post-fluidization crystallization, under stagnant conditions, are described. The formation of segregationary and uniform textures by post-fluidization crystallization of vapour condensates are also considered.

Some attention is paid to the effects of fluidization (and contemporaneous contamination of residual fluids during fluidization) on the mineralogy of diatreme-facies kimberlites.

C4

A NEW LOOK AT PRAIRIE CREEK, ARKANSAS

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Previous studies of the Prairie Creek occurrence have identified three main rock types namely; "volcanic breccias", "tuffs and fine-grained breccias" and hypabyssal kimberlite or peridotite. We take a new look at these rocks in the light of a suggestion by R.H. Mitchell (pers. comm.) that the body is not a true kimberlite but rather a lamproite.

Our investigation confirms the presence of three distinct rock groups which include both hypabyssal and crater-facies types. The so-called "volcanic breccia" and "tuffs" are both considered to be predominantly of pyroclastic origin. The "volcanic breccias" are subdivided into two sub-groups. One, composed of igneous lapilli set in a serpentinous base, is interpreted as a primary tuff. The other is thought to be a reworked tuff. The latter group is similar in many respects to the so-called "tuffs". These contain abundant comminuted and xenolithic material in addition to igneous lapilli. Certain features of these rocks are atypical of kimberlites.

The hypabyssal rocks contain two generations of relatively abundant olivine (Fo_{88-93}) in a fine-grained matrix composed of phlogopite, clinopyroxene, amphibole, perovskite, spinel and serpentine. Some phlogopite and serpentine crystallised from a glass. Although many petrographic features of these rocks are similar to those of kimberlites, the form of the euhedral olivine, presence of abundant glass and occurrence of potassic richterite are uncharacteristic of kimberlite but typical of lamproitic rocks. Both the groundmass phlogopite (4-5 wt.% TiO_2) and the bulk rock have compositions intermediate between lamproite and kimberlite.

It is concluded that the Prairie Creek intrusion is transitional between kimberlite and lamproite.

C5

POSSIBLE PRE-KIMBERLITE SERPENTINIZATION IN ULTRABASIC XENOLITHS FROM BULTFONTEIN AND JAGERSFONTEIN MINES, SOUTH AFRICA

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Textural analyses of garnet peridotites showing various degrees of deformation revealed an early generation of pre- and synkinematic serpentine that appears to predate kimberlite emplacement. In sheared nodules, serpentine fibers between recrystallized olivine and in fractured porphyroclasts and layers of orthopyroxene are consistently parallel with the planar fabric. Numerous porphyroclastic nodules have sets of serpentine-filled fractures perpendicular to the mineral elongation. In some porphyroclastic nodules random networks of serpentine-filled fractures are deformed near orthopyroxene and garnet porphyroclasts. Sections of xenolith-kimberlite contacts show that deformation-related fibrous serpentine veins may have been reopened and filled by a late generation of nonfibrous serpentine.

Time relationships between early serpentinization and K-metasomatism at Bultfontein are difficult to establish, though rare textures suggest that richterite may have overgrown olivine with serpentine-filled fractures. As some of the K-metasomatism is also synkimmatic, it is possible that the two are related. Recognition of a pre-kimberlite serpentinization overprint on anhydrous assemblages of diverse P-T conditions at Jagersfontein casts doubt on the interpretation that the two rock types were incorporated into the kimberlite at different depths. It raises the possibility that rocks originally equilibrated at different P and T became tectonically juxtaposed prior or during serpentinization preceding incorporation into the kimberlite.

C6

THE KOIDU KIMBERLITE COMPLEX, Sierra Leone.

