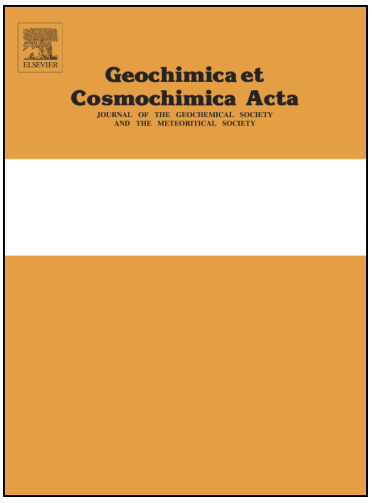

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BONANZA: AN EXTREMELY LARGE DUST GRAIN FROM A SUPERNOVA

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ABSTRACT

We report the morphology, microstructure, and isotopic composition of the largest SiC stardust grain known to have condensed from a supernova. The 25-μm diameter grain, termed Bonanza, was found in an acid-resistant residue of the Murchison meteorite. Grains of such large size have neither been observed around supernovae nor predicted to form in stellar environments. The large size of Bonanza has allowed the measurement of the isotopic composition of more elements in it than any other previous presolar grain, including: Li, B, C, N, Mg, Al, Si, S, Ca, Ti, Fe, and Ni. Bonanza exhibits large isotopic anomalies in the elements C, N, Mg, Si, Ca, Ti, Fe, and Ni typical of an astrophysical origin in ejecta of a Type II core-collapse supernova and comparable to those previously observed for other presolar SiC grains of type X. Additionally, we extracted multiple focused ion beam lift-out sections from different regions of the grain. Our transmission electron microscopy demonstrates that the crystalline order varies at the micrometer scale, and includes rare, higher order polytype domains (e.g., 15R). Analyses with STEM-EDS show Bonanza contains a heterogeneous distribution of subgrains with sizes ranging from < 10

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