**Supplementary information & extended data**

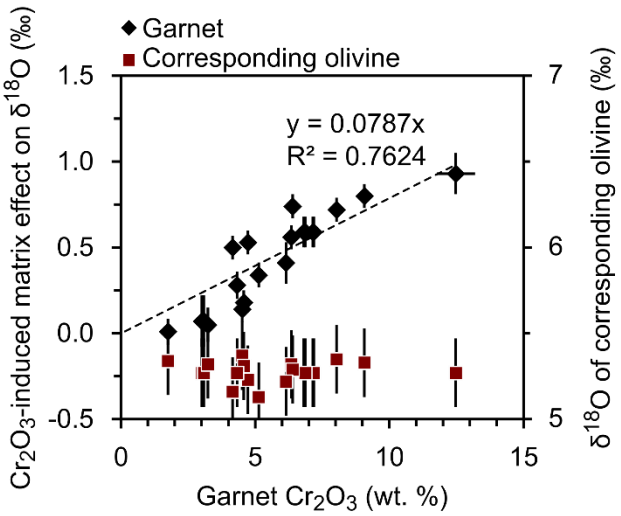


Figure S1. Coexisting garnets and olivines from peridotitic mantle xenoliths were analyzed on the ion probe to determine the instrumental fractionation associated with $Cr_2O_3$ content of garnets. The deviation of the measured garnet $\delta^{18}O$, after Ca# matrix-correction [1], from equilibrium with associated olivine is plotted, versus the $Cr_2O_3$ contents of the garnets. As all the olivines have SIMS-measured $\delta^{18}O$ within error of mantle, we assume isotopic equilibrium between garnet and olivine, and contend that the trend of SIMS-measured $\delta^{18}O$ with $Cr_2O_3$ content is a matrix effect. The trendline indicates the correction of the $\delta^{18}O$ values to a hypothetical Cr-free garnet.

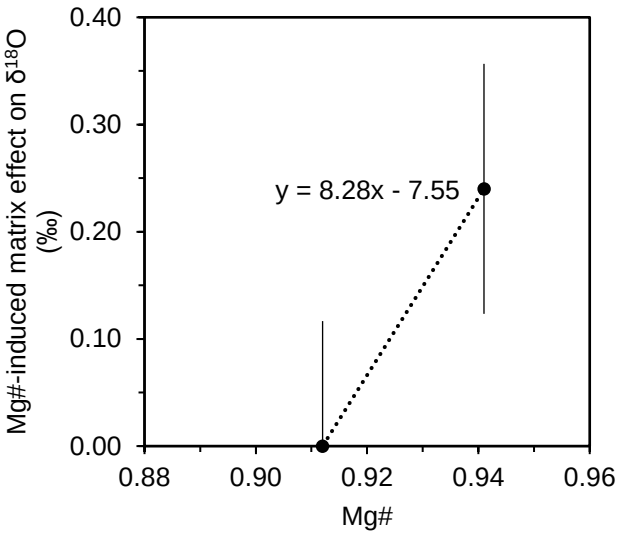


Figure S2. SIMS calibration curve for correcting the instrument mass fractionation of oxygen isotopes with enstatite Mg#. Reference material S0170 has an Mg# of 91.2 and a laser fluorination $\delta^{18}O$ of +5.64 ‰. S0444 has a slightly higher Mg# and ion probe-measured $\delta^{18}O$ that is slightly higher than the +5.76 ‰ value measured by laser fluorination [2]. Error bars incorporate 0.10 ‰ analytical uncertainty in laser fluorination measurements.

