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Earliest condensate assemblages in EL3 fragments of Almahata Sitta TC_3 asteroid: REE patterns of oldhamite and C- and N-isotopic compositions of Si_2N_2O and graphite by NanoSIMS 50 L.

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Origin of primitive EH3 and EL3 chondrites is controversially debated: (1) solar condensates with distinct REE patterns of oldhamite (CaS) reflecting REE abundances and isotopic signatures of source solar reservoirs, or (2) an unconstrained model of "*impact melting*" of preexisting proto-asteroids. We report a clear evidence for distinct REE patterns of oldhamite indicating REE frationated source solar reservoirs. We deduce a meaningfull condensation sequence as: Oldhamite→ sinoite→ graphite→ enstatite and report C- and N-isotopic compositions of graphite and sinoite, respectively in EL3 asteroid fragments MS-17 and MS-177. $\delta^{13}C$ of graphite in MS-17 ranges from -33.5 to -26.5‰, whereas $\delta^{13}C$ in MS-177 is heavier, it varies from +20.1 to +24.7‰. $\delta^{15}N$ in graphite in MS-17 ranges from +11.2 to +54.3‰. $\delta^{15}N$ in MS-177 graphite is also heavier: It varies from +42.2 to +87.6‰. $\delta^{15}N$ in sinoite in MS-17 is -24.9±15‰. An origin of EL3 by impact melting is clearly discrepant with our results.

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