country rock is scanty, only about 10-20 cm high, it attains heights of 50-100 cm over the pipe area. Among the larger trees, the covered pipe supports not only more species but also a more luxuriant and healthy growth in contrast to the surrounding terrain. Among the 26 species recorded over the pipe area, Tectona grandis, Diospyres melanoxylon and Madhuca indica attain a general height of 11. 0, 8.6 and 11.1 metres respectively in contrast to 7.6, 5.6 and 5.0 metres for the same species growing outside the pipe area. The positive geobotanical expression thus recorded is of such size and magnitude as to be apparent on air photographs. This is significant because geobotanical expression of ultrabasic rocks have generally been reported as 'conspicuously stunted and thinly developed', (Hawkes and Webb, 1962).

Detailed examination of plants on the pipe area also revealed effects of metal toxicities like chlorosis and white dead patches on leaves which obviously reflects higher Cr and Ni contents in soil over the pipe area in contrast to the country rock.

B4
A REVIEW OF THE KIMBERLITIC ROCKS OF WESTERN AUSTRALIA

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In the course of exploration for diamond, CRA Exploration Pty. Limited and the Ashton Joint Venture have discovered four diamond bearing kimberlite provinces in Western Australia. Three of these provinces are located marginal to the Kimberley Craton in the north of the state (Fig. 1), and one lies in the Carnarvon Basin, adjacent to the Yilgarn Block, some 1300 km to the southwest.

The kimberlites intrude rocks ranging in age from Lower Proterozoic to Permian, and are covered by sequences ranging in age from Cretaceous to Miocene.

The bodies range in size from dyke-like features less than one metre in width to pipes with a surface area of 128 hectares.

The bodies with larger surface area are volcanic crater deposits, champagne-glass shaped in cross section, the narrow stem corresponding to the pipe feeder. The craters are infilled with air-fall and water-deposited tuffs and epiclastic sediments. A late-stage phase in many of the West Kimberley diatremes was the emplacement of massive, igneous-textured, magmatic kimberlite, rising to the surface in the shape of a lava-blister. This magmatic kimberlite fills the central part of the craters, and overlaps the tuffs towards the margins.

Diamond content ranges from trace amounts to economic concentrations. Feasibility studies being carried out on the Argyle AK1 kimberlite pipe are currently envisaging a 2.25 million tonnes per annum operation, to come into production in 1985, producing some 20 million carats per year, while it is hoped that limited commercial production from associated alluvial deposits will commence in the latter part of 1982.

The exploration discoveries were facilitated by early recognition that the petrography, mineralogy and chemistry of the kimberlites varies from classical types resembling those of kimberley, South Africa, to unusual more highly fractionated, alkaline, silicic varieties having affinities with leucite-lamproite and composed essentially of phenocrysts of oline ± clinopyroxene ± phlogopite + glassy groundmass. Mantle nodules recovered range from dunite to lherzolite; graphic-textured intergrowths of picroilmenite and silica (after diopside?) occur at the Skerring pipe. Heavy mineral concentrates from the kimberlites yield pyrope, picroilmenite, chrome-diopside, chromite and zircon, the former two minerals being more abundant in the classical types of kimberlite.

Recognition of the characteristics of the unusual kimberlite/lamproite association strongly influenced exploration techniques, much use being made of such minerals as chromite, andradite and zircon as kimberlite indicator minerals during heavy mineral gravel sampling.

In regions where host rocks displayed a mild magnetic response it was found that the kimberlitic bodies produces recognisable magnetic anomalies from detailed aeromagnetic surveys, and much use has been made of this technique in exploration.

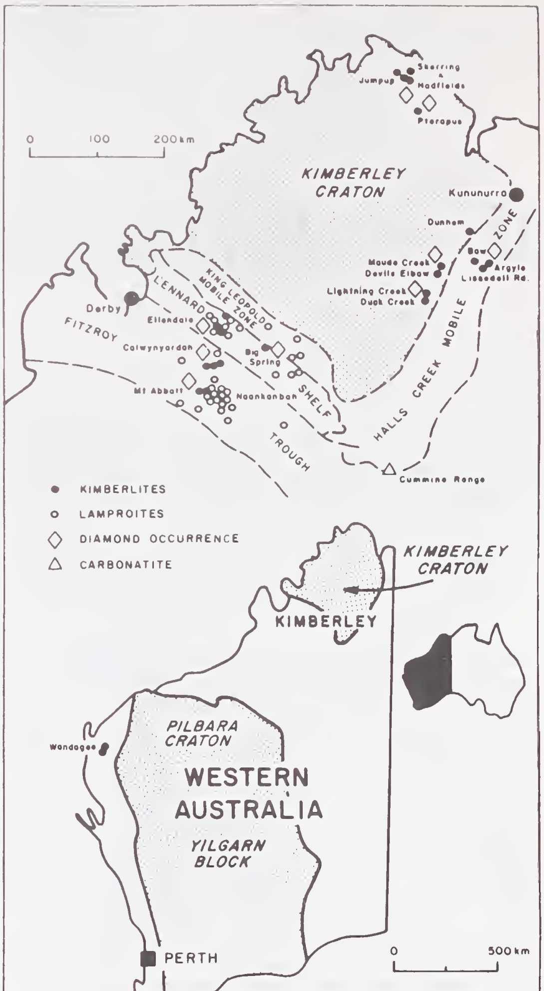

FIGURE 1.

