

Table 3. Modal Mineralogies Derived From Martian Surface Spectra^a

Mineral Group	Cimmeria Terra/Surface Type 1: Basaltic			Surface Type 2: Andesitic	
	Christensen et al.	Bandfield et al.	This Work	Bandfield et al.	This Work
Feldspar	45	50	55	35	49
Clinopyroxene	26	25	21	(10)	
Glass			(9)	25	28
Sheet silicate	(15)	(15)	(5)	(15)	(8)
Orthopyroxene		(5)	(8)		(8)
Amphibole			(2)	(6)	(4)
Olivine	(12)			(3)	(3)
Number of end-members available	59	45	29	45	29
Number of end-members used	not stated	12	9	12	7

^aNumbers in parenthesis are modeled at or below detection limits of ~10–15 vol % as stated by *Christensen et al.* [2000] and *Bandfield et al.* [2000].

result, the remaining (major) phases will show some reorganization and differences in the absolute abundance of each mineral group.

Although the deconvolution results of *Christensen et al.* [2000a] are for a spectrum representing only Cimmeria Terra (not shown here), we show their deconvolution results in Table 3 for general comparison with the results of *Bandfield et al.* [2000a] and this work. (Spectra from Cimmeria Terra are included in the surface type 1 of *Bandfield et al.* [2000a].) The results of our deconvolution of the basaltic (surface type 1) Martian spectrum lie within 5–10 vol % of the modes obtained by *Christensen et al.* [2000a] for the Cimmeria Terra spectrum, which is broadly similar, although not identical, in shape to the *Bandfield et al.* [2000a] surface type 1 spectrum. Therefore the results of all three studies are similar, regardless of the end-member set used and the number of end-members available.

Figure 5 shows the Martian data points on the mineralogy classification diagram from paper 1 along with the measured and derived terrestrial volcanic rock mineralogies. The modes obtained from terrestrial data convolved to 10 cm⁻¹ sampling show no significant variations from data derived at 2 cm⁻¹ sampling (compare to paper 1, Figure 14). Slight differences are observed in the positions of some samples but not to the extent that any rocks are reclassified; similarly, self-consistent results were obtained by *Feeley and Christensen* [1999] and *Hamilton and Christensen* [2000] in their examinations of reduced-resolution deconvolution results. Mineral abundances derived from our models of the Martian surface spectra fall in the basalt and andesite fields and are consistent with the classifications based on the spectral fields in Plate 1. Even though the deconvolutions of Martian data presented by *Christensen et al.* [2000a] and *Bandfield et al.* [2000a] were performed with different end-member sets, their modal results also fall in these fields (within their uncertainties), resulting in the same classifications. These results give additional support to the basalt-basaltic andesite and basaltic andesite-andesite Martian surface compositions described by *Bandfield et al.* [2000a] as well as to applying terrestrial volcanic classification schemes from deconvolved mineralogies for distinguishing Martian surface compositions.

Our modal mineralogy (and bulk chemistry) classifications assume that glass phases identified in the deconvolution are primary volcanic phases (as they are known to be in the terrestrial samples). On the basis of currently available information (including the lack of significant quantities of weathering

products), by Occam's Razor, our interpretation is the simplest explanation of glass formation that explains the observations. If similar glasses can be demonstrated to form by secondary processes, such as oxidation [e.g., *Miniutti et al.*, 2000] or acid-sulfate weathering [e.g., *Morris et al.*, 2000], and identical spectra and derived mineralogies can be obtained from samples affected by these conditions, new criteria for classifying glass-bearing surface types may be necessary.

4.3. Normative Plagioclase Composition Versus Color Index

Hamilton and Christensen [2000] and *Wyatt et al.* [this issue] have demonstrated that approximate solid-solution compositions for plagioclase feldspar and pyroxenes may be obtained

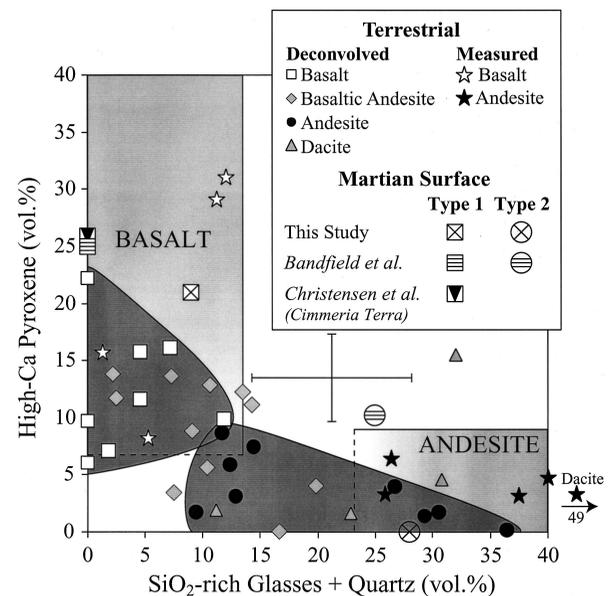


Figure 5. Modal mineralogy classification diagram from paper 1 [*Wyatt et al.*, this issue]. Terrestrial data points indicate modes derived from spectra at 10 cm⁻¹ sampling. Stars represent samples with microprobe-measured modes. Error bars represent the 1 σ uncertainties listed in Table 2 for high-Ca pyroxene and silica phases. The dark shaded fields represent basaltic and andesitic fields defined only on the basis of deconvolution results of terrestrial samples and do not take into account their measured mineralogy.