A significant proportion of the C in nearly all samples is removed by acid-washing. The soluble fraction must reside on grain boundaries and is presumed to be carbonate. In samples collected from environments in which caliche is present, carbonate contamination from meteoric sources is suspected. In others, carbonate probably also originated by post-eruptive redistribution of C from host lavas.

Most acid-washed Cr-diopside spinel lherzolites contain 10-40 ppm (by wt.) total C. These concentrations are considerably lower than those determined from previous analyses. The range in C contents of four Al-augite pyroxenites is 40-80 ppm, and one of the amphibole-phlogopite-apatite-spinel lherzolites from Nunivak Is., Alaska contains 85 ppm C.

The average C:CO_2 ratio for all samples is 0.06. Assuming that elemental C results from the reaction $2CO \rightarrow C + CO_2$, then the vapor from which C precipitated consisted of ~30 mole % CO.

A4

DIAMOND CHARACTERISTICS OF THE DE BEERS POOL MINES, KIMBERLEY, SOUTH AFRICA

J.W. HARRIS, J.B. HAWTHORNE, M.M. OOSTERVELD
Department of Applied Geology, University of Stratchclyde, 75 Montrose Street, Glasgow, G1.

Diamonds from the four operating mines at Kimberley (Bultfontein, De Beers, Dutoitspan, Wesselton), have been examined using a classification scheme which quantifies, as a function of specific diamond size classes, such physical characteristics as crystal form, colour, ultraviolet fluorescence, and plastic deformation. In addition, from a single size class, the relative abundances of syngenetic silicate, oxide and sulphide minerals in the diamonds have been determined.

The results from the classification indicates that, in general, there is usually <10% variation in the proportion of primary crystal forms between the four mines, although secondary crystal forms show more pronounced variations. Diamond colour is broadly similar for the four mines but the proportions of the principal colours (colourless, yellow, brown) are distinctive at each mine. The numbers of fluorescent diamonds are typically low, levels varying between 5-10% in the small sizes to 20-40% among the larger stones. The principal fluorescent colour is weak blue, other minor colours being strong blue, green, orange and yellow. Blue and strong blue fluorescence are distinctive for diamonds from De Beers and Wesselton, respectively. Plastic deformation levels for the four mines are also distinctive but levels are independent of diamond size. Inclusion studies indicate that the diamonds from all four mines have a dominant (90% plus) 'peridotitic' paragenesis, with a particularly high chromite inclusion content.

Differences in characteristics can separate diamonds from the four Kimberley mines, but those characteristics which can reasonably be associated with diamonds' formation are closely similar, which is compatible with the Kimberley diamonds being derived from a single diamond population.

A5

A TRANSMISSION ELECTRON MICROSCOPY STUDY OF OLIVINE INCLUSIONS IN DIAMOND

A.M. MARIE, D.H. MAINPRICE and N. SOBOLEV
Laboratoire Tectonophysique, Université de Nantes and Institute of Geology Geophysics, 630090 Novosibirsk 90).

Olivine inclusions in elasticity isotropic diamond (cubic anisotropy factor A = 2C44/C11 - C12 = 1.54) have been studied with a view to obtaining information about olivine dislocation substructure under mantle conditions. Olivine inclusions 0.05- 0.3 mm in diameter have been extrated by combustion from a diamond from the UDACHNAYA pipe, Yakatia, USSR. Individual inclusions have been mounted on cooper grids and ion thinned at 5 KV for T.E.M. examination in a JEOL microscope at 120 KV.

A low dislocation density of less than $10^4 cm^{-2}$ is observed. To obtain the maximum information from the few dislocations observed, the dislocation images have been recorded under diffracting conditions of g.b = 0, 1, 2 where g is the diffracting vector and b is the Burgers vector. Straight mixed free dislocations are present with both [001] and [100] Burgers vectors. Heated fractures on the (010) plane are observed with [100] loops and [001] straight dislocations.

The above observations are consistent with the low stress and high temperatures thought to prevail in the mantle. No evidence of a subsequent high stress crustal deformation is observed.

A6

THE ABUNDANCE AND CHEMISTRY OF MINERALS ASSOCIATED WITH DIAMONDS AT ROBERTS VICTOR MINE

J.J. GURNEY, J.W. HARRIS and *R.S. RICKARD*
Geochemistry Dept, Univ. Cape Town, Rondebosch, 7700, RSA.

A study of minerals in diamonds has shown that their abundance and chemistry are at gross variance with the xenolith mineralogy at the Roberts Victor Mine. The latter is >95% eclogitic.

Olivine and associated minerals predominate (~85%) in diamond. The most abundant paragenesis is harzburgitic (ol,opx,±chr±gar). There is a small garnet lherzolite field (+cpx). The above minerals are similar to peridotitic inclusions world wide; (high Mg/Fe, Cr_2O_3, low CaO). An exception is that opx usually has a higher Al_2O_3 (>1wt%) and Cr_2O_3 (>0.5wt.%). Two gar/ol pairs give high equilibration temperatures >1300°C, but a cpx (Ca/Ca+Mg=0.45) probably equilibrated at ~1100°C.

Eclogitic gar and cpx are subordinate (~15%) to peridotitic inclusions. Sulphide occurs in both associations and a single felspar of presumed eclogitic affinity is the only other mineral found in 166 diamonds.

There is a large compositional gap between the peridotitic and eclogitic inclusion minerals. The latter are characterised by high Fe/Mg, TiO_2, Al_2O_3, CaO, Na_2O and K_2O and by lower Cr_2O_3. The garnets are ~65% almandine, and fall outside the compositional field for Rovic eclogite (Hatton 1978). The cpx show a positive MgO/Cr_2O_3 correlation; negative for MgO/Al_2O_3, MgO/Na_2O and MgO/K_2O.