B5
THE GEOLOGY OF THE MAYENG KIMBERLITE SILLS

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The Mayeng Kimberlite Sills occur in the northern Cape province of South Africa, approximately 70 km north of Kimberley. The sill complex was recently discovered by DBCM prospecting personnel, in an area where previously known kimberlites occur to the north and south. These sills are intruded into a massive but jointed andesitic horizon unconformably underlying the local Ecca shales. The Mayeng sills are different to other sill complexes in the Kimberley area, where instrusion into Ecca shales is probably controlled by the overlying Kimberley Dolerite Sheet. An extensive drilling program indicated that the sill complex comprises numerous sills, apparently lensoid in shape and occurring at irregular depths. This is due to intrusion into randomly spaced planes of weakness in the jointed host lava. Detailed drilling results outlined two main sill zones, one dominantly macroporphyritic, the other aphanitic. Throughout the sill complex, however, both textural types of kimberlite are found. The petrography, mineral chemistry and bulk rock chemistries of the two main sill types have been examined in detail.

Despite the obvious differences in texture, the kimberlite sills are mineralogically similar and classification as macroporphyritic and aphanitic-hypabyssal facies, ilmenite-rich phlogopite kimberlites would be appropriate. The mineralogical similarities of the two textural types of kimberlite are reflected in similar bulk rock compositions, although minor trace element differences are noted. In addition to a geochemical examination of the major xenocrysts, the relationships between the dominant matrix minerals have also been investigated. Of particular interest is the presence of chromian-rich ilmenite inclusions in olivine and occasionally phlogopite phenocrysts. Mantle xenoliths comprising phlogopite-ilmenite assemblages and clinopyroxene-ilmenite intergrowths are observed, though rarely. The mineral chemistry of these xenoliths has been documented and will be compared with examples from other kimberlites. From the petrographic and geochemical investigations the two textural varieties of kimberlite are apparently related, possibly through filter pressing processes and/or multiple intrusion.

B6

DIAMONDIFEROUS KIMBERLITES AT ORROROO, SOUTH AUSTRALIA

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A suite of Jurassic dykes and associated blows ranging in thickness from a few millimetres to 30 metres occur near Orroroo, South Australia. All the intrusions at surface are extensively altered but most of them are apparently petrographically similar and can be identified as altered phlogopite-rich kimberlites. Fresh material was obtained from one of the dykes at 60 metres depth. This borehole core can be classified as a hypabyssal, calcite, phlogopite kimberlite. Mineral chemistry of olivine and groundmass phlogopite, tetraferriphlogopite rims, serpentine, perovskite, spinel and clinopyroxene are characteristic of kimberlites. Whole-rock geochemistry of this dyke is also typical of such mineralogical varieties of kimberlite.
The kimberlite dykes can be divided into three main geographic groups each falling on a different, but sub-parallel, strike line. Variations in the nature of the heavy mineral concentrate and diamond content correlates with this grouping. Together with the petrography, this suggests that the dykes were intruded as three separate, but related pulses. Although no ultramafic xenoliths were found, the chemistry of garnets, ilmenites, diopsides and spinels is discussed.
Details of the shape and colour of the diamonds recovered from the kimberlites are given. Enstatite and magnesio-wustite occur as inclusions in the diamonds.

B7

THE PETROLOGY OF OLIVINE MELILITITES FROM NATAL, SOUTH AFRICA

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Six new occurrences of olivine melilitites have been discovered on the East Coast of South Africa. These occur as small pipes and dykes in north central Natal. They are important as they are the first recorded occurrences of alkaline ultrabasic magmatism in this area. The rocks intrude sediments of the Karoo and Cape Supergroups. The occurrences are mineralogically similar to those found on the West Coast (Moore 1979).

Petrographically both diatreme facies and hypabyssal facies textures are recognized. The diatreme facies rocks consists of varying proportions of country rock fragments, rounded 'pellets' and earlier generation fragments of olivine melilitite and phlogopite phenocrysts set in an extremely fine-grained matrix of rare clinopyroxene microlites, secondary clay minerals and cryptocrystalline carbonate. The earlier generation fragments are extensively altered but relicts of olivine, melilite, perovskite, phlogopite and small spinels can be recognized. These are set in a base of secondary clay minerals and lesser cryptocrystalline carbonate.

The hypabyssal olivine melilitites are porphyritic rocks. They consist of phenocrysts of altered olivine and minor augite, phlogopite and ilmenite in a finer grained groundmass. This consists of altered melilite, phlogopite, diopside, apatite, spinels and perovskite set in a base of serpentine and minor calcite.

These rocks are similar to kimberlites in several respect i.e. their mode of emplacement, textures and to a limited extent their mineralogy.

B8

THE 1977 EXPLOSIVE ERUPTIONS OF THE UKINREK MAARS, ALASKA

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In March/April 1977 the two small Ukinrek maars formed on the Aleutian Range when weakly undersaturated alkali olivin basalt magma rose 13 km behind the Andesite volcanic chain. During the volcanic activity eruption clouds rose to heights of up to 6500 m.

The West Maar formed within 3 days and reached a diameter of 170 m and a depth of 35 m. Its activity started with near-surface explosions leading to ejection of large partially frozen (permafrost) moraines and conglomerates and intermittant lava fountaining. After a maar forming collapse the level of explosions retreated to deeper levels which caused ejection of blocks of the dike feeding the initial eruptions.

The East Maar formed during the following 6 days. The maar reached a diameter of 300 m and a depth of 70 m. During the eruptions frequently two styles of activity could be observed simultaneously within the maar: phreatomagmatic eruptions next to lava fountaining. Whereas the phreatomagmatic produced juvenile lapilli and bombs of relatively low vesicularity of round to cauliflower shape, as well as large amounts of wall rock fragments, the lava fountains caused formation of scoriaceous fragments.