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## Chemical and structural analysis of proposed ca. 3.7 Ga stromatolites from the Isua Supracrustal Belt (West Greenland) - a reappraisal

Mike Zawaski<sup>1</sup>, Nigel Kelly<sup>1,2</sup>, Omero Felipe Orlandini<sup>1,3</sup>, Claire Nichols<sup>4</sup>, Abigail Allwood<sup>5</sup>, and **Stephen Mojzsis**<sup>1,6</sup>

<sup>1</sup>University of Colorado, CRiO, Geological Sciences, Boulder, CO 80309, United States of America

<sup>2</sup>Bruker Nano Analytics, Bruker Nano Analytics, Am Studio 2D, 12489 Berlin, Germany

<sup>3</sup>Department of Geological Sciences, University of Texas at Austin, 2275 Speedway Stop C9000, Austin, TX 78712, United States of America

<sup>4</sup>Department of Earth, Atmospheric, and Planetary Sciences, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA 02139, United States of America

<sup>5</sup>NASA Jet Propulsion Laboratory, 4800 Oak Grove Drive, Pasadena, CA 91109, United States of America

<sup>6</sup>Institute for Geological and Geochemical Research, Research Centre for Astronomy and Earth Sciences, Hungarian Academy of Sciences, 45 Budaörsi Street, H-1112 Budapest, Hungary

The biogenicity of proposed stromatolites from deformed greenschist/amphibolite facies Eoarchean (ca. 3.71 Ga) rocks of the Isua Supracrustal Belt (ISB) in West Greenland, is debated [1,2; cf. 3]. To assess their promise as primary sedimentary structures – as opposed to artefacts of strain localization in layered ductile rocks – we report new field mapping at the discovery site of Nutman et al. (2016) to guide micro- and macro-structural investigations and geochemical sampling. Discontinuous field relations preclude confident assignment of these outcrops as being structurally overturned as originally argued. The structures are not deformed conical stromatolites, but instead linear inverted ridges aligned with azimuths of local and regional fold axes, and parallel to linear structures. Combined major element (e.g., Ca, Mg, Si) scanning  $\mu$ XRF maps, and electron back-scattered diffraction (EBSD) patterns on fresh surfaces cut perpendicular and parallel to the ridges show that the structures lack any internal laminae. Seeming internal layering previously inferred for these features instead arises from variable weathering of outcrop surfaces that otherwise conceal structureless quartz  $\pm$  dolomite granoblastic cores. These asymmetric boudins sit between semi-continuous competent layers of enveloping quartzite in a calc-silicate schist. Boudinage fabrics reflect viscosity contrasts of the different ductile layers during deformation, and are thus not of primary origin. Collectively, our results show that such structures were probably never stromatolites, but are instead the expected result of a tectonic fabric that preserves no fine-scale primary sedimentary structure.

[1] Nutman, A.P. et al. 2016, Rapid emergence of life shown by discovery of 3,700-million-year-old microbial structures: *Nature*, v. 537, p. 535–538; [2] Nutman, A.P. et al., 2019, Cross-examining Earth's oldest stromatolites: Seeing through the effects of heterogeneous deformation,

metamorphism and metasomatism affecting Isua (Greenland) 3700-Ma sedimentary rocks: Precambrian Research, v. 331, p. 105347; [3] Allwood, A.C. et al. 2018, Reassessing evidence of life in 3,700-million-year-old rocks of Greenland: Nature, doi: 10.1038/s41586-018-0610-4.