COMPOSITION OF IMPACT MELTS FROM STATION 13 AT APOLLO 16; Randy L. Korotev, Dept. of Earth & Planetary Sciences and the McDonnell Center for the Space Sciences, Washington University, St. Louis, MO 63130

Station 13 at the Apollo 16 site was located about 0.75 km away from North Ray crater (slightly less than one crater diameter). Samples from station 13 are thought to be ejecta from the upper portion of the stratigraphy sampled by the North Ray impactor [1-3]. For this work, nearly all of the rake and small rock samples (>1 g) identified by Stöffler et al. [3] as impact melt breccias (clast-bearing) and impact melt rocks (clast-free) were studied. Two to six subsamples each of 31 melt rocks were analyzed by high-precision INAA (a larger number of subsamples was analyzed of the larger rocks) as part of a systematic effort to compositionally characterize crystalline melt rocks from Apollo 16 [4-6].

Some correspondence between composition and petrographic classification occurs (Fig. 1). All feldspathic microporphyritic melt breccias (FMMBs) and intergranular melt breccias (IgMBs) are similar to each other in composition for all elements determined except that the FMMBs range to more feldspathic compositions (e.g., lower Sc and Sm concentrations). Among the different subsamples of a given rock, subsamples of FMMBs tend to show a greater degree of scatter than those of IgMBs (not shown), suggesting a larger or more varied clast content. Sample 63536 (the only breccia classified by [3] as subophitic-ophitic-intersertal, *coarse-grained*) is indistinguishable in composition from sample 63545 (a clast-free, subophitic-ophitic-intersertal melt rock). Most, but not all, of the micropoikilitic samples are rich in ITEs (incompatible trace elements). Sample 63597 is unusually poor in ITEs for such a Sc-rich, poikilitic rock.

Eastern (Descartes) trend. In 2-element plots using Sc as one element, Apollo 16 melt rocks roughly define two trends that are less obvious on plots that use a major element instead [e.g., 3,7,8,9,10]. The low-Sm/Sc trend involves mostly the FMMBs and IgMBs from station 13, but includes some samples collected on the Cayley plains. This trend is designated the "Eastern" trend in Fig. 2 after the arguments and model of Stöffler et al. [3] that ITE-poor melts such as the FMMBs derive from the Descartes formation because they are relatively uncontaminated with KREEP. In addition to the low Sm/Sc ratio, *all* samples plotting on the Eastern trend have relatively low concentrations of siderophile elements (e.g, Ni: <300 μg/g, mean=80 μg/g) and high Ir/Au ratios compared to samples plotting on the Western (high-Sm/Sc) trend (Ni: 230-1600 μg/g, mean=780 μg/g). Also, values of *Mg'* are less for samples of the Eastern trend (typically 60-66, except 72 for 63597 [3]) than for samples of the Western trend (68-81) (*Mg'* = bulk mole percent Mg/[Mg+Fe]). These observations indicate that both the target rocks and impactors of the melt rocks of the Eastern trend are different than those of the Western trend.

Although the "Eastern" samples plot along a linear trend in Fig. 2, the FMMBs and IgMBs, which have low Sc concentrations, form a population distinct from the more Sc-rich samples (>7 μg/g) when other elements are considered (not shown, but Ni and Sm/Eu are diagnostic). This alone suggests at least 2 impacts. The FMMB/IgMB population may correspond with compositional group 4 of [7]. The 7 Sc-rich samples in the trend include clast-free melt rocks 68415, 68416, and 63549 which are 'type specimens' of compositional group 3 [11,7]. The new data show that 63537 is compositionally indistinguishable from 63549. Although all 4 samples are similar to each other in composition, the two 635xx samples have ~10% lower concentrations of Sc and ITEs than the 6841x samples and a higher Ir/Au ratio (3.7 vs. 2.1), suggesting that the station-13 samples (63549 and 63537) are not fragments of the same melt sheet as the station-8 samples (68415 and 68416). The remaining 3 samples (63597, 64817, and 65758) are each distinctly different from any others when all measured elements are considered. Thus, it is likely that the samples of the "Eastern" trend were formed by several different impacts, probably into the Descartes formation to the east and south of the site. It is not clear which, if any, of these melt rocks represents primary Nectaris melt, but the FMMBs and IgMBs are probably too feldspathic to be melts from a basin-forming event, assuming that large impacts sample deep material that is less feldspathic than the surface rocks.

Western (Cayley) trend. Most of the samples of the Western trend were collected on the Cayley plains. Several different impacts are required to have produced these rocks [3,8,10,12] and the "trend" may actually consist of several subtrends. Each impact sampled a volume of crust of different average composition (ITE and Al_2O_3 concentrations, *Mg'*, etc.). The correlation of Sc and Sm concentrations is not expected from simple igneous fractionation; it is most likely a large-scale mixing trend between mafic components of the lower crust that are contaminated by or in association with urKREEP [13] and feldspathic, KREEP-poor, upper crustal material.