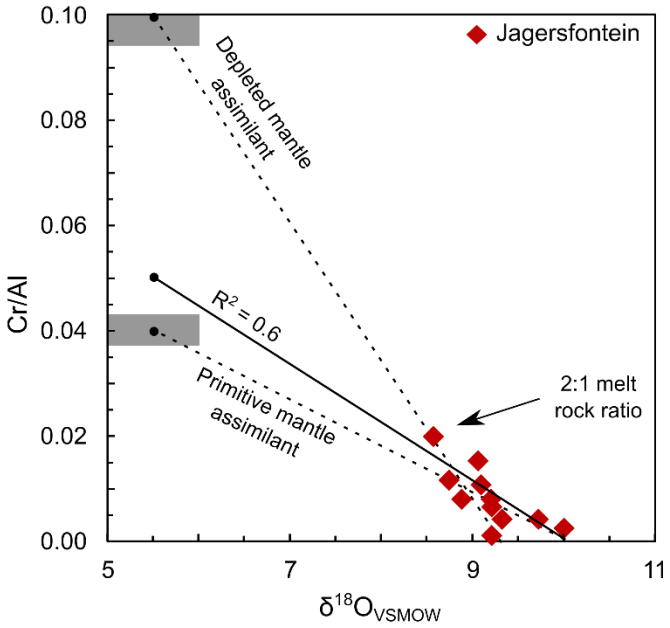


Figure S3. Linear regression (solid line; $r^2$ of 0.6) for Jagersfontein majorite Cr/Al and oxygen isotopes. The line indicates that a 5.5 ‰ mantle assimilate should have a Cr/Al content of ~0.05, whereas primitive mantle has a Cr/Al of 0.06 and depleted mantle has a Cr/Al of 0.1 (grey boxes and dotted lines). Only a ~2:1 melt:rock ratio is necessary to crystallize the highest Cr/Al majorite.

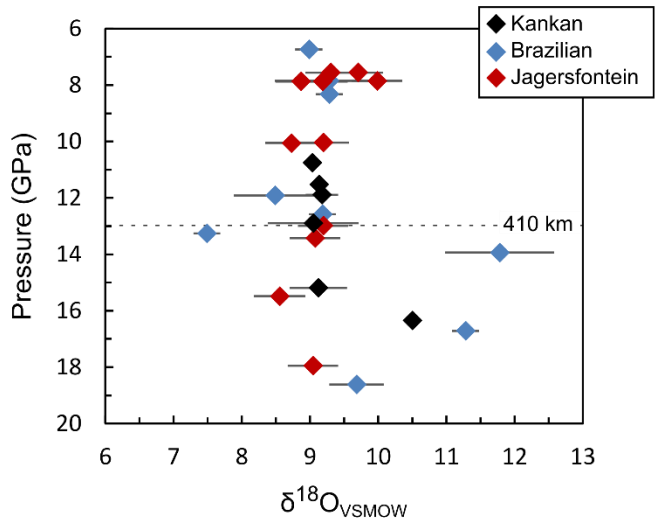


Figure S4. Oxygen isotopes for Brazilian, Jagersfontein, and Kankan majorites versus pressure estimates derived from the formulation of Beyer & Frost (2017) [7]. Error bars are 2σ standard deviation [8,9].

Table S1. Mineral assemblages of analyzed Kankan diamonds. Abbreviations include lherzolitic (lherz), eclogitic (eclo), websteritic (web), majoritic (maj), and enstatite (Opx). Opx indicates the enstatite, or "former bridgmanite" that have low NiO and interpreted as being from the lower mantle. Carbon isotopic data from Stachel et al. 2002 did not report errors [10].

| Sample | KK-26 | KK-65 | KK-86 | KK-96 | KK-78 | KK-101 | KK-97a | KK-97b | KK-61 |
|---|---|---|---|---|---|---|---|---|---|
| Type | Lherz Gt | Lherz Gt | Eclo Gt | Web Gt | Lherz Gt | Eclo Gt | Maj Gt * | Maj Gt * | Maj Gt * |
| Other inclusions | Ol | Cpx, Opx, Ol | n.a. | Cpx | Ol | n.a. | n.a. | n.a. | n.a. |
| Formation (GPa/km) | <250 km | <250 km | <250 km | <250 km | <250 km | <250 km | 12 GPa** | 12 GPa** | 12 GPa** |
| $\delta^{13}C$ | -4.50 | -2.21 | -4.96 | -5.37 | -3.61 | -5.78 | -1.54 | -1.54 | -0.35 |
| $\delta^{18}O$ | 5.72 | 5.34 | 3.83 | 5.29 | 5.33 | 6.09 | 9.05 | 9.15 | 9.19 |
| $\delta^{18}O$ 2σ SD | 0.24 | 0.22 | 0.07 | 0.20 | 0.29 | 0.21 | 0.08 | 0.10 | 0.24 |
| $SiO_2$ | 41.77 | 41.02 | 39.08 | 40.71 | 40.94 | 39.93 | 40.89 | 41.08 | 42.92 |
| $TiO_2$ | 0.28 | 0.01 | 0.74 | 0.50 | 0.01 | 0.40 | 1.66 | 1.60 | 1.37 |
| $A_{l2}O_3$ | 18.28 | 17.27 | 21.12 | 22.36 | 18.09 | 22.72 | 19.77 | 19.33 | 17.89 |
| $Cr_2O_3$ | 5.51 | 8.22 | 0.04 | 0.05 | 7.26 | 0.01 | 0.05 | 0.04 | 0.14 |
| FeO | 7.09 | 6.06 | 21.17 | 15.33 | 6.43 | 13.00 | 12.68 | 12.34 | 12.77 |
| MnO | 0.31 | 0.28 | 0.41 | 0.32 | 0.31 | 0.23 | 0.28 | 0.28 | 0.38 |
| NiO | 0.01 | 0.01 | bdl | bdl | bdl | 0.01 | 0.01 | 0.01 | 0.01 |
| MgO | 20.87 | 19.52 | 8.00 | 14.59 | 19.41 | 10.87 | 10.01 | 1bdl | 16.89 |
| CaO | 5.13 | 6.86 | 9.43 | 5.54 | 6.47 | 12.18 | 14.49 | 14.58 | 6.48 |
| $Na_2O$ | bdl | bdl | 0.21 | 0.24 | bdl | 0.16 | 0.55 | 0.63 | 0.48 |
| $K_2O$ | bdl | bdl | bdl | bdl | bdl | bdl | bdl | bdl | bdl |
| Total | 99.25 | 99.25 | 100.20 | 99.64 | 98.92 | 99.51 | 100.39 | 99.89 | 99.33 |