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Three Kimberlite pipes, multiple dikes, and a small ring-dike complex of kimberlite occur in the Yengema-Koidu area. Dikes are both older and younger than the kimberlite pipes and a variety of textural, petrological, and mineralogical types characterize the complex. Discrete ilmenite nodules show evidence of coupled exsolution (ilm_{ss} from $geik_{ss}$) and subsolidus reduction (sp_{ss} from ilm_{ss}) associated with Cpy + Po+Pn. These ilmenites have 3-6 wt% MgO and 0.2-1.4 wt% Cr_2O_3. Redox reactions producing Mn-rich ilmenites (up to 16% MnO) and spinels (up to 1.2 wt% MnO are intimately associated with calcite. Ilmenites in Ilm-pyroxene intergrowths contain 10-12 wt% MgO and 0.8-1.5 wt% Cr_2O_3, and are associated with Jd pyroxene, sulfides, and trapped magmatic inclusions. Both diamond-bearing and non-diamond bearing eclogites are present, and metallic Fe has been identified in one eclogite. Discrete chlorite nodules (up to 5cm in size) and primary groundmass chlorite are highly oxidized (8-20 wt% Fe_2O_3, low in Al_2O_3 (9-10 wt%), and high in MgO (2[illegible]-28 wt%) Phylogopites low in Cr_2O_3 (0.05 wt%), TiO_2 (0.20 wt%) and high in FeO (7-8 wt%) have reversed pleochroism, and are mantled by normal pleochroic phlogopites high in Cr_2O_3 (1.5 wt%), TiO_2 (2-3 wt%), and low in FeO (4-5 wt%). Core phlogopites are preferentially replaced by chlorite. Bulk chemistry of dike and pipe kimberlites are markedly different in the ranges of composition: the former are tightly clustered (e.g. MgO= 26-32 wt%, CaO= 3-8 wt%, Al_2O_3= 2-4 wt%) whereas the latter are heterogeneous (e.g. MgO= 16-30 wt%, CaO= 2-18 wt%, Al_2O_3= 2-9 wt%). Volatile variations (CO_2 and H_2O) suggest that the earliest kimberlite magma (i.e. autolith) was H_2O enriched, that the later kimberlite was CO_2 enriched (i.e. autolith encasement) and that the host kimberlite (i.e. youngest) was intermediate. Preliminary paleomagnetic studies record paleovector directions consistent with a Jurassic age of diatreme emplacement.

C7

CARBONATE TUFF FROM MELKFONTEIN, EAST GRIQUALAND, SOUTH AFRICA

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The Melkfontein carbonate tuff overlies the southern slopes of a ridge of Beaufort sandstone that is cut by Karro dolerite intrusions. The tuff is considered a remnant of a volcano and is believed to have erupted at a relatively recent age (63 M.Y.), in comparison to the nearby kimberlitic intrusions.

The carbonate tuff is composed of calcite that encloses numerous xenocrysts of garnet, clinopyroxene, amphibole, mica, and plagioclase together with "cognate" magnetite, apatite, and zircon crystals. Garnet is iron-rich (Mg/Mg + Fe^{+2} 0.40 - 0.54, TiO_2 0.04 - 0.2 wt %, Cr_2O_3 0.01 - 0.07 wt%). Clinopyroxene (Mg/Mg + Fe^{+2} 0.45 - 0.68, Ca/Ca + Mg 0.54 - 0.57) is sodic, containing 3.0 to 6.5 wt % Na_2O. Alkali amphibole (Na_2O 4.0 - 4.5, K_2O 1.2 - 1.4, TiO_2 1.2 - 1.7 wt %) occurs as discrete xenocrysts or as rims on clinopyroxene. Biotite is iron-rich (Mg/Mg + Fe^{+2} 0.51 - 0.62) and contains 1.5 to 2.4 wt % TiO_2. Plagioclase occurs as discrete xenocrysts of albite ($Ab_{98.1}An_{0.9}Or_{1.0}$) or as crystals of andesine ($Ab_{70.2}An_{27.5}Or_{2.3}$) attached to large garnet xenocrysts. The mineral chemistry of clinopyroxene, garnet, amphibole, and mica in the Melkfontein tuff is different from that reported for these minerals in carbonatites (or kimberlites). It is similar, however, to the mineral chemistry reported for these minerals in garnet granulite xenoliths from Lesotho kimberlites (Griffin et al., 1979). Such similarity suggests that they are derived by disaggregation of garnet granulite xenoliths from the lower crust at Melkfontein. The occurrence of "cognate" magnetite (1.7 - 8.6 wt % MgO, 1.4 - 7.8 wt % TiO_2, <0.01 wt % Cr_2O_3), apatite, and zircon in the Melkfontein tuff suggests some similarity to carbonatites.

