Mineral Inclusions in Diamond – a Scouser's view.

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Scientific studies on inclusion-bearing diamonds began in the 19th Century, but were still largely observational well into the first half of the 20th. The first analytical work used X-rays for unambiguous identification. The initial 1953 work was followed by major inclusion research programmes in Russia and southern Africa. Inclusion identification criteria were developed. With the advent of the electron microprobe, new work was initiated in America and Russia and systematic studies begun on inclusion-bearing diamonds from the mines of southern Africa. FTIR and the carbon and nitrogen isotopic compositions of the host diamonds were added to these inclusion data. Thus began integrated research programmes on inclusions and diamonds from specific sources.

Unequivocal inclusions from the lower mantle were first recovered from diamonds in Australia. Other 'deep' diamonds were then identified and integrated studies revealed that lower mantle and transition zone diamonds have distinct characteristics. Thus diamond formation, although in some cases relatively rare, occurs over a depth range from about 150km to about 700km.

Using the Sm-Nd isotopes in aliquoted peridotitic garnet inclusions, the first diamond genesis age was determined in 1984. The 3300 Ma model age was followed by other ancient isochron ages as a result of studies on both periodotitic and eclogitic type silicate inclusions in diamonds from specific mines in southern Africa, Australia and Russia. Ar-Ar determinations on eclogitic clinopyroxene inclusions also established eruption ages of diamonds from kimberlite. Measuring femtogramme levels of Re-Os isotopes, analyses of single eclogitic sulphide inclusions, provided isochron ages (for the diamonds) similar to those obtained from silicate inclusions. Most recently, Canadian peridotitic sulphide inclusions have given an isochron genesis age of 3500Ma.

Thus, research on inclusions in diamonds is still very exciting, even after 40 years.