Table S1. continued

| Sample | KK-61 | KK-81 | KK-1 | KK-5 | KK-044c | KK-103 | KK-045 | KK-044e | KK-203 |
|---|---|---|---|---|---|---|---|---|---|
| Type | Maj Gt * | Maj Gt * | Maj Gt * | Maj Gt * | Opx | Opx | Opx | Opx | Opx |
| Other inclusions | n.a. | Cpx | Opx | n.a. | FPer, Wal, Ol | FPer | Sanidine | FPer, Wal, Ol | FPer, Ol, Cpx |
| Formation (GPa/km) | 12 GPa** | 15 GPa** | 13 GPa** | 16 GPa** | >660 km | >660 km | >660 km | >660 km | >660 km |
| $\delta^{13}C$ | -0.35 | -3.13 | 0.89 | -0.91 | -4.10 | -3.88 | -3.50 | -4.10 | bdl |
| $\delta^{18}O$ | 9.19 | 9.14 | 9.06 | 10.52 | 5.78 | 5.33 | 5.53 | 5.63 | 5.29 |
| $\delta^{18}O$ 2σ SD | 0.24 | 0.42 | 0.67 | 0.07 | 0.20 | 0.17 | 0.12 | 0.19 | 0.17 |
| $SiO_2$ | 42.92 | 43.78 | 42.43 | 43.68 | 56.83 | 56.44 | 56.81 | 56.71 | 57.94 |
| $TiO_2$ | 1.37 | 1.22 | 1.48 | 0.07 | 0.06 | 0.05 | 0.01 | 0.06 | 0.01 |
| $Al_2O_3$ | 17.89 | 17.27 | 17.19 | 20.56 | 1.09 | 1.18 | 0.96 | 1.10 | 0.36 |
| $Cr_2O_3$ | 0.14 | 0.08 | 0.04 | 0.06 | 0.36 | 0.37 | 0.29 | 0.36 | 0.38 |
| FeO | 12.77 | 11.08 | 12.78 | 12.22 | 3.48 | 3.67 | 3.36 | 3.47 | 2.70 |
| MnO | 0.38 | 0.27 | 0.25 | 0.36 | 0.11 | 0.11 | 0.12 | 0.11 | 0.10 |
| NiO | 0.01 | 0.02 | 0.01 | 0.02 | 0.01 | 0.03 | bdl | 0.01 | bdl |
| MgO | 16.89 | 15.08 | 10.92 | 16.24 | 37.27 | 37.07 | 37.11 | 37.10 | 37.99 |
| CaO | 6.48 | 9.15 | 14.67 | 4.60 | 0.06 | 0.06 | 0.03 | 0.05 | 0.08 |
| $Na_2O$ | 0.48 | 1.02 | 0.69 | 1.26 | bdl | bdl | 0.04 | bdl | 0.02 |
| $K_2O$ | bdl | bdl | 0.01 | bdl | 0.01 | bdl | bdl | bdl | bdl |
| Total | 99.33 | 98.97 | 100.46 | 99.07 | 99.28 | 98.98 | 98.73 | 98.97 | 99.57 |

*Majoritic garnet defined here as ≥ to 3.04 Si (pfu). **Depth of formation for majorites calculated using Beyer and Frost (2017) [7]. n.a. indicates not applicable, SD indicates standard deviation, and bdl indicates values below the detection limit (0.009 % Si, 0.018 % Na, 0.011 % Fe, 0.011% Al, 0.011 Mn, 0.007 % Mg, 0.016 % Cr, 0.005 % K, 0.005 % Ca, 0.012 % Ti, 0.013 % Ni).

