ON THE ALKALI SYENITES OCCURRING NEAR KUNDULUR, KHAMMAM DISTRICT, ANDHRA PRADESH

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Introduction: The occurrence of syenites near Kundulur (17°40′ : 81°24′), a small village in Khamman district, Andhra Pradesh, was reported by Nair and Mahadevan (1968). To the north-west of Kundulur, two seperate syenite bands, intervened by biotite gneiss, extend in a NE-SW direction. The northern band is about one mile, and the southern band is a little over one mile in length. The maximum width of the bands is about 3 furlongs. The present paper deals with the petrographical, mineralogical and chemical aspects of these syenites.

Geological setting: The country rocks for the syenites comprise garnetiferous biotite gneiss, amphibolite and pyroxene granulite. The alkali rocks stand out conspicuously as positive topography from the surrounding low country. Within the alkali syenite bands, a central core of nepheline syenite, pegmatoid at places, is fringed successively by biotite-nepheline syenite, hornblende-nepheline syenite and perthite-pyroxene syenite. Nepheline forms pods and lenses at places within biotite- and hornblende nepheline syenite. The syenite complex is emplaced within biotite gneiss and granulites. In the syenite bands well marked foliation is developed with dips varying from 50° towards 130° to 66° towards 145° and is conformable with the attitude of foliation of the country rocks. The syenites are gneissose on account of the parallel disposition of the elongated clusters of dark and light minerals in alternate bands. Mineral lineation is developed occasionally in the syenites, the general attitude of plunge being 18° towards 190°.

Petrography of the country rocks: Garnetiferous biotite gneiss is a medium grained rock with well developed foliation having an assemblage of quartz, biotite ($N_Y = 1.582$ to 1.590, pleochroic from straw yellow to deep brown, $X < Z$), porphyroblasts of garnet ($a = 11.565$, almandine), orthoclase (having the unresolved $131/1\bar{3}1$ reflections) and plagioclase (An_{37}). Apatite, zircon and calcite occur as accessories.

Amphibolite occurs as thin bands and lenses within biotite gneiss and consists chiefly of hornblende ($Z \wedge c = 19°$, pleochroism: X = yellowish green, Y = deep green; Z = deep bluish green), plagioclase (An_{43}) and strained quartz. Accessory minerals are zircon, apatite and opaques.

Calc-granulite occurring as insignificant bands, are medium grained rocks having coarse, colourless grains of diopside ($Z \wedge c = 38°$) and quartz as its chief constituents together with plagioclase (varying from oligoclase to andesine) and bleached biotite. Graphite, abundant at some places, occurs as small needles. Apatite is the common accessory.

Petrography and mineralogy of the syenites: Petrographically, the syenites may be grouped as: (1) Pyroxene-bearing perthite syenite, (2) Hornblende-nepheline syenite and (3) Biotite-nepheline syenite.

Perthite syenite is a coarse to medium grained leucocratic rock with sporadic clots of alkalic pyroxene. The nepheline syenites on the other hand develop hydrous mafic silicates (hornblende and biotite) as chief mafic constituents. Average modal composition of the two types of nepheline syenites are shown in Table I. It is significant to observe that similar petrographic types occur as dominant members of the alkalic massif of Kunavaram extending further south (Bose *et al* 1971).

The syenites of Kundulur are hypersolvus types developing microperthite as the dominant constituent. The alkali feldspar may show varying degrees of exsolution even leading to ultimate unmixing, but in general the feldspar is a mesoperthite. The potassic phase in the microperthite frequently develops the characteristic twinning of microcline, and in biotite nepheline syenite the triclinicity of the potassium feldspar phase is appreciably high ($\triangle = 0.91$), which would imply a slow subsolidus cooling of the syenite body.

Discrete plagioclase grains are present in the central part of the biotite-nepheline syenite bands while plagioclase is absent at their marginal part. Zoning of plagio-

TABLE I

MODAL COMPOSITION OF NEPHELINE SYENITES

	1	2	3	4
Perthite	53.40	49.71	52.70	53.71
Plagioclase	3.94	0.41	10.60	4.63
Nepheline	20.67	30.46	20.20	16.01
Biotite	12.11	12.85	10 40	9.19
Hornblende	—	—	—	9.18
Calcite	7.59	3.98	5.00	2.00
Apatite	0.26	0.14	0.70	0.36
Sphene	—	0.06	0.05	4.92
Muscovite	1.50	—	—	—
Scapolite	0.04	0.16	—	—
Zircon	—	0 15	—	—
Opaques	0.44	2.06	0.30	—
Total	99.95	99.97	99.95	100.00

