

Martian clay minerals: Context and implications for weathering of a basaltic crust

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The Mars Express OMEGA team discovered clay minerals on the Martian surface from near infrared remote sensing spectra [1-4]. In this paper, I examine some of these clay deposits using near infrared ($\lambda \cong 0.4\text{-}3\ \mu\text{m}$) OMEGA data as well as thermal infrared ($\lambda \cong 6\text{-}40\ \mu\text{m}$) spectra from the Mars Global Surveyor TES instrument. I also use high resolution images and thermophysical data to constrain the geologic context of these deposits.

At least two clay mineral types are detected (Al- and Mg/Fe-bearing) [1-3] and, in general, the Martian clay deposits correspond to extremely ancient rocks. The occurrence of clay minerals is usually tied to specific photogeologic units; the clay mineral distributions do not cut across multiple terrain units. Based on thermal infrared spectral observations, the clays are usually associated with other silicate minerals (plagioclase, \pm mafic glass, \pm pyroxene, \pm olivine). To date, none of the clay mineral occurrences are associated with detectable quartz, opal-CT, zeolites, or carbonates. Thermal infrared spectra do not show the same strong evidence for clay minerals as the near infrared observations show.

The geologic scenarios that are most consistent with these observations are: 1) erosion and redistribution of a basaltic protolith where the clay minerals occur as clasts or cement in clastic rocks, or 2) diagenetic alteration of mafic ash or sediments. The geologic context of localized Martian clay mineral deposits detected to date is not consistent with origin by volcano-ice interaction, regional metamorphism, or low-temperature weathering of rock surfaces or varnish-like rock coatings. These deposits on Mars provide insight into early Solar System aqueous surface processes at a time when the surfaces of Mars and Earth may have been much more similar.

References

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Native PAHs in hard coal particles as a possible source of increased PAH concentrations in river sediments

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Due to coal mining, transport and incomplete coal combustion, coal particles can be dispersed into soils and sediments where they can present a source of polycyclic aromatic hydrocarbons (PAHs) [1]. Once released into the environment, they play a pivotal role (amongst char coal, coke and soot) by carrying the predominant part of e.g. PAHs present in the sediment-water system. These particles together with their carcinogenic load can be taken up by organisms and the emanating risks have rarely been investigated [2]. While pyrogenic PAHs are known to be ubiquitous in environment, it is hardly recognized that native PAHs are the reason for elevated PAH concentrations in hard coals [3] being released into the environment during coal mining and transport. Although native PAHs have been in focus of previous research, [4, 5], a general overview of PAHs in hard coals from various large hard coal mining areas has not yet been reported.

The aim of this study is to elucidate (1) whether increased native PAH concentrations are present in hard coal samples from large mining areas and (2) whether PAH amounts and patterns correspond to hard coal rank.

In this study, for the analysis of PAHs in hard coal samples from some large mining areas (i.e. China, US, Australia, Indonesia, Poland, Germany, Ukraine, Kazakhstan), we applied accelerated solvent extraction using dichloromethane and fractionation according to polarity by column chromatography. Subsequently, fractions containing PAHs (~50 PAHs) were analyzed by GC-MS. First results of the study will be presented.

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