Table S2. Standards utilized for EPMA analyses

| Element | Analyzing crystals | Standard |
|---|---|---|
| Si kα | LTAP | Fo90.5 olivine from Harvard |
| Ti kα | PET | $TiO_2$ rutile from MTI |
| Al kα | TAP | Frank Smith pyrope garnet |
| Cr kα | PET | $Cr_2O_3$ chromium oxide from Alfa Aesar |
| Fe kα | LLIF | $Fe_2SiO_4$ fayalite from Rockport, MA |
| Ni kα | LLIF | Ni nickel from Alfa Aesar |
| Mn kα | LLIF | $(Mn,Fe)_3Al_2Si_3O_{12}$ spessartine from Navegadora Mine, Brazil |
| Mg kα | LTAP | Fo90.5 olivine from Harvard |
| Ca kα | LPET | Plagioclase (labradorite) from Oregon, USNM 115900 |
| Na kα | TAP | $NaAlSi_3O_8$ albite from Virginia, Harvard 131705 |
| K kα | LPET | $KAlSi_3O_8$ sanidine from Itrongay, Madagascar |

**secondary standards included the Gore garnet from NY, DUR Fo90 from San Carlos, Enstatite H131709 from Harvard collection (Sri Lanka).

Table S3. The Mg# of bridgmanite and ferropericlase for experiments and natural samples. The average Kankan Mg# of bridgmanite and ferropericlase is between the Mg# expected for Fo91 and Fo89 starting material. This aligns well with the average Mg# of 90 of pyrolite [11].

| | Fo91 starting material [12] | Fo89 starting material [12] | Kankan Mg# average | Kankan Mg# 2σ |
|---|---|---|---|---|
| Bridgmanite | 95.5 | 94.7 | 95.0 | 2.5 |
| Ferropericlase | 87.0 | 86.3 | 86.7 | 1.4 |

**Supplementary references for sourced data. Accession codes for following database will be made available before publication.**

Eclogitic diamond $\delta^{13}C$ and $\delta^{15}N$ : [13–42]

Superdeep diamond $\delta^{13}C$ and $\delta^{15}N$ [23,26–29,43–47]

Eclogitic and peridotitic garnet inclusion Mg#: [13,14,35–41,43,45,48,15,49–58,17,59–68,19,69–78,21,79–88,22,23,25,26]

## References in supplementary material


1. Ickert, R. B. & Stern, R. A. Matrix Corrections and Error Analysis in High-Precision SIMS18O/16O Measurements of Ca–Mg–Fe Garnet. *Geostand. Geoanal. Res.* **37**, 429–448 (2013).
2. Lowry, D., Mattey, D. P. & Harris, J. W. Oxygen isotope composition of syngenetic inclusions in diamond from the Finsch Mine, RSA. *Geochim. Cosmochim. Acta* **63**, 1825–1836 (1999).
3. DePaolo, D. J. Trace element and isotopic effects of combined wallrock assimilation and fractional crystallization. *Earth Planet. Sci. Lett.* **53**, 189–202 (1981).
4. McDonough, W. F. & Rudnick, R. L. Mineralogy and composition of the upper mantle. *Rev. Miner. Geochem.* **37**, 139–164 (1998).
5. Eiler, J. M. Oxygen Isotope Variations of Basaltic Lavas and Upper Mantle Rocks. *Rev.*

*Miner. Geochem.* **43**, 319–364 (2001).

6. Stachel, T., Viljoen, K. S., Brey, G. & Harris, J. W. Metasomatic processes in lherzolitic and harzburgitic domains of diamondiferous lithospheric mantle: REE in garnets from xenoliths and inclusions in diamonds. *Earth Planet. Sci. Lett.* **159**, 1–12 (1998).
7. Beyer, C. & Frost, D. J. The depth of sub-lithospheric diamond formation and the redistribution of carbon in the deep mantle. *Earth Planet. Sci. Lett.* **461**, 30–39 (2017).
8. Ickert, R. B., Stachel, T., Stern, R. A. & Harris, J. W. Extreme 18O-enrichment in majorite constrains a crustal origin of transition zone diamonds. *Geochemical Perspect. Lett.* **1**, 65–74 (2015).
9. Burnham, A. D. *et al.* Stable isotope evidence for crustal recycling as recorded by superdeep diamonds. *Earth Planet. Sci. Lett.* **432**, 374–380 (2015).
10. Stachel, T., Harris, J. W., Aulbach, S. & Deines, P. Kankan diamonds (Guinea) III: δ13C and nitrogen characteristics of deep diamonds. *Contrib. to Mineral. Petrol.* **142**, 465–475 (2002).
11. Ringwood, A. E. Composition of the upper mantle. in *Composition and petrology of the earth's mantle* 431 (1975).
12. Katsura, T. & Ito, E. Determination of Fe-Mg partitioning between perovskite and magnesiowüstite. *Geophys. Res. Lett.* **23**, 2005–2008 (1996).
13. Banas, A. Diamonds and their formation: Characterization of diamonds from the Buffalo Head Hills, Alberta, and, Metasomatism recorded by garnet inclusions from the De Beers Pool, South Africa. (2006).
14. Sobolev, N. V. *et al.* Morphology, inclusions and carbon isotopic composition of diamonds from the King George alluvial deposit and the Argyle lamproitic pipe, Western

Australia. *Russ Geol Geophys* **12**, 3–18 (1989).