C8

THE OPAQUE OXIDES OF THE WESSELTON MINE KIMBERLITE, KIMBERLEY, SOUTH AFRICA.

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The Wesselton Mine is one of four operating diamond mines in Kimberley, South Africa. It yields approximately 330000 carats of diamonds a year. The Wesselton kimberlite pipe has had a complex geological history and excluding minor dykes and sills, 9 or possibly 10 different kimberlite intrusions have been recognised between the 435 and 1020 metre levels. In addition two major areas of contact breccias occur below the 660 metre level (Clement pers. comm.).

The kimberlites have been examined petrographically with particular emphasis on the opaque minerals in the groundmass. These minerals are spinels, ilmenite, perovskite and rutile. Representative microprobe analyses of these minerals have been obtained.

Subhedral to euhedral groundmass spinels in the Wesselton mine kimberlites range in size from 0,002mm to 0,1mm but are usually 0,04mm. They exhibit a normal magmatic trend and evolve from low TiO_2, high Cr_2O_3 cores (picrochromites) to low Cr_2O_3, high TiO_2 and Fe_2O_3 rims (titanomagnetite). Despite some chemical overlap, spinels from different kimberlite intrusions can be distinguished from one another. The Wesselton spinels do not show a zonation trend from titanomagnetite cores to magnesium pleonaste rims similar to that described for the De Beers kimberlite by Pasteris (1980).

Ilmenite xenocrysts and primary groundmass ilmenites in the Wesselton kimberlites are characterised by high MgO and Cr_2O_3 contents, the highest MgO contents occuring in the groundmass ilmenites. Both varieties of ilmenite display reverse zonation with rims more magnesium than cores.

C9

MAGMA MIXING IN THE EVOLUTION OF KIMBERLITE: COMPOSITIONALLY DISTINCT MEGACRYST SUITES FROM S.W. PENNSYLVANIA, USA.

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Megacryst populations recording a fractionation interval within kimberlitic melts have been documented from many occurrences; a locality in Pennsylvania records a magma-mixing event involving a fractionated melt and a less evolved, perhaps parental, melt. Furthermore, there is complete documentation of the subsequent evolution of the hybrid melt to its final crystallization.

Two compositionally distinct populations of megacrysts and phenocrysts occur: (1) a primitive suite composed of Cr-garnet and olivine (Fo 92-90), the latter containing inclusions of Cr-garnet, Cr-diopside, enstatite, and immiscible sulphide blebs; and (2) a more evolved suite consisting of Cr-poor garnet, olivine (Fo 85-83), and megacrysts and inclusions of picroilmenite. The two populations are compositionally similar to different stages of the fractionation sequence of kimberlites possessing a continuum of megacryst compositions (e.g., the Monastery kimberlite), particularly with regard to the compositions of co-precipitating Cr-poor garnet and picroilmenite. Reverse Mg-zonation in ilmenite megacryst rims and zonation in all olivine rims to an equilibrium composition of Fo 88 provide tangible evidence for mixing of the two populations and their host melts. Ilmenite, identical in composition to that in the re-equilibrated megacryst rims, was a liquidus phase in the hybrid melt, followed paragenetically by Cr-spinel, then Ti-magnetite; Cr-, Ti-phlogopite, zoned to Ti-phlogopite is the dominant mafic silicate phase.

P-T calculations on garnet lherzolite xenoliths indicate formation of the kimberlitic melt at 53-55 kb and 1320-1350°C; values from the megacrysts indicate that the mixing took place at lower temperatures (1170-1200°C).

Mixing calculations verify the mineral evolutions observed and have allowed an assessment of the relative proportions of the melts involved in the mixing.

C10

LES ROCHES ULTRAPOTASSIQUES (LAMPROITES) DE LA REGION VOLCANIQUE NEOGENE DU SUD-EST DE L'ESPAGNE

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