

Lamproites in India

B. H. SCOTT SMITH

2555 Edgemont Boulevard, North Vancouver, British Columbia, Canada V7R 2M9.

The Majhgawan diamond mine and nearby Hinota pipe, Madhya Pradesh are classified here as olivine lamproites and not kimberlites. These bodies, therefore, comprise a newly recognised province of diamondiferous olivine lamproites which are extremely rare worldwide.

Other intrusions in India have been proposed as lamproites (e.g., Paul and Sarkar 1984; Bergman and Baker 1984; Reddy 1987). Information for relevant localities is reviewed (Table 1).

Rocks from *Majhgawan* and *Hinota* are lapilli tuffs. The juvenile lapilli are composed of olivine macrocrysts and phenocrysts set in glassy groundmasses containing mica, vesicles, apatite and altered perovskite. The petrographic classification of these rocks is problematic because of their glassy nature and paucity in primary minerals. Various features, however, are atypical of kimberlites and more typical of lamproites. These include the occurrence of glass, in particular of scoriaceous juvenile lapilli, the complex shapes of the olivine macrocrysts (probably imposed morphology) and phenocrysts (crystal aggregates) and polysynthetic twinning in the phlogopite. Also phlogopite compositions (high TiO_2 contents, 5.3-7.3 wt.%) and whole-rock compositions (e.g., high Ba, 3634-27300ppm) are more similar to lamproites than kimberlites. These rocks are very similar to those found at Ellendale and Argyle (Western Australia), Prairie Creek (Arkansas) and Kapamba (Zambia). The apparent paucity of mantle-derived xenoliths and xenocrysts at Majhgawan is also similar to that noted in the other lamproites. These data suggest therefore that Majhgawan and Hinota are not kimberlites but should rather be classified as lamproites. The samples examined are hence classified mostly as glassy olivine lamproite lapilli tuffs although some autolithic breccias may be present.

The *Wajrakarur/Lattavaram* bodies (Andhra Pradesh) are composed mostly of mica-bearing monticellite kimberlite. Contamination by late-stage xenolith digestion produces pectolite-clinopyroxene-bearing kimberlite. Texturally, the bodies are predominantly hypabyssal but pelletal tuffisitic kimberlite breccia (diatreme-facies) is present in the

largest body. They probably represent the root zones of substantially eroded diatremes. Pipes 1, 3, 4 and 6 are typical kimberlites and contain some diamond and relatively common mantle-derived xenoliths and xenocrysts. Pipes 2 and 5 display some petrographic features (e.g., paucity of olivine macrocrysts, probable melilite pseudomorphs) which are not typical of, but do not preclude their classification as, kimberlites. Pipes 2 and 5 also appear to be devoid of diamond, mantle-derived xenoliths and xenocrysts. These differences are not sufficient to suggest that these two pipes represent a different rock type such as lamproite. They are, rather, more extreme varieties of kimberlite.

Lamprophyre dykes both at *Chelima* and in the *Gondwana Coalfields* could include lamproites. Information for *Angor*, *Banda* and *Jungel* suggests that they are not kimberlites or lamproites. Insufficient information is available for the intrusions at *Zangamrajupalle*, *Maddur* and *Warangal* to comment further but it is doubtful whether they are kimberlites or lamproites.

It is noteworthy that the only confirmed lamproites (Majhgawan) and kimberlites (Wajrakarur/Lattavaram) constitute the only known primary sources of diamond in India. They are Proterozoic and similar in age to other lamproites, kimberlites and related rocks worldwide. The tectonic setting of these provinces may also be similar to those elsewhere. The Wajrakarur/Lattavaram kimberlites occur well within Dharwar craton, while it appears that the lamproites (Majhgawan/Hinota) may occur towards the margin of the Aravalli craton and might even be associated with a rift. Although there are numerous published papers on the "kimberlitic" bodies of India this review shows the great need for new detailed petrological studies of many of these localities.

Acknowledgements — The author is indebted to R. B. Hargraves, F. R. Boyd, P. Kresten and S. C. Bergman for donating samples without which this study would not have been possible.

