Climatic constraints on Cambrian palaeogeography

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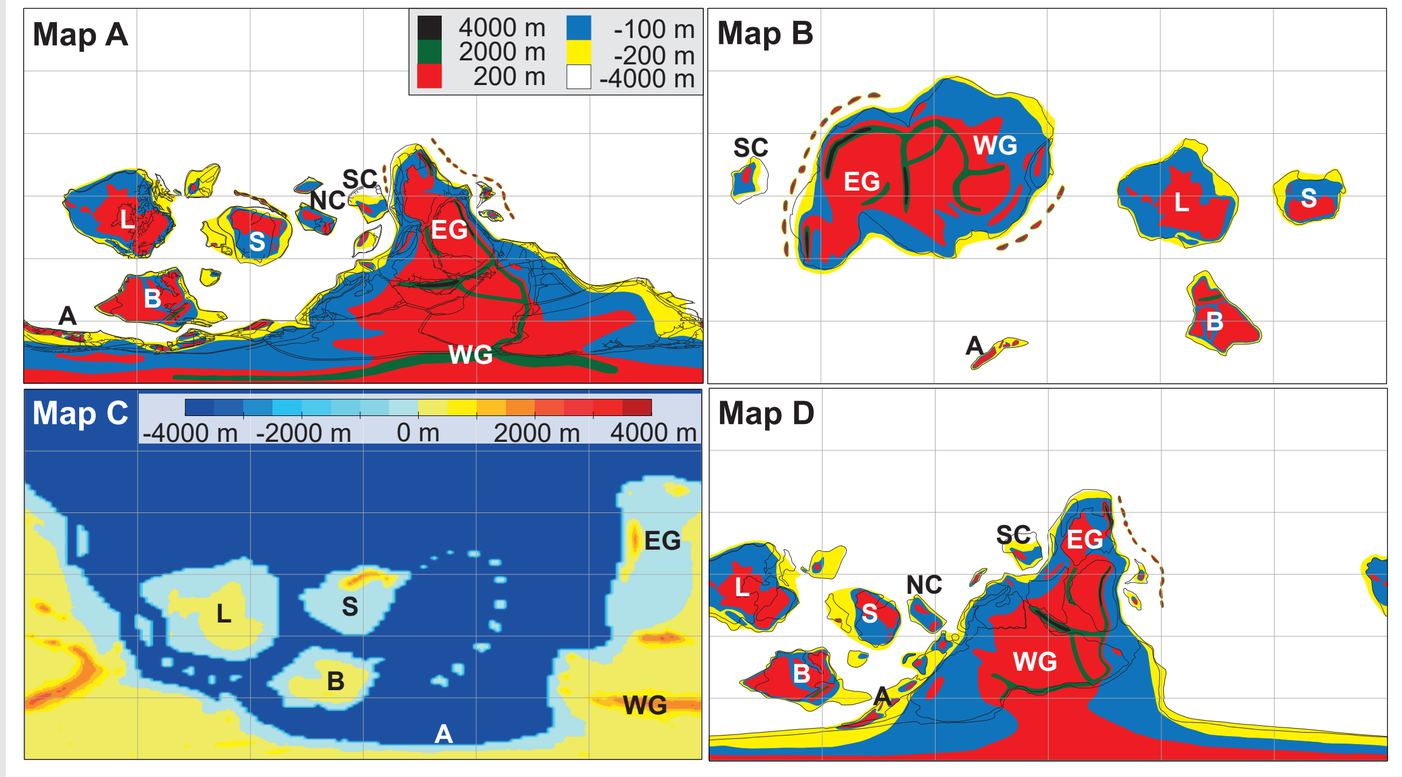
1. Rationale: Divergent Cambrian palaeocontinental configurations