15. Deines, P. & Harris, J. W. New insights into the occurrence of 13C-depleted carbon in the mantle from two closely associated kimberlites: Letlhakane and Orapa, Botswana. *Lithos* **77**, 125–142 (2004).

16. De Stefano, A., Kopylova, M. G., Cartigny, P. & Afanasiev, V. Diamonds and eclogites of the Jericho kimberlite (Northern Canada). *Contrib. to Mineral. Petrol.* **158**, 295–315 (2009).

17. Davies, R. M., Griffin, W. L., O'Reilly, S. Y. & Andrew, A. S. Unusual mineral inclusions and carbon isotopes of alluvial diamonds from Bingara, eastern Australia. *Lithos* **69**, 51–66 (2003).

18. Davies, R. *et al.* Diamonds from the deep: pipe DO-27, Slave Craton, Canada. *Int. Kimberl. Conf. Ext. Abstr.* **7**, 170–172 (1998).

19. Davies, R. M., Griffin, W. L., O'Reilly, S. Y. & Doyle, B. J. Mineral inclusions and geochemical characteristics of microdiamonds from the DO27, A154, A21, A418, DO18, DD17 and Ranch Lake kimberlites at Lac de Gras, Slave Craton, Canada. *Lithos* **77**, 39–55 (2004).

20. Tappert, R. The nature of diamonds and their mineral inclusions: A study on diamonds from the Panda (Canada) and Jagersfontein (South Africa) kimberlites and from placer deposits in Brazil. (2005).

21. Cartigny, P. *et al.* A mantle origin for Paleoarchean peridotitic diamonds from the Panda kimberlite, Slave Craton: Evidence from 13C-, 15N- and 33,34S-stable isotope systematics. *Lithos* **112**, 852–864 (2009).

22. Phillips, D., Harris, J. W. & Viljoen, K. S. Mineral chemistry and thermobarometry of

inclusions from De Beers Pool diamonds, Kimberley, South Africa. *Lithos* **77**, 155–179 (2004).

23. Wilding, M. C. Study of Diamonds Syngenetic Inclusions. (1990).
24. Aulbach, S. *et al.* Diamond formation episodes at the southern margin of the Kaapvaal Craton: Re-Os systematics of sulfide inclusions from the Jagersfontein Mine. *Contrib. to Mineral. Petrol.* **157**, 525–540 (2009).
25. Jaques, A. L., Sun, S. S. & Chappel, B. W. Geochemistry of the Argyle (AK1) lamproite pipe, Western Australia. *Geol. Soc. Aust. Spec. Publ.* **14**, (1989).
26. Davies, R. M., Griffin, W. L., O'Reilly, S. Y. & McCandless, T. E. Inclusions in diamonds from the K14 and K10 kimberlites, Buffalo Hills, Alberta, Canada: Diamond growth in a plume? *Lithos* **77**, 99–111 (2004).
27. Tappert, R. *et al.* Diamonds from Jagersfontein (South Africa): Messengers from the sublithospheric mantle. *Contrib. to Mineral. Petrol.* **150**, 505–522 (2005).
28. Palot, M., Cartigny, P., Harris, J. W., Kaminsky, F. V. & Stachel, T. Evidence for deep mantle convection and primordial heterogeneity from nitrogen and carbon stable isotopes in diamond. *Earth Planet. Sci. Lett.* **357**–**358**, 179–193 (2012).
29. Cartigny, P., Boyd, S., Harris, J. & Javoy, M. Nitrogen isotopes in peridotitic diamonds from Fuxian, China: the mantle signature. *Terra Nov.* **9**, 175–179 (1997).
30. Cartigny, P., Harris, J. W. & Javoy, M. Eclogitic diamond formation at Jwaneng: No room for a recycled component. *Science (80-. ).* **280**, 1421–1424 (1998).
31. Cartigny, P., Stachel, T., Harris, J. W. & Javoy, M. Constraining diamond metasomatic growth using C- and N-stable isotopes: Examples from Namibia. *Lithos* **77**, 359–373 (2004).

