Mineralogy, Structure and Morphology of Western Eos Chaos Trough of Valles Marineris, Mars

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INTRODUCTION

- Chaotic terrains of Mars are enclosed and semi-enclosed deep seated region composed of knobs, rock masses of different sizes and elevated, irregular and flat-topped mounts which are often marked out as mesas with steep slopes (Rodriguez et al., 2005a; Meresse et al., 2008; Warner et al., 2011).
- Majority of the chaotic terrains lie near to the Martian equator or dichotomy boundary (Figure 1a). And the Eos chaos (Figure 1b) is an equatorial chaotic terrain, located on the East of Valles Marineris (with central coordinates ~16°49'12.00"S and ~46° 7'12.00"W).

RESEARCH PROBLEM

- To investigate the geological processes which significantly influenced the formation and evolution of the near circular western Eos Chaos trough.(Figure 2)

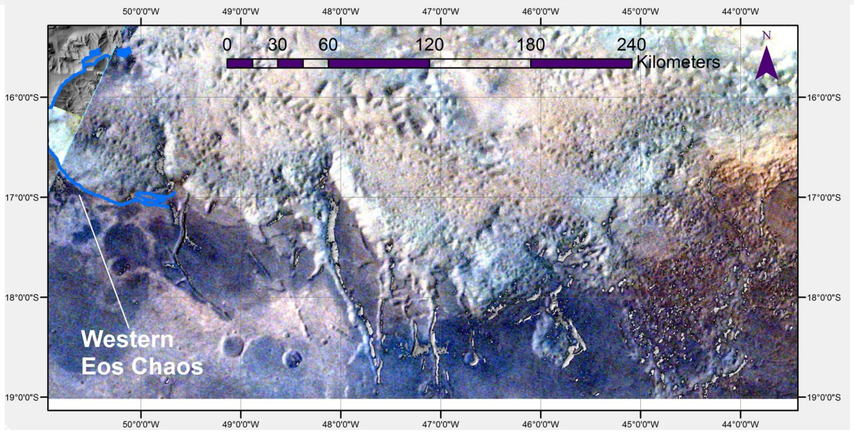

Figure 2:Eos Chaos terrain represented in Mars Colour Camera (MCC) image of Valles Marineris area. The study area is marked in blue line.