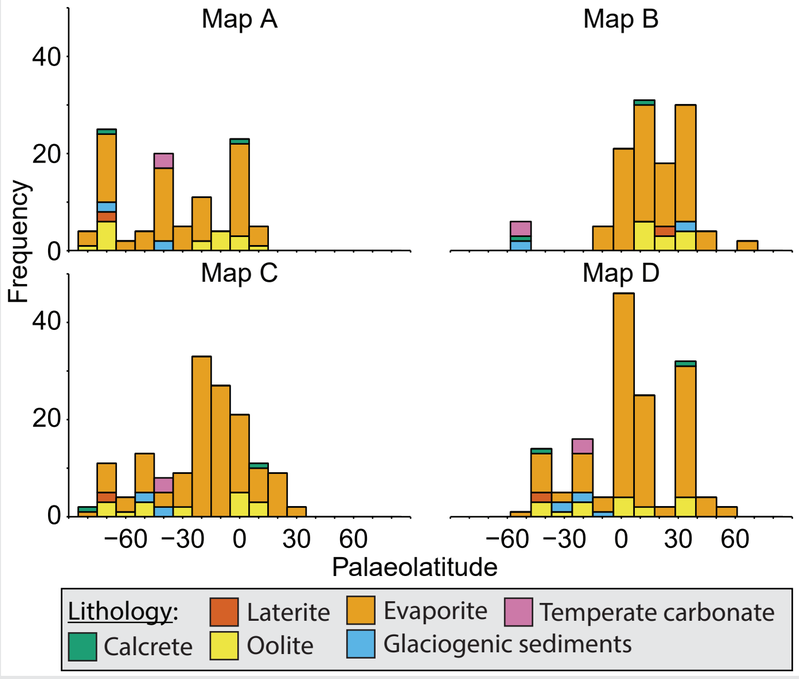
There are **substantial differences** between recently published **Cambrian continental configurations**. The biggest discrepancies are around **Gondwana,** and which region, if any (see Map B), resided over the **South Pole**. The discrepancies arise from the **different methods** used to reconstruct each configuration.



Map A after BugPlates[1] and Torsvik & Cocks[2,3], using palaeomagnetic and brachiopod biogeographic data. **Map B** after Landing *et al.*[4,5], using lithological data. **Map C** after Scotese[6], using palaeomagnetic, lithological, and biogeographic data. **Map D** after Álvaro *et al.*[7], adapting Map A using trilobite biogeographic data. **Continents**: A = Avalonia; B = Baltica; EG = East Gondwana; L = Laurentia; NC = North China; S = Siberia; SC = South China; WG = West Gondwana.

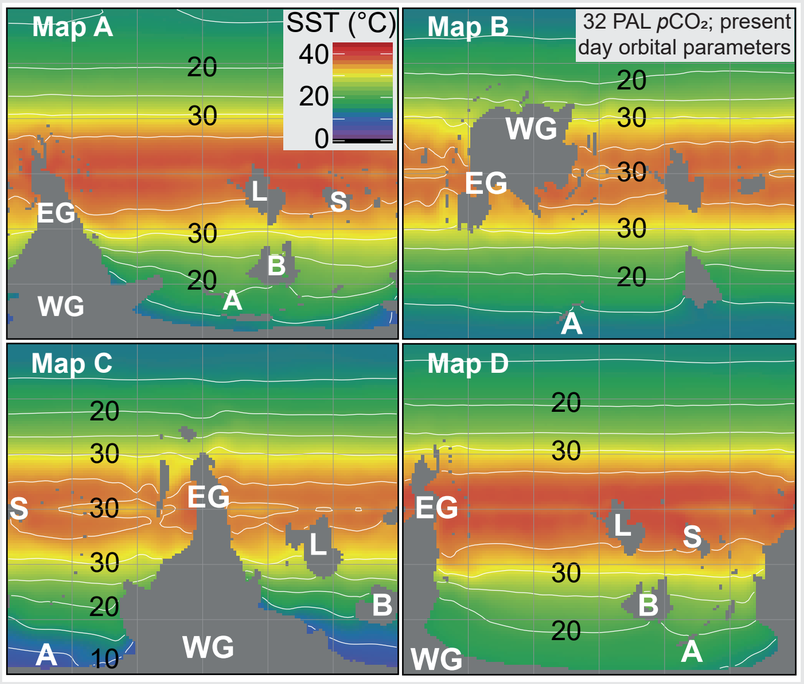
2. Methods: Lithologies

Terreneuvian to Cambrian Series 2 climatically sensitive lithology deposits were located on each map.



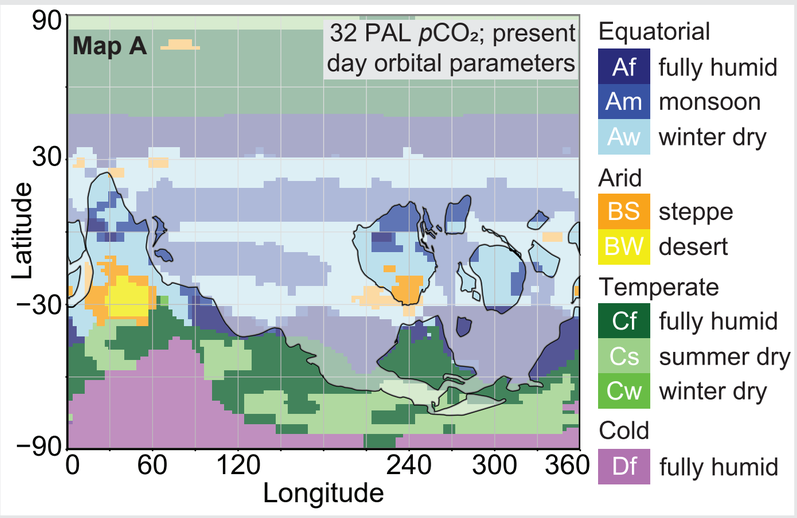
Models

Simulations were run on the Fast Ocean Atmosphere Model (FOAM)[8] for 3 pCO_2 (16, 32, 64 PAL) and 5 orbital conditions.



