

"PYROXENITE XENOLITH" IN MARE BASALT 10050: EVIDENCE OF THERMAL EROSION BY MARE VOLCANICS ? J. W. Delano; Department of Geological Sciences; State University of New York; Albany, NY 12222

Introduction

A "pyroxenite xenolith" measuring 80 x 170 microns was reported by Beatty and Albee [1,2] in high-Ti mare basalt, 10050. This basalt is coarse-grained and texturally most similar to the group 'B2' [2]. The xenolith was described as a fine-grained polycrystalline aggregate consisting of 80% clinopyroxene, 6% orthopyroxene, and 14% plagioclase [2]. Beatty and Albee [2] noted that the minerals were not in chemical equilibrium and that partial assimilation of the xenolith had occurred following its incorporation into the 10050 lava [2]. There was even the suggestion that the xenolith may represent the breakdown of a high-pressure assemblage involving garnet [2].

The scientific importance of this pyroxenite xenolith is that it may be a sample of the lunar mantle acquired during ascent of the magma through a conduit [1,2]. Alternatively, the clast may have been incorporated into the magma at low pressure as the magma rose through and flowed onto the regolith. Since the process of 'thermal erosion' may have involved the assimilation of a few percent of exotic components by mare basalts during emplacement [3-5], this pyroxenite xenolith might be the first sample-based evidence for this. The chemical and isotopic effects of this hypothetical assimilation would complicate interpretations of the mantle source-regions of mare magmas. The present study was begun to address this issue.

New Data

Additional electron microprobe analyses and backscattered electron images have been acquired on the "pyroxenite xenolith" in 10050,31. These new data show that the homogeneous, Fe- and Al-rich clinopyroxene identified by Beatty and Albee [1,2] as comprising 80% of the clast is not an unzoned crystal but is instead 3 compositionally distinct impact glasses (X, Y, Z in Figures 1a,b; Table). Glasses 'Y' and 'Z' (Figures 1a,b) are in sharp contact indicating that a high cooling-rate prevailed. This juxtaposition of a rapidly cooled glassy clast with a slowly cooled lava is a peculiar occurrence. Glass 'X' is vesicular and contains schlieren, in addition to crushed mineral fragments (augite, plagioclase, ilmenite). The present data agree with the phase identifications made by Beatty and Albee [2] for the remaining 20% of the sample, except that their orthopyroxene is actually pigeonite.

An additional constraint on the possible origin of this clast is that it is located on the edge of thin-section 10050,31. This location would be fortuitous if this clast were a xenolith, as proposed by [1,2]. These new data support an alternative view that this clast is an impact melt at the floor of a micrometeorite crater on an exterior surface of mare basalt, 10050. Since the size of the hypothesized impact crater is comparable to the mean grain-size of this basalt, the impact melts (i.e. glasses X, Y, Z in Figures 1a,b) are compositionally distinct (Table).

A problem for the proposed impact origin of this clast is that the 15-micron pigeonite grain in glass 'Z' (Figures 1a,b) is more magnesian than any of the pigeonites analyzed by Beatty and Albee [1] in 10050. Therefore, this pigeonite is not merely an unresorbed remanent grain, but may have undergone partial fusion during the shock event to become enriched in Mg relative to Fe.

Conclusion

The fact that this clast was observed at all by Beatty and Albee [1,2] is a testimony to the thoroughness of their study on the Apollo 11 basalts. However, the current data do not support their interpretation that the clast is a pyroxenite xenolith from the deep lunar interior. Instead, this clast consists of three compositionally distinct impact glasses probably generated by a micrometeoritic impact onto an exterior surface of mare basalt 10050. This clast can be interpreted as an impact melt on the floor of a zap pit.

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Since this clast is not a xenolith, it unfortunately provides no evidence bearing on the important issue as to whether the geochemistries of mare basalts were affected by thermal erosion [3-5] during emplacement. The search continues.

