COMPARISON OF CLASTS IN MARTIAN METEORITE NORTHWEST AFRICA 7034 TO TES AND MINI-TES DATA.

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Introduction: An ongoing objective of remote sensing studies at Mars is to identify the specific source locations of Martian meteorites [e.g., 1, 2]. We are obtaining new thermal infrared spectra of individual phases and clasts in the polymict breccia Northwest Africa (NWA) 7034 to develop a comprehensive spectral library that will be used, in part, for new analyses of infrared spectral data acquired at Mars.

Background: Martian meteorites are the only samples available for detailed laboratory analysis of key Martian isotopic, chemical, and mineralogical characteristics but they lack crucial geologic context. The polymict breccia NWA 7034 [3] has been suggested to have originated in the Noachian highlands [4], large portions of which are relatively dust-free and offer a new opportunity to search for the source region or locality of a Martian meteorite and its component lithologies. NWA 7034 lithologies are different from those represented by the other Martian meteorites but are chemically similar to terrains measured from orbit and by rovers [4, 5]. [6-8] have characterized individual phases and/or the bulk spectral properties of NWA 7034, variously covering all or part of the spectrum from the visible to the thermal infrared. Whole-rock spectra are useful for searching for similar bulk materials on the Martian surface, however, spectra obtained from different clast types within the breccia would allow for characterization of additional kinds of Martian crustal rocks, which can then be sought on the Martian surface.

Analytical Method: We use mapping μ-FTIR spectroscopy (4000 - 400 cm^{-1}, 2.5 - 25 μm) to measure the infrared spectra of clasts and individual phases in NWA 7034 thin sections and slabs. Using corresponding chemical and petrographic maps, we are able to target specific lithologies to obtain their infrared spectra.

Preliminary Results: We measured spectra from thin section NWA 7034 3B,2 and two cut slabs of Northwest Africa 8674 (1A and 1B), which collectively contain virtually every type of clast observed in NWA 7034, including: basalt; Fe-, Ti-, and P-rich (FTP); trachyandesite (TA); basaltic andesite (BA); vitrophyre/melt; and mineral clasts [5]. The individual clasts exhibit a wide range of spectral characteristics that are diagnostic of their mineralogies (Figure 1). Our bulk spectrum of NWA 7034 is virtually identical to that of [8]. Vitrophyre/melt clasts are very similar to the bulk spectrum, albeit with muted contrast, consistent with the observation that most of these clasts are devitrified [5]. The spectra of igneous clasts (e.g., basalt) exhibit a transition from low Ca pyroxene-dominated to increasingly plagioclase-bearing (e.g., loss of the 510 cm^{-1} pyroxene minimum, appearance of oligoclase features at 537, 639 cm^{-1} and 1200-1000 cm^{-1}). FTP clasts are comprised primarily of plagioclase, apatite, and Fe– Ti oxides. Some FTP clasts are dominated by apatite (doublets at 1087/1043 cm^{-1} and 605/568 cm^{-1}).

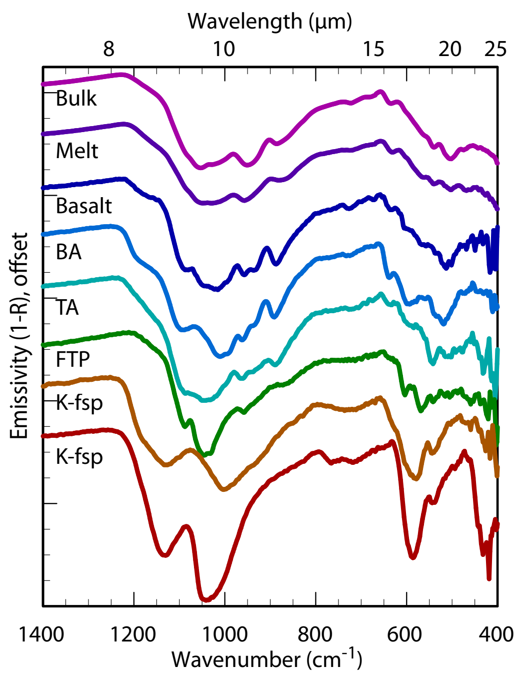

Figure 1. IR spectra of NWA 7034 ("bulk") and clast types. K-fsp = alkali feldspar clasts.

In comparison to other Martian meteorites and spectra measured by the Thermal Emission Spectrometer (TES) and Mini-TES at Mars (not shown), the bulk spectrum of NWA 7034 exhibits stronger pyroxene features than Surface Types 1 and 2 and also differs from pigeonite-rich Martian meteorites (Zagami & Los Angeles). Wishstone-class rocks (which resemble plagioclase-phyric basalt) are not a good match to the igneous clasts as they contain much less pyroxene (~15 vol%) [9]. Clinopyroxene- and olivine-rich meteorites (e.g., Nakhlites, lherzolites) and rocks on Mars (Adirondack olivine basalts) are not represented among the clasts we have measured to date.

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