Morphotype disparity in the Precambrian

R. L. Moore\textsuperscript{1,4}, J. Reitner\textsuperscript{2}, M. D. Baiser\textsuperscript{3}, P. C. J. Donoghue\textsuperscript{1}, B. E. Schirrmieister\textsuperscript{1}

\textsuperscript{1} Palaeobiology, School of Earth Sciences, Life Science Building, University of Bristol, UK
\textsuperscript{2} Department of Geobiology, Centre for Geosciences, Faculty of Geosciences and Geography, Georg-August-University of Goettingen, Germany
\textsuperscript{3} Department of Earth Sciences, University of Oxford, UK
\textsuperscript{4} Current address: Insitut de Physique du Globe de Paris, France: moore@ipgp.fr

Introduction
Prokaryotes have dominated life on Earth for >2 billion years often acting as biological impetus to prompt environmental changes. However, microbes from the Precambrian are poorly preserved and thus little is known about ancient communities. In order to better understand how these communities changed throughout the Precambrian we examined spheroidal microfossils from three different deposits for changes in size, abundance and biovolume. We used light microscopy and Synchrotron Radiation X-ray Tomographic Microscopy\textsuperscript{1} to perform novel analyses on these microbial remains to assess how these three factors varied throughout this period of Earth’s history.

Materials
Strelley Pool, Australia—3.45 Ga
Gunflint Chert, Canada—2.1 Ga
Rasthof Cap Carb, Namibia—650 Ma

Methods
Light Microscopy
Synchrotron Radiation X-ray Tomographic Microscopy (SRXTM)

Biovolume calculations:
Biovolume was calculated using a combination of diameter measurements and abundance counts. The calculations used the following assumptions:
1. The shape of a spherical microfossil is that of a perfect sphere
2. A random sampling of 100 diameter measurements accurately represents size distribution
3. 4 abundance counts in 4 separate rock regions accurately represent microfossil abundance

Results

- Cell abundance decreased towards the end of the Precambrian
- Biovolume remained relatively constant (0.17% Strelley, 0.17% Gunflint, 0.16% Rasthof)
- Size and disparity increased through time

Discussion and Conclusions
Consistent biovolumes found through time with negative correlation between large cell size and abundance potentially indicates that microfossils grew in a nutrient limited system.

The observed increase in cell size and the corresponding decrease in surface to volume ratio may be attributed to selective factors such as increased motility in response to predation\textsuperscript{2,3}.

Size increase may also be linked to preservational bias. With smaller prokaryotes having been predated by grazers\textsuperscript{3,4}.

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