QUE94281: SHALLOW PLUTONIC VLT COMPONENTS AND HIGHLANDS COMPONENTS; BRADLEY L. JOLLIFF, KAYLYNN M. ROCKOW, AND RANDY L. KOROTEV. DEPARTMENT OF EARTH AND PLANETARY SCIENCES AND THE MCDONNELL CENTER FOR THE SPACE SCIENCES, WASHINGTON UNIVERSITY, ST. LOUIS, MO, 63130.

QUE94281, one of the newest lunar meteorites discovered in Antarctica, is a glassy-matrix, clast-rich regolith breccia containing a clast assemblage dominated by mineral debris from a shallow plutonic environment with compositional similarity to VLT (very-low-Ti) basalt. Abundant coarse pyroxene clasts are finely exsolved and have compositions similar to pyroxenes of known lunar VLT basalts and other lunar meteorites of basaltic composition. Pyroxene compositions follow a slow-cooling trend leading to the assemblage fayalite-hedenbergite-quartz. Coarse plagioclase clasts have An contents of ~68-95, similar to the other "basaltic" meteorites. As a proxy for the bulk composition of the meteorite, the composition of the fusion crust is very similar to the bulk composition of Yamato 793274 and reflects the dominant contribution of the VLT-composition mineral clasts. However, the clast assemblage also contains numerous subrounded, glassy and finely crystalline melt-breccias of highlands origin. Lithic clasts that have fine-grained basaltic texture are rare.

In this abstract, we present the results of our initial investigation of QUE94281 based on petrographic observations and electron microprobe analysis of thin section QUE94281,10. Analysis by INA of several small chips of the meteorite is in progress. To date, we have surveyed the major element compositions of the largest mineral clasts, several lithic and glass clasts, glass of the fusion crust, and a large glass vein that transects the section.

The fusion crust ranges in thickness up to ~0.5 mm in our section. Its composition (Table 1) is nearly identical to that of Yamato 793274 [1, 2], hereafter referred to as Y-793274. The fusion crust of QUE94281 is somewhat more aluminous than most known VLT basalt compositions [3], a reflection of its mixed clast assemblage. The large, vesicular glass vein (see also [4]) is not fractured, suggesting formation when the rock was ejected from the Moon, but it has a distinctly more aluminous composition than the fusion crust (Table 1). Several small, elliptical glass clasts have distinctly basaltic (low-Ti and VLT) compositions (FeO = 19-20 wt.%).

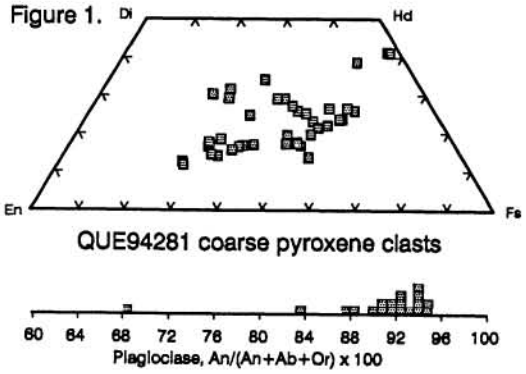
Table 1. Electron microprobe analysis of QUE94281.

	Fusion Crust n=5	Glass Vein n=8
SiO_2	45.63	45.21
TiO_2	0.59	0.50
Al_2O_3	17.15	19.92
Cr_2O_3	0.26	0.25
FeO	12.86	10.98
MnO	0.18	0.15
MgO	9.61	10.11
CaO	12.35	12.54
Na_2O	0.45	0.50
K_2O	0.11	0.08
P_2O_5	0.06	0.08
Sum	99.3	100.3
Mg'	57.1	62.1

Mg'=molar MgO/(MgO+FeO)x100

One of the most striking features of this new lunar sample is the abundance of relatively coarse-grained (up to 0.8 mm grain size) exsolved pigeonite and ferroaugite fragments (Fig. 1, 2a). Individual grains are only moderately zoned in composition, typically contain fine (001) lamellar exsolution (Fig. 2c,d), and together define a compositional trend (Fig. 1) similar to that of pyroxenes of slowly cooled Luna 24 VLT basalts [3], and similar to pyroxenes of Y-793174 [5, 6], Y-793169 [6], Asuka 881757 [6], and EET87521 [7]. Coarse plagioclase clasts have An contents of 68-95, lower than those from Apollo 17 and Luna 24 VLT basalts (An >90), but similar to those in the mafic lunar meteorites. We observe among the clasts relatively coarse hedenbergite, fayalite, and silica, as well as fine-grained intergrowths of these minerals (Fig. 2b); these are indicative of strong differentiation, but slow cooling, and were also observed in Y-793274 [5].

Figure 1.



