SHORT COMMUNICATION

DISCOVERY OF KIMBERLITE PIPES IN GADWAL AREA, MAHBUBNAGAR DISTRICT, ANDHRA PRADESH

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Three kimberlite pipes are reported from Siddanpalli village in Gadwal area, Mahbubnagar district, Andhra Pradesh, bringing to light a new kimberlite cluster. Significance of the find lies in the fact that these kimberlite pipes are located in the Krishna river basin well known for its alluvial diamond mining activity since historic times. These pipes are being studied for their diamond potential.

Dharwar Craton with two distinct kimberlite fields known so far viz., the Wajrakarur Kimberlite Field (WKF) and the Narayanpet Kimberlite Field (NKF) is a prominent kimberlite province in India. Multidisciplinary studies involving photogeological and remote sensing data interpretation, geological traverse mapping and indicator mineral surveys in Gadwal area led to the discovery of three kimberlite pipes near Siddanpalli, located about 35 km west of Gadwal. This find along with the recently reported kimberlite pipes in Raichur area, Karnataka (Shivanna et al. 2002) has opened up new vistas in diamond exploration.

Geology

The area forms a part of the granite-greenstone terrain constituting the eastern block of the Dharwar Craton and exposes mainly granitic rocks and two narrow linear greenstone belts - the Gadwal schist belt in the east and the Raichur schist belt in the west (Fig.l). The granitic rocks belong to two major compositional groups viz., the tonalite-granodiorite-adamellite (TGA) suite and the adamellite-granite (AG) suite (Gopal Reddy etal. 1991). The greenstone lithologies include amphibolite, ultramafite, metabasalt, quartz-sericite schist and Banded Iron Formation (Ramam and Murthy, 1997). Two sets of mafic dykes trending NW- SE to WNW-ESE and ENE-WSW intrude the granite greenstone ensemble. The area is affected by intense brittle shears, fractures and faults trending WNW-ESE, ENE-WSW, NNW-SSE, N-S and NW-SE. Those trending WNW-ESE appear to be repeatedly reactivated as evidenced from the intense fracturing and shearing observed in the mafic dykes and quartz reefs emplaced along them. These faults/fractures also generally control the drainage in the area.

Kimberlite emplacements, in general, are believed to be controlled by major deep-seated faults. Intersections of major faults, tear faults resultant of reactivation of the major ones, splay faults and fold closures form favourable structural loci locally (Mitchell, 1986; Janse, 1992). The area west of Gadwal was targeted for the kimberlite search based on the favourable geological and structural setup.

Field Occurrence of the **Kimberlite** Pipe

The three kimberlite bodies designated as SK-1, SK-2 and SK-3 are emplaced in the granitic rocks either along the WNW-ESE trending major fault or the NW-SE trending tear faults adjacent to the WNW-ESE fault. Intense fracturing seen in the quartz reef emplaced along this WNW-ESE trending fault suggests reactivation of this regional fault.

Siddanpalli kimberlite-1 (SK-1) is located 2 km N25°E of Siddanpalli. It is amelanocratic, macrocrystic, hardebank kimberlite measuring 100 m X 65 m. Macrocrysts of olivine, phlogopite and ilmenite are embedded in a groundmass of serpentinised and carbonated olivine. Under microscope two generations of highly serpentinised olivine pseudo-morphs with carbonate rim are seen (Fig.2). Large rounded macrocrysts and euhedral micro phenocrysts of olivine of 0.102-2.0 mm filled with carbonate and serpentine occur in a microcrystalline groundmass composed mainly of carbonate, perovskite and opaques. The opaques are mainly ilmenite and chromite. It contains crustal xenoliths of granite (measuring upto 15 *cm* across) and later carbonate veins. Panned concentrates of the weathered kimberlite have yielded picroilmenite, spinels, chrome-diopside and pyrope garnets and co-existing phases of chrome diopside + opaques and olivine + opaques.

