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

R. Mamallan, Dhirendra Kumar and R. K. Bajpai

Regional Centre for Exploration and Research, Atomic Minerals Division, P.O. Assam Rifles, Shillong 793 011, India

The newly discovered plutonic-sub volcanic ultramafic-mafic alkaline complex at Jasra consists dominantly of pyroxenites (with layers of titano-magnetite) 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 Gondwanaland during the Late Jurassic period. Pyroxenite and titano-magnetite 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)[1] 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 Borpani fracture zone in the south. It covers an area of 2.5 km^2 (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 titano-magnetite; (ii) mafites: olivine gabbro and basic dykes; (iii) alkaline 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 sphene, 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 titano-magnetite, 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 titano-augite, apatite, olivine (Fo 15–Fo 55), rutile and biotite constitute the minor components.

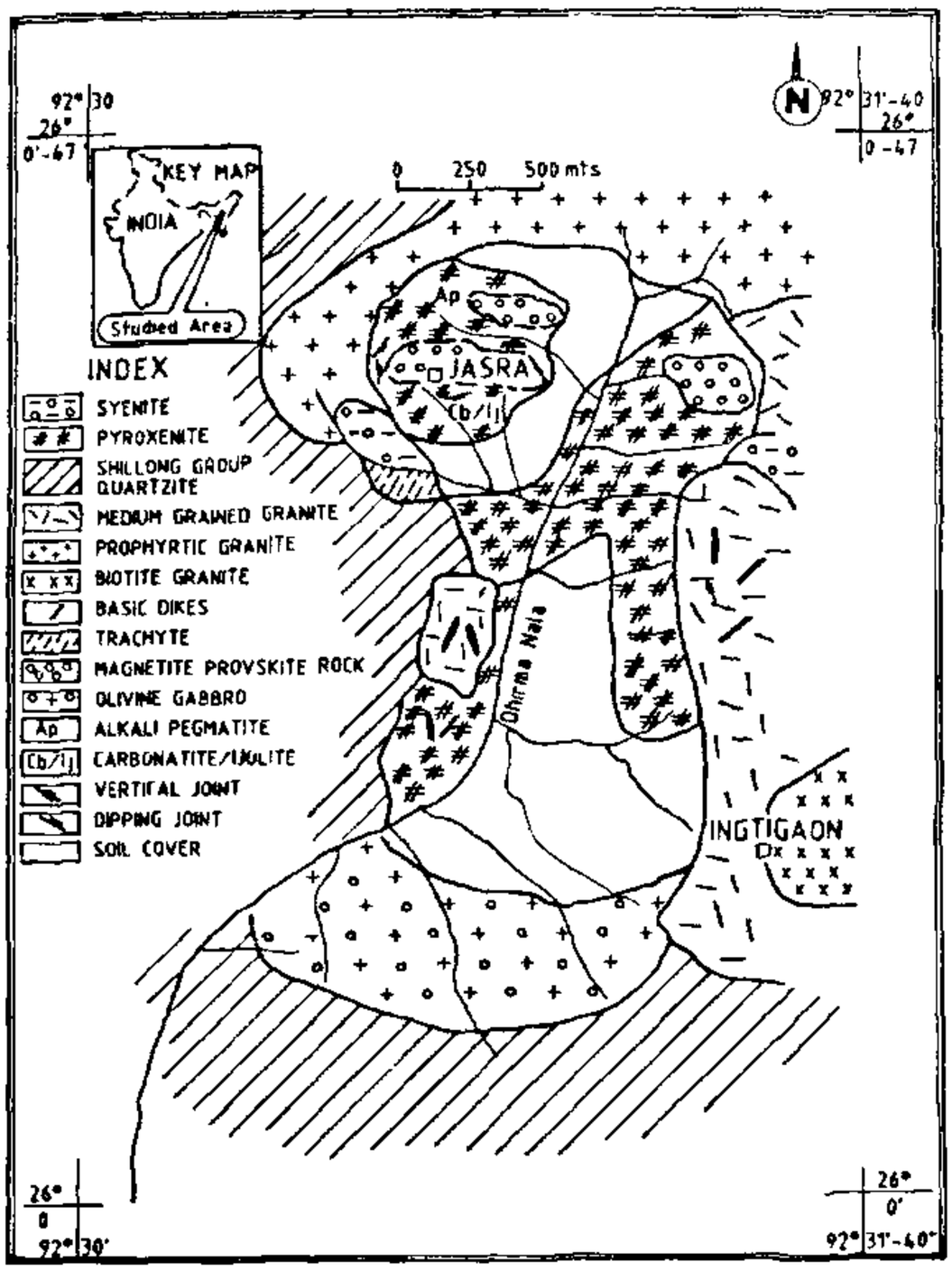

Figure 1. Geological map of Jasra mafic–ultramafic-alkaline complex, Karbi-Anglong District, Assam.

Coarse-grained, grey-coloured alkali syenite mainly consists of perthite and plagioclase while aegirine-augite, sphene, 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, sphene, 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 titano-magnetite, 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 Jasra, Karbi-Anglong District, Assam

Rock type	SiO_2	Al_2O_3	FeO	Fe_2O_3	TiO_2	MnO	P_2O_5	Na_2O	K_2O	CaO	MgO	H_2O	LOI
Syenite	61.87	15.82	1.76	3.63	0.81	0.08	0 22	5.20	5.76	2 30	1 14	0.16	0.52
Nephelene syenite	50.86	18.86	1.58	5.51	1.05	0.19	0 03	8 66	7.49	2.62	0.57	0 16	2.58
Fenitized syenite	58 40	11 67	1 80	7.99	1.25	0 14	0.19	3.20	5.47	5.82	1.93	0 12	0.45
