Another present from the very deep Earth: ringwoodite and zirconia in super-deep diamonds

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Natural diamonds and their inclusions provide unique glimpses of mantle processes from as deep as ~800 km and dating back to 3.5 G.y. Once formed, diamonds are commonly interpreted to travel upward (slowly or very rapidly). Instead, here we report the finding of an unprecedented composite inclusion in an African super-deep diamond consisting of ringwoodite [γ-(Mg,Fe2)SiO4] (the second finding to date), tetragonal zirconia (ZrO2), and coesite (SiO2). We interpret zirconia + coesite and ringwoodite as prograde transformation products after zircon or reidite (ZrSiO4) and olivine [α-(Mg,Fe2)SiO4] or wadsleyite [β-(Mg,Fe2)SiO4], respectively. This inclusion assemblage can be explained if the diamond travelled downward after entrapping olivine/wadsleyite + zircon/reidite, dragged down by a subducting slab, before being delivered to the surface. This indicates that the commonly assumed view that diamonds form at, and capture material from, a specific mantle level and then travel upward is probably too simplistic.