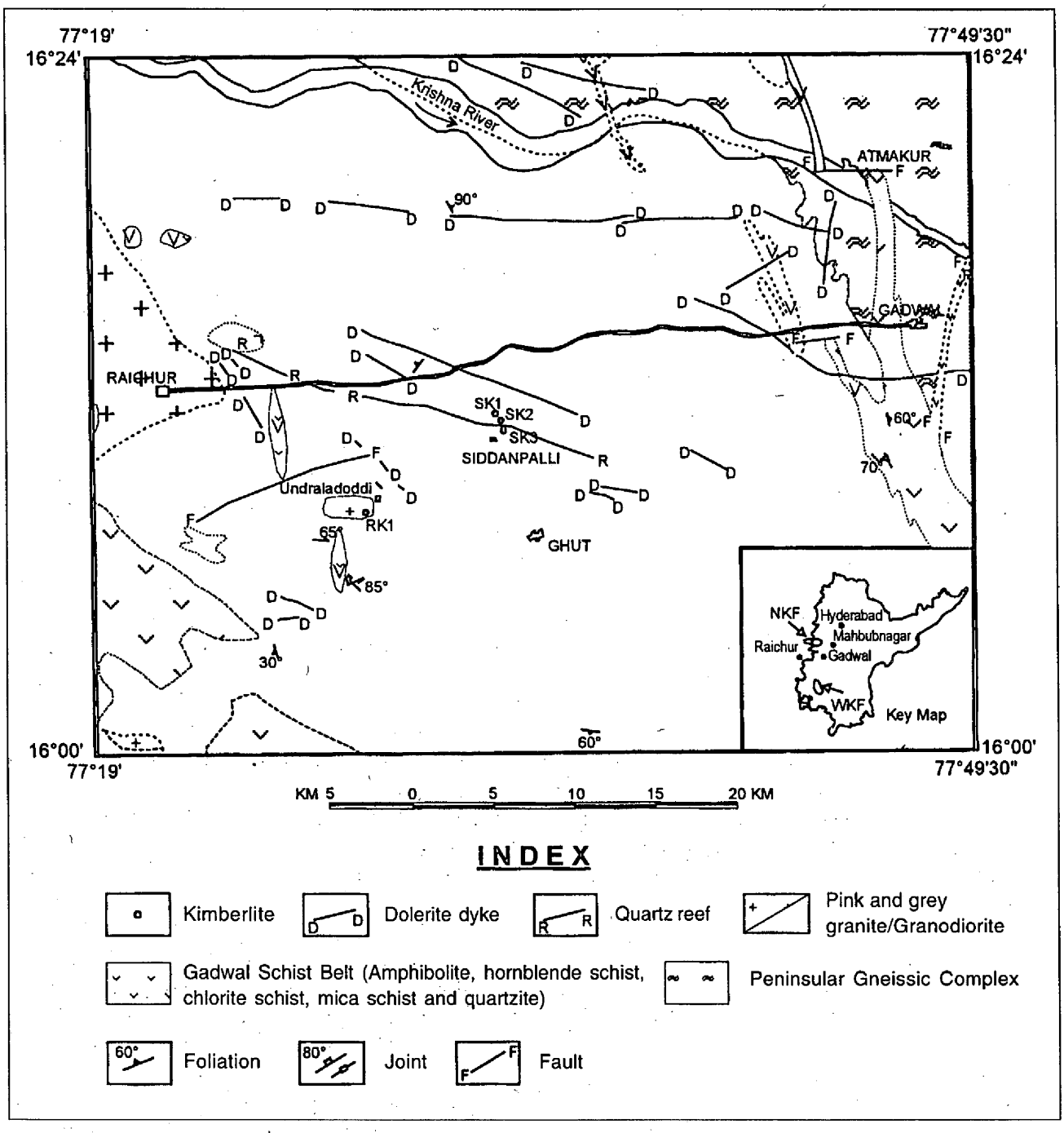

Fig.1. Geological map of Gadwal area, Mahbubnagar District, A.P., showing kimberlite locations.

Siddanpalli kimberlite-2 (SK-2) is located 1.75 km N35°E of Siddanpalli and is mostly a weathered kimberlite concealed under ~1 m thick buff coloured calcrete cover. This kimberlite appears to be a twin body measuring 100 m X 50 m with a satellite body measuring 10 m X 10 m. A few hard outcrops, greenish black in colour, of the main body are exposed along the stream cutting and the weathered part (Yellow ground) is exposed on the stream bank in a well. In thin sections, it shows pseudomorphs of olivine (0.2 5 mm - 4 mm) set in a crypto to microcrystalline groundmass of serpentine, carbonate, perovskite (0.025 mm – 0.125 mm) and phlogopite (Fig.3). Olivine is completely altered to serpentine and carbonate. Opaques are ilmenite, magnetite and chromite. Crustal xenoliths measuring 2 cm