32. Palot, M., Cartigny, P. & Viljoen, F. Diamond origin and genesis: A C and N stable isotope study on diamonds from a single eclogitic xenolith (Kaalvallei, South Africa). *Lithos* **112**, 758–766 (2009).

33. Thomassot, E. *et al.* Metasomatic diamond growth: A multi-isotope study (13C, 15N, 33S, 34S) of sulphide inclusions and their host diamonds from Jwaneng (Botswana). *Earth Planet. Sci. Lett.* **282**, 79–90 (2009).

34. Shirey, S. B. *et al.* Archean emplacement of eclogitic components into the lithospheric mantle during formation of the Kaapvaal Craton. *Geophys. Res. Lett.* **28**, 2509–2512 (2001).

35. Donnelly, C. L., Stachel, T., Creighton, S., Muehlenbachs, K. & Whiteford, S. Diamonds and their mineral inclusions from the A154 South pipe, Diavik Diamond Mine, Northwest territories, Canada. *Lithos* **98**, 160–176 (2007).

36. Donnelly, C. The characterization of diamonds and their mineral inclusions from the Diavik Diamond Mine, Lac de Gras, Northwest Territories, Canada. (2006).

37. Shatsky, V. S., Zedgenizov, D. A., Ragozin, A. L. & Kalinina, V. V. Carbon isotopes and nitrogen contents in placer diamonds from the NE Siberian craton: implications for diamond origins. *Eur. J. Mineral.* **26**, 41–52 (2014).

38. Schulze, D. J., Coopersmith, H. G., Harte, B. & Pizzolato, L.-A. Mineral inclusions in diamonds from the Kelsey Lake Mine, Colorado, USA: Depleted Archean mantle beneath the Proterozoic Yavapai province. *Geochim. Cosmochim. Acta* **72**, 1685–1695 (2008).

39. Leost, I., Stachel, T., Brey, G. P., Harris, J. W. & Ryabchikov, I. D. Diamond formation and source carbonation: mineral associations in diamonds from Namibia. *Contrib. to Mineral. Petrol.* **145**, 15–24 (2003).

40. Laiginhas, F. A. T. P. Diamonds from the Ural Mountains : their characteristics and the mineralogy and geochemistry of their inclusions. PhD Thesis, University of Glasgow. (2008).

41. Kaminsky, F., Zakharchenko, O. & Griffin W. Diamond from the Guaniamo area, Venezuela. *Can. Mineral.* **38**, 1347–1370 (2000).

42. Jaques, A. L. *et al.* Composition of crystalline inclusions and C-isotopic composition of Argyle and Ellendale diamonds. *Kimberlites Relat. rocks* **2**, 966–989 (1989).

43. Pokhilenko, N. P., Sobolev, N. V., Reutsky, V. N., Hall, A. E. & Taylor, L. A. Crystalline inclusions and C isotope ratios in diamonds from the Snap Lake/King Lake kimberlite dyke system: Evidence of ultradeep and enriched lithospheric mantle. *Lithos* **77**, 57–67 (2004).

44. Kaminsky, F. V. *et al.* Superdeep diamonds from the Juina area, Mato Grosso State, Brazil. *Contrib. Miner. Pet.* **140**, 734–753 (2001).

45. Stachel, T., Banas, A., Muehlenbachs, K., Kurszlaukis, S. & Walker, E. C. Archean diamonds from Wawa (Canada): Samples from deep cratonic roots predating cratonization of the Superior Province. *Contrib. to Mineral. Petrol.* **151**, 737–750 (2006).

46. Palot, M. *et al.* The transition zone as a host for recycled volatiles: Evidence from nitrogen and carbon isotopes in ultra-deep diamonds from Monastery and Jagersfontein (South Africa). *Chem. Geol.* **466**, 733–749 (2017).

47. Palot, M., Pearson, D. G., Stern, R. A., Stachel, T. & Harris, J. W. Isotopic constraints on the nature and circulation of deep mantle C-H-O-N fluids: Carbon and nitrogen systematics within ultra-deep diamonds from Kankan (Guinea). *Geochim. Cosmochim. Acta* **139**, 26–46 (2014).

48. Appleyard, C. M., Viljoen, K. S. & Dobbe, R. A study of eclogitic diamonds and their inclusions from the Finsch kimberlite pipe, South Africa. *Lithos* **77**, 317–332 (2004).

49. Aulbach, S. The chemistry of syngenetic mineral inclusions in diamonds from Venetia and the stable isotope composition of diamonds from Mwadui and the Kankan district. (Universitat Frankfurt, Frankfurt, 1999).

50. Chinn, I. L. A study of unusual diamonds from the George Creek K1 kimberlite dyke, Colorado. **1**, (University of Cape Town, 1995).

