PETROGRAPHY AND PETROLOGY OF CLASTS FROM
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61175 is a friable polymict breccia collected near Plum Crater at the
Apollo 16 landing site. This breccia is the largest of a small number of
samples returned from the Apollo 16 site which contain a wide variety of
clasts. The general texture of the matrix and a discussion of ANT suite and
basalt clasts has been presented (1). This paper presents data from
melt-rock and metamorphic clasts found in 61175.

Melt-rock clasts:
Melt-rock clasts are the most texturally diverse of all the clasts found
in 61175. Textures range from glassy, sometimes nearly opaque, hyalo-
crystalline rocks with few xenocrysts or xenoliths to felty holocrystalline
rocks containing euhedral spinels, euhedral to subhedral phenocrysts or
xenocrysts of plagioclase or olivine, and the occasional xenolith. Grain size
is highly variable, from glasses with quench texture containing crystallites
1-2 microns in largest dimension to completely crystalline rocks with
crystals from 0.1 to several millimeters in largest dimension. The
coarsest grained melt rocks resemble basalts, and those not containing
xenoliths cannot be readily differentiated from basalts.

The melt rocks are chemically diverse as indicated by the variety of
mineral assemblages found and their diverse mineral and glass chemistries
(Figs. 1, 2).

Melt-rock pyroxenes differ from those of the basalts mainly in their
texture. Generally melt-rock pyroxenes appear as small euhedral to sub-
hedral grains bounded by lath-like plagioclases, but lack the sieve-like
texture found in pyroxenes from the basalt clasts. Pyroxenes may poikil-
itically enclose small olivines, plagioclase or ilmenite. Pyroxenes from
some of the more coarse-grained melt rocks closely resemble those of the
basalts texturally and in mineral chemistry. Sieve-like, poikilitic pyro-
exenes which include ilmenite, a zirconium mineral, apatite and iron metal
are common; and many contain low and high Ca pyroxene as irregular
anhedral patches. These pyroxenes, with their diverse suite of tiny
mineral inclusions, may encompass more than 25% of the rock. Magnesian
spinel is commonly found with this group of melt rocks.

The compositions of the glasses in the melt rocks reflect the range of
rock types present in 61175. The glasses appear divisible into at least
three groups, an aluminous low FeO + MgO group, an intermediate group
which is titanium-rich and resembles the Apollo 17 glass 74220, 40 (2), and
a very high iron group which is virtually titanium-free. Many of these
glasses are partly devitrified, with regular growth of crystallites of
ilmenite (?) in the high Ti group, or olivine and/or pyroxene in the other
two groups.

Hornfels:
This clast type is distinct texturally from all other clasts in 61175.
Rocks with hornfels texture are characterized by irregular anhedral plagi-
clase porphyroblasts (or xenocrysts), occasionally enclosing small round
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Olivine crystals, surrounded by small anhedral pyroxene and olivine grains. Pyroxene is the dominant mafic mineral. In transmitted light the pyroxene and olivine grains appear as a granular mass surrounding the feldspars. Both pyroxenes and olivine are homogeneous, and vary little in composition within a single clast. Six hornfels clasts have been studied in detail. On the basis of pyroxene and olivine analyses, two groups appear (Fig. 1). The more magnesian group, containing five of the six clasts, appears as a tight grouping of magnesian pigeonites and orthopyroxenes (?) coexisting with olivine ranging in composition from Fo73-Fo76. Plagioclases are much more variable in composition ranging from An83-An100. The more sodic plagioclases often occur as inclusions in the pyroxene.

The other hornfels clast analyzed is distinct. It contains much more iron-rich olivine (Fo55-Fo58) and pyroxene (Wo3-13 En63-53 Fs33-34) than that of the other group. Plagioclase (An92-100), chromite, troilite and ilmenite are also present. This clast resembles the gabbroic anorthosite hornfels described by Chao et al. from 67455 which contains minerals of the following compositions; olivine (Fo46-55), clinopyroxene (Wo7-40 En55-40 Fs38-20) and orthopyroxene (Wo2-3 En56-62 Fs42-35) (Chao, pers. comm. and (3)). The more iron-rich clast from 61175 differs texturally from those of the more magnesian group in that there are indications of an original igneous texture.

On the basis of mineral chemistry, the magnesian hornfelses resemble the melt rocks, but without the augites, and with less range in mineral composition. They also resemble (on the basis of mineral-chemistry) the coarse-grained granulitic ANT (mainly norite) found as clasts in 61175. The more iron-rich hornfels resembles neither.

Conclusions:
Melt rocks and hornfelses found in 61175 contain minerals of similar composition, except for one iron-rich hornfels. Hornfelses of similar texture and composition to those in 61175 have been found in other Apollo 16 rocks, such as 67455 (Chao, pers. comm.) and 67915 (4). The presence of similar rocks in other Apollo 16 samples of differing overall character suggests that the event(s) causing the metamorphic texture, the formation of melt rocks and the production of basalts may not be merely confined to one station. Deciphering the sequence of events and their relationship to one another must await age analysis of the various rock type.

References:
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Fig. 1. Pyroxene and olivine analyses from 61175. ■ Hornfels, olivines and pyroxenes; ● Melt-rock olivines. Dashed line indicates pyroxene field for melt rocks.

Fig. 2. FeO vs MgO (weight %) and FeO vs Al₂O₃ for glasses from 61175 melt-rock clasts. * 74220, 40. Glasses represented by ■ contain from 10-34% TiO₂, but are otherwise similar to the orange glass 74220. The remaining symbols indicate different clasts.