Jasra ultramafic-mafic-alkaline complex: A new find in the Shillong Plateau, Northeastern India

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The newly discovered plutonic-sub volcanic ultramafic-mafic alkaline complex at Jasra consists dominantly of pyroxenites (with layers of titanomagnetite) with subordinate amount of syenitic, alkali gabbroic bodies and very minor veins of ijolite, carbonatite and basic dykes. This complex in all probability is part of the larger alkaline magmatic activity in Shillong Plateau-Mikir Hills massif, apparently related to the break-up of Gondwana land during the Late Jurassic period. Pyroxenite and titanomagnetite are associated with higher concentration of titanium, niobium, thorium, rare-earth elements and metallic sulphides.

The Jasra complex is located on the eastern fringe of Shillong Plateau in Hamren subdivision Karbi Anglong district, Assam, NE India (92° 30' 00"–92° 31' 47" and 26° 00' 00"–26° 01' 47"). This complex was discovered on the basis of clues provided by aeromagnetic data (NGRI 1980) and LANDSAT TM imagery. This complex is nestled within three prominent fracture systems viz. Barapani-Tyrssad Shear zone in the north, Kopili fault in the east and Boppani fracture zone in the south. It covers an area of 2.5 km² (Figure 1) intruding the Shillong Group of metasedimentary rocks comprising quartzites and phyllites along the southern and western margins and by granitoids along the northern and eastern peripheries.

This complex preserves a wide petrologic spectrum represented by (i) ultramafites: pyroxenite and its variants with layers and lenses of titanomagnetite; (ii) mafites: olivine gabbro and basic dykes; (iii) alkali rocks: syenite, trachyte, alkali pegmatite and ijolite and (iv) carbonatite and fenite.

Pyroxenites in general exhibit wide textural and compositional variation. Bulk of them are coarse-grained with euhedral diopsidic augite as their dominant component with spheine, calcite, rutile and perovskite; introduction of soda partly resulted in the transition of diopsidic augite to aegerine-augite. Pyroxenite variants with olivine and nepheline are also noticed. Bands and lenses of titanomagnetite, apparently representing the primary magmatic differentiates, occur within pyroxenites and they range in thickness from a few centimetres to a metre. Olivine gabbro constitutes a prominent litho-unit enveloping the southern periphery of the complex. Plagioclase and augite constitute the major mineral components while titanomag-emitte, apatite, olivine (Fo 15–Fo 55), rutile and biotite constitute the minor components.

Coarse-grained, grey-coloured alkali syenite mainly consists of perthite and plagioclase while aegirine-augite, sphe- line, nepheline, biotite, magnetite, rutile and apatite occur as accessories. Volcanic rocks with their characteristic trachytic texture occur as pipe-like bodies traversing the Shillong Group quartzites. The fine-grained groundmass contains laths of plagioclase, biotite, augite, and well-developed hornblende, apatite, spheine, pyrite and magnetite. Thin veins of ijolite and carbonatite (5 cm to 50 cm) intersect the pyroxenites. The alkali pegmatite is a coarse-grained, leucocratic rock composed mainly of titanomagnetite, clino-pyroxene and nepheline. Medium-grained granites are traversed by a network of basic dykes, the thickness of which varies from a few centimetres to half a metre. These dykes mark the closing stage of magmatism in this complex. The alkali pyroxenites and associated rocks like syenites display a varying degree of fenitization at the contact of ijolite and carbonatite veins. Besides a few boulders of Hb andesite have also been noticed in the southeastern part of the complex. The whole rock analyses (wt%) of some of the representative rocks of the complex are presented in Table 1.

The characteristic features of the Jasra complex are:

(i) A crudely defined concentric compositional zoning
Table 1. Whole rock analyses (wt%) of representative rock samples from Jaara, Karbi-Anlgong District, Assam

