A GEOCHEMICAL-PETROLOGIC STUDY OF THE POPULATIONS OF COARSE-FINES PARTICLES IN APENNINE FRONT SOILS; Marilyn M. Lindstrom, NASA Johnson Space Center, Houston, TX 77058 and Ursula B. Marvin, Harvard-Smithsonian Center for Astrophysics, Cambridge MA 02138

In an attempt to identify new Apennine Front rocks and evaluate the proportions of rock types at various sites we have begun a study of coarse-fines from Apennine Front soils 15313 (Sta 7) and 15403 (Sta 6a). These soils were chosen because they were expected to exhibit extremes in highland rock populations.

PROCEDURES: After sieving and washing with freon, the soil particles were sorted under a binocular microscope and briefly described. A subset of the most distinctive crystalline rocks thought to represent highland plutonic rocks, granulites, mare and KREEP basalts and impact melts were split for INAA and thin section. In all, 23 particles from 15313 and 18 particles from 15403 were analyzed by INAA at JSC. Thin sections were made from 18 particles from 15313 and 16 particles from 15403. Sample descriptions and microprobe analyses are being performed at Harvard.

POPULATIONS: Table 1 lists fragment populations for 15313 and 15403, their corresponding coarse fines (1), and three other Apennine Front soils for which data are available (2,3). All of the soils have abundant regolith breccia fragments, although impact melt fragments appear to be more abundant than regolith breccias in 15403-4. The populations of crystalline particles in 15313 and 15403 are dramatically different. 15403 is dominated by KREEP basalts, QMD and KREEP-rich melts, which is not surprising given its association with breccia 15405, the original KREEP basalt-QMD breccia (4). It also contains a few mare basalt fragments, but no non-KREEPy highland rocks. 15313, on the other hand, contains several highland plutonic rocks, both KREEP-poor and KREEP-rich impact melts, and a higher proportion of mare basalts. It contains very little igneous KREEP component. The other three soils are intermediate in population, with 15434 closely resembling 15403-4.

PARTICLE TYPES: Preliminary descriptions of particle types are given here, major element data and detailed petrologic descriptions are not yet available. Anorthositic, noritic, and ultramafic rocks: The nine highland rocks from 15313 range widely in composition. Three particles are anorthosite or noritic anorthosite, four are anorthositic norite or norite. One norite, 15313,53 (ts,87) is a beautiful plutonic particle with a small patch of mesostasis minerals. Another norite, 15313,72 (ts,95) is not pristine and looks more like an anorthosite invaded by a mafic KREEPy melt. Most of these particles are similar to other highland rock fragments found at the Apennine Front (5,6). Two particles are ultramafic: 15313,69 (ts,94) is a peridotite consisting of 90% pyroxene, 10% plagioclase; 15313,17 is a peridotite rich in olivine. Both peridotites have surprisingly high REE concentrations (La ~2ppm) for their ultramafic composition. KREEP basalts and QMD: Eight fragments from 15403 and one from 15313 are KREEP basalts typical of those at Apollo 15. They range in grain-size from fine to medium-coarse, but all consist of pyroxene, plagioclase, ilmenite, and a variety of mesostasis minerals and glass. Three fragments of QMD-like materials are described in a companion abstract (7). Mare basalts and green glass: Six particles in 15313 and two in 15403 are mare basalts. Most of the 15313 particles are typical Apollo 15 mare basalts, but one from 15313 (40) and both in 15403 (26 & 27) are picritic mare basalts (8,9). One green glass clod was found in 15313. Impact Melts: Both KREEP-rich and KREEP-poor impact melts were found in both soils, but the proportions differ markedly. The impact melts are generally fine-grained and often have
poikilitic patches. With La contents ranging from 69 to 26 ppm, most of the
KREEP-rich melts fall in groups A and B (10), but one is a group C-D melt. The
KREEP-poor melts have La contents ranging from 4.4 to 8.8 ppm, which fall in
the lower REE part of the range for KREEP-poor impact melts (11).

DISCUSSION: This geochemical-petrologic study of Apennine Front coarse
fines particles has shown that soils are excellent sources of interesting rock
fragments and provide valuable information on populations. The ultramafic and
QMD fragments are unusual and require further detailed study. The noritic,
anorthositic, KREEP and mare basalt, and impact melt particles supplement
existing studies of those rock types. The population differences among
Apennine Front soils may be used to suggest stratigraphy. For example, Ryder
(8) suggested that picritic basalts overlie typical mare basalts because the
picritic basalts are found at the base of the front, but not on the mare
plains. The identification of picritic basalts without typical mare basalts in
15403 provides strong support for this suggestion because the soil was
collected at Sta 6a, the highest point sampled at the Apennine Front.

REFERENCES: (1) G. Ryder (1989) Apollo 15 Coarse Fines Catalog, NASA JSC,
(1990) PLPSC20, in press.

TABLE 1. POPULATIONS OF APENNINE FRONT SOIL PARTICLES. Listed are numbers of
analyzed particles. Numbers in parentheses are total number of similar particles. * In 15272 highland
rocks and KREEP-poor impact melts are grouped together and listed under A/N/P, and KREEP-basalts and
KREEP-rich impact melts are grouped together and listed under KREEP basalts. # For 4-10 mm particles both
KREEP-rich and KREEP-poor impact melts are a combined and listed under KREEP-rich melts.

<table>
<thead>
<tr>
<th>Sample</th>
<th>15313</th>
<th>15314</th>
<th>15403</th>
<th>15404</th>
<th>15243</th>
<th>15272</th>
<th>15434</th>
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<tr>
<td>Size(mm)</td>
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<td>4-10</td>
<td>2-4</td>
<td>4-10</td>
<td>2-4</td>
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<td>7</td>
<td>6a</td>
<td>6a</td>
<td>6</td>
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<td>7</td>
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<tr>
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<td>3</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>7*</td>
<td>1</td>
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<tr>
<td>KB</td>
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<td>1</td>
<td>8(13)</td>
<td>1</td>
<td>7</td>
<td>15*</td>
<td>15</td>
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<tr>
<td>QMD</td>
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<td>0</td>
<td>2(3)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>MB</td>
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<td>7</td>
<td>2(4)</td>
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<td>0</td>
<td>4</td>
<td>3</td>
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<tr>
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<td>0</td>
<td>0</td>
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<td>0</td>
</tr>
<tr>
<td>KM</td>
<td>3</td>
<td>6#</td>
<td>5(9)</td>
<td>16#</td>
<td>8</td>
<td>*</td>
<td>12#</td>
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<tr>
<td>KPI</td>
<td>3</td>
<td>#</td>
<td>1</td>
<td>#</td>
<td>3</td>
<td>*</td>
<td>#</td>
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<td>20</td>
<td>21</td>
<td>48</td>
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<tr>
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<td>few</td>
<td>1</td>
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