One of the most common types of melt from the Cayley plains is the "VHA" (alias, group-2) melt from the dimict breccias [5,7,10]. Trace element data show that the dimict-breccia melt is compositionally distinct from the otherwise-similar "VHA" melt found at station 13 and in the feldspathic fragmental breccias of North Ray crater [14]. This observation erases one of the few remaining commonalities between the rocks of the Cayley regolith and those excavated from North Ray crater beneath the Cayley blanket and supports the idea that there is a fundamental difference between the protoliths of the Descartes highlands and the Cayley plains.

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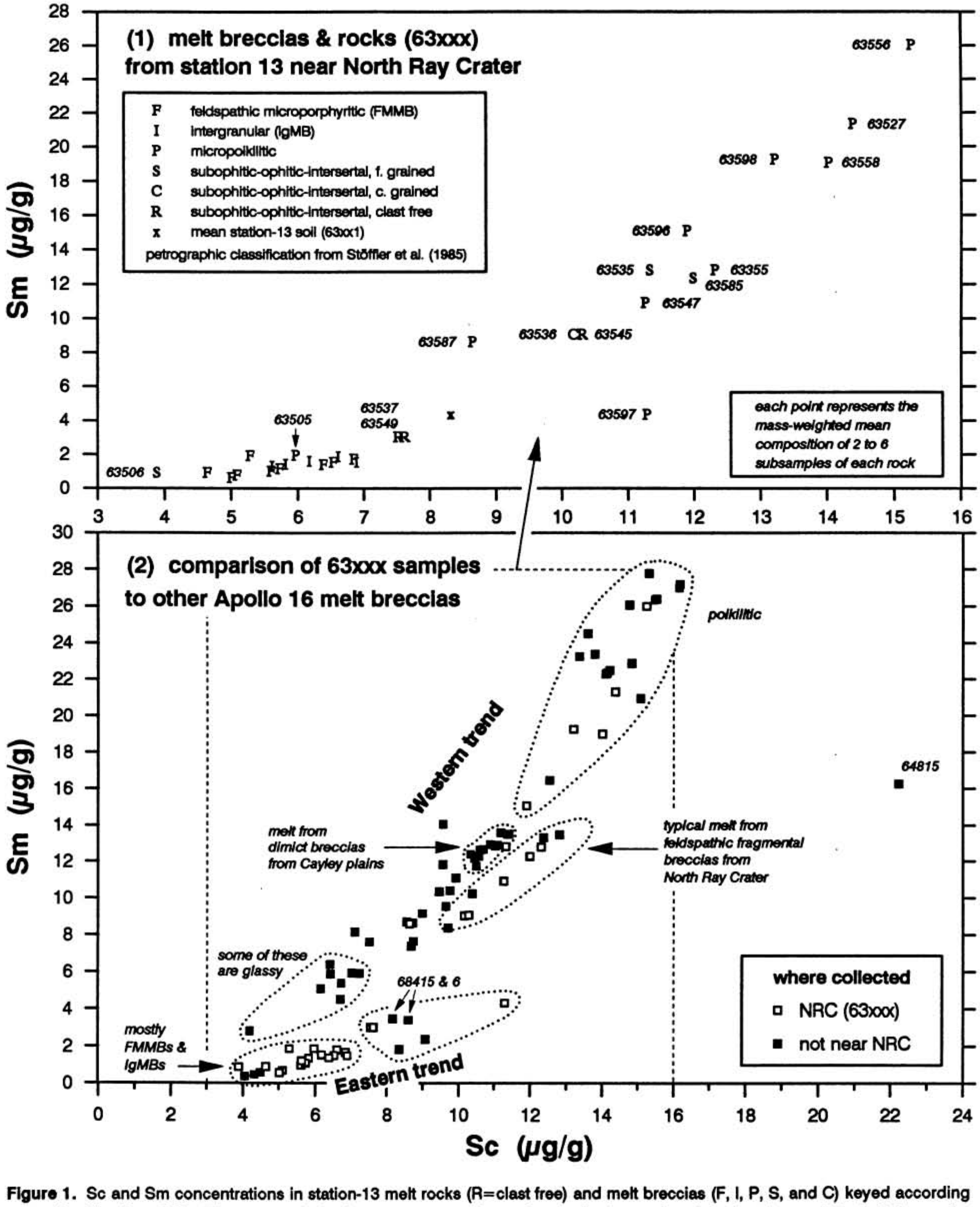

Figure 1. Sc and Sm concentrations in station-13 melt rocks (R=clast free) and melt breccias (F, I, P, S, and C) keyed according to classification of [3]. The mass-weighted mean concentrations of several subsamples of each rock are plotted. Subsamples are usually similar in composition; in the few cases where one was anomalous, the anomolous subsample was excluded from the mean. Usually, anomalous subsamples are compositionally more feldspathic, suggesting that most large clasts are anorthosite or plagioclase.

Figure 2. Comparison of compositions of 63xxx samples of Fig. 1 with melt breccias from the surface of the Cayley plains (from all stations except 11 and 13). Fields for some sample with similar petrographic or compositional characteristics are indicated by the dotted rings. Additional data from [4-6].