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**Carbonaceous biosignatures of diverse chemotrophic microbial communities
from chert nodules of the Ediacaran Doushantuo Formation**

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ABSTRACT

The Ediacaran Doushantuo Formation (DST) is renowned for exceptionally preserved Precambrian fossils including metazoans. Some of these fossils, particularly microfossils such as multicellular algae and acanthomorphic acritarchs, are preserved in DST chert nodules. To better understand the geomicrobiological processes that contributed to the authigenic formation of DST chert nodules and facilitated exceptional fossil preservation, we analyzed organic matter in these chert nodules and the surrounding matrix (calcareous mudstone) using multiple in-situ techniques: confocal laser Raman spectroscopy, micro-Fourier transform infrared spectroscopy (FTIR), and secondary ion mass spectroscopy (SIMS). We found strong ultrastructural, chemical, and isotopic heterogeneities in the organic matter as indicated by the

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