Chapter 3

A Review of Outline on Spectroscopic vis–a–vis Geochemical Study of Earth Analogues for Mars

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ABSTRACT

It is widely recognized that interpretations about the planet Mars must begin by using Earth as a reference, because Earth analogues can provide ground truth to constrain interpretations on the geological history of Mars. Fortunately, Deccan Basalt and its derivatives, exposed in Kutch area of Gujarat, can be considered as best candidate from Indian subcontinent to approximate this analogue in terms of petrology, stratigraphy and geochemical similarity. It is believed that Deccan Volcanic province with its extensive volcanic plains, cones and craters as well as abundant hydrous sulphates of secondary origin, approximates the geological, geomorphological and environmental conditions on the Mars.

BACKGROUND OF THE STUDY AND IMPORTANCE AT THE NATIONAL LEVEL

Siddaiha and Kumar (2009) reported occurrence of Minamiite (a Ca-variety of Jarosite) from Matanomadh area in Kutch for the first time. Jain et al. 2011 confirmed the occurrence of Jarosite from the same area. It was concluded that Jarosite from this area can be considered as a potentialanalogue for Martian hydrated sulphates as it has been formed through hotspot activities and having a similar geological set up as that of Tharsis and other regions on Mars.

Biswas (1992) placed Matanomadh Formation immediately overlying Deccan Basalt. So high chances are there that Jarosite formed from basalt or its derivative only. Though they are reported from Paleocene sandstones of Kutch but their occurrence in shales is also ubiquitous (Chattoraj 2011). See Figure 1. Chitale and Guven (1987) related the formation of natro-alunite (end member of Jarosite family) to the post-diagenetic formation of sulfuric acid-rich solutions by the oxidation of pyrite in the black shales of the Matanomadh basin. Understanding the processes involved in the formation of hydrous sulfates in the Deccan volcanic province of Kutch would therefore, help in inferring about the similar processes that might have been operated and/or operational in the Mars.

PROBLEM STATEMENT

Spectral vis-à-vis geochemical analyses of the hydrous sulfates from the Deccan Volcanic Province (DVP) of Kutch is proposed to be carried out in order to get insights into the fluid-rock interaction under extreme condition of high Eh and low pH in a basaltic terrain similar to that observed in the Meridiani Planum and other regions on Mars.

The niche research area is focused on stature of Jarosites derived Deccan Trap in Kutch as terrestrial analogues of Mars. Its geochemical signature is yet to be established to compare with that of Mars. More particularly, the source mineral and the process involved are to be proved compatible with Jarosites reported from Mars.

Chattoraj et al (2009) reported that some of the some framboidal pyrites in shales in Matanomadh Formation which indicates a marshy marine/estuarine or coastal environment. This kind of environment is reported to be hostile for Jarosite formation as the increased humidity will lead to its transformation of ferric oxy-hydroxides. Thus the optimal condition for Jarosite formation is to be defined and then can be extrapolated to Martian environment. Nonetheless, the Deccan basalts in Kutch is a promisinganalogue site for improving our understandingof the Martian surface aswell as for comparing the geologicprocesses on the two planets.

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