

## Diamonds from the deep

The oxidation state of Earth's silicate-rich mantle has had a profound effect on our planet's evolution, including core–mantle differentiation, mineral formation, and the distribution and availability of carbon, hydrogen, and oxygen. Most measurements derive from the highly oxidized upper mantle, yet theory and experiments suggest that the deep mantle should include chemically reduced regions and metallic iron alloys. Now Evan Smith of the Gemological Institute of America and colleagues report that a certain class of large gem-quality diamonds—including the 3106-carat Cullinan, the largest ever found—provides direct verification of those predictions: metallic

inclusions of a solidified mixture of iron, nickel, carbon, and sulfur.

The inclusions, like this 0.3 mm one from a 5-carat diamond, are silvery in appearance, have black graphitic cracks extending from them, and sometimes are surrounded by a thin layer of methane or hydrogen. They indicate that the diamonds precipitated from pockets of metallic liquid, a sign of reducing conditions. Other mineral inclusions place those pockets at depths of 360–750 km, a range that spans the transition region between the upper and lower mantle and is much deeper than where most other gem-quality diamonds form. (E. M. Smith et al., *Science* **354**, 1403, 2016.)

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