A "CHONDRITE" OF LUNAR ORIGIN: TEXTURES, LITHIC FRAGMENTS, GLASSES
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Rock 14318 is a densely welded microbreccia consisting of fragments of
shock-modified and recrystallized anorthosite, norite, troctolite, KREEP
norite, basalt, dunite, as well as glass fragments, glass spherules, and
chondrules, embedded into a partly glassy, fine-grained matrix. Chondrules,
glasses, and lithic fragments are welded to the matrix, and fractures usually
cut across particle-matrix boundaries. Glass spherules (and fragments) are
sometimes recrystallized and partly devitrified but can readily be distin-
guished from chondrules: the latter often have igneous textures (i.e. large
crystals embedded in a fine-grained matrix)[1], and resemble in all textural
properties meteoritic chondrules and artificial chondrule-like spherules that
were formed by spontaneous crystallization of highly supercooled, molten
silicate droplets [2]. The results of this study may be summarized as fol-
lows: i) Lithic fragments in 14318 range widely in composition and are divided into
an anorthositic-noritic-troctolitic [ANT] group, KREEP norite group, basalt
group, and dunite. Although most fragments have shock-modified and recrystal-
lized rather than igneous textures, they are considered to be derivatives of
igneous rocks (i.e. they are metaigneous rocks). ii) ANT lithic fragments are
similar to those reported from Apollo 11 [3], Apollo 12 [4] and Luna 16 [5].
Norites are low in K and P and are not to be confused with KREEP norites.
However, 14318 does, in addition, contain KREEP norite fragments that are
similar to previously described KREEP norite lithic fragments from Apollo 12
[4-6]. Separation of KREEP norites from ANT norites is not always sharp but
gradational (Fig. 1). iii) The basaltic lithic fragment suite is represented
by only one specimen, but similar fragments were found in low abundance in
other Apollo 14 samples. The basaltic fragment is similar to rock 14053 but
lower in K and P than the lithic fragments of a second basaltic suite, the K-
rich basalt group, found in other Apollo 14 rocks [7]. However, in 14318,
this group is represented by K-rich basalt glasses and chondrules (Fig. 1;
Table I). iv) A single lithic fragment of feldspathic dunite (magnesian) was
found, lending additional support to earlier suggestions that ultramafic rocks
occur on the moon [3-5]. v) Glasses are the compositional analogs to the ANT
and KREEP norite lithic fragments. The third glass group, the K-rich basalt
glass, has no lithic fragment counterparts in rock 14318 but does in other
Apollo 14 sections [7]. K-rich basalt glasses are similar to mare basalts in
major elements but are enriched in K and P, indicating they may not be mare-
derived (Table I). Although REE were not determined it is possible that the
K-rich basalt glasses represent a suite of rocks enriched in KREEP in compar-
ison to KREEP norite. Glass cementing microbreccia 14318(matrix glass) is

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Table I: Bulk compositions of lithic fragment, glass, and chondrule groups from 14318.4 (broad electron beam techniques; wt.%)

<table>
<thead>
<tr>
<th>&quot;Igneous&quot; Lithic Fragments</th>
<th>Glasses</th>
<th>Chondrules</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ANT</td>
<td>KREEP</td>
</tr>
<tr>
<td>SiO₂</td>
<td>44.6</td>
<td>47.0</td>
</tr>
<tr>
<td>TiO₂</td>
<td>0.30</td>
<td>1.39</td>
</tr>
<tr>
<td>Al₂O₃</td>
<td>27.0</td>
<td>18.0</td>
</tr>
<tr>
<td>Cr₂O₃</td>
<td>0.11</td>
<td>0.16</td>
</tr>
<tr>
<td>FeO</td>
<td>4.6</td>
<td>9.5</td>
</tr>
<tr>
<td>MnO</td>
<td>0.06</td>
<td>0.14</td>
</tr>
<tr>
<td>MgO</td>
<td>5.8</td>
<td>9.24</td>
</tr>
<tr>
<td>CaO</td>
<td>15.5</td>
<td>11.0</td>
</tr>
<tr>
<td>Na₂O</td>
<td>0.49</td>
<td>0.86</td>
</tr>
<tr>
<td>K₂O</td>
<td>0.12</td>
<td>0.52</td>
</tr>
<tr>
<td>P₂O₅</td>
<td>0.10</td>
<td>0.57</td>
</tr>
<tr>
<td>Total</td>
<td>98.68</td>
<td>98.38</td>
</tr>
</tbody>
</table>

No. Specimens 4 7 11 1 18 12 9 22 3 2

The data presented above indicates the predominance of KREEP norite composition with compositional similarities to ANT norite (Fig. 1). vi) Chondrules are the compositional analogs to the ANT, KREEP norite, and K-rich basaltic lithic fragments. Most chondrules, however, are of ANT norite composition (Fig. 1). vii) Apollo 11 and 12 and Luna 16 mare-type basaltic lithic fragments and glasses are rare. viii) On the basis of its texture, it is suggested that rock 14318 and its chondrules[1] originated in a large-scale impact event. The similarity in texture between 14318 and polymict-brecciated chondrites suggests that meteoritic chondrites may have formed in similar large-scale impact events on parent meteorite bodies. However, the question of the origin of meteoritic chondrules by either impact or condensation from the solar nebula cannot be resolved on the basis of the lunar evidence.


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"Igneous" Lithic Fragments

Glasses

Chondrules

"Igneous" lithic fragments, glasses, and chondrules from rock 14318