

Detection of phyllosilicate mineral zonations on Mars by contextual processing of Mars Express Omega imagery

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#### ABSTRACT

Recent data from the hyperspectral imagers OMEGA (ESA) and CRISM (NASA) have shown that several areas on Mars contain hydrated minerals, more specifically iron-magnesium phyllosilicates and aluminium phyllosilicates. Although these are readily interpreted as being of sedimentary origin, the deposition mechanism and geological setting so far remained elusive. Understanding the origin of these deposits is a key to understanding the geological evolution of Mars.

The "white mica index" (Van Ruitenbeek et al., 2006) is a spectral proxy for the Ishikawa index (Ishikawa et al., 1976). This is a measure for breakdown of sodic plagioclase and volcanic glass, through depletion of Na and Ca and enrichment in K and Mg replacing feldspars by white mica's and chlorite. The "silicification index" measures Si enrichment or depletion of Al, and can spectrally be derived from the depth of the Al-OH absorption feature. The wavelength position of this absorption feature varies from 2185 to 2235 nm as a (linear) function of the Al content of mica's. Alteration facies obtained by mapping changes in the Al-OH feature are then interpreted to derive a possible fluid circulation model through paleo-hydrothermal systems on Mars.

Both sensor noise and the effect of an unknown atmosphere dominated by carbon dioxide require the use of contextual image processing techniques rather than traditional pixel-based classifications. A template matching image processing technique (van der Werff et al., 2007) matches a user-defined template of a boundary to a hyperspectral image data set to find (crisp or fuzzy) boundaries in the image. We will use the spectral characteristics of various facies obtained with mineral alteration indices to feed the template with information to characterize the alteration system. Subtle transitions can be interpreted in terms of changes in pressure-temperature conditions in a hydrothermal system and possibly related to fluid migration patterns. This technique has recently been applied to HyMAP data of the Pilbara hydrothermal system (van Ruitenbeek et al., 2008) and has proven to work well.

In this paper, we show results of patterns found in surface mineralogy of selected mineral deposits on Mars and a preliminary interpretation in terms of sedimentary or metamorphic origin.

#### REFERENCES

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