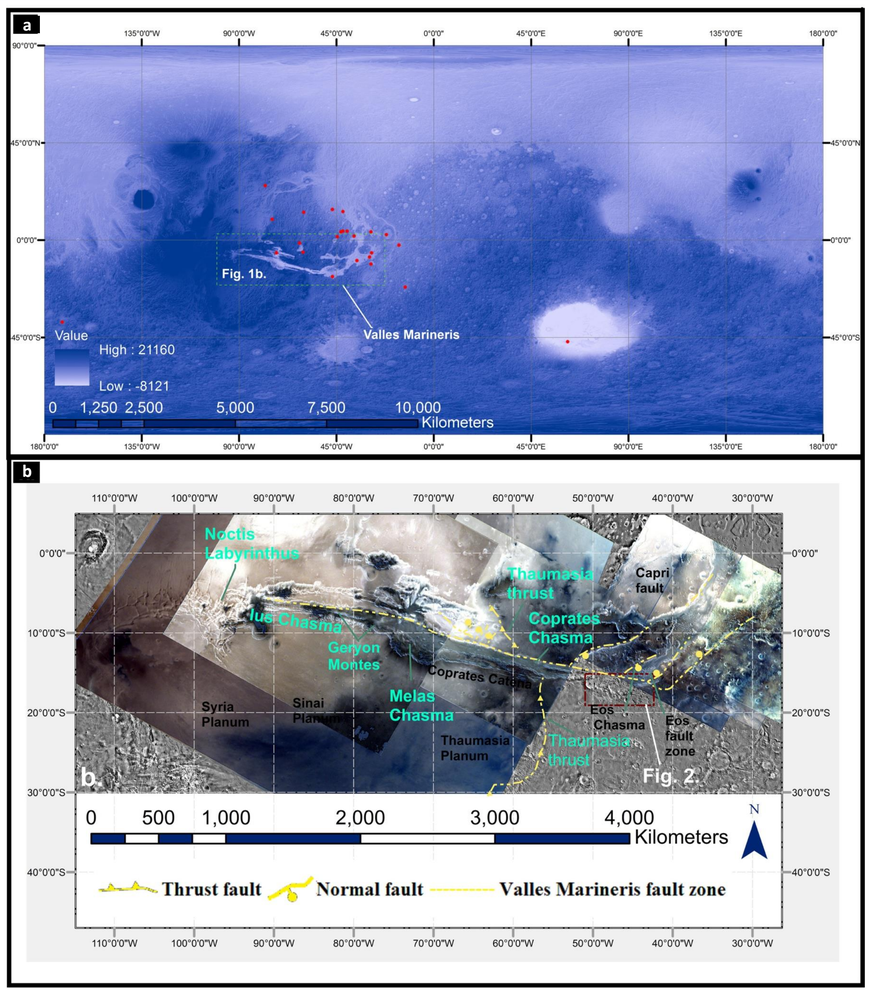

Figure 1:(a)Topographic image of Martian surface prepared from Mars Orbital Laser Altimeter (MOLA) of the Mars Global Surveyor (MGS). The study area Valles Marineris is marked within the image. Major chaotic terrains are shown as red points. (b) Major Tectonic features in and around Valles Marineris are shown in a mosaic of MCC-Viking images

DATA SETS AND METHODS

- Mars Colour Camera (MCC) onboard ISRO's Mars Orbiter Mission (MOM1), Context Camera (CTX), High Resolution Imaging Science Experiment (HiRISE) and Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) aboard NASA's MRO mission.

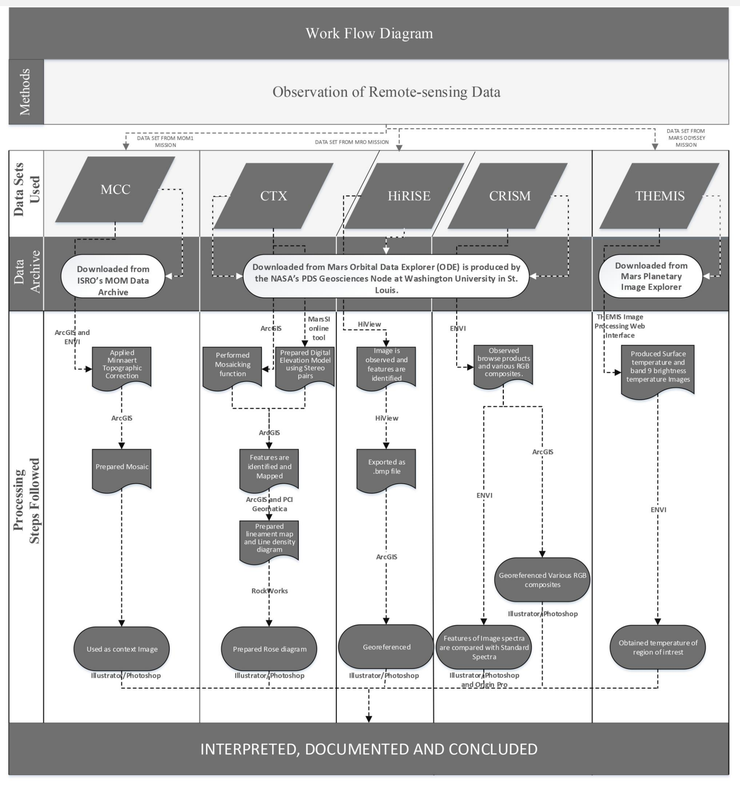

Figure 3:Workflow diagram explaining the methodology followed.

RESULTS AND DISCUSSION

- Abandoned channels, micro-deltaic deposits at channel mouths, streamlined islands and possible paleo-lakes with deltaic sediments suggest paleo hydration processes.
- Subsurface layered ice, very young active viscous flow and structures resembling remnants of glacial moraine were also identified.
- Offset of fault scarps, channels and wall rocks indicate tectonic movements.
- Absorption features of low-grade metamorphic and hydrated minerals were found.

