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**Nature and origin of diamond in Almahatta Sitta
Ureilite Ms-170**

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We report the occurrence and nature of diamond in Almahatta Sitta ureilite, and discuss its possible origin. We report the first meteoritic occurrence of many diamonds having hexahedron- or octahedron-like habits, which corresponds to {001} or {111} of diamond single crystals, respectively, albeit not always idiomorphic. TEM images and EBSD analysis show that most diamonds are uniquely large single crystals ($> \sim 100 \mu\text{m}$). No specific crystallographic orientation between graphite and diamond is found. The isotopic distribution images obtained by NanoSIMS show sector zoning, heterogeneous nitrogen abundance and $\delta^{13}\text{C}$ among individual diamonds and even within FIB slices of single crystals. They reflect crystal sector zoning. Idiomorphic single diamonds did not form from graphite through martensitic phase transformation mechanism by a dynamic event. Rather likely the diamonds formed by chemical vapor deposition (CVD) process in the solar nebula (or formed from a fluid at the deep interior of a large ureilite parent-body). Deformation textures induced by a later dynamic event were observed by TEM in diamonds.

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Cite abstract as:

Miyahara, M.M., Ohtani, E.O., El Goresy, A.El.G., Lin, Y.T.L., et al. (2012) Nature and origin of diamond in Almahatta Sitta Ureilite Ms-170. Paneth Kolloquium, Nördlingen (Germany), abstract URL: <http://www.paneth.eu/PanethKolloquium/2012/0136.pdf> (abstract #0136).