faulting on the main ridge in the focal zone.

Besides these two ridges it has been found that the Himalayan foreland basin has many similar basement features which have normal or angular relationship with the trend of the Himalayan orogen. The Faizabad Ridge in north-central Uttar Pradesh-western Nepal border, the Monghyr-Saharsa Ridge in Bihar-Nepal border and the basement metamorphics of Assam Plateau in Assam valley-Arunachal Pradesh are some of these features which make the overlying areas seismic prone. As the Himalayan orogeny has not yet ceased, the terminal zone of the basement ridges is accumulating stresses and releasing them in the form of cyclic seismic tremors. In the past most of these areas have already experienced massive earthquakes and they would do so in future. The WNW-ESE trending fracture zone with 'slump belt' of about 316 km produced on 15 January 1934 Bihar and Nepal earthquake[33] and various NW-SE to E-W fractures and cracks developed due to seismicity in the Dharamshala area[31,34] are oriented normal to the direction of the maximum principal compressive stress, similar to the features in the Bhagirathi valley.

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Camptonite dyke from the Pikkili alkaline complex, Dharmapuri District, Tamil Nadu

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A camptonite dyke (25 × 3 m) occurs within the leucocratic nepheline syenites of the Pikkili alkaline complex. It is a melanocratic, fine to medium-grained rock with porphyritic to panidiomorphic texture. The dyke rock is composed of phenocrysts of clinopyroxene (aegirine-augite), amphibole (hastingsite) and olivine set in a relatively fresh ground mass comprising plagioclase, orthoclase, pyroxene, amphibole, nepheline, sodalite and traces of opaque oxides, apatite and calcite. The alkaline character of the dyke is suggested by its petrochemistry and norm. The camptonite represents the last phase of alkaline activity in the pikkili alkaline pluton.

LAMPROPHYRES associated with alkaline (or sub-alkaline) massifs have been described from Kishangarh in Rajasthan[1], Purimetla[2], Settupalle[3], Uppalapadu[4], Elchuru[5–7] and Kellampalle[8] from Andhra Pradesh. The Pikkili area in Tamil Nadu is another example of the association of lamprophyre with the alkaline complex. The Pikkili alkaline complex (12° 9′–12° 21′ N and 78° 0′–78° 06′ E) in Tamil Nadu is composed of theralite, melanocratic-, mesocratic-, and leucocratic-nepheline syenite, nepheline syenite pegmatite, alkaline lamprophyre (camptonite) and dolerite dykes[9]. The alkaline rocks were intruded into a group of Precambrian amphibolites, granulites and charnockites (Eastern Ghats).

The dyke (25 × 3 m) occurs within leucocratic nepheline syenites, south of Anjaneyar Koil (12°13′ N and 78°05′ E). It makes sharp contacts with the host and does not exhibit any chilled margins, thus reflecting relatively longlived melt flow in the channelway[8, 10]. It trends in N 80° E with steep dip (80°–85°) due SE.

The lamprophyre is melanocratic, fine to medium-grained with reddish weathered surfaces. Under the microscope, the rock exhibits porphyritic and a poorly developed panidiomorphic texture, characteristic of lamprophyres[11]. The phenocrysts are clinopyroxene, amphibole and olivine, and the groundmass is composed of relatively fresh grains of plagioclase, orthoclase, pyroxene, amphibole, nepheline and sodalite; accessory minerals include opaque oxides (ilmenite and magnetite), apatite and calcite. The modal mineralogy is very close to that of a camptonite variety of the alkaline lamprophyre branch of Rock[12] (Table 1). The mineral assemblage probably indicates a frozen melt, suspended crystals and volatile phase which gave rise to groundmass, phenocrysts and H_2O/CO_2-rich minerals respectively – a uniquely complete magma system as reported from Kellampalle[8, 10].

Pyroxene (aegirine-augite: $2V_\alpha = 89°$; $Z \wedge c = 65°$; yellowish green) occurs as euhedral to subhedral grains with occasional glomero-porphyritic aggregate. Amphibole (hastingsite: $Z \wedge c = 18°$; yellowish brown) occurs as slender discrete grains in close association with the pyroxene. Subhedral to anhedral plagioclase (An_{18-36}) has poikilitic relationship with mafic minerals; it also occurs as granular aggregates. Subhedral orthoclase shows carlsbad twinning. Olivine ($2V_\gamma = 87°$; $\alpha = 1.658$; $\beta = 1.674$; $\gamma = 1.696$) occurring as rounded to subrounded grains is usually altered to serpentine. The alkaline lamprophyre of Pikkili, characterized by the mineral assemblage (clinopyroxene+amphibole), differs from the aforesaid lamprophyres of Andhra Pradesh wherein assemblages such as (olivine+clinopyroxene+biotite)[2, 3] (clinopyroxene+biotite)[5–7], (biotite alone)[5–7] and (amphibole+biotite)[8] have been reported. The lamprophyre of Pikkili, similar to that of Purimetla[2] and Settupalle[3] carries plagioclase and orthoclase as the felsic phase in the matrix whereas the Elchuru[5–7] and Kellampalle[8] occurrences contain the sole orthoclase perthite.

