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The intriguing character of the macromolecular organic matter from ungrouped C2 WIS91600

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Insight into the chemical history of an ungrouped type 2 carbonaceous chondrite meteorite, Wisconsin Range (WIS) 91600, is gained through molecular analyses of insoluble organic matter (IOM) using solid-state ^{13}C nuclear magnetic resonance (NMR) spectroscopy, X-ray absorption near edge structure spectroscopy (XANES), and pyrolysis gas chromatography coupled with mass spectrometry (pyr-GC/MS), and our previous bulk elemental and isotopic data. The IOM from WIS 91600 exhibits similarities in its abundance and bulk d^{15}N value with IOM from another ungrouped carbonaceous chondrite Tagish Lake, while it exhibits H/C, d^{13}C, and dD values that are more similar to IOM from the heated CM, Pecora Escarpment (PCA) 91008. The ^{13}C NMR spectra of IOM of WIS 91600 and Tagish Lake are similar, except for a greater abundance of CHxO species in the latter and sharper carbonyl absorption in the former. Unusual cross-polarization (CP) dynamics is observed for WIS 91600 that indicate the presence of two physically distinct organic domains, in which the degrees of aromatic condensation are distinctly different. The presence of two different organic domains in WIS 91600 is consistent with its brecciated nature. The formation of more condensed aromatics is the likely result of short duration thermal excursions during impacts. The fact that both WIS 91600 and PCA 91008 were subjected to short duration heating that is distinct from the thermal history of type 3 chondrites is confirmed by Carbon-XANES. Finally, after being briefly heated (400 degrees C for 10 s), the pyrolysis behavior of Tagish Lake IOM is similar to that of WIS 91600 and PCA 91008. We conclude that WIS 91600 experienced very moderate, short duration heating at low temperatures (less than 500 degrees C) after an episode of aqueous alteration under conditions that were similar to those experienced by Tagish Lake.

Keywords: macromolecular organic matter, ungrouped carbonaceous chondrite, metamorphosed CM, shock heating, WIS 91600, Tagish Lake