NON-KIMBERLITIC DIAMONDS SOURCE ROCKS.

Janse, A.J.A.

Mintel Pty Ltd, 11 Rowsley Way, Carine, Western Australia 6020.

Since the discovery of kimberlite as a major primary source rock for diamonds in 1872 various claims have been made for other rocks, which are not kimberlites, to represent a source rock for diamonds. These claims have, at various times, been disputed, ridiculed or proved wrong and in general very little attention was paid to them as the alleged diamond deposits were economically insignificant.

In 1978 and 1979 olivine lamproite was found to be a primary source rock for economically very important diamond deposits. Since then the matter ceased to be of academic interest only and increasing attention has been focussed on assessing the validity of the discoveries of diamonds in various kinds of rock.

In many cases the original discovery could not be repeated by other investigators and it was claimed that the original mineral was misidentified, being a variety of the spinel group instead of diamond. Be that as it may, improved sample processing techniques and modern X-ray equipment have shown that diamonds occur in rocks other than kimberlites and olivine lamproites. Traces of diamond have been reported from related rocks such as less mafic lamproites (leucite lamproites), ultramafic and alkalic lamprophyres (alnoites, aillikites, damkjernites, monchiquites), but there are an increasing number of reports, often quite well substantiated, which state that diamonds were found in dunite/harzburgite or garnet pyroxenite in ophiolite complexes, garnet peridotite in gneiss and in alkaline basalt, eclogite in gneiss, alkaline basalt, dolerite, granite, pegmatite and of course in meteorites and in meteorite impact structures (Table 1).

There are also reports that small diamonds and microdiamonds were found in low grade metamorphic greywacke-turbidite sequences of Lower to Middle Proterozoic age, i.e. Ghana and Northern Territory of Australia, for which no kimberlitic or lamproitic source rock can be found, and in high grade metamorphic paragneiss for which it is claimed that the diamonds have a metamorphic genesis (Kokchetav, Northern Kazakhstan).

Finally there are reports that the isotopic composition of carbonados in Bahia indicates that these may be derived from non-kimberlitic source rocks.

Most of these occurrences are not economically important, except for the alluvial diamond deposits of southeastern Kalimantan (if it is accepted that these are derived from an ophiolitic source rock), for the Popigay impact structure which apparently contains a large resource of small diamonds and which would be economic if it were not located well above the arctic circle, and for the carbonado deposits in Bahia.

Recent research has indicated that diamonds in kimberlites and olivine lamproites are derived from three deep seated sources, i.e. garnet lherzolite, garnet harzburgite and eclogite. It is interesting to note that similar deep seated rocks are brought to the surface by tectonic forces in ophiolite, peridotite and eclogite complexes and that diamonds are claimed to have been found in these rocks in some places.

The content of diamond in these deep seated rocks can be extremely high in places. It can be measured in percentages in eclogite nodules in kimberlites from South Africa or if the octahedral graphites in the Beni Bousera ophiolite are true pseudomorphs after diamond, it can reach 20 per cent. Thus the search is on for an ophiolite in which the diamonds have not been transformed into graphite. Graphite has been found in eclogite and garnet peridotite nodules in kimberlite pipes (Orapa, Jagersfontein, Mir), but also in carbonatites, which gives food for thought and impetus for a wider search.

It is likely that the list in Table 1 is neither complete nor conclusive. Certain occurrences will be or have already been proved wrong (diamonds in alkaline basalt in Kamchatka) or doubtful (metamorphic genesis for diamonds in Kokchetav), but it is certain that other occurrences will be added in future.

TABLE 1. NON-KIMBERLITIC DIAMOND SOURCE ROCKS CLAIMED BY VARIOUS AUTHORS

	Rock Types	Grade	Indicator Minerals
1.	Eclogites in gneissic country rock Kokchetav (Kazakhstan)	high	Py-Alm garnet, Na-Cr pyroxene
2.	Garnet-Pyroxenite in Ophiolite complexes Beni Bousera (Morocco)	high?	Py-Alm garnet, chromite
3.	Harzburgite/Dunite in Ophiolite complexes Tibet, British Columbia	low	Chromite, platinum minerals
4.	Dunites as pipes in country rock Upper Volta	low	Chromite, Mn-ilmenite
5.	Alkaline ultrabasic complexes Kotui (Northern Siberia)	low	Chromite, pyrope garnet
6.	Ultramafic lamprophyres Western Australia	low	Chromite, Perovskite
7.	Alkaline lamprophyres (Monchiquites) Western Australia	low	Chromite
8.	Lherzolite nodules in alkaline basalt Mongolia	low	Pyrope, Cr-diopside
9.	High grade metamorphics Kokchetav (Kazakhstan)	high?	Py-Alm garnet, pyroxene
10.	Garnet Peridotite in gneissic country rock Bohemia	low	Pyrope, Cr-diopside, chromite
11.	Olivine Bombs in basalt Ruang Volcano (North Sulawesi)	low	Diamond, olivine
12.	Meteorite impact structures Popigay (Northern Siberia)	high?	Hexagonal diamond
13.	Dolerite/diabase dykes New South Wales	low	Diamond
14.	Xenocrysts in alkaline basalt Kamchatka	low	Diamond
15.	Turbidite/greywacke Ghana, Northern Territory	high/med	Diamond
16.	Lithified Precambrian Conglomerate Bahia	medium	Carbonado