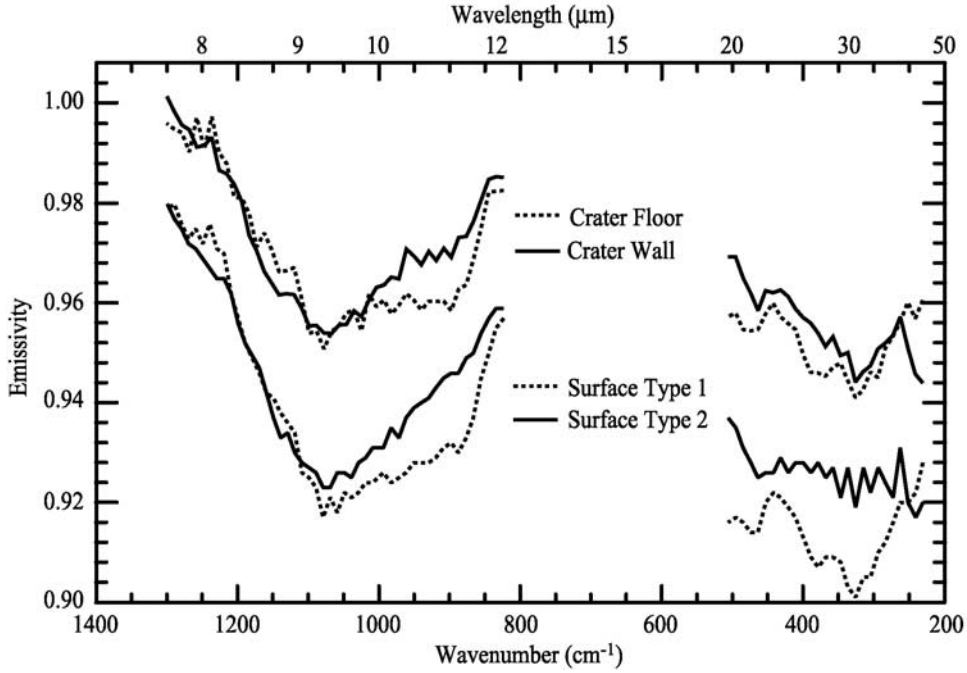

Figure 7. Average atmospherically corrected thermal emissivity spectra of low-albedo intracrater materials compared to surface type 1 and type 2 spectral end-members. The crater floor is dominated by surface type 1 components, whereas the crater wall is dominated by surface type 2 components.

dominate beneath the dust-covered region between this band and the basalt-dominated southern highlands.

5.1.2. Mixture of Basalt and Weathered Basalt

[33] Residual sedimentary "wet" deposits [*Head et al.*, 2002] and/or indigenous coastal marine sediments [*Parker et al.*, 1993] could explain the observed mixing band of surface type 1 and 2 compositions if interpreted as basalt and weathered basalt. Figure 11 shows the extent of the Hesperian Vastitas Borealis Formation in southern Acidalia Planitia, which has been interpreted as a thin veneer of residual sediment deposited on top of older Hesperian ridged material [*Head et al.*, 2002]. The Vastitas Borealis formation occupies about 45% of the entire northern lowlands [*Tanaka and Scott*, 1987] and has been proposed by *Head et al.* [2002] to represent material transported to the north by large volumes of water. Also shown in Figure 11 are geomorphic contacts previously interpreted as ancient shorelines [*Parker et al.*, 1993]. The elevations of these contacts have been examined with high-resolution MOLA data and found to approximate an equipotential line [*Head et al.*, 1999], supporting the hypothesis of an ancient ocean basin.

[34] In a "wet" deposit model, surface type 1 material originating in the basalt- dominated southern highlands was transported to southern Acidalia Planitia by floods that carved the large outflow channels in Chryse Planitia. The transported basaltic material was altered where water ponded and was later deposited as a thin residual veneer (Vastitas Borealis Formation) when the water was lost. Figure 11 shows that the Vastitas Borealis formation contact coincides very well with the transition between surface type 1 basalt and type 2 weathered basalt.

[35] In an indigenous coastal marine model, the transition between the two surface types marks the southern extent of submarine alteration of indigenous basalt caused by large bodies of standing water in the northern lowlands. Proposed shoreline contacts in Chryse and Acidalia Planitiae (Figure 11) also coincide very well with the transition zone between surface type 1 basalt and type 2 weathered basalt. The basalt-dominated band and large volume of weathered basalt in central Acidalia are both interpreted in this scenario as indigenous materials reflecting a progression of more advanced alteration of basalt toward deeper water levels.

[36] The wet transport model does not directly address the presence or absence of long-term, large standing bodies of water (oceans?) in the northern lowlands. It does, however, provide possible insight into the origin of some unusual surface properties in the region. The northern lowlands, including southern Acidalia Planitia, are extremely smooth at several scale lengths, comparable to abyssal plains on Earth [e.g., *Smith et al.*, 1998; *Aharonson et al.*, 1998; *Head et al.*, 2002]. The emplacement of aqueously altered outflow channel deposits could provide a mode of formation for this smoothing [*Head et al.*, 2002]. This explanation does not preclude the presence of oceans, as they could have existed prior to material transport (Noachian [e.g., *Clifford and Parker*, 2001]). However, in this case, sediment transported into preexisting large bodies of water and later deposited would result in a similar thin veneer of altered material (Vastitas Borealis formation).

[37] In summary, the basalt and andesite/weathered basalt interpretations allow for multiple working hypotheses to describe the origin of the surface type 1 and type 2 mixing/transition in southern Acidalia Planitia. The "dry" transport model and "wet" transport and/or indigenous coastal marine models fit within existing geologic scenarios describing the sedimentary and volcanic history of the region.