RELATIONSHIPS AMONG IMPACT MELT SAMPLES FROM THE TAURUS-LITTROW MASSIFS, APOLLO 17 LANDING SITE. G. Ryder, Lunar and Planetary Institute, Center for Advanced Space Studies, 3600 Bay Area Boulevard, Houston, TX 77058-1113.

Impact melt rocks dominate the samples collected from the lower slopes of the massifs bordering the Taurus-Littrow Valley during the the Apollo 17 landing mission. A large number of them, most of which have poikilitic groundmasses, form a reasonably tight chemical cluster and they have been virtually unanimously interpreted as melt created in the Serenitatis event itself [1,2 and others]. A large number of samples from the South Massif have aphanitic textures and are more clast-rich; they form a more chemically disperse and distinct group. Several authors have suggested that these samples were also produced during the Serenitatis impact [3,4]. However, the mineral clast populations and the chemical trends within these groups differ and there is a hiatus between them. Further, multiple analyses of individual aphanitic rocks show that there are quite distinct compositions among them. Thus the only evidence to suggest that they are from the same event is that they are from the same landing site, which I suggest is barely an argument. Most likely, the aphanites represent a number of smaller impacts around the landing site after the Serenitatis event. Other impact melts distinct from each other and from both the poikilitic and aphanitic groups attest to the history of impacting in the region over a fairly restricted time range.

Impact melt rocks are recognized by their igneous groundmass, their clasts, and their content of siderophiles of meteoritic origin. In the present study, the chemical compositions of petrographically-identified impact melt rocks (i.e. samples larger than 1 cm) from the Apollo 17 highlands are used to explore relationships and processes. Data have been culled from the literature, and augmented by my own unpublished analyses of both "Serenitatis" rocks [5], aphanites from 72255, and other distinct melts. The basic hiatus between the poikilitic "Serenitatis" rocks and the aphanitic rocks shows on many 2-element plots, not just the commonly-used TiO₂ v. Sc (Fig. 1) but also Eu v. Sm (Fig. 2) and Cr v. Al₂O₃ (Fig. 3). Some scatter results from the small sample sizes often used, in conjunction with clasts being unrepresentatively included in the analyzed portion.

Spudis [3] noted that the diversity of the aphanitic group was large compared with other melt groups, and suggested that the "homogenous melt" model did not necessarily apply to basin-scale melting events. If so, then all of the Apollo 17 poikilitic and aphanitic rocks could have formed in the Serenitatis event. Analogously, a wide variety of melts at the Apollo 16 site could be claimed as from the Nectaris event. However, there may be no reason to believe that the Apollo 17 aphanites formed in a single event. Some are individual bombs in any case, and the aphanites did not form in large bodies of melt (or if they did, we somehow only sampled margins).

Figures 1 and 2 show that individual aphanites (which are multicomponent in most cases) have their own limited range of compositions - there is no overlap of aphanites from 73215 and 73255 for example, and indeed the differences between those two rocks are almost as great as the differences between them and the "Serenitatis" group. It is evident that any trend formed by the Apollo 17 aphanites as a group or individually do not point towards the "Serenitatis" group. Thus even to claim that the aphanites were formed in one event, and that that was the same event as formed the "Serenitatis" group, is not based on any valid claims from chemical variations or relationships. The clast populations of the aphanites differ from those of the "Serenitatis" group in detail [6] as well as in generalities [1], and it is apparent that the melts themselves do too.

New chronological data show that the "Serenitatis" group is at least 25 Ma older than the Imbrium event, and thus are definitely not related to it [7, this volume]. The age of any of the aphanites is less certain, but published dates suggest that they too are younger in general than the "Serenitatis" group. The other varied impact melt rocks from the site, including the complex 76055, and a poikilitic clast unlike the Serenitatis ones embedded within aphanite 72255, as well as some K-rich examples, attest to impacts into a variety of targets; the crust around the Taurus-Littrow Valley is/was not homogeneous by any means. Except for its higher TiO₂ content, the poikilitic clast in 72255 is more like its host aphanite in its chemistry than it is like the "Serenitatis" rocks.
TAURUS-LITTROW IMPACT MELTS: Ryder, G.

Figure 1. TiO$_2$ v. Sc for Apollo 17 highlands impact melts. Large S = my own unpublished analyses of "Serenitatis" impact melts; small s = literature data for "Serenitatis" impact melts. Small letters are individual aphanites. a = 72215 b = 72235 c = 72255 d = 72275 (all Boulder 1, Station 2) e = 73215 f = 73235 g = 73255 h = 72315. The filled circles are various other impact melts, including 76055. The filled squares indicate the poikilitic clast in 72255. The R is the regolith on the fresh South Massif landslide.

Figure 2. Eu v. Sm for Apollo 17 highlands melts. Legend as for Fig. 1.

Figure 3. Cr v. Al$_2$O$_3$ for Apollo 17 highlands melts. Legend as for Fig. 1.