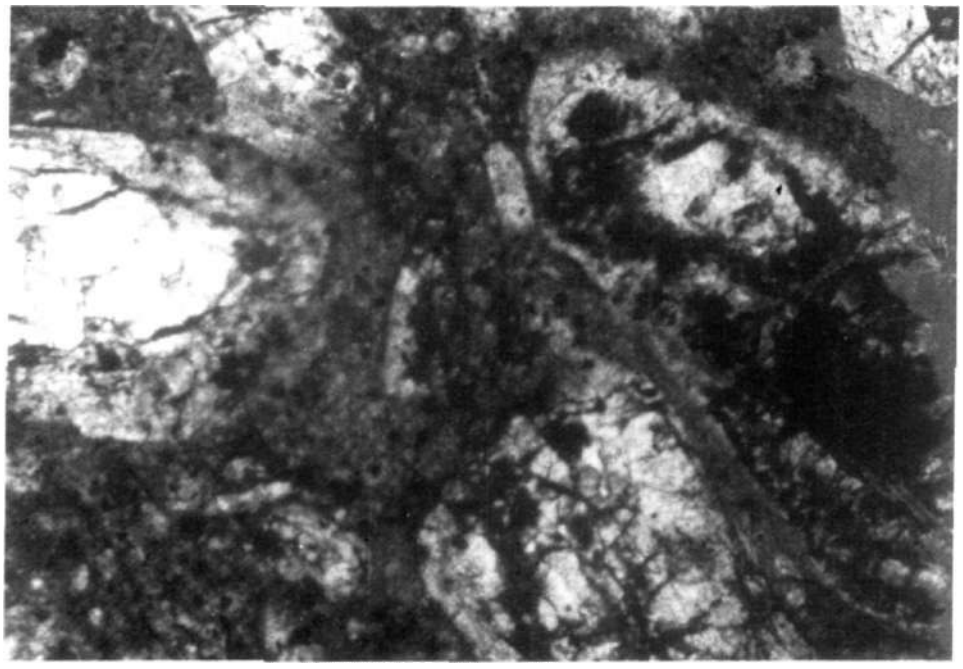

Fig.2. Photomicrograph of pipe SK-1 showing large rounded macrocrysts of olivine set in a fine-grained matrix consisting of euhedral olivine and opaques. The olivine macrocrysts are mantled by serpentine and carbonate rim (magnification 40x).

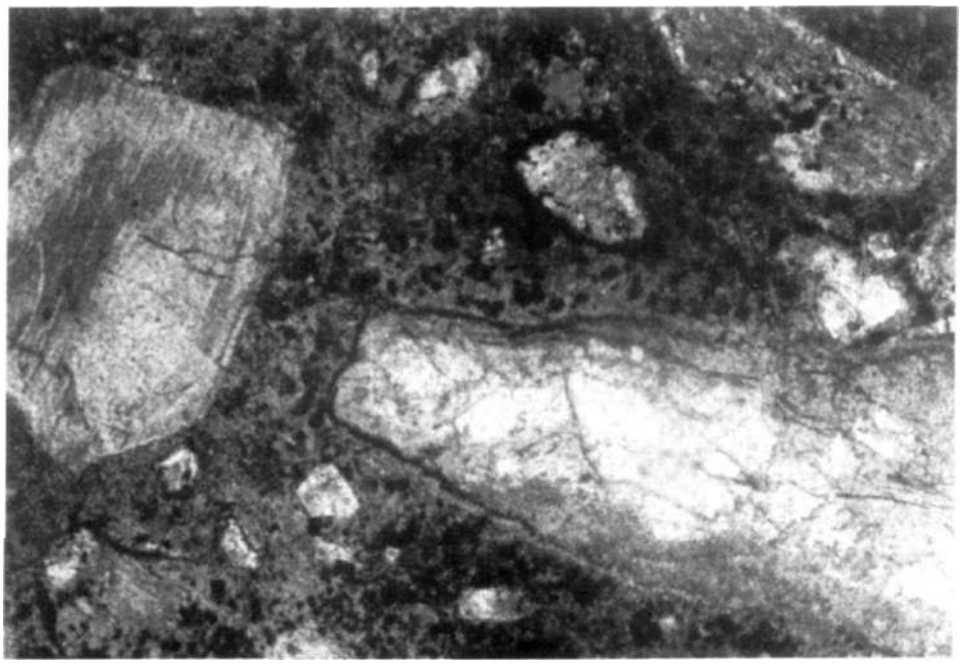

Fig.3. Photomicrograph (PPL) of pipe SK-2 showing large rounded macrocrysts of olivine set in a fine-grained matrix consisting of euhedral olivine diopside and opaques. The large elongated fragment on the extreme right of the photo is a crustal xenolith (magnification 40x).

to 10 cm are present. Panned concentrates of the weathered kimberlite have yielded ilmenite, spinels, chrome diopside and pyrope garnets.

Siddanpalli kimberlite-3 (SK-3) is located about 1.25 km N70°E of Siddanpalli. It measures 26 m X 14 m. It is partly weathered and partly hardebank kimberlite. Hard outcrops are exposed in a well and the weathered part in a streambed. Hardebank outcrops are melanocratic, macrocrystic and fractured containing macrocrysts of

olivine, phlogopite and ilmenite in a groundmass of carbonated and serpentinised olivine. In thin sections it shows highly altered phenocrysts of olivine (0.125 mm - 2.5 mm) set in a cryptocrystalline groundmass of carbonate and perovskite (0.025 mm - 0.125 mm). Olivine pseudomorphs have euhedral and rounded outlines while perovskite is euhedral. Groundmass is highly altered and traversed by a number of carbonate veins. Panned concentrates of weathered kimberlite have yielded spinels, chrome diopside and pyrope garnet.

