30 kilobars. Normative bulk compositions of the eclogites are equivalent to picrite, olivine tholeiite, alkali olivine basalt, basanite and basaltic anorthosite. Compared to equivalent phases precipitated from laboratory melts, eclogite clinopyroxenes contain higher jadeite and SiO_2 and lower Ca-Tschermak molecule, whereas garnets contain higher grossular. Eclogite bulk compositions are dissimilar to those of mafic liquids derived by partial melting of mantle peridotites. Eclogites contain higher Al_2O_3, Na_2O and locally K_2O, and lower MgO and Cr_2O_3. Such compositions are similar to those of clinopyroxene + garnet ± kyanite + feldspar cumulates precipitated from tholeiitic and calc-alkaline laboratory melts. Chemical compositions support the hypothesis of Green and Ringwood (1967) that the eclogites may be metamorphosed residua and cumulates from partially melted subducted oceanic crust.
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D17

ILMENITE IN UPPER MANTLE POLYMICT XENOLITHS FROM BULTFONTEIN

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Four polymict deformed xenoliths from Bultfontein, each of which have a strong disequilibrium garnet lherzolitic mineralogy, also contain abundant ilmenite. The ilmenite occurs either as transgressive veins or as isolated patches and 'blebs' and is closely associated with phlogopite and often rutile as well as occasional sulphides. The ilmenite in the various xenoliths broadly have similar compositions being characterised by high but variable Cr_2O_3 (1-5 wt.%) contents and relatively constant and high MgO (14-15 wt.%) contents, while the rutile is also often enriched in Cr_2O_3 (3-4 wt.%). Where the ilmenite occurs as veins, which are clearly intrusive into the xenoliths, the smaller veins and the edges of the larger veins invariably have the higher Cr_2O_3 contents, perhaps in response to temperature variation during crystallisation. No armalcolite has been found which is suggestive of a high pressure (more than 20 kb) paragenesis for the ilmenite. The mineral chemistry of the ilmenite and rutile is described in detail and is also compared to xenocrystal material and available experimental data. This information is used to develop a possible phenocrystal model of formation for the majority of the ilmenite which occurs in kimberlite.

D18

PETROLOGY AND GEOCHEMISTRY OF ULTRAMAFIC XENOLITHS FROM THE GERONIMO VOLCANIC FIELD

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Ultramafic xenoliths included in Plio/Pleistocene alkali basalts from the Geronimo Volcanic Field (GVF) record a multistage evolution for the mantle beneath SE Arizona. The dominance of unfoliated, granuloblastic, Type I harzburgites and clinopyroxene-depleted spinel lherzolites at GVF supports the occurrence of a major depletion event in the mantle followed by a period of re-equilibration. The coherence of major element mineral chemistry data indicates that variation in bulk rock major element chemistry among the xenoliths is a function of modal mineral abundances and that equilibration conditions were relatively uniform. Variation in Fe/Mg and REE abundances indicates different degrees of depletion among the xenoliths. INAA analyses of REE in cpx from cpx-rich spinel lherzolites have high, LREE-enriched patterns while cpx from depleted (cpx-poor) spinel lherzolites and harzburgites may be as much as an order of magnitude lower in REE.

Composite xenoliths are abundant and of two types: 1) websterite or diopside veins in spinel lherzolite, and 2) Type II clinopyroxenite cross-cutting wehrlite or spinel lherzolite. Chemically, the Type II clinopyroxenites are distinguished from the Type I xenoliths by higher Al, Ti, Ca and Na, but lower Mg. They typically possess igneous textures in which cpx subpoikilitically to poikilitically encloses olivines and probably formed as the crystallization of magma in dikes or conduits under mantle conditions.

Kaersutite peridotites, similar to the Type II spinel-bearing clinopyroxenites, are locally abundant. The kaersutite commonly forms large, cm-sized, optically continuous crystals which partially replace clinopyroxenes of varying crystallographic orientations. The origin of the amphibole is enigmatic, but may represent the final, fluid-rich stage of crystallization of magma trapped at depth.

D19

TWO-PYROXENE INTERGROWTHS FROM SOUTH AFRICA

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Megacrysts consisting of two-pyroxene intergrowths in which one of the phases has obviously exsolved from the other have been investigated. These megacrysts were obtained from Koffiefontein, and the Bellsbank area kimberlites. All previous studies of megacrysts to date have been for the most part on discrete mineral grains. Conclusions made from such studies are based on the assumption that the discrete megacrysts may have formed in equilibrium. In the case of the 2-pyroxene intergrowths no assumption is necessary as it is a fact that the two phases have equilibrated together.

The pyroxenes forming the intergrowths are typically diopside-enstatite. In some instances minor garnet either as lamella or rounded blebs is present. Either enstatite or diopside may be the host with the other mineral occurring as the exsolved phase. All analyses of the clinopyroxenes and orthopyroxene pairs were used in determining pressures and temperatures of equilibration via the computer program TEMPEST. Temperature (Lindsley and Dixon, 1976) versus pressure (Wells, 1977) plot for the Bellsbank intergrowths define a geotherm generally similar to ones suggested for other kimberlites in the region. It appears that most of the intergrowths have cooled to the geotherm and there is little evidence for abnormal temperature environ-