The Effect of Oxidation on the Visible Near-Infrared Spectra of Basaltic Minerals with Implications for Age Dating Volcanic Flows on Venus

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Venus' crust is composed mostly of basaltic rock, which is in contact with its hot caustic atmosphere; they should react, weathering the rock and producing mineral surface coatings [1,2]. These surface coatings will affect the basalts' optical and radar characteristics [3,4]. However, the chemical products and rates of basalt weathering on Venus and how these affect visible-near infrared (VNIR) spectra (emittance and reflectance) are not well constrained.

Here we present new VNIR reflectance spectra of Fe-bearing olivine that was oxidized in terrestrial atmosphere at 600°C and 900°C. Ongoing experiments focus on the effects of oxidization on the mineralogy and VNIR reflectance spectra of pyroxenes and glasses.

Our results on olivine highlight an important issue for identification of minerals or rocks by VNIR spectroscopy: for the 600°C experiments, the 1 µm absorption band of olivine shallows significantly after only 1 month of oxidation; for the 900°C experiments, the same ~1 µm band is no longer apparent after only 2 weeks. The reflectance spectrum of the oxidized olivine becomes featureless – consistent with an optically thick coating of magnetite and/or hematite. Such rapid oxidation and coating suggests that 'weathering' on Venus should also be fast, and perhaps that basalt flows with low emissivities [5] may only be years old.

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