<table>
<thead>
<tr>
<th>Rock type</th>
<th>SiO₂</th>
<th>Al₂O₃</th>
<th>FeO</th>
<th>Fe₂O₃</th>
<th>TiO₂</th>
<th>MnO</th>
<th>P₂O₅</th>
<th>Na₂O</th>
<th>K₂O</th>
<th>CaO</th>
<th>MgO</th>
<th>LiO</th>
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<tbody>
<tr>
<td>Syenite</td>
<td>61.87</td>
<td>15.82</td>
<td>1.76</td>
<td>3.63</td>
<td>0.81</td>
<td>0.08</td>
<td>0.22</td>
<td>5.20</td>
<td>5.76</td>
<td>2.30</td>
<td>0.14</td>
<td>0.16</td>
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<tr>
<td>Neptunian syenite</td>
<td>50.86</td>
<td>18.86</td>
<td>1.58</td>
<td>5.51</td>
<td>1.05</td>
<td>0.19</td>
<td>0.03</td>
<td>8.66</td>
<td>7.49</td>
<td>2.62</td>
<td>0.57</td>
<td>0.16</td>
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<tr>
<td>Fenitized syenite</td>
<td>58.40</td>
<td>11.67</td>
<td>1.80</td>
<td>7.99</td>
<td>1.25</td>
<td>0.14</td>
<td>0.19</td>
<td>3.20</td>
<td>5.47</td>
<td>5.82</td>
<td>1.93</td>
<td>0.12</td>
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<td>Olivine gabbro</td>
<td>44.00</td>
<td>10.40</td>
<td>10.33</td>
<td>4.87</td>
<td>4.57</td>
<td>0.23</td>
<td>0.21</td>
<td>2.89</td>
<td>1.13</td>
<td>12.41</td>
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<td>8.68</td>
<td>6.57</td>
<td>8.26</td>
<td>7.06</td>
<td>0.26</td>
<td>0.47</td>
<td>2.60</td>
<td>1.60</td>
<td>19.74</td>
<td>4.47</td>
<td>0.12</td>
</tr>
<tr>
<td>Pyroxenite</td>
<td>33.82</td>
<td>9.92</td>
<td>6.25</td>
<td>10.62</td>
<td>6.69</td>
<td>0.34</td>
<td>0.39</td>
<td>3.47</td>
<td>2.14</td>
<td>19.80</td>
<td>5.92</td>
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<tr>
<td>Titanomagnetite</td>
<td>0.83</td>
<td>9.83</td>
<td>18.14</td>
<td>21.96</td>
<td>20.83</td>
<td>0.46</td>
<td>0.02</td>
<td>1.16</td>
<td>0.06</td>
<td>18.03</td>
<td>5.37</td>
<td>0.23</td>
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<td>16.17</td>
<td>8.02</td>
<td>5.96</td>
<td>19.19</td>
<td>30.68</td>
<td>0.07</td>
<td>0.02</td>
<td>1.44</td>
<td>0.05</td>
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<td>4.11</td>
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<td>Hornblende</td>
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<td>17.5</td>
<td>1.65</td>
<td>3.73</td>
<td>1.05</td>
<td>0.19</td>
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<td>2.2</td>
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<td>Trachyte</td>
<td>47.33</td>
<td>12.83</td>
<td>4.56</td>
<td>11.7</td>
<td>4.87</td>
<td>0.38</td>
<td>0.51</td>
<td>2.60</td>
<td>0.95</td>
<td>21.17</td>
<td>4.21</td>
<td>0.15</td>
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</tbody>
</table>

Analysed by conventional wet chemical procedure.
Analyists: Adarsh Kumar, AMD, Shillong.

i.e. basic centre to sub silicic/silicic margins. (ii) The occurrence of prominent alkali gabbro bodies running parallel to the boundary of the complex. (iii) The presence of gabbroic layers in pyroxenites. (iv) The presence of layers and lenses of titanomagnetite in pyroxenites as manifestation of magmatic sedimentation in a magma chamber and (v) The presence of macroscopic and microscopic layering in pyroxenites.

Rare metal (niobium and thorium) and rare earth element potentials related to the complex include magnetite, ilmenite, perovskite and thorium-bearing minerals. The titanomagnetite on an average contains 26.17% FeO, 43.42% TiO₂, 0.07% ThO₂ and 2468 ppm of niobium. Soil cover over this lithounit approximately contains 8053 ppm of total rare earth elements. Ubiquitous sulphide mineralization, occurring as dissemination, veins and fracture fillings in pyroxenites was also noticed. The sulphide minerals identified include pyrite, chalcopyrite, bornite and covellite.

The Shillong Plateau—Mikir Hills massif is studded with at least four alkali-carbonatite complexes viz. Sung Valley, Samchampi, Daragiri and Swangkre. The alkaline-carbonatite magmatism in this region belongs to two distinct episodes during Late Jurassic (156±16 Ma; 149±5 Ma and 105 Ma), a period marked by crustal upheaval resulting in the folding and fragmentation of the Gondwanaland and the northward drifting of the Indian Plate, after being separated from Antarctica. In view of the similarities in geological setting and regional tectonics together with petromineralogical attributes of the Jasara complex with the other known alkali-carbonatite complexes in the Shillong Plateau, this newly discovered alkali complex seems to represent a part of the widespread alkali magmatism which took place during the Jurassic period.

1 Report on "Airborne magnetic survey over parts of Meghalaya and Assam (India)", NGRI, 1980, 80–169, 1–86.

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Epithermal stratabound barite mineralization around Doon Valley

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Fluid inclusion studies on barite mineralization suggest a temperature of deposition at 100° to 140°C for the parent hydrothermal fluid, with a salinity range 9 to 14 wt.% NaCl equiv, and density around unit value. The field, petrographic and inclusion studies show a stratabound epithermal nature for this mineralization.

The barite mineralization located in the Tons valley and in the Song valley (Simaur Dist., H.P, and Dehra Dun Dist., U.P.) occurs within the Pindarziec Nagath