

# SMALL SHELLY FOSSILS: A new approach to calculating Cambrian ocean temperatures?



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## 1. Background

Most modern animal phyla appear in the fossil record of the Cambrian Period, ~541–485 million years ago (Ma). But the marine environment of this important interval in Earth's biological history is poorly constrained. Temperatures throughout the rest of the Palaeozoic are now quite well-known, but there are no reliable data for the Cambrian Period (Fig. 1).

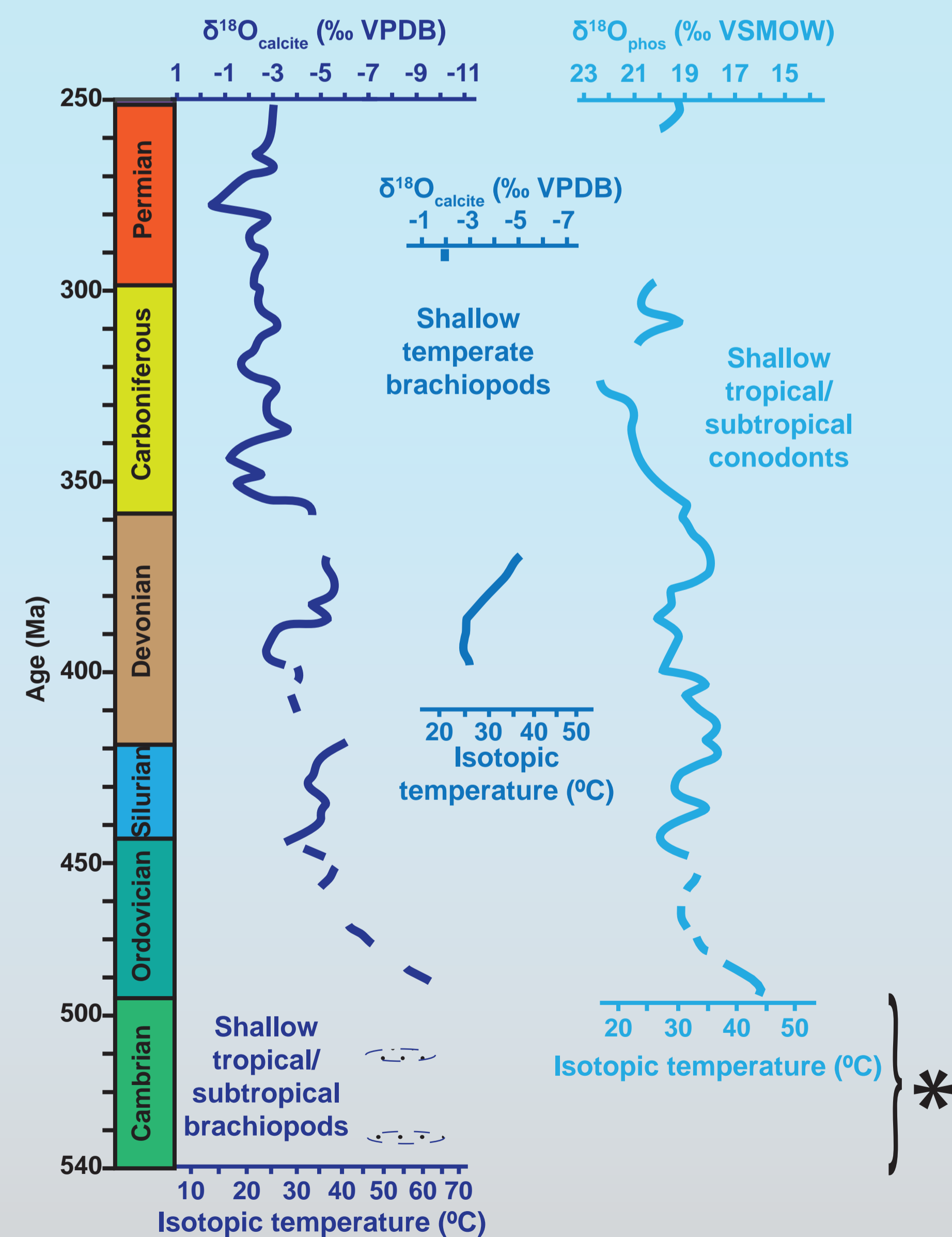


Fig.1. Isotopic temperatures for the Palaeozoic Era. \*Note the death of Cambrian data. Simplified after Grossman (2012).

## 2. Research Questions

1. Do Cambrian 'small shelly fossils' preserve ancient environmental proxy data (in skeletal  $\delta^{18}\text{O}$ ).
2. Can we use this to find Cambrian sea temperatures?
3. Can a wider range of phosphatic fossils be used to investigate past climates?