Major element composition of two samples of camptonite of Pikkili along with the calculated norms are presented in the Table 2. The presence of normative nepheline and low K_2O/Na_2O ratio (avr. 0.625) indicates the alkaline nature of lamprophyre[13] (Table 2). Though camptonite is more comparable to the average alkaline lamprophyre than calcalkaline especially with respect to Na_2O, K_2O and CaO, it is relatively enriched in Al_2O_3 and depleted in MgO contents in comparison with both the types (Table 2). The alkaline character of the lamprophyre is further proved in a normative discriminant diagram (Figure 1).

The Elchuru lamprophyres are considered to be comagmatic with the nepheline syenites, malignites and shonkinites in which they occur[5, 6]. The Kellampalle lamprophyre is associated with the early formed tholeiitic gabbros and the lamprophyric magma is considered to have come from a deeper source than tholeiitic magma and their association reflects either heterogeneity *or* varying depth levels of melting within the mantle[8].

Table 1. Modal composition (vol. %) of the Pikkili alkaline lamprophyre

Modal mineralogy	Pikkili lamprophyre	General range in typical alkaline lamprophyre[10]
Amphibole (hastingsite*)	24%	2–50%
Biotite or phlogopite	Nil	2–30
Clinopyroxene (aegirine-augite*)	15	20–50
Plagioclase* or orthoclase*	41	25–50
Feldspathoid (nepheline* and sodalite*)	4	15
Garnet	Nil	5
Glass	Nil	30
Olivine	12	10
Apatite	1	Trace
Calcite	1	Trace
Accessories (magnetite* and ilmenite*)	2	–
Type of lamprophyre	Camptonite	Camptonite/ Sannaite/ Monchiquite

*Present in the Pikkili lamprophyre.

Table 2. Chemical composition of the Pikkili camptonite dyke

	1	2	3	4	5
SiO_2	50.54	48 86	49 70	42.50	51 00
TiO_2	1.27	1.07	1.17	2.90	1 10
Al_2O_3	15 49	15 69	15.59	13.70	14.00
Fe_2O_3	4 45	3.73	4.09	12.00*	8 20*
FeO	5 40	6.70	6 05	–	–
MnO	0 06	0 12	0.09	0.20	0 13
MgO	4 84	4 94	4.89	7 10	7.00
CaO	11 50	12 45	11.97	10 30	7.00
Na_2O	3 23	3.06	3.14	3 00	2 70
K_2O	2.01	1 92	1 97	2 00	3 10
P_2O_5	0.19	0.18	0.18	0 74	0.60
H_2O	0.74	1.11	0.93	3 10	2.40
Total	99 72	99 83	99 77	97.54	97 23
K_2O/Na_2O	0 62	0 63	0 625	0 67	1 15
Or	11 68	11.12			
Ab	25 28	17 42			
An	21 96	23 63			
Ne	1.07	4 47			
Di	27 40	30 32			
Ol	2 29	4 01			
Mt	6 50	5 34			
Il	2 43	1 98			
Ap	0 34	0 34			

1 & 2 = Camptonites of Pikkili, 3 = Average of camptonite of Pikkili, 4 = Average of alkaline lamprophyre (AL)[13], 5 = Average of calcalkaline lamprophyre (CAL)[13]; * = Total iron as Fe_2O_3