1. Avg. of 3 biotite-nepheline syenites from the northern band in Kundulur.
2. Avg. of 3 biotite-nepheline syenites from the southern band in Kundulur.
3. Biotite-nepheline syenite of Kunavaram.
3. Avg. of 2 hornblende-nepheline syenites of Kundulur.

clase, having albite rims, is present and is possibly related with the history of the unmixing of the potassium feldspar phase. Coarse grains of nepheline occur at the interstices of alkali feldspars. Biotite, in the syenites, shows strong absorption and high refringence X = pale straw yellow, Y = dark brown, Z = dark greenish brown to opaque; $\beta = 1.665$ implying appreciable amount of iron rich component in the phase. Amphibole in the hornblende nepheline syenite is common hornblende with $Z \wedge c = 19°$ and pleochroism X = yellowish green, Z = dark bluish green, X < Z. Well developed crystals of sphene are present in hornblende biotite syenite. Under the microscope it appears to be fersmanite having uniaxial negative character and weak pleochroism.

TABLE II

	1	2	3
SiO_2	49.08	53.12	55.41
TiO_2	0.90	0.65	0.33
Al_2O_3	21.74	22.16	23.34
Fe_2O_3	2.04	0.32	1.22
FeO	3.17	2.88	2.22
MgO	0.11	0.68	0.22
MnO	0.16	0.02	—
CaO	3.53	3.13	1.47
Na_2O	5.63	5.91	7.99
K_2O	9.41	7.12	6 58
P_2O_5	0.27	0.29	0.12
CO_2	2.78	1.99	0.94
H_2O^+	1.07	1.14	0.26
H_2O^-	0.13	0.12	—
Total	100 02	99.53	100 10
or	56.16	42.08	39.92
ab	3.35	26.69	29.29
an	—	1.27	1.36
ne	22.89	12.59	20.73
cor	2.55	4.24	2.55
ol	2.49	4.25	2.35
mt	2.78	0.46	1.76
il	1.67	1.23	0.62
ap	0.34	0.72	—
ct	6.00	4.52	2.14
cn	0.32	—	—

Coordinates for petrogeny's residua system:

	1	2	3
ks	38.74	29.39	24.86
ne	29.99	33.26	41.16
qz	31.27	37.35	33 98

1. Sp. No. S.220, biotite-nepheline syenite of Kundulur.
Analyst: B. P. Gupta.

2. Sp. No. KN 7, biotite-nepheline syenite of Kunavaram.
Analyst: B. P. Gupta.

3. Average of 7 biotite-nepheline syenites of Koraput
(Bose, 1970)

Chemical composition of biotite-nepheline syenite: The nepheline syenite of Kundulur has lower silica content relative to syenites of Kunavaram and Koraput, but it has higher potash content. The Na_2O content is much less than the K_2O content in the biotite nepheline syenite of Kundulur. The total normative alkali feldspars is lower and normative nepheline higher in Kundulur syenite. The chemical analyses of the rock type of Kundulur, Kunavaram and Koraput are given in Table II.

With reference to co-ordinates for petrogeny's residua system, it is observed that the nepheline syenite of Kundulur has a composition lying more towards Kalsilite corner relative to nepheline syenites of Kunavaram and Koraput.

Petrography and association of the nepheline syenite of Kundulur with perthite syenite strongly suggest the rock to be related to those of Kunavaram and Koraput complexes; but unlike that in Koraput, the Kundulur syenites are not spatially associated with any basic member.

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SIGNIFICANCE OF CM DIAGRAMS OF SOME JURASSIC AND CRETACEOUS SEDIMENTS OF KUTCH (GUJARAT)

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Introduction: Sedimentary petrologists of late have emphasized the importance of grain-size studies to understand the nature of deposition of clastic sediments, and the recent trend has been towards definition of individual samples by their textural parameters and definition of the deposit as a whole by the variation shown by these parameters. Textural parameters thus give useful information about the environment. Passega (1957) has established the relationship between texture of sediments and processes of deposition, rather than between texture and environment as a whole. According to him (Passega, 1964), fairly precise relationships exist between texture and mechanism of transport, and these relationships can have a wide application as a means of geological investigation.

A clastic deposit is formed by sediments transported in different ways. In particular, the finest fractions may be transported independently of the coarser