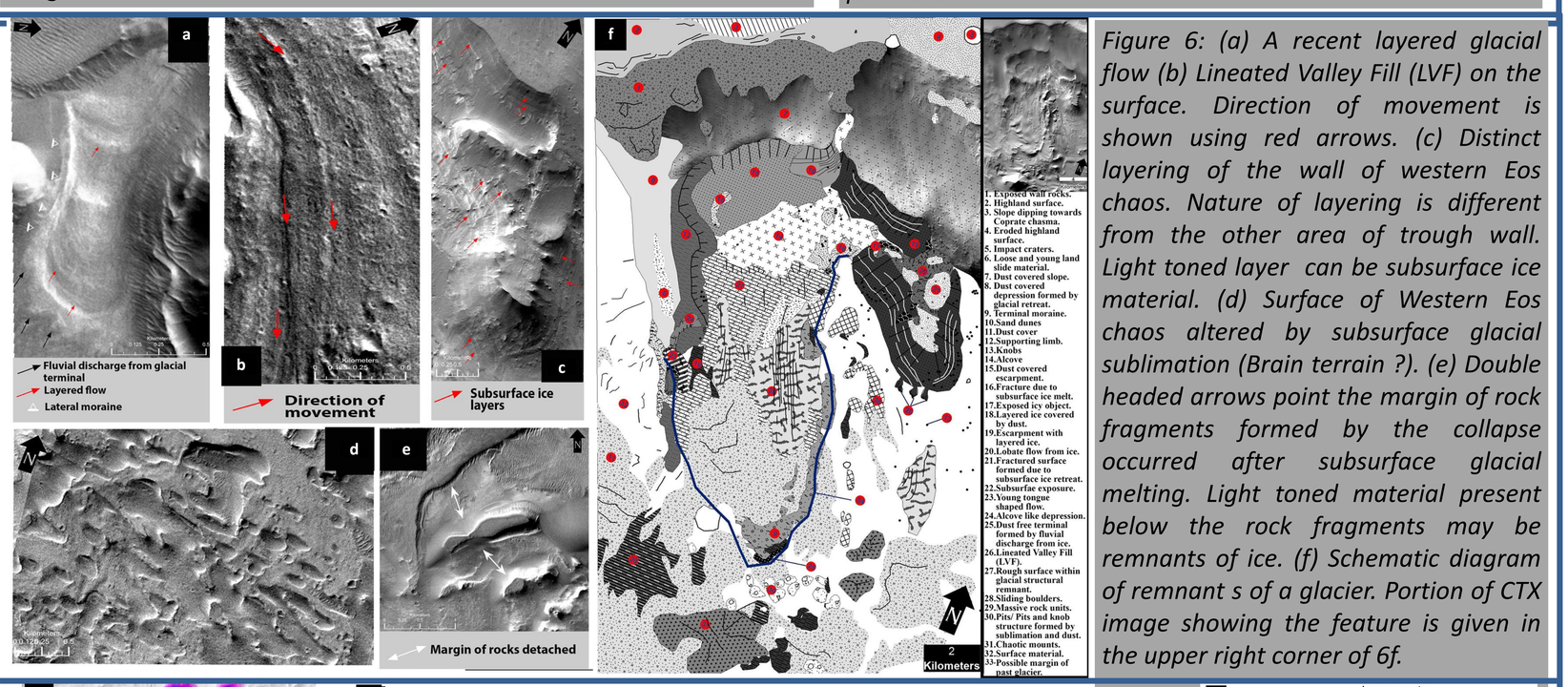

Figure 6: (a) A recent layered glacial flow (b) Lineated Valley Fill (LVF) on the surface. Direction of movement is shown using red arrows. (c) Distinct layering of the wall of western Eos chaos. Nature of layering is different from the other area of trough wall. Light toned layer can be subsurface ice material. (d) Surface of Western Eos chaos altered by subsurface glacial sublimation (Brain terrain ?). (e) Double headed arrows point the margin of rock fragments formed by the collapse occurred after subsurface glacial melting. Light toned material present below the rock fragments may be remnants of ice. (f) Schematic diagram of remnant s of a glacier. Portion of CTX image showing the feature is given in the upper right corner of 6f.

