MORPHOLOGICAL AND MINERALOGICAL MAPPING OF IUS CHASMA OF VALLES MARINERIS USING MCC/MOM & CRISM/MRO DATASETS. S. Arivazhagan[1], T. Sivasankari[2] , [1 2]Centre For Applied Geology, Gandhigram Rural Institute - Deemed to be University, Gandhigram, Dindigul-624302, India ([1]arivusv@gmail.com and [2]sankari159@gmail.com).

Introduction: Valles Marineris, the largest canyon system of the solar system is located in the south western region of the Martian surface. The origin of Valles Marineris is still in debate that whether it is formed due to the tectonic activity or due to the erosion of fluvial processes. Many scientists and researchers all over the world had proposed several hypothesis and models the origin and evolution of Valles Marineris. The present study involves the mineral mapping of Ius Chasma of Valles Marineris particularly for the presence of mafic minerals (Olivine and Low calcium pyroxene[LCP] and High Calcium Pyroxene [HCP]), phyllosilicates and sulphates by using the spectral summary parameters of Mars Reconnaissance Orbiter-Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) data and identifying the mophological features of Ius Chasma using the Mars Color camera (MCC) onboard Mars Orbiter Mission (MOM) datasets.

Study Area: Valles Marineris lies in between -2˚ to -18˚ S latitude and -26˚ to -108˚W longitude extending about 4000 km in length, 200 km in width and 7 km in depth. It has a total areal coverage of about ~ 44, 54, 672 Sq. km, covering about 1/5 th of the Martian surface. The formation of the Valles Marineris would have took place in the Noachian to Hesperian age that dates back about ~3.5 bya [9]. The Valles Marineris province is divided into 11 regions. Ius Chasma is taken for the study due to its complexity nature. The Ius Chasma extends about ~550 km in length, 2 km in width and 6 km in depth.

Results and Discussion: *Morphology of Ius Chasma:* The Digital Elevation Model of Valles Marineris is shown in Fig. 1. a. Ius chasma is characterized by a complex morphology with the maximum altitude of 4000 m with presence of mountain range in between a valley which has an altitude of ~3500 m which is evident from the profile graph shown in Fig. 1. b. The morphological features identified from MCC *(Fig. 1. c)* are plateau, depression, crater, valley floor, valley wall with gullies, mountain, etc., The presence of gullies indicates the presence of fluvial activity in the geological past.

Mineral Mapping using CRISM: The methodology adopted for the mineral mapping using the spectral parameters is given in Fig. 2.

Mafic Minerals: Common rock forming mafic minerals include olivine, pyroxene, were mapped in the present study. Olivine is identified by the broad absorption centered at 1000 nm due to the Fe^{2+} absorption where as pyroxene is identified by the absorption near 1000 nm and 2000 nm. The mineral distribution of olivine, the spectra of olivine obtained from CRISM data, the CRISM spectral library plot of olivine is shown in fig. 3.a. Similarly, the mineral distribution of pyroxene, the spectra of pyroxene obtained from CRISM data, the CRISM spectral library plot of pyroxene is shown in fig. 3. b. The presence of Mafic minerals like olivine and pyroxene indicates that surface material is of volcanic origin [1, 5].

Phyllosilicate: Spectral analysis for phyllosilicates shows the presence of two minerals namely Allophane ($Al_2O_3 \cdot (SiO_2)_{1.3\text{-}2} \cdot (2.5\text{-}3)H_2O$) and Serpetine ($(Mg,Fe,Ni,Al,Zn,Mn)_{2-3}(Si,Al,Fe)_2O_5(OH)_4$). Allophane shows absorption features at 1450 nm, and 1900 nm due to H_2O and near 2350 nm due to the Al-OH overtones [6]. The presence of allophane indicates the low temperature chemical weathering [7]. The mineral distribution of phyllosilicates, the spectra of Allophane obtained from CRISM data and the CRISM spectral library plot of Allophane is shown in Fig. 3. c. Serpentine shows absorption features near 1300 nm due to OH overtones and near 2300 nm due to Al-OH and Mg-OH. The presence of Serpentine indicates the hydrothermal alteration of ultramaficc rocks [2,3, 8]. The mineral distribution of phyllosilicates, the spectra of serpentine obtained from CRISM data and the CRISM spectral library plot of serpentine is shown in fig. 3. d**.**

*Sulphates***:** Spectral analysis for sulphates shows the presence of sulphate mineral Copiaptite ($Fe^{2+}Fe_4^{3+}(SO_4)_6.(OH)_2.20H_2O$) which shows absorption at 900 nm due to Fe absorbtoin and a narrow absorptoin near 1400 nm and 1900 nm due to the water molecule. The presence of sulphate indicates the presence of aqueous environmnet in the past [4, 10]**.** The mineral distribution of sulphate, spectra of Copiaptite obtained from CRISM data and the CRISM spectral library plot of Copiaptite is shown in Fig. 3.e.

Summary: The spectral parameters of MRO-CRISM data were used to map the mineral distribution in the Ius Chasma region. The spatial analysis from CRISM data reveals the distribution of mineral classes that includes mafic minerals, phyllosilicates and sulphates. The presence of mafic minerals indicate the volcanic origin of rocks and they are widely distributed on the northwestern as well as cenral parts of the Chasma.The presence of phyllosilicates reveals the continuous hydrous alteration and they are dominantly found in the central and eastern parts whereas the

presence of sulphates indicates the aqeous environmment and they are widely distributed in the valley floor. The present work reflects the preliminary morphologic and minerlaogic analysis for Ius Chasma. The forthcoming MCC and TIS data of MOM will be incorporated for further analysis.

