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Diverse microfossils and taphonomic windows in the Cryogenian non-glacial interlude Ikiakpuk Group of the Brooks Range, Alaska

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The recovery of the biosphere following the Cryogenian Sturtian Glaciation is an active area of study and relies on the still emerging Neoproterozoic fossil record. In addition to identifying microfossils from this interval, it is important to understand the taphonomic processes and biases that may skew our perspectives on those ancient communities. Past studies that investigated carbonates from the Cryogenian non-glacial interlude have uncovered microfossil assemblages that include bacterial and eukaryotic microfossils. One of these carbonate deposits – the Ikiakpuk Group in the Brooks Range of Alaska – preserves pyritized *Obruchevella*, a cyanobacterial fossil. However, only a few samples from this group have been studied, and pyritized *Obruchevella* are the only fossils yet identified. We hypothesize that the microbiota in this environment may have been more diverse than previously thought and that *Obruchevella* represent an organism-specific taphonomic window and bias related to their physiology or biochemistry. In order to test this hypothesis and better constrain the microfossil diversity and taphonomic window(s) throughout the Ikiakpuk Group, we investigate five previously studied and five new samples from this deposit. Using acid maceration, we identified and isolated additional specimens of helically-coiled *Obruchevella* and a variety of previously uncharacterized structures with distinct morphologies. Through light microscopy and scanning electron microscopy (SEM) with energy dispersive x-ray spectroscopy (EDS), we have discovered three additional putative fossil morphotypes: 1) spherical walled structures with a concave edge, 2) spherical walled structures with a tapered edge, and 3) elongated walled structures. Unlike pyritized *Obruchevella*, these new morphotypes are preserved by phosphate, iron oxides, and aluminosilicates, and all of these taphonomic modes can be found within the same sample. These results establish a greater microfossil diversity in the Ikiakpuk Group assemblage that may include both eukaryotic and bacterial organisms. The different modes of preservation within individual samples point to potential organisms-specific taphonomic windows that may relate to microbial physiology, ecosystem dynamics, and/or ambient environmental conditions. Further research on these assemblages of the Ikiakpuk Group will enable us to constrain both the local microbiota and ecology while adding to our global understanding of biosphere recovery during the Cryogenian non-glacial interlude.