Olivine gabbro	44 00	10 40	10 33	4.87	4.57	0.23	0 21	2.89	1.13	12.41	8 77	0.08	0 04
Pyroxenite	38.82	8 68	6 57	8.26	7.06	0 26	0.47	2.60	1.60	19.74	4.47	0 12	0.49
Pyroxenite	33.82	9.92	6.25	10.62	6 69	0.34	0.39	3.47	2.14	19.80	5.92	0.26	1 17
Titano magnetite rock	0.83	9 83	18 14	21.96	20.83	0 46	0 02	1.16	0 06	18.03	5.37	0.23	2.62
Titano magnetite rock	16.17	8 02	5 96	19.19	30.68	0 07	0.02	1.44	0.05	12.81	4 11	0.14	1.05
Hornblende andesite	60.7	17.5	1.65	3.73	1.05	0 19	0.17	7.31	4 52	2.2	0.81	0.09	0 13
Trachyte	47 33	12.83	4.56	11 7	4 87	0 38	0.51	2 60	0 95	21.17	4 21	0 15	1.15

Analysed by conventional wet chemical procedure.
Analysts: 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 titano-magnetite 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 potentialities related to the complex include magnetite, ilmenite, perovskite and thorium-bearing minerals. The titano-magnetite on an average contains 26.17% FeO, 43.42% TiO_2, 0.07% ThO_2 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 atleast four alkaline-carbonatite complexes viz. Sung Valley[2], Samchampi[3], Darugiri[4] and Swangkre[5]. The alkaline-carbonatite magmatism in this region belongs to two distinct episodes during Late Jurassic (156 ± 16 Ma[6]; 149 ± 5 Ma[7] and 105 Ma[8]), a period marked by crustal upheaval resulting in the rifting 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 alkaline-carbonatite complexes in the Shillong Plateau, this newly discovered alkaline complex seems to represent a part of the widespread alkaline magmatism which took place during the Jurassic period.

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Received 13 September 1993; revised accepted 28 October 1993

Epithermal stratabound barite mineralization around Doon Valley

Rajesh Sharma and H. K. Sachan
Wadia Institute of Himalayan Geology, Dehra Dun 248 001, India

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 (Sirmaur Dist., H.P. and Dehra Dun Dist., U.P.) occurs within the Proterozoic Nagthat