
Rock 62295 was found perched on the surface of the slopes of Buster Crater at STA 2 and is a 251 g fragment of crystalline rock possibly derived from the Cayley formation. In hand specimen it is medium gray, 0.1-0.9 mm grain size, slightly heterogeneous with occasional feldspar-lined miarolitic cavities. The mineralogical composition corresponds to a spinel-bearing allivalite, the fine grain size suggests that it is effusive. Two thin sections from the 28 and 42 chips gave the three modes:

<table>
<thead>
<tr>
<th>Grain Size</th>
<th>Mineral</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.8 - 0.3 mm</td>
<td>Plagioclase</td>
<td>50-57 (28) 48 (42)</td>
</tr>
<tr>
<td>0.3 - 0.03</td>
<td>Olivine</td>
<td>1-1</td>
</tr>
<tr>
<td>0.5 - 0.1</td>
<td>Mesostasis</td>
<td>20-15</td>
</tr>
<tr>
<td>0.05 - 0.01</td>
<td>Spinel</td>
<td>4-3</td>
</tr>
<tr>
<td>0.05</td>
<td>Ilmenite</td>
<td>1-1</td>
</tr>
<tr>
<td>0.1</td>
<td>Sulfide/metal</td>
<td>1-1</td>
</tr>
</tbody>
</table>

Spinel occurs as minute 'colorless' octahedra set in the plagioclase and to a very minor extent in the portions of the olivine phenocrysts that are intergrown with feldspar. Larger, pale pink crystals occur between feldspar laths but are variable in distribution, up to 6% in 42 where they tend to occur in small clusters. This spinel is aluminous with Mg/Fe = 9 and with 4% Cr2O3.

Olivine. Two 0.8 mm phenocrysts (Fo 93-89) occur; thread-and drop-like colorless glass inclusions with minute gas bubbles are common. The phenocrysts have a skeletal overgrowth of olivine (Fo 85-82) intergrown with plagioclase containing isolated spinel octahedra.

Plagioclase. The main texture of the rock is controlled by randomly oriented idiomorphic anorthite laths (An 90 Ab9.2 Or0.8) some of which show inclusions of colorless octahedral spinel, others include of spinel and branching single-crystal skeletal olivine (Fo 87-82) simulating a graphic intergrowth. In parts of the rock, the intergrowths are more finely lamellar and may include some pyroxene.

Opaques. Ilmenite occurs as interstitial plates between the feldspars. Iron and troilite occur sporadically in irregular <0.01 mm patches and also interstitially.

Two larger (80-100 μm) composite (FeNi) metal areas occur associated with troilite and schreibersite.

The first area, subangular to irregular in outline, has troilite at one end as peripheral crystals somewhat intergrown with the matrix silicate. The troilite has a sharp contact with a central area of taenite, 50 μm across, which has a straight line boundary on its other side with an equal extent of kamacite. Etching with Nital revealed that the kamacite is full of submicron drops of isothermal taenite [1] and that the main area of the taenite is now converted into a blocky martensite [2] bordered adjacent to the troilite by a one micron zone of structureless taenite. Microprobe scans across the composite grain showed an asymmetric U-profile for Ni in the taenite and a uniform

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composition for the kamacite area. The taenite adjacent to the troilite had 24.2% Ni, the martensite at minimum scan - 12.1% Ni, 0.6% Co and adjacent to kamacite - 19.2% Ni. The kamacite and its included isothermal taenite was not resolvable by electron probe and together gave 6.3% Ni, 0.75% Co. The composition of the taenite at the kamacite and troilite interfaces is probably somewhat higher than the values recorded because of the steepness of the diffusion profile, maybe 25 and 35% Ni respectively, the former being above and the latter below the MS transformation curve at low temperatures. The estimated bulk metal composition is Fe 88.8%, Ni 10.5%, Co 0.7%.

The second area, rounded to irregular in outline, has marginal troilite intergrown with the silicate matrix and shows three drops, 10-15 μm in size, of troilite and schreibersite [2, 3, 4]. Provisional measurements suggest that there is no nickel depletion zone in the kamacite enclosing the schreibersite. The kamacite itself contains many submicron drops of isothermal taenite as previously. Although somewhat rounded the schreibersite shows no evidence of partial melting or of a phosphide-metal eutectic. One 12 μm rounded area in the kamacite is composite, one half being schreibersite, the other an unidentified anisotropic phase of weaker reflectivity and a darker 'lilac' hue.

The dark mesostasis is composed of feathery and barred crystallites of olivine, plagioclase and maybe clinopyroxene. The two former minerals can be seen growing in optical continuity as outgrowths from the crystals forming the body of the rock. Small skeletal plates of ilmenite are relatively abundant. Minute submicron droplets of metal and troilite occur. The ultimate matrix is a dense brown irresolvable devitrified glass.

The general texture of the rock, with skeletal olivine and graphic intergrowth of olivine and plagioclase in a quench matrix suggests rapid cooling. The mineral phases present are comparable with those in terrestrial allivalites, which are, however, cumulative rocks related to melts of gabbric composition. The texture of 62295 is that of a true melt rock that would have started to crystallize about 1300°C and is comparable in composition with some recrystallized fragments from the Apollo 15 and Luna 20 sites [5].

The nature of 62295 suggests the following alternative origins: 1) remobilization of an early accumulate from an anorthositic gabbro magma or remobilization of a crystalline residuum from the fractional melting at depth of an anorthositic gabbro rock with, in either case, subsequent crystallization under effusive conditions; 2) impact melting of a shallow-seated allivalitic accumulate; 3) the production of an allivalitic liquid by fractional remelting of an anorthositic gabbro by successive impacts.

There are geophysical and geochemical arguments for a concentration of iron from silicate melts within the moon although the petrographic evidence is of necessity slight, so it is not impossible that the complex areas of iron alloys described represent xenoliths caught up in a rapid erupted melt. The primary grain size could be developed within the crust of a slowly cooling moon, but it is probable that the ascent and quenching of a melt would have been slow enough to produce a more marked modification of the original texture than just the development of the micron-sized isothermal taenite.
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On balance, the origin of 62295 by impact melting of a pre-existing allivalitic rock is favored. The larger metal areas would then represent incorporated, slowly cooled chondritic or iron meteoritic fragments, the production of isothermal taenite being the only metamorphic effect of the short term immersion of the fragments in the rapidly quenched melt.

REFERENCES


