CO_2-bearing diamonds in eclogite xenoliths from the Sloan 2 kimberite, Colorado.

I. L. Chinn[1], M.E. McCallum[2], C. Harris[1], H. J. Milledge[3], and J. J. Gurney[1]

1: Dept of Geological Sciences, University of Cape Town, Rondebosch, 7700, South Africa
2: PO Box 272 421, Fort Collins, Colorado, CO 80527, USA
3: Dept of Geological Science, University College London, Gower St, WC1E 6BT,United Kingdom

Eclogite xenoliths from the Sloan kimberlite of the Colorado-Wyoming Kimberlite Province have been interpreted as the products of subducted oceanic crust (Ater et al., 1984). Diamondiferous eclogites from this locality have been studied by McCandless and Collins (1989). Several undescribed graphite, graphite-diamond and diamond eclogites from the Sloan 2 kimberlite pipe have been investigated in terms of mineral compositions and Infra-red absorption characteristics of the diamonds. Carbon isotope compositions are currently being analysed at the University of Cape Town.

Differences in texture and mineral composition detected between the different types of carbonaceous xenoliths are thought to be a function of disparate temperatures and pressures of origin in the diamond and graphite stability fields. Clinopyroxene grains are considerably altered to mixtures of secondary pyroxene, mica and carbonate, whereas garnet grains are less altered except for the development of kelyphitic rims in some cases. Graphite occurs as rounded lumps, specks, sheet-like aggregates or pseudomorphs after diamond with surface features characteristic of xenolithic diamonds (e.g. serrate laminae) preserved as relict textures. Diamonds are generally colourless, except for three specimens which show pale brown discolouration. These diamonds proved to contain spectral evidence of high pressure CO_2 within the diamond lattice.

The presence of submicroscopic inclusions of CO_2 in a diamond from an unknown source has been inferred from IR absorption peaks (Schrauder and Navon, 1993). Subsequently numerous CO_2-bearing diamonds from the George Creek kimberlite dyke in Colorado have been studied (Chinn, 1995; Chinn et al., 1995). An eclogitic source for the CO_2-bearing diamond growth generation was proposed (Chinn 1995), but the discovery of CO_2-bearing diamonds *in situ* within eclogitic nodules from a nearby State Line locality provides unequivocal evidence of an eclogitic origin for these CO_2-bearing diamonds.

References

Ater, P.C., Eggler, D.H., and McCallum, M.E., 1984, Petrology and geochemistry of mantle eclogite xenoliths from Colorado-Wyoming kimberlites: *In*: Kornprobst, J., ed., Kimberlites II: The Mantle and Crust-Mantle Relationships, Elsevier, p. 309-318.

Chinn, I.L. 1995, A study of unusual diamonds from the George Creek K1 kimberlite dyke, Colorado. Unpubl. PhD thesis, University of Cape Town.

Chinn, I.L., Gurney, J.J, Milledge, H.J., Taylor, W.R. and Woods, P.A. 1995, Cathodoluminescence properties of CO_2-bearing and CO_2-free diamonds from the George Creek K1 kimberlite dike. Intl. Geol. Rev., 37, p. 254-258.

McCandless, T.E. and Collins, D.S. 1989, A diamond-graphite eclogite from the Sloan 2 kimberlite, Colorado, USA: Geol. Soc. Aust. Spec Publ. No. 14, p. 1063-1069.

Schrauder, M. and Navon, O., 1993, Solid carbon dioxide in a natural diamond: Nature, 365, p. 42-44.