Fig. 1 (a). Example of a map of “model temperatures” made up by automated fitting of several thousand FTIR spectra in a map of a diamond from Murowa, Zimbabwe. Model temperatures are calculated using a single assumed mantle residence time. The higher model temperatures in the core and lower temperatures in the rim reflect a growth and annealing history with at least two stages. (b). Modeling the possible combinations of temperature and time that could explain the FTIR characteristics of a zoned diamond from Murowa\textsuperscript{16}.
Fig. 2 (a). Cathodoluminescence (CL) image of Marange diamond MAR06b$^{30}$, showing core-to-rim SIMS analytical spots. (b). Raman map showing distribution of graphite and methane micro-inclusions in a homogeneously grown cuboid zone. (c). Outwardly decreasing nitrogen content (atomic ppm) with increasing $\delta^{13}$C (‰) in this same cuboid growth zone (red) and other cuboid growth zones (grey). The modeled trend (red dashed line) is for CH$_4$:CO$_2$ of 1:1 and assumes an initial $\delta^{13}$C for the fluid of -7.4 ‰. For an assumed water content of 98 mol%, the observed variation corresponds to 0.7% crystallization of the entire fluid (and 35% of the carbon in the fluid). For details on modeling see Stachel et al.$^{31}$. 
Fig. 3(a,b). Scanning electron microscope images of monocrystalline diamond slices containing trapped inclusions, prepared by focused ion beam thinning from diamonds synthesised at 7 GPa and 1300 °C for 30 hours. The fluid is lost from the inclusions once they become exposed leaving only cavities.
Fig. 4 (a,b). SiO$_2$ and Cl versus MgO content of HDF microinclusions in 89 fibrous diamonds from different lithospheric provinces (in wt.% on a water- and carbonate-free basis). The high-Mg carbonatitic compositions are close to experimental near solidus melts of carbonate-peridotite, while the low-Mg carbonatitic to silicic HDFs form an array close in composition to experimentally produced fluids/melts in the eclogite+carbonate±water system$^{73,74,76-78}$. The saline HDF endmember have been related to fluids derived from seawater-altered subducted slabs$^{79}$. Data: DeBeers-Pool, Koingnaas, S. Africa, & Kankan, Guinea, from Weiss et al. (ref$^{73}$, accepted MS in EPSL, and unpublished data); Koffiefontein, S. Africa, from Izraeli et al.$^{80}$; Brazil from Shiryaev et al.$^{81}$; Diavik, Canada & Udachnaya, Siberia, from Klein Ben-David et al.$^{82,83}$; Jwaneng, Botswana, from Schrauder and Navon$^{84}$; Panda, Canada, from Tomlinson et al.$^{85}$; Wawa, Canada, from Smith et al.$^{86}$
Fig. 5. Lherzolitic diamond formation through time: ca. 2.1 to 1.8 Ga diamonds from Premier (Kaapvaal craton) and 23rd Party Congress/Udachnaya (Siberian craton), 1.4 Ga diamonds from Ellendale (Western Australia)\textsuperscript{97}, 1.1 to 1.0 Ga diamonds from 23rd Party Congress/Mir (Siberian craton)\textsuperscript{98} and Venetia (Zimbabwe craton)\textsuperscript{99}; and 0.72 Ga diamonds from Attawapiskat (Superior craton)\textsuperscript{100}; numbers in parentheses give host kimberlite eruption ages (in giga-years) to illustrate the delay between lherzolitisation and kimberlite magmatism. Shown for comparison is the age distribution of kimberlites from Tappe et al.\textsuperscript{95}, Os model ages of mantle sulphides from Griffin et al.\textsuperscript{101}, which reflect predominantly Archaean craton formation when strongly refractory and reducing mantle lithosphere formed, and for xenoliths from the Siberian craton, which show a major Palaeoproterozoic lithospheric mantle formation event\textsuperscript{102}. 
Archean sediments are shown for comparison. EM1 sulfide grains from Pitcairn [14], HIMU sulfide grains from Mangaïa [13], and MORB [11,12] are homogeneous and devoid of MIF, sulfides from subcontinental lithospheric mantle and from some OIB contain the relict of Archean surficial sulfur. SID compositions are best explained by a combination of atmospheric and biotic effect and resemble as previously observed in Archean chemical sediments. Sulfide in OIB carry negative $\Delta^{33}$S together with negative $\delta^{34}$S as previously observed in sulfides from altered oceanic crust.
Fig. 7. (a) Histogram of δ^{13}C values of transition zone diamonds from Jagersfontein and Monastery (South Africa), the Juina area in Brazil (containing either majorite or Ca-rich inclusions) and Kankan (Guinea). The mantle range (grey band) is defined by the study of fibrous diamonds, mid-ocean ridge basalts, carbonatites and kimberlites. Data sources^{111,129-139}. (b) Histogram of δ^{15}N values of transition zone diamonds from Jagersfontein, Monastery, Brazil and Kankan. Data sources^{129,133-135}. (c) Schematic history of diamond formation in the transition zone, illustrating the deep recycling of surficial carbon and nitrogen in the mantle. At each locality, transition diamonds did not necessarily form during single subduction events.
Fig. 8. Bulk silicate earth normalized trace element composition of (a) ‘calcium silicate perovskite’ and (b) majoritic garnet inclusions compared with models for these phases in subsolidus peridotite (dashed blue) and MORB (dashed red) at transition zone conditions, as described in Thomson et. al. Inclusion compositions from: Davies et al.; Stachel et al.; Kaminsky et al.; Tappert et al.; Bulanova et al.; Hutchison; Moore et al.; Burnham et al. (c) Pressure-temperature plot showing the solidi of model carbonated MORB with 2.5 wt% CO\textsubscript{2} and ~4.5% CO\textsubscript{2} relative to model geotherms for slab surface temperature at modern subduction zones (Syracuse et al.). The solidi create a depth interval over which most slab surface temperatures intersect the melting curves, producing a region of carbonated melt generation. Also shown are calculated pressures of majoritic garnet inclusions in diamonds from South America and South Africa, calculated from the barometer of Beyer et al.
Fig. 9. Photograph of Juina diamond JuC-29 and a magnified view of the ringwoodite inclusion (lower panel, centre of image) showing the characteristic indigo-blue color of ringwoodite.
**Figure 10 (a).** Metallic inclusions in a 9.56 carat CLIPPIR diamond with an enlargement of one of the inclusions. These metallic inclusions sometimes have a needle-like tail and typically have large, graphitic decompression cracks around them. **(b)** Depth constraints place the origin of these diamonds within the mantle transition zone, where they are associated with subducted lithologies. The metallic inclusions are evidence for reduced, metal-bearing regions of the deep mantle, below a depth of approximately 250 km.