Altered Silicate Minerals on Arisia, Pavonis and Ascraeus Mons of Tharsis Volcanic Provinces of Mars

Raj R. Patel1, Rohit Nagori2, A. S. Arya2 and Archana M. Nair1
1. Indian Institute of Technology Guwahati, India, 2. Space Application Centre, Indian Space Research Organisation, Ahmedabad, India.

INTRODUCTION

Three shield volcanoes aligned SW-NE: Arisia Mons (Figure 1: A, C and F), Pavonis Mons (Figure 1: A, D and G) and Ascraeus Mons (Figure 1: A, E and H) are large shield volcanoes located in Tharsis Volcanic Provinces (Figure 1: A and B) of planet Mars. In the present study, reflectance data of MRO-CRISM (Figure 1: F, G and H) was used to map silicate mineral pyroxene in Arisia chasma, a steep sided depression located in the northeastern flank of Arisia Mons and in caldera region of Pavonis and Ascraeus Mons. The presence of these minerals provides the evidence for origin and formation of the Tharsis provinces. Pyroxene minerals outcrops found in early-Noachian to mid-Noachian period must be exposed by erosion from mantle [1]. The ancient Noachian ages suggests that the deposits were derived from a mantle depleted in aluminum and calcium [1]. Viking Orbiter data suggests that Arisia Mons, Pavonis Mons and Ascraeus Mons had similar evolutionary trends [2]. OMEGA on Mars Express earlier found LCP and HCP on surface of Mars [1][3].

MATERIALS AND METHODOLOGY

MRO (Mars Reconnaissance Orbiter): CRISM (Compact Reconnaissance Imaging Spectrometer for Mars) reflectance dataset (Figure 1: F, G and H) have been used to identify minerals on the Tharsis Montes. CRISM TRDR Hyperspectral data set of Arisia Mons (FRT0000475E), Pavonis Mons (FRT00006D86) and Ascraeus Mons (FRT000123CD) were downloaded from PDS website. Following methodology flow followed in image processing.

RESULTS AND DISCUSSION

After following standard CRISM methodology for CRISM images FRT0000475E (Figure 2:A), FRT00006D86 (Figure 2:A) and FRT000123CD (Figure 4:A), silicate mineral pyroxene have been identified. Pyroxenes are important group of rock forming inosilicate mineral found in igneous rock. Pyroxene comprises the most dominant component of the igneous Martian crust [4][5].

CONCLUSION

MRO-CRISM dataset confirms presence of highly altered silicate mineral pyroxene in Arisia chasma region of Arisia Mons and caldera part of Pavonis and Ascraeus Mons. Possible explanation of highly altered pyroxenes could be weathering of in-situ basaltic lava material or another extreme possibility of hydrothermal precipitation. To understand formation of minerals, mineral alterations and associated environments, morphological studies are of great help. Hence, an integration of study on mineral alterations and geomorphology of Tharsis volcanic provinces is important in elucidating the evolutionary history of Tharsis Montes with respect to Mars.

ACKNOWLEDGEMENT

RRP would like to express his gratitude to Space Applications Centre (ISRO), Ahmedabad for the training received under TREEES. RRP would also like to thank Mr. Sumit Pathak, SRF, SAC (ISRO), Ahmedabad for his valuable suggestions. AMN would like to acknowledge ISRO MOM for the funding received for her project. All data used in this study are publically available from the NASA PDS.

REFERENCES