Supporting Online Material

Analyses

The Fe isotopic composition was measured on a MicroMass Isoprobe multi collector inductively coupled plasma mass spectrometer at the Isotope Geochemistry Laboratory of the Field Museum, Chicago (1). Powdered rock samples were dissolved in a mixture of HF-HNO₃-HClO₄. Iron was fixed on AG1-X8 200-400 mesh resin in 6 M HCl and was then eluted in 0.4 M HCl. This step was repeated twice. Isotope analyses were performed on MC-ICPMS by standard bracketing with the IRMM-014 reference material.

All major and trace element analyses were carried out at the Service d’Analyse des Roches et des Minéraux (SARM), CRPG-CNRS, Vandœuvre-lès-Nancy, France. Major element analyses, including Fe (Tables 1 and S1), were done on a Jobin-Yvon JY 70 ICP-AES. The Ti measurements given in Table 1 were obtained by spectrophotometric analysis on a Beckman DU 62 spectrophotometer after HF-HClO₄ attack (detection limit 0.0006 wt% TiO₂). Complete dissolution of all mineral phases, especially magnetite, was checked before analysis. The TiO₂ concentration measured in the geostandard AC-E is 0.104 wt% [recommended working value TiO₂= 0.11 ± 0.02 wt% (2)]. The molar Fe/Ti ratio of table 1 is based on total iron Fe₂O₃(T) from table S1 and Ti molar concentration measured spectrophotometrically (not listed).

Table S1: Major element analysis (weight %).

<table>
<thead>
<tr>
<th>Sample</th>
<th>SiO₂</th>
<th>Al₂O₃</th>
<th>Fe₂O₃(T)</th>
<th>FeO</th>
<th>MnO</th>
<th>MgO</th>
<th>CaO</th>
<th>Na₂O</th>
<th>K₂O</th>
<th>TiO₂</th>
<th>P₂O₅</th>
<th>LOI</th>
<th>Total</th>
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<td>G91-26#1</td>
<td>78.11</td>
<td>&lt;0.20</td>
<td>13.92</td>
<td>8.74</td>
<td>0.19</td>
<td>3.32</td>
<td>5.31</td>
<td>&lt;0.15</td>
<td>&lt;0.10</td>
<td>&lt;0.03</td>
<td>&lt;0.03</td>
<td>-0.48</td>
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<td>SM/GR/97/2</td>
<td>63.38</td>
<td>16.81</td>
<td>5.18</td>
<td>3.85</td>
<td>0.07</td>
<td>2.84</td>
<td>5.03</td>
<td>4.13</td>
<td>1.55</td>
<td>0.45</td>
<td>0.08</td>
<td>0.58</td>
<td>100.10</td>
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<td>SM/GR/97/3</td>
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<td>5.47</td>
<td>14.41</td>
<td>8.06</td>
<td>0.19</td>
<td>20.64</td>
<td>10.27</td>
<td>0.20</td>
<td>&lt;0.10</td>
<td>0.59</td>
<td>&lt;0.03</td>
<td>1.63</td>
<td>99.72</td>
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<td>SM/GR/97/4</td>
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<td>12.70</td>
<td>9.09</td>
<td>7.05</td>
<td>0.13</td>
<td>8.79</td>
<td>6.63</td>
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<td>1.81</td>
<td>0.31</td>
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<td>100.05</td>
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<td>5.53</td>
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<td>&lt;0.03</td>
<td>0.23</td>
<td>99.95</td>
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<td>11.05</td>
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<td>0.20</td>
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<td>0.31</td>
<td>0.04</td>
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<td>1.89</td>
<td>1.55</td>
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<td>0.01</td>
<td>0.01</td>
<td>0.06</td>
<td></td>
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</tr>
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</table>

a Recommended working values (2).
**Samples**

The sample set includes rocks from the Akilia association (3-6) occurring on Akilia island and Innersuartuut island in Godhåbsfjord, southwestern Greenland. This association includes ultramafic rocks, metagabbros, and banded quartz-pyroxene rocks of putative sedimentary origin. In addition two samples were studied that form part of the tonalitic orthogneisses that surround the Akilia association in the extreme southwestern corner of Akilia Island. Sample G91-26 was collected by A.P. Nutman. Sample AK-98 was collected by M. van Zuilen. All other samples were collected by S. Moorbath.