Petrochemistry and Mineral Chemistry

Chemically all the three kimberlites are undersaturated in silica (SiO_2 24.37-28.27 wt%), rich in magnesium (MgO 26.57 - 28.86 wt%) and titanium (TiO_2 2.56- 3.33 wt%) and they are comparable with those of WKF and NKF (Table 1). They fall in the classical kimberlite field of Bergman (1987) when plotted in the ternary diagrams involving Al_2O_3 - FeO - MgO and *Kfi* -Al_2O_3 - MgO. Major oxide compositions determined by EPMA of the indicator minerals recovered from the panned concentrates of these kimberlites (Table 2) indicate that the garnets clearly include two populations viz.,those derived from crustal rocks characterised by low MgO (1.38- 2.68 wt %) and those of mantle origin rich in MgO(>20 wt %). The spinel composition indicates that they include chromite and magnesio-chromite. The chrome diopside composition indicates a typical mantle signature with Cr_2O_3 ranging from 1.69 to 2.67 wt %.

These kimberlite bodies together with those reported around Raichur in Karnataka (Shivanna et al. 2002) perhaps

Table 1. Petrochemistry of Siddanpalli, WKF and NKF kimberlites

	SKI	SK2	SK3	KL-3 (WKF)	CC-5 (WKF)	KK-2 (NKF)
SiO_2	24.37	27.39	28.27	27.61	24.94	32.89
TiO_2	3.33	2.56	2.44	4.71	2.84	3.61
AI_2O_3	1.96	1.83	1.73	3.07	2.39	4.42
Fe_2O_3*	11.091	10.26	11.28	13.46	12.02	13.32
MnO	0.16	0.20	0.18	0.21	0.20	0.19
MgO	26.57	26.99	28.86	24.39	26.02	23.60
CaO	14.41	12.68	10.51	12.07	14.21	13.60
Na_2O	-	0.48	0.21	-	-	-
K_2O	0.11	0.13	0.05	1.17	0.51	1.06
P A	1.83	1.33	'1.27	0.72	1.08	0.48
S	0.06	0.04	0.03	0.04	0.05	0.22
Cr_2O_3	0.15	. 0.13	0.17	0.14	0.22	0.16
NiO	0.10	0.11	0.13	0.09	0.12	0.06
BaO	0.04	0.11	0.06	0.15	0.28	-
LOI	16.14	16.50	15.36	13.67	16.27	6.31
TOTAL	**100.32**	**100.74**	**100.55**	**100.96**	**101.15**	**99.92**

* Total Fe represented as Fe_2O_3

Note: Analysis by X'UNIQUI II (Philips) X-ray spectrometry system in PPOD laboratory, AMSE Wing, GS1, Bangalore.

Table 2. Mineral chemistry of indicator minerals

Oxides	SK--1		SK--2		SK--3	
	Garnet (2)*	Spinel (6)	Spinel (6)	Chrome Diopside (7)	Garnet (3)	Spinel (16)
SiO_2	40.09 -41.10	0.08-0.45	0.30-0.50	52.07-53.55	37.05-42.22	0.16-0.33
TiO_2	0.11- 0.37	0.05-1.46	0.16-2.96	0.16-2.96	0.02-0.33	0.18-4.86
$A1_20$,	19.18-19.47	9.55-20.78	11.46-24.01	11.46-24.01	20.09-21.25	3.25-15.17
Cr_2O_3	6.46-6.72	41.20-61.81	37.15-58.94	1.69-2.67	0.00-5.00	47.75-59.07
FeO	5.92-6.06	12.84-24.20	11.92-20.94	11.92-20.94	5.56-36.30	12.47-20.52
MnO	0.23	0.12-0.28	0.20-0.29	0.20-0.29	0.29-4.34	0.15-0.29
MgO	2.68-20.90	14.79-16.51	14.89-16.85	14.89-16.85	1.38-21.77	13.35-17.21
CaO	6.49-6.56	0.00-0.03	0.00-0.02	0.00-0.02	0.56-4.99	0.00-0.02
Na_2O	0.02-0.03	0.00-0.04	0.00-0.04	0.00-0.04	0.00-0.03	0.00-0.03
K_2O	0.00	0.00	0.00	0.00	0.00	0.00
NiO	0.00-0.03	0.05-0.23	0.02-0.24	0.12-0.24	0.00-0.03	0.00-0.16

**(Figures in parentheses indicate number of grains)*

constitute a separate kimberlite field about 100 km north of the WKF and 60-75 km south of the NKF and can be designated as the Raichur Kimberlite Field.

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