51. Daniels, L. R. M. & Gurney, J. J. Diamond Inclusions from the Dokolwayo Kimberlite, Swaziland. *Proc. 7th int. Kimberl. Conf.* 134–142 (1999).

52. Mc Kenna, N., Gurney, J. J., Klump, J. & Davidson, J. M. Aspect of diamond mineralisation and distribution at the Helam Mine, South Africa. *Lithos* **77**, 193–208 (2004).

53. McDade, P. & Harris, J. W. Multiple diamond sources at the Kalahari Craton Margin: Letseng-la-terai, Lesotho. in *Goldschmidt Conference Heidelberg* 1 (1996).

54. Meyer, H. O. A., Zhang, A. N. D. I., Milledge, H. J. & Mendelssohn, M. J. Diamonds and mineral inclusions in diamonds from Shandong and Liaoning province, China. *Diamonds Charact. Genes. Explor. CPRM Spec. Publ. B 1* 98–105 (1994).

55. Misra, K. C., Anand, M., Taylor, L. A. & Sobolev, N. V. Multi-stage metasomatism of diamondiferous eclogite xenoliths from the Udachnaya kimberlite pipe, Yakutia, Siberia. *Contrib. to Mineral. Petrol.* **146**, 696–714 (2004).

56. Moore, R. O. & Gurney, J. J. Mineral inclusions in diamond from Monastery kimberlite, South Africa. in *Kimberlites and related rocks* 1041 (1989).

57. Nestola, F. *et al. In situ* analysis of garnet inclusion in diamond using single-crystal X-ray

diffraction and X-ray micro-tomography. *Eur. J. Mineral.* **24**, 599–606 (2012).

58. Otter, M. L., and J. J. G. Mineral inclusions in diamonds from the Sloan diatremes, Colorado-Wyoming State Line kimberlite district, North America. in *Kimberlites and related rocks* 1042–1053 (1989).

59. Richardson, S. H., Shirey, S. B. & Harris, J. W. Episodic diamond genesis at Jwaneng, Botswana, and implications for Kaapvaal craton evolution. *Lithos* **77**, 143–154 (2004).

60. Zedgenizov, D. A., Kagi, H., Shatsky, V. S. & Sobolev, N. V. Carbonatitic melts in cuboid diamonds from Udachnaya kimberlite pipe (Yakutia): evidence from vibrational spectroscopy. *Mineral. Mag.* **68**, 61–73 (2004).

61. Sobolev, N. V., Sobolev, V. N., Snyder, G. A., Yefimova, E. S. & Taylor, L. A. Significance of Eclogitic and Related Parageneses of Natural Diamonds. *Int. Geol. Rev.* **41**, 129–140 (1999).

62. Stachel, T. & Harris, J. W. Syngenetic inclusions in diamond from the Birim field (Ghana) - a deep peridotitic profile with a history of depletion and re-enrichment. *Contrib. to Mineral. Petrol.* **127**, 336–352 (1997).

63. Tappert, R., Stachel, T., Harris, J. W., Shimizu, N. & Brey, G. P. Mineral inclusions in diamonds from the Panda kimberlite, Slave province, Canada. *Eur. J. Miner.* **17**, 423–440 (2005).

64. Tappert, R. *et al.* Subducting oceanic crust: The source of deep diamonds. *Geology* **33**, 565–568 (2005).

65. Viljoen, F., Dobbe, R., Harris, J. & Smit, B. Trace element chemistry of mineral inclusions in eclogitic diamonds from the Premier (Cullinan) and Finsch kimberlites, South Africa: Implications for the evolution of their mantle source. *Lithos* **118**, 156–168

(2010).

66. Westerlund, K. J. & Gurney, J. J. Silicate and oxide inclusion characteristics and infra-red absorption analysis of diamonds from the Klipspringer kimberlites, South Africa. *South African J. Geol.* **107**, 131–146 (2004).

67. Wilding, M. C., Harte, B., Fallick, A. E. & Harris, J. W. Inclusion chemistry, carbon isotopes and nitrogen distribution in diamonds from the Bultfontein Mine, South Africa. *Diamonds Charact. Genes. Explor. CPRM Spec Publ Jan/94* 116–126 (1994).

68. Sobolev, N. V. *et al.* Mineral inclusions in the diamonds of arkhangelsk kimberlite province. *Geol. i Geofiz.* 358–370 (1997).

69. Smith, C. B. *et al.* Nature and genesis of Kalimantan diamonds. *Lithos* **112**, 822–832 (2009).

70. Tappert, R., Stachel, T., Harris, J. W., Muehlenbachs, K. & Brey, G. P. Placer Diamonds from Brazil: Indicators of the Composition of the Earth's Mantle and the Distance to Their Kimberlitic Sources. *Econ. Geol.* **101**, 453–470 (2006).

