

"Maltese-cross" diamonds: a spectroscopic approach to understanding formation conditions and element partitioning

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An interesting set of diamond samples (locality unknown) shows a variety of 'maltese-cross' sectorial growth features (Fig. 1). The samples are all in the form of plates cut from the centre of the original diamonds. They are characterised by high nitrogen concentrations (>1800 ppm) and 10–20% IaB nitrogen aggregation.

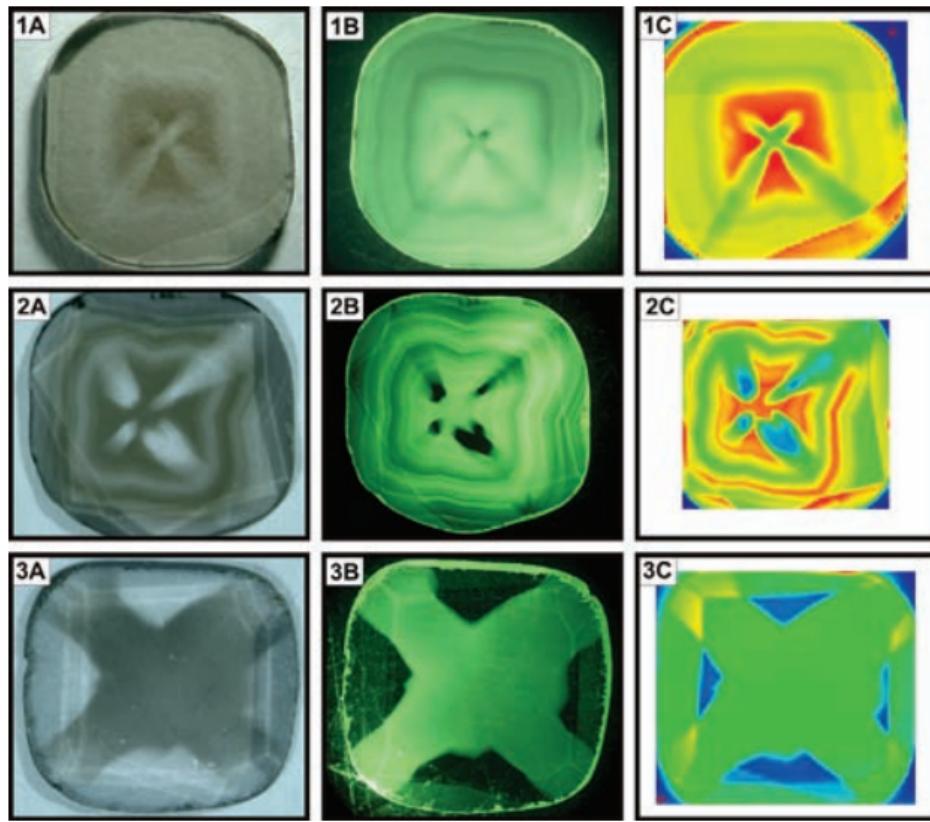


Fig. 1: Images of 3 diamonds from the collection of 13. Images A are taken under visible light, B are taken under UV & C are false colour IR maps showing the relative intensity of the 3107 cm^{-1} (hydrogen) band (blue shows lowest absorption and red the highest).

A new method of IR mapping that can deconvolute several thousand spectra from an individual stone is being applied to these samples. This novel technique can produce false-colour maps showing the distribution of nitrogen content and aggregation states, as well as hydrogen and platelet defects. These maps should allow for easier characterization of samples based upon their concentration and distribution parameters of these various defects [1]. They may also provide data regarding the preferential incorporation of nitrogen on the octahedral faces compared to the cube faces [2,3].

Nitrogen incorporation in diamond has been interpreted as being both compatible [4] and incompatible [5]. The incompatible-behaviour model suggests that high nitrogen concentrations occur due to rapid disequilibrium growth, while slow equilibrium growth would produce nitrogen-free (Type II) diamonds. How the interpreted growth histories of these samples fit into this argument will be of great interest.

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