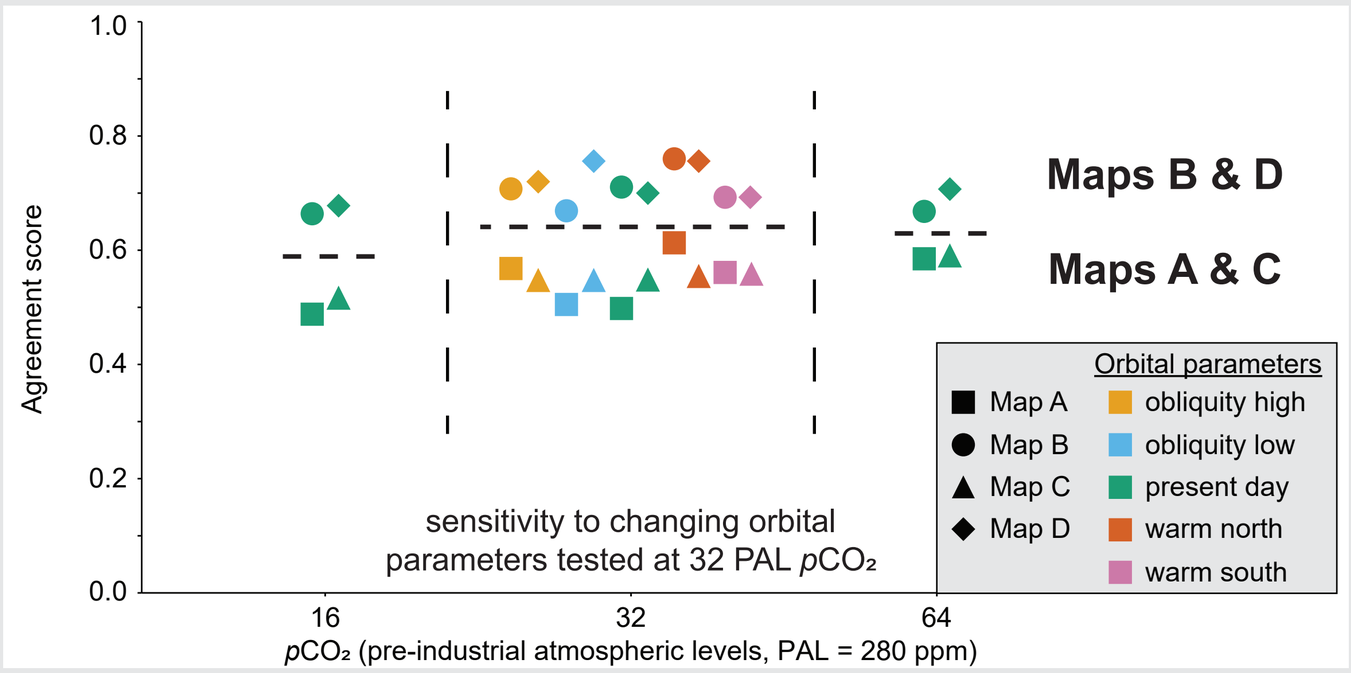
Climate zones

Model outputs were converted to Köppen climate zones[9]. For each map, a weighted score was calculated[10] that represents the agreement between the lithological database and simulated climate zones.



3. Results: Data/Model agreement

Palaeogeography exerts a **greater control** on data/model agreement than **orbital forcing** or atmospheric **carbon dioxide** levels. The continental configurations of **maps B and D** better explain the **climate zones** that are supported by **lower Cambrian lithological data**. **Coupling quantitative** climate **models** with **qualitative** geological **palaeoclimate data** is a valuable method for better constraining the **geographic and climatic context** of the origin and rise of complex life.



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References: [1]BugPlates, 2009. [2]Torsvik & Cocks, 2013, *in* Geol. Soc. Mem. 38. [3]Torsvik & Cocks, 2016, *Earth History and Palaeogeography*. [4]Landing *et al.*, 2013a, *ESR*. [5]Landing *et al.*, 2013b, *Geol. Mag.* [6]Scotese, 2016, *Palaeomap Project*. [7]Álvaro *et al.,* 2013, *in* Geol. Soc. Spec. Pub. 275. [8]Jacob, 1997, *PhD Thesis*. [9]Rubel & Kottek, 2011, *Meteoro. Zeitschrift*. [10]Monteiro *et al.*, 2012, *Paleoceanography*.