The breccia contains a diverse assortment of lithic clasts. These include a plagioclase rich clast with fine-grained olivine granules and interstitial whitlockite (Fig. 2e), a fine-grained, intergranular basalt or melt rock (Fig. 2f) containing olivine and pyroxene of Mg' = 63 and 72, respectively, and a plag-pyroxene-olivine-ilmenite assemblage with magnesian mafic minerals (Mg'=80), but An_{63} plagioclase. Subrounded impact-melt breccia clasts are common and have mafic to aluminous matrix compositions, e.g., 17-24 wt.% Al_2O_3. Although it may be very similar to the considerably smaller Y-793274, and possibly paired with it, QUE94281 contains a wealth of lithologic variety and warrants much additional study.

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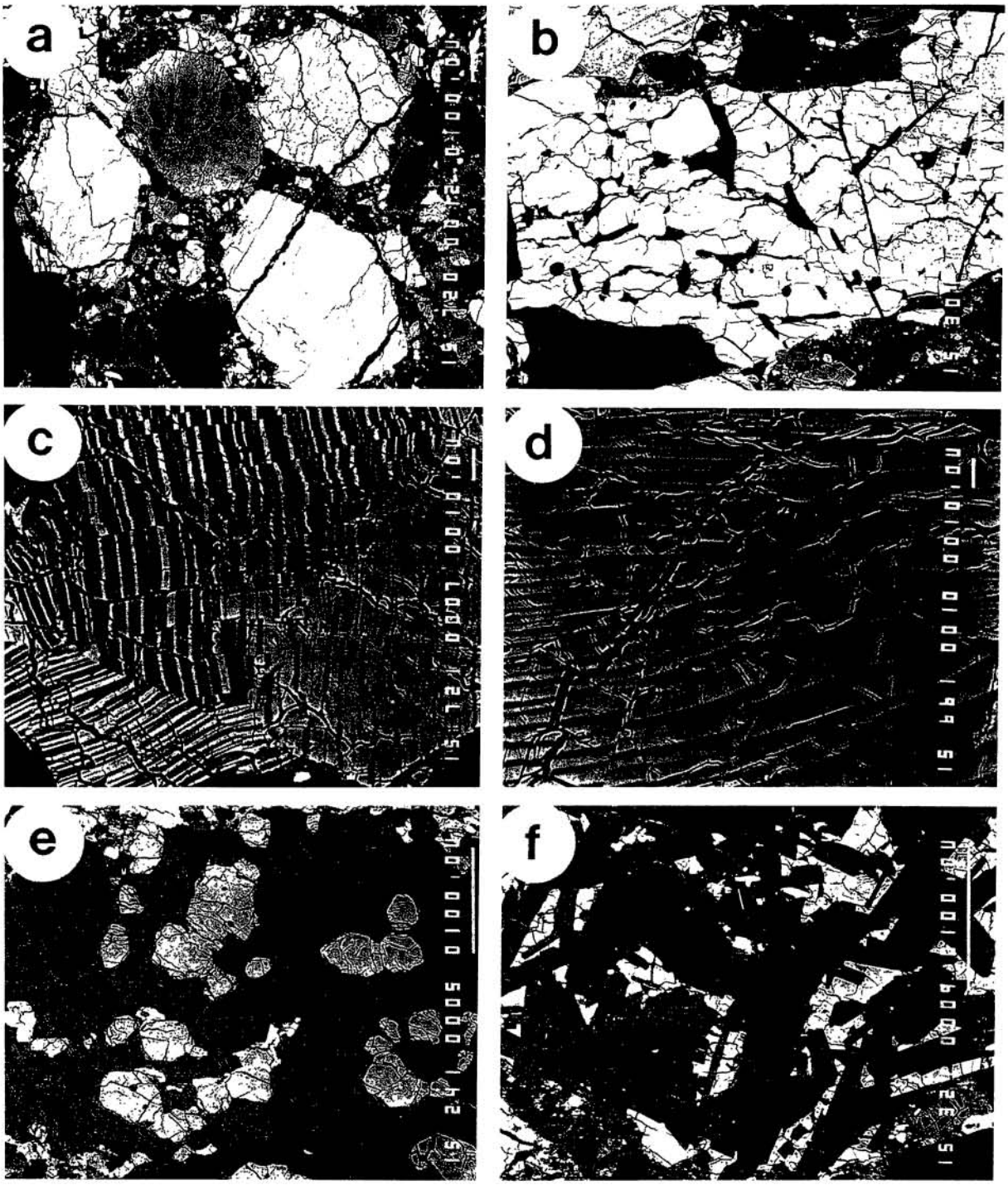

Figure 2. Backscattered-electron images of clasts in QUE94281,10. (a) Coarse pyroxene clasts; field of view ~1.5 mm. Brightness indicates degree of Fe-enrichment. The smaller bright grain is hedenbergite and the larger bright grain is ferroaugite. (b) Fine-grained assemblage, in order of brightness, of hedenbergite, fayalite, K-feldspar, and silica; scale bar is 100 μm. (c) & (d) Finely exsolved pyroxene grains; scale bar is 10 μm. (e) Fine-grained plagioclase-rich granulite with olivine granules and whitlockite (bright). (f) Fine-grained, plagioclase-rich, intergranular-textured lithic clast.