Bergman, S. C. and Baker, N. R. (1984) A new look at the Proterozoic dykes from Chelima Andhra Pradesh, India: diamondiferous lamproite? *Geol. Soc. Amer. Abstr.* **16**, p. 444.

Paul, D. K. and Sarkar, A. (1984) Petrogenesis of some Indian lamprophyres. Proceedings of SYMPET Jaipur 1981. *Special Publ. Geol. Surv. India* **12**, 45-54.

Reddy, T. A. K. (1987) Kimberlite and lamproite rocks of Wajrakarur area, Andhra Pradesh. *Geol. Soc. India Journal* **30**, 1-12.

Table 1 Summary

Locality	Name	Ages	Published Classifications	Classification this study
1	Majhgawan	1135my	kimberlite	ol lamproite lapilli tuff
1	Hinota		kimberlite	ol lamproite lapilli tuff
2	Angor		kimberlite peridotite ol-pyroxenite- gabbro	not kimberlite ?peridotite-gabbro
3	Jungel	919my	kimberlite ?metavolcanics	not kimberlite
4	Gondwana Coalfields	110my	lamproites lamprophyres	should be investigated may include lamproite
5	Wajrakarur P1		kimberlite	mica-bearing hypabyssal kimberlite and pelletal tuffistic kimberlite breccia
5	Wajrakarur P2	840my	lamproite kimberlite	hypabyssal monticellite kimberlite
5	Lattavaram P3	933my 956my	kimberlite	hypabyssal monticellite kimberlite (*-/phlogopite)
5	Lattavaram P4	926my 1023my	kimberlite	hypabyssal mica-bearing monticellite kimberlite contaminated to pectolite- cpx-bearing kimberlite
5	Mulgiripalle P5		lamproite kimberlite	hypabyssal mellilite- and monticellite-bearing phlogopite kimberlite contaminated to pectolite- cpx-bearing kimberlite
5	Wajrakarur P6		kimberlite	altered hypabyssal kimberlite
6	Chelima	1340my	minette kimberlite/ carbonatite lamproite	minette or lamproite requires further study
7	Zangamrajupalle		kimberlite	requires further investigation
8	Maddur		ol-lamproite	reported data does not support classification as lamproite, further study necessary
9	Warangal		kimberlite/ carbonatite	reported data unusual for kimberlite or lamproite

Legend: ol - olivine; cpx - clinopyroxene

WORKSHOP ON DIAMONDS



July 15-16, 1989 • Washington, D.C.

Extended Abstracts

28th INTERNATIONAL GEOLOGICAL CONGRESS

EXTENDED ABSTRACTS

WORKSHOP ON DIAMONDS

July 15-16, 1989 • Washington, D. C.



SPONSORS

Carnegie Institution of Washington
Harry Winston Foundation
Mineralogical Society of America
International Mineralogical Association