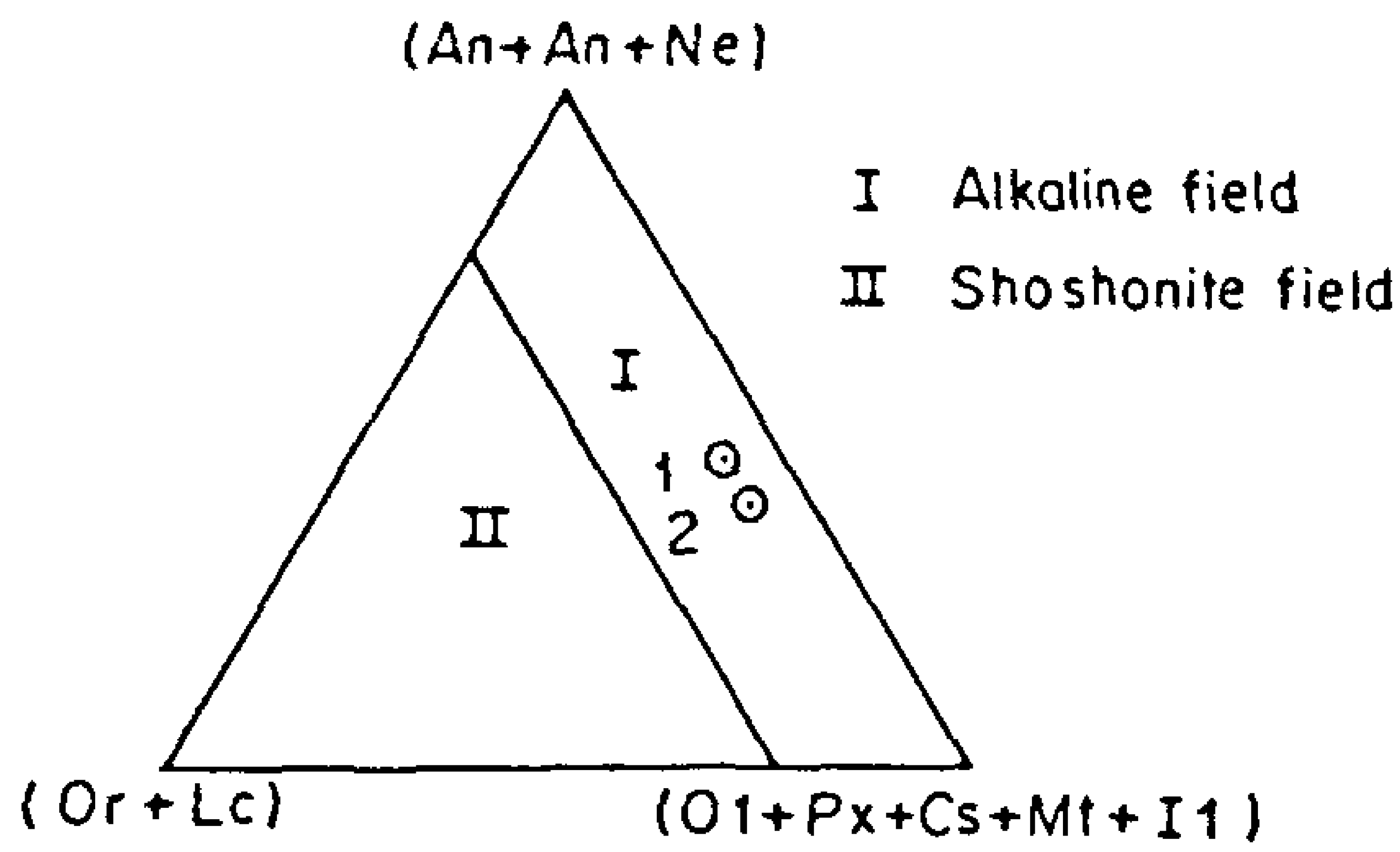

Figure 1. Pikkili camptonite plotted in normative discriminative diagram (after Rock[11])

The mineralogy of Pikkili camptonite suggests its genetic relationship with the alkaline complex. Theralites represent the first phase[9] while the camptonite represents the last phase of alkaline magmatism at Pikkili.

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Occurrence of scorodite in an auriferous zone of Gulaldih area, Sonbhadra District, Uttar Pradesh, India

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The paper records the first occurrence of scorodite ($FeAsO_4.2H_2O$, hydrated iron arsenate) in the auriferous zone of Gulaldih area, Sonbhadra district, Uttar Pradesh. The mode of occurrence, lithological assemblage, physical and microscopic characters of this mineral and its association with gold are discussed.

The study area is situated about 35 km SW of Obra thermal power station in Sonbhadra district, Uttar Pradesh (Figure 1). It exposes a volcano-sedimentary sequence, metamorphosed to the green schist to lower amphibolite facies belonging to Agori Formation of Mahakaosal Group. The main rock types include phyllite, metagreywacke, quartzite, banded magnetite quartzite and metabasics. The sequence is intruded by quartz veins and dolerites.