71. Stachel, T., Harris, J. W. & Brey, G. P. Rare and unusual mineral inclusions in diamonds from Mwadui, Tanzania. *Contrib. Miner. Pet.* **132**, 34–47 (1998).

72. Stachel, T., Viljoen, K. S., McDade, P. & Harris, J. W. Diamondiferous lithospheric roots along the western margin of the Kalahari Craton?the peridotitic inclusion suite in diamonds from Orapa and Jwaneng. *Contrib. to Mineral. Petrol.* **147**, 32–47 (2004).

73. Harris, J. W., Stachel, T., Léost, I. & Brey, G. P. Peridotitic diamonds from Namibia: constraints on the composition and evolution of their mantle source. *Lithos* **77**, 209–223 (2004).

74. Kopylova, M. G., Gurney, J. J. & Daniels, L. R. M. Mineral inclusions in diamonds from

the River Ranch kimberlite, Zimbabwe. *Contrib. to Mineral. Petrol.* **129**, 366–384 (1997).

75. Kaminsky, F. V. & Khachatryan, G. K. Characteristics of nitrogen and other impurities in diamond, as revealed by infrared absorption data. *Can. Miner.* **39**, 1733–1745 (2001).

76. Harris, J. W. The Physical Characteristics and Syngenetic Inclusion Geochemistry of Diamonds from Pipe 50, Liaoning Province, People's Republic of China. *Proc. Int. Kimberl. Conf.* **2**, 106–115 (1994).

77. Wang, W. & Gasparik, T. Metasomatic clinopyroxene inclusions in diamonds from the Liaoning Province, China. *Geochim. Cosmochim. Acta* **65**, 611–620 (2001).

78. Stachel, T., Harris, J. W., Tappert, R. & Brey, G. P. Peridotitic diamonds from the Slave and the Kaapvaal cratons - similarities and differences based on a preliminary data set. *Lithos* **71**, 489–503 (2003).

79. Van Rythoven, A. D. *et al.* Diamond crystals and their mineral inclusions from the Lynx kimberlite dyke complex, central Quebec. *Can. Mineral.* **49**, 691–706 (2011).

80. Sobolev, N. V. *et al.* Petrogenetic significance of minor elements in olivines from diamonds and peridotite xenoliths from kimberlites of Yakutia. *Lithos* **112**, 701–713 (2009).

81. Sobolev, N. V. *et al.* Mineral inclusions in microdiamonds and macrodiamonds from kimberlites of Yakutia: a comparative study. *Lithos* **77**, 225–242 (2004).

82. Logvinova, A., Taylor, L. A., Sovolev, N. V. & Floss, C. Eclogitic Diamond Inclusions from the Komsomolskaya Pipe, Yakutia. in *American Geophysical Union, Fall Meeting* **V41E-1515**, (2005).

83. Sobolev, N. V., Pokhilenko, N. P., Lavrent'ev, Y. G. & Yefimova, E. S. Deep-seated xenoliths, xenocrysts in kimberlites and crystalline inclusions in diamonds from

'Udachnaya' kimberlite pipe, Yakutia. in *International Kimberlite Conference: Extended Abstracts. Vol 2.* (2019). doi:10.29173/ikc1038

84. Viljoen, K. S., Harris, J. W., Ivanic, T., Richardson, S. H. & Gray, K. Trace element chemistry of peridotitic garnets in diamonds from the Premier (Cullinan) and Finsch kimberlites, South Africa: Contrasting styles of mantle metasomatism. *Lithos* **208**, 1–15 (2014).

85. Hunt, L., Stachel, T., McCandless, T. E., Armstrong, J. & Muelenbachs, K. Diamonds and their mineral inclusions from the Renard kimberlites in Quebec. *Lithos* **142**–**143**, 267–284 (2012).

86. Miller, C. E., Kopylova, M. G. & Ryder, J. Vanished diamondiferous cratonic root beneath the Southern Superior province: evidence from diamond inclusions in the Wawa metaconglomerate. *Contrib. to Mineral. Petrol.* **164**, 697–714 (2012).

87. Stachel, T., Brey, G. P. & Harris, J. W. Kankan diamonds (Guinea) I: from the lithosphere down to the transition zone. *Contrib. to Mineral. Petrol.* **140**, 1–15 (2000).

88. Barashkov, Y. P. & Zudin, N. G. Composition of garnets with diamond inclusions from krasnopresnenskaya kimberlite pipe (Yakutia). *Geol. i Geofiz.* 353–357 (1997). doi:10.29173/ikc1770