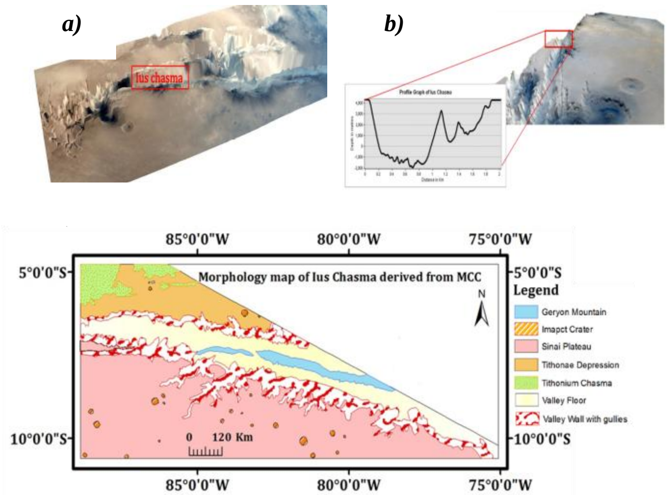

Fig. 1. a) DEM generated using MCC; b) Profile Graph of Ius Chasma; c) Morphology Map of Ius Chasma

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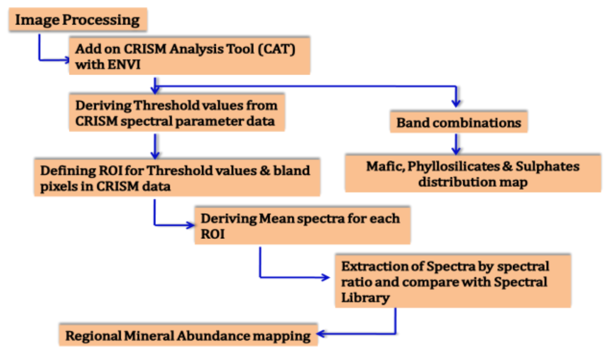

Fig. 2. Image processing methodology adopted for mineral mapping

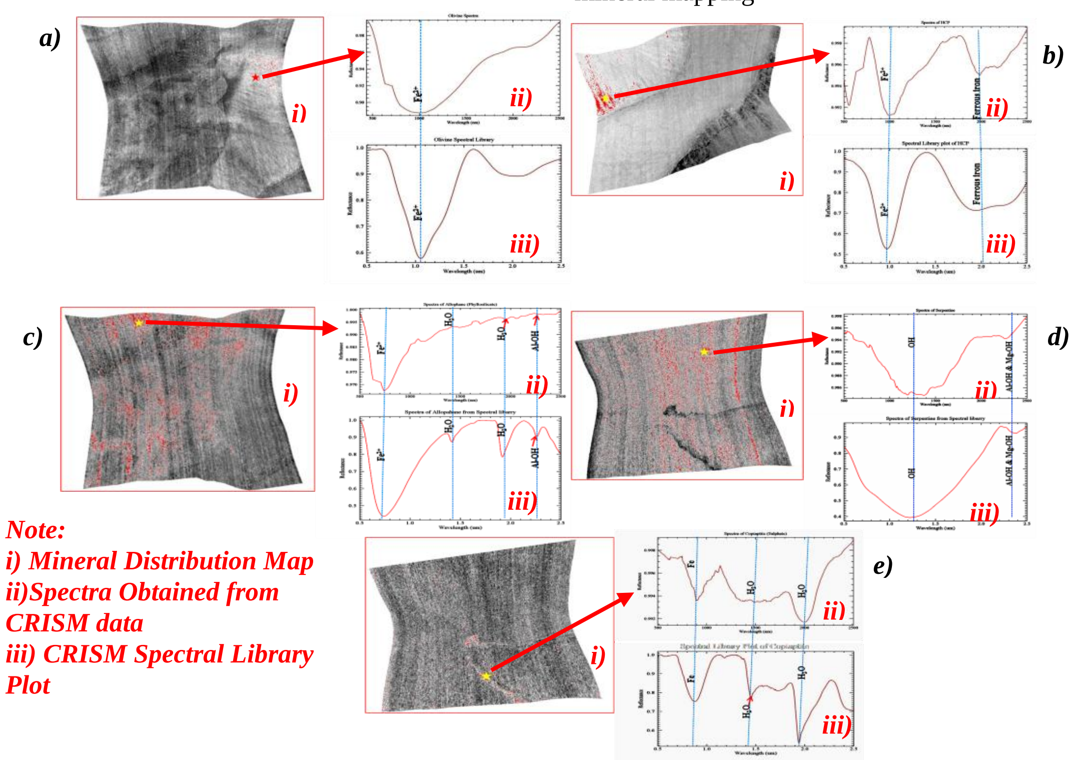

Fig.3. a) Mineral Distribution and Spectra of Olivine; b)Mineral Distribution and Spectra of Pyroxene; c) Mineral Distribution of phyllosilicates and Spectra of Allophane; d) Mineral Distribution of phyllosilicates and Spectra of Serpentine; e) Mineral Distribution of Sulphates and Spectra of Copiaptite.