WESTERN EOS CHAOS ON MARS: A POTENTIAL SITE FOR FUTURE LANDING AND RETURNING SAMPLES, Asif Iqbal Kakkassery¹, V. J. Rajesh¹, ¹Department of Earth and Space Sciences, Indian Institute of Space Science and Technology, Valiamala P.O., Thiruvananthapuram 695 547, India (asifiqbal@gmail.com; rajeshvij@iist.ac.in)

Introduction: Scientific analyses of rocks and minerals using diverse techniques are essential for understanding the origin and evolution of a rocky planetary body. Rocks and minerals of Martian surface have to be analysed in detail as our knowledge of surface evolution and composition of Mars is mostly confined to the interpretation of the results from payloads in orbiters, landers and rovers. The surface and subsurface samples of Martian surface, if available, could be analysed, dated and interpreted in scientific means in order to further understand the origin and evolution of Mars. Though the nature of tectonism is a debatable topic for Martian researchers many scientists consider that the Valles Marineris is a structural remnant of tectonic activity which had been prevailed on Mars[1]. Abundant mineralogical and structural evidences for past fluvial activities have been noticed from Valles Marineris region. As northern lowlands were preferred landing sites for the missions that accomplished the aim of landing on Mars, the knowledge regarding Southern Highlands and Valles Marineris is only through the orbital data. Landing on Valles Marineris and subsequent analysis of rock samples can address important scientific aspects of tectonics and aqueous processes.

Eos Chaos is a potential location on Eastern part of Valles Marineris. It is evident that the Eos chaos along with other eastern segments of Valles Marineris have experienced fluvial processes for a considerable period [2,3].

![Resource ROI and Landing Site](image)

Figure 1: A MCC-CTX mosaic of Eos chaos showing proposed landing site with comparatively less abundant rocks for safe landing. Other selected regions of interests with moderately abundant rocks are also shown. Resource ROI shows presence of hydrated and low grade metamorphic minerals. Science ROI1 contain channels that shed light to past aqueous processes and possible life signatures. Science ROI 2 is an impact crater and ejecta blanket. ROI 3 contains a number of grabens from which past tectonic activity can be explored. Science ROI 4 contains light toned layered deposits, landslides and vertical tectonic structure.

Data sets and methodology: Mars Color Camera (MCC) data from ISRO’s Mars Orbiter Mission (MOM 1) and Context camera (CTX) imageries, Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) hyperspectral data from NASA’s Mars Reconnaissance Orbiter mission are the preliminary tools employed for this study.

Results and discussions: Low-grade metamorphism has been identified from a few areas on Mars and presence of metamorphic minerals such as prehnite, chlorite, hydrated silica and analcimite have been identified from restricted environments such as breccia blocks, isolated outcrops and eroded debris. [4,5,6] Presence of low-grade metamorphic minerals such as prehnite and chlorite indicates a distinct temperature (~250-380 °C) compared to the surface and a rich aqueous environment. Prehnite and chlorite minerals form in prehnite-pumpellyte facies to lower green schist facies. Zoisite, a hydrous mineral in epidote group often associated with prehnite and chlorite, is rarely reported from Mars. We report an occurrence of zoisite in S-W trending slope of Eos chaos. Hydrothermal fluid interaction with host rocks in subsurface conditions (temperatures ranging from ~250-380 °C) may have produced zoisite and later brought to the surface. The lower Al₂O₃ contents of Martian surface prevents the formation of zoisite in surface conditions [6].

Conclusion: Landing of a rover and further analyses of returned samples from Eos Chaos can shed light on past aqueous activities in this region. As zoisite is detected from Western Eos Chaos, chemical analyses of subsurface materials can lead to a better understanding of low grade metamorphic conditions prevailed in Martian subsurface. Grabens, light toned layered deposits, landslides etc. are some of the features on this area that help us to understand the structural and compositional evolution along with any evidences for the past life existed.