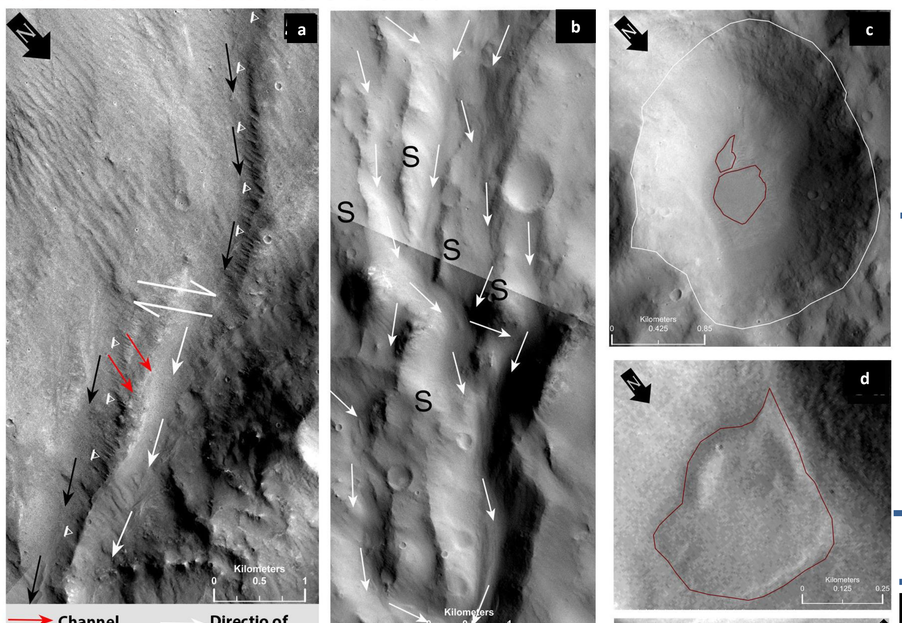

Figure 5: (a)Vertex of white triangles points the normal fault scarp. The normal fault scarp is offset by the slip fault movement. The channel was affected by the slip fault and resulted a new path of flow shown by white arrows. The black arrows point the direction of flow through the channel before the slip fault occurred. The red arrows show the levee formed between the channels. b)Tributaries of channel (Ch3) and stream lined islands formed by them. Braided appearance of the channel can be noticed. White arrows point towards the direction of flow and letter 's' represent streamlined islands. (c) A possible paleo-lake. (d &e) Fan shaped deposit formed at the mouth of channels

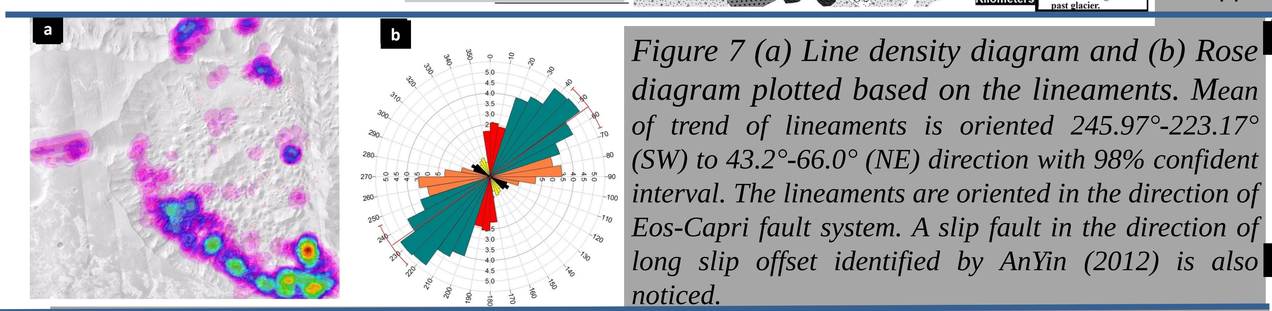

Figure 7 (a) Line density diagram and (b) Rose diagram plotted based on the lineaments. Mean of trend of lineaments is oriented 245.97°-223.17° (SW) to 43.2°-66.0° (NE) direction with 98% confident interval. The lineaments are oriented in the direction of Eos-Capri fault system. A slip fault in the direction of long slip offset identified by AnYin (2012) is also noticed.