**Akilia association at the southwestern end of Akilia island:**

SM/GR/97/4 Grey gabbroic rock (amphibolite), occurring west of the main quartz-pyroxene body. This sample has been studied before for direct age determination of the supracrustal association (7), and is similar to the gabbroic samples studied by (8). Mineral assemblage: plagioclase, amphibole, orthopyroxene, clinopyroxene, biotite, and minor magnetite.


G91-26 Banded quartz-pyroxene rock collected originally by A.P. Nutman. This specific sample forms part of the collection of Scripps Institution of Oceanography, La Jolla, California. In this collection it is labeled as ANU92-197, which refers to the catalogue number at the Australian National University. Throughout this manuscript this sample is referred to by its field number G91-26, as was done by others (6,9-12). This sample is thought to represent a fine-grained part within the main body of the predominantly coarse-grained quartz-pyroxene rock, and it has been claimed to contain the oldest traces of life on Earth (9). Mineral assemblage: quartz, orthopyroxene, clinopyroxene, amphibole, magnetite, and minor pyrite, pyrrhotite, chalcopyrite, apatite, calcite.

SM/GR/97/5 Banded quartz-pyroxene rock from the same locality as sample G91-26. Trace element chemistry of this sample has been studied in detail by (13). Mineral assemblage: quartz, orthopyroxene, clinopyroxene, amphibole, and minor calcite, magnetite, apatite and pyrite.

AK-98 Banded quartz-pyroxene rock. The sample represents the coarse-grained middle part of the main body of the quartz-pyroxene rock. Mineral assemblage: quartz, orthopyroxene, clinopyroxene, amphibole, and minor magnetite and apatite.

At the direct contact between the supracrustal rocks and tonalitic gneisses in the southwestern end of Akilia:

SM/GR/97/2 Granitoid gneiss, with tonalitic to quartz-dioritic composition. This rock has been studied in detail for age-determination of the Akilia suite (7,14). An equivalent sample from this site has been described by (6) (sample G88-66). This rock occurs at the southern contact with the supracrustal rocks of the Akilia association. Mineral assemblage: quartz, plagioclase, K-feldspar, amphibole, biotite, and minor magnetite and pyrite.
SM/GR/97/7 Granitoid gneiss, with tonalitic to quartz-dioritic composition. Northern contact with Akilia suite, southwestern part of Akilia island. This sample has been studied in detail for age-determination of the Akilia suite (7, 14). Equivalent samples from this site have been described by (6) (sample G93-05), and by (10) (sample GR9716). Mineral assemblage: quartz, plagioclase, K-feldspar, amphibole, biotite, and minor magnetite and pyrite.

Akilia association at Innersuartuut island ca. 10 km south of Akilia island:

SM/GR/97/9 Banded quartz-pyroxene rock. Trace element chemistry of this sample has been studied in detail by (13). Mineral assemblage: quartz, orthopyroxene, clinopyroxene, amphibole, and minor magnetite, garnet and pyrite.

171770 Banded quartz-pyroxene rock, from the same locality as sample SM/GR/97/9. Contains less quartz than sample SM/GR/97/9. The banded rock formation on this island is similar to Akilia and this particular sample contains graphite. Trace element chemistry of this sample has been studied in detail by (13). Mineral assemblage: quartz, orthopyroxene, clinopyroxene, amphibole, and minor magnetite, garnet and pyrite.

171771 Banded quartz-pyroxene rock, 50 m from 171770. This mafic mineral-dominated rock is not really banded, but very rich in magnetite. Mineral assemblage: quartz, orthopyroxene, clinopyroxene, amphibole, magnetite, and minor garnet.

Isua Supracrustal Belt:

IF-G Banded Iron Formation. This is a geostandard described by (2, 15). The sample was collected by P. Appel from the north-easternmost part of the Isua Supracrustal Belt in southern West Greenland, and is described as an oxide-facies banded iron formation (16). Mineral assemblage: quartz, magnetite, and minor amphibole, pyrite, apatite and carbonate.
References