Volatilization of water within the deposit leads to rapid, and perhaps explosive, degassing of the deposit, with pits corresponding to locations of degassing pipes (see [4]).

Martian central uplifts: We are compiling a database of crater-exposed bedrock from CUs on Mars using visible images, thermophysical and spectral data primarily derived from instruments on MRO with a focus on HiRISE-scale morphology [6].

Allochthonous units. All Martain CUs in our database exhibit the wide-spread occurrence of a dark-toned, smooth, rigid unit that ranges from clast-poor to clast-rich. This dark-toned unit is often observed as a contiguous mapable unit that extends from the summit of the CU to the crater floor. This unit is most consistent with being impact melt deposits based on their occurrence as a coating, or a flow that varies in clast content. We also interpret a variety of cross-cutting tabular bodies ranging from several meters to as much as a km or so across as allochthonous dikes and sills.

Parautochthonous units. Three types of bedrock are exposed within Martian CUs that conformably underlie, are embayed by, and cross-cut by fractures, faults and dikes. We classify these based on their HiRISE-scale textures (from most obvious to least) [6]: 1) Layered Bedrock (LB) (see [7-10]), 2) Fractured-Massive Bedrock (FB) (see [11-13) and 3) Megabreciated Bedrock (MB) (see [6, 11]). Our preliminary results, based on spectral/petrogenetic interpretations and the global distribution of these three textural types, suggests that CU bedrock correlates well with the local, regional and global Martian geologic history as interpreted from surface mapping.

Structures. Different types of deformation features are observed to occur within Martian CUs. LB-type CUs are the most informative as the layers provide a frame of reference that enables the easy identification of structures such as faults and what appear to be folds [7, 10]. Fractures, joints, faults, dykes and sills are readily recognized at the scale of HiRISE and are currently being mapped in detail by our companion studies by Nuhn et al. [11] and Ding et al. [13] presented at this conference.

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