Figure 8:(a) Continuum removed image spectra having absorption features of zoisite and kieserite. (B) Library spectra of zoisite and kieserite

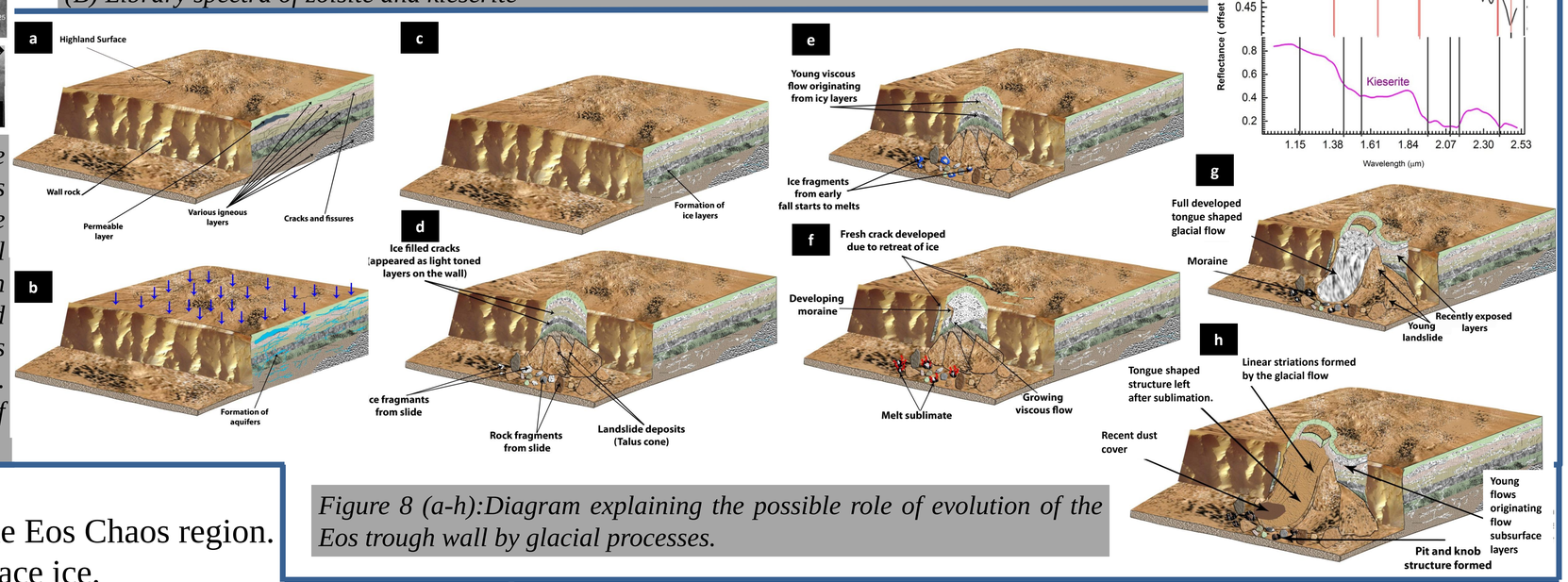

Figure 8 (a-h):Diagram explaining the possible role of evolution of the Eos trough wall by glacial processes.

CONCLUSION

- Aqueous as well as glacial processes were prevailed in the Eos Chaos region.
- The layered deposits and young flows hint present subsurface ice.
- Minor tectonic movements were happened here and major stagnant southern hemisphere prevented further movement
- Presence of low-grade metamorphic minerals indicate unique conditions prevailed over the Eos Chaos.
- All the above mentioned environment makes this trough a potential site for future geological exploration.

ACKNOWLEDGEMENTS

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