Scorodite-bearing zones have a cumulative strike length of about 2.5 km and width from 0.3 m to 2.0 m in the area. Scorodite is restricted to the zone of oxidation. It occurs as pale greenish encrustation on the surface of host rocks viz, chlorite phyllite, metagreywacke, chert and quartz veins and forms cryptocrystalline masses and rhombic pseudomorphs after alteration of arsenopyrite. Few specks of other primary sulphides such as pyrite an chalcopyrite coupled with stains of limonite and malachite in the oxidised zones are recorded. At one place, minute specks (up to 1 mm size) of native gold

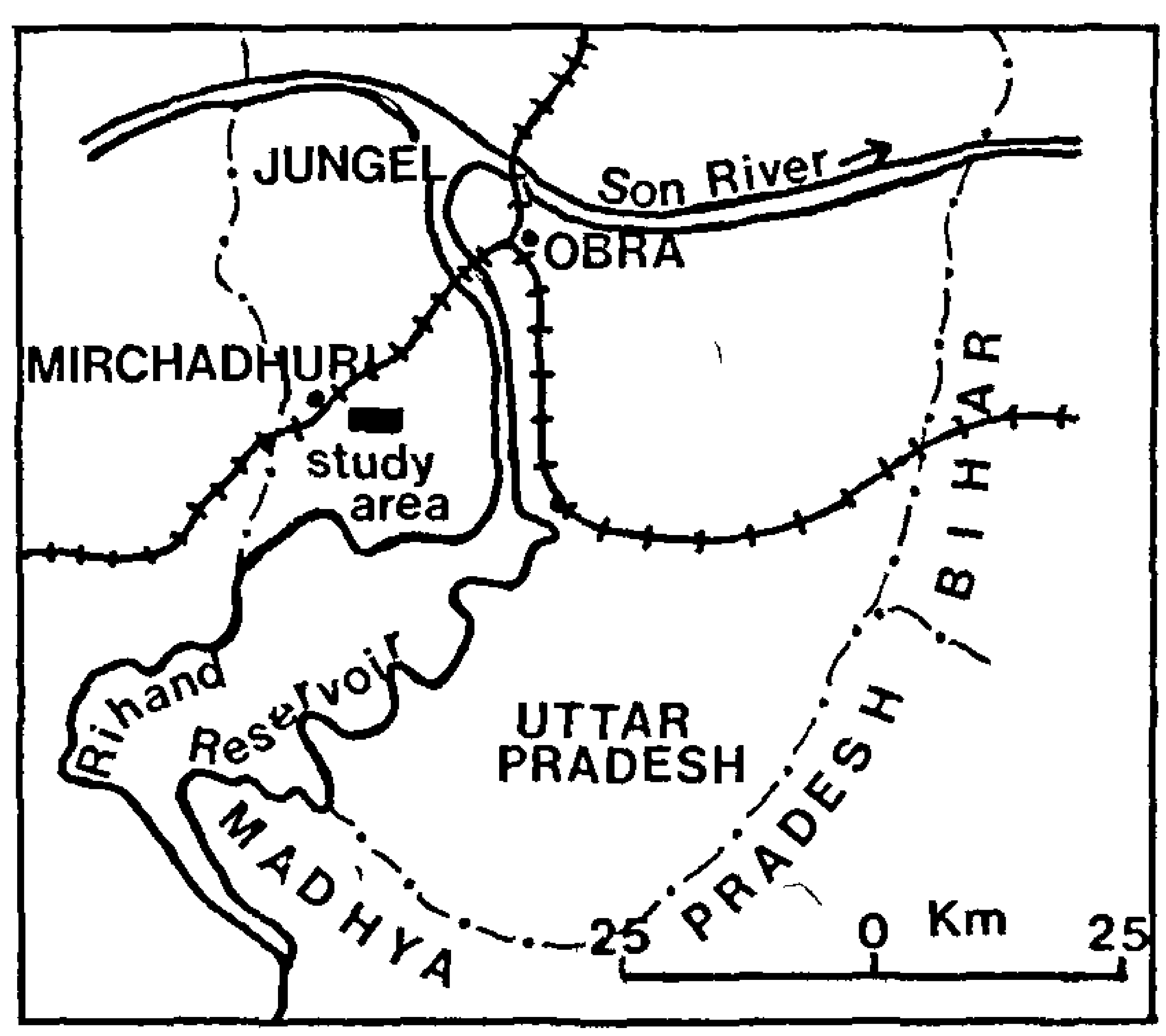

Figure 1.