Micro-windows into Earth's subduction flux from diamonds

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While diminuitive in size, solid and fluid inclusions within diamonds trap pristine chemical information about the time-integrated effects of subduction cycling throughout ~700 km of Earth's mantle. Sub-micron fluid inclusions within lithospheric diamonds reveal a spectrum of trace element and Sr-Nd-Pb isotope diversity that probably reflects the subduction cycling of lithophile elements from ancient crustal materials [1]. A vivid illustration of the link between oceanic crust and diamond-forming fluids is seen in fluid-rich diamonds from the Slave craton. Saline diamond fluids - high in Cl and K - from the Ekati mine are characterised by positive Eu and Sr anomalies that provide a powerful link to their origin from a recycled oceanic slab protolith. $^{87}Sr/^{86}Sr$ ratios of the saline fluids indicate derivation from Mesozoic seawater. The fluid evolution trends in the Ekati diamonds are consistent with saline fluids being primary agents for metasomatic change in the lithosphere via expulsion from a closely underlying subducted slab. Such fluids, if un-buffered by peridotitic mantle, may contribute to the striking oxygen isotope variability recently seen in eclogitic diamond inclusions from southern Africa [2] which confirm a link between eclogitic diamond formation and altered oceanic crust. Deeper-derived, sub-lithospheric diamonds containing majorite garnet also have been shown to have clear subducted slab protolith signatures, evident from their elevated $\delta^{18}O$ characteristics [3]. This link with the oceanic crust is further evident in the mineralogical, trace element and C isotopic complexity of super-deep diamonds, originating from the mantle transition zone to lower mantle [4, 5, 6]. Finally, the water content of parts of the peridotitic transition zone as shown by ringwoodite in diamond [7] may reflect the subduction of water and its subsequent thermally controlled solubility during slab maturation and dehydration.

[1] Klein-BenDavid *et al.* (2014) *GCA* **125**, 146-169. [2] Ickert *et al.* (2013) *EPSL* **364**, 85-97. [3] Ickert et al., (submitted) [4] Walter *et al.* (2011) *Science* **334**, 54-57. Thomson *et al.* (2014) *CMP* **168**, 1081. [5] Palot *et al.* – this conference. [6] Stachel *et al.* (2005) *Elements* **1**, 73-78. [7] Pearson *et al.* (2014) *Nature* **507**, 221-224.