## 3. Small Shelly Fossils (SSFs)

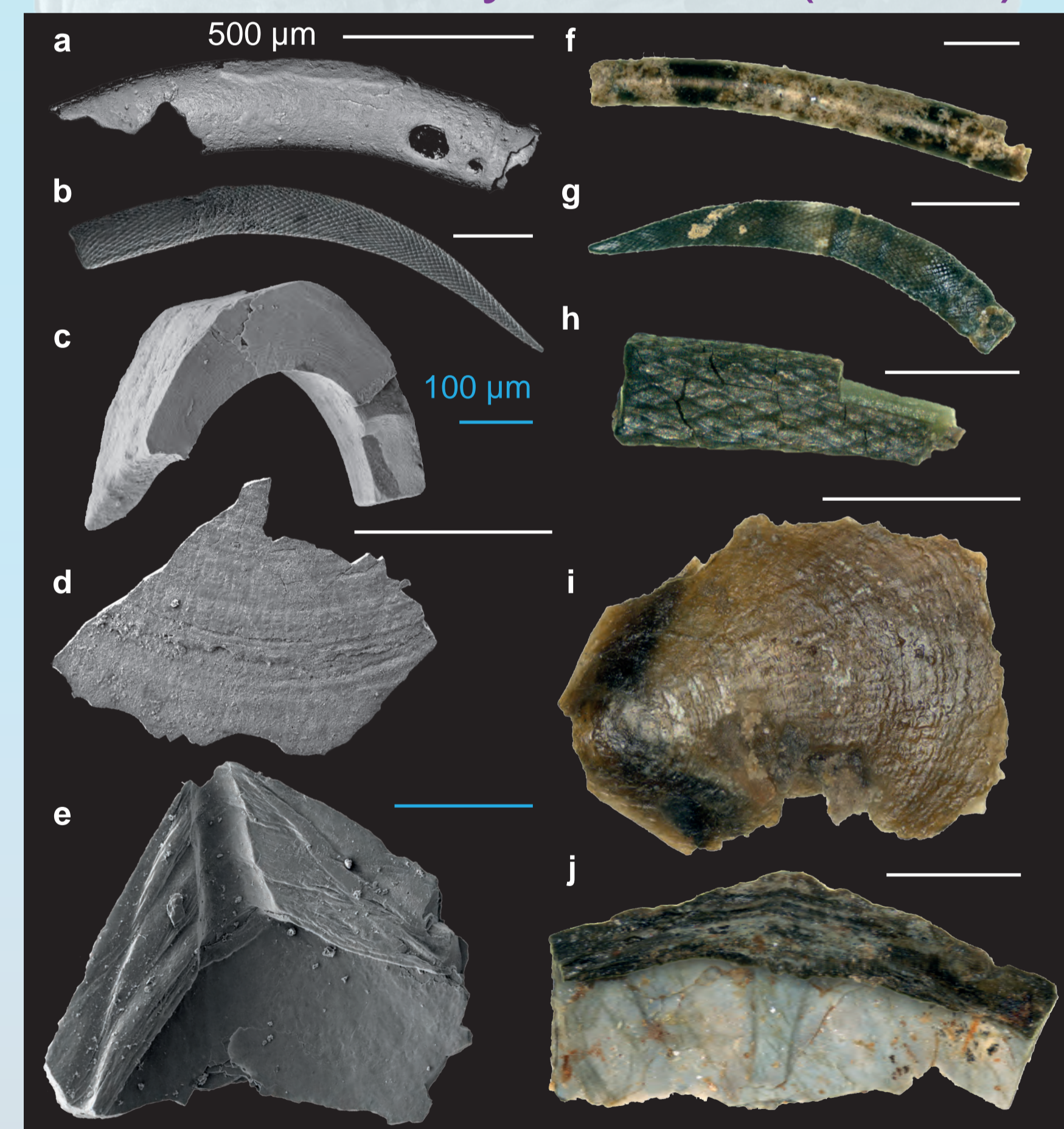


Fig.2. SSFs from the Comley Limestone. (a-e) SEM images; (f-j) IFM images. (a,f) *Hyolithellus*; (b,g,h) *Rhombocorniculum*; (c) *Torelrella*; (d,e,i,j) lingulid brachiopods.

SSFs come in a variety of shapes, belong to at least 6 animal phyla and are made of carbonate, silica or phosphate (Fig. 2). Here we investigate well-preserved SSFs from the recently dated Lower Comley Limestone Formation, Shropshire (Harvey et al., 2011).

