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UNDERLYING STRUCTURAL CONTROL OF SMALL SCALE FAULT AND FRACTURE ORIENTATIONS VIEWED IN HIRISE IMAGES WITHIN WEST CANDOR CHASMA, MARS. C. Birnie[1], F. Fueten[1], R. Stesky[2], E. Hauber[3], [1]Department of Earth Sciences, Brock University L2S 3A1, St. Catharines, Ontario, Canada <colin.birnie@brocku.ca>; [2]Pangaea Scientific, Brockville, Ontario, Canada; [3]Institute of Planetary Research, German Aerospace Center (DLR), Berlin, Germany.

Introduction: The Valles Marineris system of normal-fault-bounded troughs (Fig. 1A) is thought to have resulted from a two-stage evolution in which isolated ancestral basins were linked during later extensional faulting [1,2,3]. Located within the chasmata are interior layered deposits (ILD), the origins of which are still uncertain [e.g., 4]. Ceti Mensa, a large ILD covering much of central West Candor, reaches heights up to 2900m above the surrounding chasma floor [5].

Three faults trending 101°-107° (referred to here as border faults) and two cross-faults trending ~40° (collectively referred to as chasma-bounding faults) are proposed for the formation of West Candor [6,7] (Fig. 1B). However, no faults of sufficient size are expressed at the surface within ILDs and therefore cannot be directly linked to these underlying faults [8].

The purpose of this study is to determine if the orientations of small-scale faults and fractures within the ILD reveal information about large-scale underlying chasma-forming faults.

Methodology: Twenty-nine HiRISE [9] images were examined. Where not obscured by dunes or dust cover, deformation features can be observed throughout the area and were separated into several categories based on morphology. *Faults* are defined by an observable offset in layering or scarp morphology (Fig. 1C). *Orthogonal Fracture Sets* are composed of a dominant set of parallel fractures and an orthogonally oriented secondary set of sub-parallel fractures that generally do not cross-cut the dominant set (Fig. 1D). Other structures were also measured, but are not reported upon here. All fault and fracture orientations were measured in plan view.

Observations and Discussion: Orthogonal fractures show strong preferred orientations at 105°-120° and 20°-35° for the dominant and secondary set, respectively (Fig. 1E). In most cases, a strong alignment exists between fractures and the proposed trends of chasma-bounding faults and the eastern edge of Ceti Mensa. No consistent relationship was found between the local topographic slope direction and the dominant fracture orientation. Locally, the dominant and secondary fractures may form a mutually abutting relationship or the dominant fracture orientation may switch to the previously secondary orientation.

Fractures along the proposed border and cross-faults [6,7] strongly reflect the faults orientations and are most abundant where border and cross-faults intersect (e.g., along the east and west borders of Ceti Mensa at their northern margins).

The average fault trend (Fig. 1E) is dominated by a large number of faults located near the southwestern blunted termination. In this area, faults do not follow the presumed trends of the underlying faults, consistent with the conclusions of previous work that this material was deposited during a landslide [8,10]. Faults present throughout the rest of the study area are oblique (Fig. 1E) to the assumed underlying faults. Faults are found in large numbers (e.g., the northwestern blunted termination and northwestern Ceti Mensa), where they appear to be accommodating differential vertical displacement along the large underlying cross-faults.

Conclusions: Small-scale fractures and faults observed in the ILD of Candor Chasma closely parallel the border and cross-fault orientations [6,7], providing a clear relationship with large scale structures below the chasma floor. The orthogonal fracture sets are the best indicator of the underlying fault orientations and positions due to their abundance and close genetic relationship. The concentrations of northeast trending fractures away from the known cross fault locations suggest that additional large cross-faults may exist. Two possible candidates have been added to Figure 1B.

The oblique nature of the faults to the east and west of Ceti Mensa may indicate they are release faults [11] accommodating differential vertical displacement along the border faults of Ceti Mensa.