REFERENCES: [1] Beatty and Albee (1978) LPSC 9th, p. 359-463; [2] Beatty and Albee (1980) LPS-XI, p. 67-69; [3] Wilson and Head (1980) LPS-XI, p. 1260-1262; [4] Head and Wilson (1980) LPS-XI, p. 426-428; [5] Head (1990) LPI-LAPST Workshop on Mare Volcanism and Basalt Petrogenesis, p. 7-8.

Figure 1a: Backscattered electron image of clast in 10050,31.

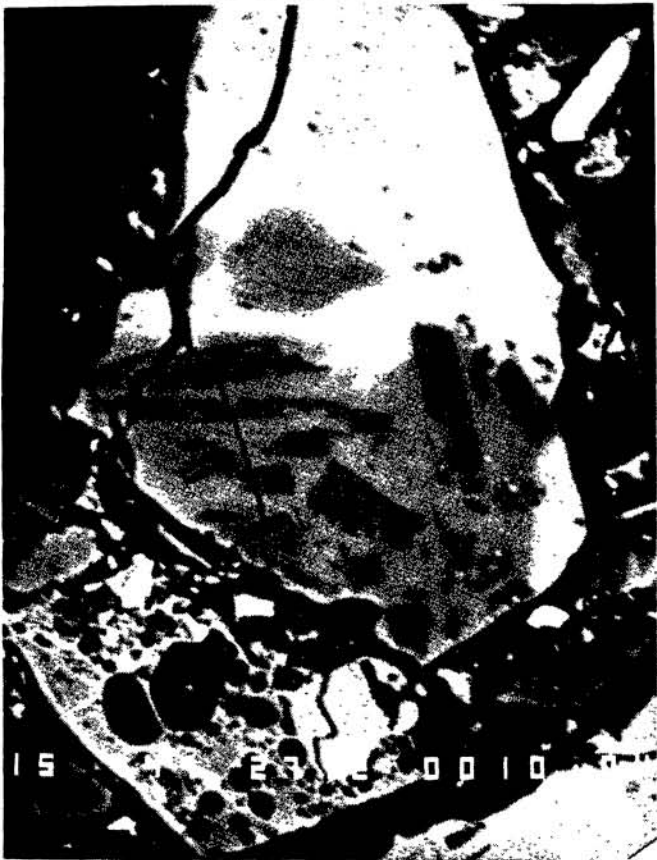
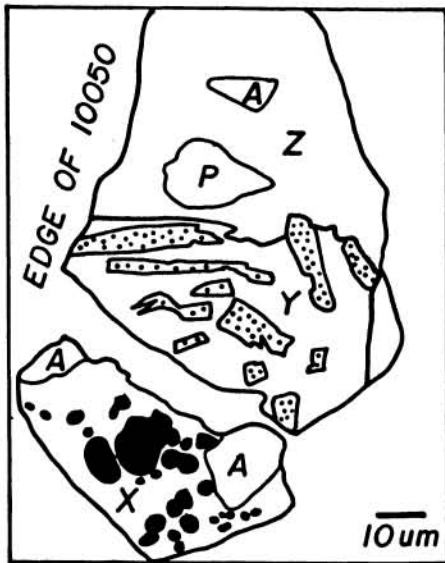


Figure 1b: Map identifying phases from backscattered electron image.



- A** AUGITE
- P** PIGEONITE
- Z** PLAG
- Y** VESICLE
- X** GLASS

Table. Three impact glasses in 10050,31 clast.

(weight %)	Glass 'X'	Glass 'Y'	Glass 'Z'
SiO ₂	42.3	46.4	46.6
TiO ₂	6.14	1.23	2.64
Al ₂ O ₃	14.8	17.0	10.7
Cr ₂ O ₃	0.30	0.17	0.12
FeO	14.1	9.80	22.4
MnO	0.20	0.13	0.28
MgO	8.01	12.2	5.33
CaO	12.9	11.9	11.6
Na ₂ O	0.22	0.57	0.30
K ₂ O	0.18	0.12	0.09
Q	0	0	1.2
or	1.1	0.7	0.5
ab	1.9	4.8	2.5
an	38.9	43.5	27.6
di	20.6	12.6	25.6
hy	21.6	22.0	37.4
ol	3.2	13.4	0
ilm	11.7	2.3	5.0