## 4. Preservation

Before being analysed for palaeotemperature data, the SSFs must be shown to preserve original biological chemical data. Initial preservation tests suggest that at least some of the material is very well preserved (Fig. 3).

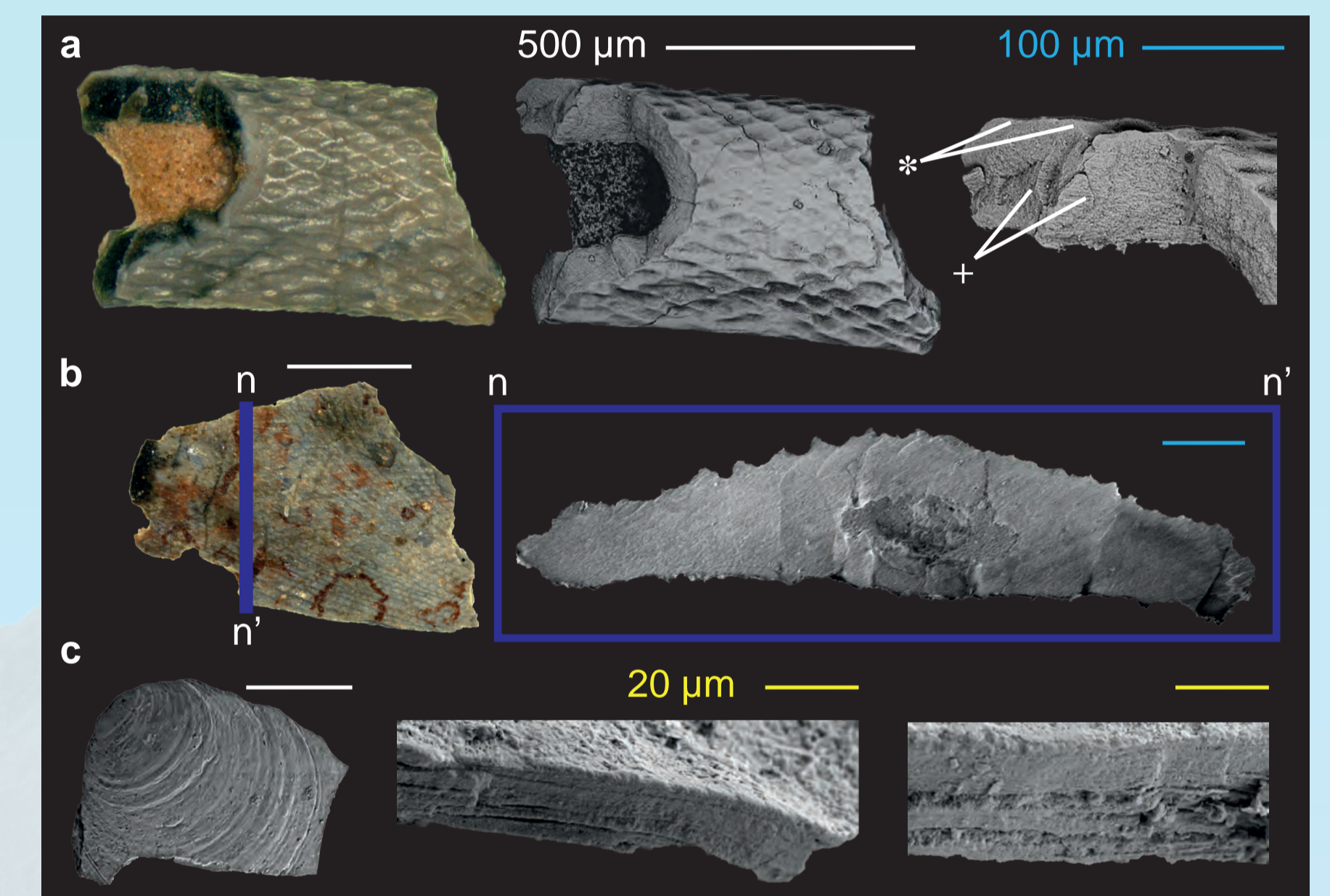


Fig.3. Colour may relate to phosphate ultrastructure (a, b). (\*)massive, recrystallised; (+)prismatic, original. Original laminae preserved in lingulid brachiopods, fractured specimen

## 5. Research in Context

- Environmental explanations have been involved for Cambrian big biological and evolutionary questions, but the environment is not yet well-understood.
- Methods developed during through this work will help improve the reliability of of phosphate oxygen as an environmental proxy, in both 'deep'and 'recent' time.

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Grossman, E. L. 2012: in Gradstein F. M., et al., *The Geologic Timescale*, 181–206.

Harvey T. H. P. et al., 2011: *J. Geol. Soc.* 168, 705–716.