Geophysical Research Abstracts, Vol. 9, 10402, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-10402

Near- and mid-infrared reflectance spectroscopy of komatiites

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Considered as primitive lavas, a significant constituent of the Hadean crust, and beside basalt another component of Archean greenstone belts, komatiites are important for understanding the evolution of the early Earth. Also, the possible existence of komatiite material (or rocks with komatiite-like compositions) in other planetary bodies of our Solar System has been proposed.

On Venus, the forming agents of the canali channels are considered to be low-viscosity lavas that remain fluid for very long distances. Possible speculated lavas include komatiites and high-Fe-Ti lunar type basalts (Gregg and Greeley, 1993). Some other long and voluminous lava flows observed on the Venusian surface could also represent komatiitic deposits (McMillan, 2005).

Galileo spacecraft and Earth-based telescopic observations of Jupiter's volcanic moon Io revealed numerous eruptions involving extremely high temperature (1430 - 1730 C) materials. These temperatures are consistent with either ultramafic material similar to terrestrial Precambrian komatiites (one possible analog would be the komatiites of the Commondale greenstone belt in South Africa) or superheated mafic volcanism (Williams et al., 1999).

Komatiite has been also referenced for possible similar material of the Martian volcanism from observations and data from Phobos 2 Imaging Spectrometer (Reyes and Christensen, 1994; Mustard et al., 1993).

However some of those hypotheses are still under speculation and sample analysis missions are undoubtedly needed to distinguish the propositions on the nature, origin, and physical properties of the Martian, Venusian and Ionian volcanisms. But as well,

if we fully understand the volcanology and properties of komatiite, it may help interpreting extraterrestrial features observed on those bodies. In this sense, komatiite lavas may be potential and useful terrestrial analogs to model and understand the volcanism on some planetary bodies like Mars, Venus and Io.

One of the techniques to derive significant information about mineralogy of volcanic material is the use of reflectance spectroscopy. Regarding komatiite, there is a substantial lack of spectroscopic data and properties. Here we present the near and mid-infrared reflectance spectral laboratory study of a suite of komatiite samples from various locations in the world. This work is important for constraining the physical properties of komatiites but as well could be used as a database for future remote sensing of extraterrestrial volcanic material.