CONVENORS

F. R. Boyd, H. O. A. Meyer and N. V. Sobolev

TABLE OF CONTENTS

ZHANG ANDI and HENRY O. A. MEYER: Inclusions in diamonds from Chinese kimberlites.....	1
F. R. BOYD and P. H. NIXON: The origin of low-Ca garnet harzburgites and their relationship to diamond crystallization.....	4
G. BREY , T. KÖHLER and K. NICKEL: Geothermobarometry in natural four-phase lherzolites: Experiments from 10 - 60 kb, new thermobarometers and application.....	8
J. E. BUTLER: Chemical vapor deposition of diamond.....	11
G. I. COOPER, M. J. MENDELSSOHN and H. J. MILLEDGE: High pressure / temperature experiments with natural diamond	14
PETER DEINES: Regularities in the C and nitrogen content of the mantle revealed through studies of diamonds and the chemistry of their inclusions	18
EMMANUEL FRITSCH and KENNETH V. G. SCARRATT: Optical properties of one type of natural diamonds with high hydrogen content	21
W. L. GRIFFIN, J. J. GURNEY, C. G. RYAN, D. R. COUSENS, S. H. SIE and G. F. SUTER: Trapping temperatures and trace elements in P-type garnets in diamonds: a proton microprobe study.....	23
STEPHEN E. HAGGERTY: Upper mantle oxidation state and diamond genesis.....	26
J. W. HARRIS: Variations in the physical and chemical properties of natural diamonds.....	29
E. JAGOUTZ, V. S. SHATSKY, N. V. SOBOLEV: Pb-Nd-Sr isotopic study of the Kokchetav Massif, the outcrop of the lower lithosphere	32
A. L. JAQUES: Lamproitic diamonds and their inclusions: New insights from the West Australian deposits.....	36
M. B. KIRKLEY and J. J. GURNEY: Carbon isotope modelling of biogenic origins for carbon in eclogitic diamonds	40
T.E. MCCANDLESS: Microdiamonds from the Sloan 1 and 2 kimberlites, Colorado, USA	44
T. E. MCCANDLESS, M. B. KIRKLEY, D. N. ROBINSON, J. J. GURNEY, W. L. GRIFFIN, D. R. COUSENS and F. R. BOYD: Some initial observations on polycrystalline diamonds mainly from Orapa.....	47
HENRY O. A. MEYER: Diamond in space and time.....	52
H. J. MILLEDGE, M. J. MENDELSSOHN, S. R. BOYD, C. T. PILLINGER and M. SEAL: Infrared topography and carbon and nitrogen isotope distribution in natural and synthetic diamonds in relation to mantle processes	55
M. A. MOATS and G. C. ULMER: (CCO) and (FMQ) oxygen buffer values for upper mantle conditions: Implications for kimberlite, carbonatite, and diamond genesis	61
R. O. MOORE, J. J. GURNEY and W. L. GRIFFIN: Trace element abundance patterns in diamond inclusions from the Monastery Mine, South Africa	65
O. NAVON, B. SPETTEL, I. H. HUTCHEON, G. R. ROSSMAN and G. J. WASSERBURG: Micro-inclusions in diamonds from Zaire and Botswana.....	69

P. H. NIXON, G. R. DAVIES, E. CONDLIFFE, R. BAKER and R. BAXTER BROWN: Discovery of ancient source rocks of Venezuela diamonds	73
M. L. OTTER, J. J. GURNEY and T. E. MCCANDLESS: The carbon isotope composition of Sloan diamonds	76
M. OZIMA, S. ZASHU, and S. R. BOYD: Noble gas isotopic composition in coated diamonds: Representative of the upper and lower mantle?	80
D. G. PEARSON, G. R. DAVIES, and P. H. NIXON: Graphite-bearing pyroxenites from Morocco: Evidence of recycled oceanic lithosphere and the origin of E-type diamond	83
STEPHEN H. RICHARDSON: Radiogenic isotope studies of diamond inclusions	87
B. H. SCOTT SMITH: Lamproites in India	91
V. S. SHATSKY, N. V. SOBOLEV and E. S. YEFIMOVA: Morphological features of accessory microdiamonds from metamorphic rocks of the earth's crust	94
JAMES E. SHIGLEY and EMMANUEL FRITSCH: Comparison of natural and synthetic diamond	96
N. SHIMIZU, J. J. GURNEY and R. MOORE: Trace elements geochemistry of garnet inclusions in diamonds from the Finsch and Koffiefontein kimberlite pipes	100
C. B. SMITH, J. J. GURNEY, J. W. HARRIS, M. L. OTTER, M. B. KIRKLEY, and E. JAGOUTZ: Nd and Sr isotope systematics of large eclogite and lherzolite paragenesis single diamonds, Finsch and Kimberley Pool	102
N. V. SOBOLEV, A. V. SOBOLEV, N. P. POKHILENKO and E. S. YEFIMOVA: Chrome spinels coexisting with Yakutian diamonds	105
ICHIRO SUNAGAWA: Diamond growth at low and high pressure	109
DARCY P. SVISERO and HENRY O. A. MEYER: Diamonds from Romaria Mine, Minas Gerais, Brazil	113
MAURA S. WEATHERS, WILLIAM A. BASSETT, and EUGENE HUANG: The melting of diamond at high pressure	115