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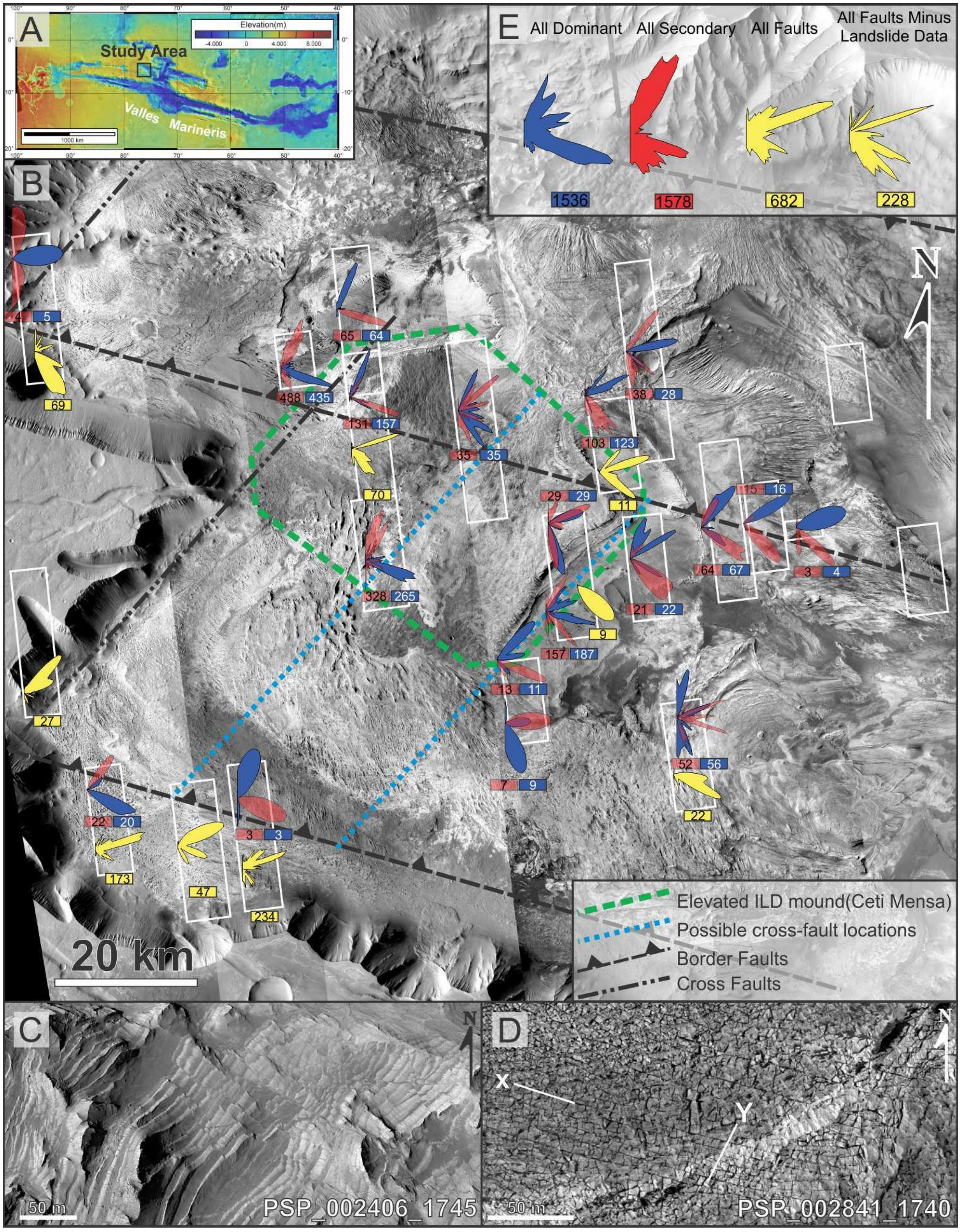

Figure 1. A - Location map. **B** - CTX mosaic of West Candor Chasma. White boxes denote locations of HiRISE images. Border faults inferred by Schultz and Lin [2001], triangles denoting the hanging wall. Cross-faults responsible for the blunted terminations of Candor Chasma described by Wilkins and Schultz [2003]. Blue dotted lines show the location of additional large cross-faults. Orientations are presented in rose diagrams using a Gaussian filter with the number of measurements recorded beneath; Red = Dominant fracture set, Blue = Secondary fractures set, Yellow = faults. **C** - Example of the type of faults recorded. **D** - Orthogonal fracture set archetype; X = Dominant fracture set direction, Y = Secondary fracture set direction. **E** - Cumulative rose diagrams for orthogonal fracture and faults.