

We would like to thank Dr Kozdon for his constructive comments, which we will incorporate into the next version of our manuscript. Below we copied his original comments (in bold) and added our answers one-by-one.

Foraminifera are arguably one of the most important archives of the Earth's past climate, however, the incorporation of environmental signals into the shell chemistry is only well-studied for foraminifera of the order Rotaliida. Using other foraminifer orders for paleoclimate reconstructions such as the order of the Nodosariid would open the door to countless new applications. For example, Nodosariata appear much earlier in the fossil record than the Rotaliida, which could extend the range of foraminifera-based reconstructions significantly.

However, published data and proxy calibrations (in particular for trace element based proxies) for Nodosariata are very sparse to non-existent, thus, the study presented by Pachon et al. presenting B/Ca, Na/Ca, Mg/Ca, Sr/Ca and Ba/Ca measurements from Nodosariata shells (by LA-ICP-MS) and relationships between Mg/Ca and temperature as well as Na/Ca and salinity is a highly appreciated first step to expand the Mg/Ca temperature proxy (and Na/Ca salinity proxy) to a new and vastly underutilized order of foraminifera.

I have a couple of minor comments and remarks that I would like to see addressed and/or included in the paper before I consider this manuscript ready for publication:

Discussion:

The fact that Nodosariata appear in the Carboniferous provides researchers with the opportunity to extend the range of foraminifera-based climate reconstructions significantly (the authors are also mentioning this in the abstract as a motivation for this study). However, how realistic would it be to find Carboniferous shells that are well-enough preserved for paleoclimate reconstructions? Any prior studies assessing the preservation of these shells? I think this needs several sentences of discussion.

We agree with the reviewer that finding well preserved shells indeed becomes increasingly challenging further back in geological time. We added to the text (lines 261-264): "Using the chemical composition of fossil shells this far back in time requires careful assessment of the calcite for diagenetic overprints."

Also, there are many studies discussing the evolution of seawater Mg/Ca over time - this is relevant for the accuracy of the Mg/Ca temperature proxy in 'deep-time'. I believe that the discussion-section of this manuscript would benefit by the addition of a few sentences addressing this topic.

We agree that the current uncertainty in reconstructed seawater Mg/Ca and the combined influences of temperature and seawater Mg/Ca on foraminiferal Mg/Ca (particularly in extinct species) hampers accurate and precise temperature reconstructions. However, seawater $[Ca^{2+}]$ and $[Mg^{2+}]$ reconstructions may well improve in the future and so will the mechanistic understanding of Mg-incorporation improve. We decided to keep the potential of T-reconstructions in deep time, but have added some cautions (lines 264-266) when aiming for such reconstructions.

Method:

LA-ICPMS analyses of foraminifera shells are not trivial, and many papers have been published, discussing different approaches of analysis and methodologies to process the data. I am not able to find many information within this manuscript. For example, was the entire LA-ICPMS profile

integrated, and the average element/Ca ratios calculated? Was the intrashell variability monitored, while the laser milled through the chamber wall? There could be some additional information in this signal. Where there any criteria for cut-off? (e.g., laser penetrates the chamber wall – at what point to end integration of the data).

We did explain this somewhat in the manuscript already (lines 111 to 117) and we refer to earlier publications on this subject from our group. To accommodate the reviewers' comments we now added: For average calculating average chamber elemental ratios we integrated the entire laser ablation profile, which was monitored for each measurement.

Laser ablation system sample cell	NIOZ
Wavelength	193nm
Pulse duration	4 ns
Laser fluence	1 J/cm ²
Laser spot size	60 μm
Laser repetition rate	6 Hz
Carrier gas flow rate (He)	0.6 L/min

What type of laser was used, what was the wavelength (193 nm?). In addition, I had to google the NFHS-2-NP standard. Please add some info. Did the authors perform a standard-sample-standard bracketing approach? I assume they did, but I wasn't able to find this in the description.

For the NFHS-2-NP standard we referred to Boer et al. (2022). This publication lists the methods used and data of all laboratory involved in obtaining the reference data used for calibration. This paper also gives the settings and equipment used in the analyses, including the exact settings and standard bracketing and statistical data treatment. For completeness and easy access we here now added a short overview of the most important parameters. "The wavelength of the LA-ICPMS used is deep ultra violet (193 nm), which is excellently suited for ablating carbonates (Reichert et al., 2003).

Figure 1: The legends in the temperature and salinity plots are not clear. What are the symbols labelled "Nodosariida?" I am guessing the actual water depths of the sediment samples from which the shells were recovered. What are then the symbols labeled "sample_location"?

This figure was not very clear and we have now included an improved version of this figure. We removed the other stations we investigated and we did not find enough nodosarids. Also, we have indicated the location of the CTD station used for the temperature and salinity profile. In the depth profile we have only added those station which were used for our calibration.

According to the text, samples were collected at 105 m, 272 m, and 619 m water depth. Thus, we should have data from only 3 depths. Why are more depth intervals in the plot?

We have changed this accordingly, see also answer to previous comment.

Also, why are >20 red dots/markers in the map? This is not clear. According to table 1, there are just 3 stations where foraminifera, chemical and physical seawater parameters were collected. Then why so many dots? Please revise the legend and caption of Fig. 1, otherwise, it is very confusing.

We have changed this based on the comment. We agree that this was not very clear. See also to previous comments/answers.

Some minor items to address:

Figures 3, 4: please write rose-Bengal observed (or living) instead of rB observed

We will change this accordingly.

Line 58: it shall read: "...that can be optically..."

Correct: now changed 'than' to 'that'.

Line 67: ~ 190 Ma

Agreed and changed accordingly.

Line 73: suggest

Changed

Line 75: along a depth transect

Added 'a' (now line 82).

Line 117: It sounds as if the repeatability is based on data from a different analytical session (Boer et al., 2022) using NFHS-2-NP standard. However, this study used the MACS-3 standard for calibration. What is the repeatability on MACS-3?

Repeatability based on RSDs of measurements of NFHS-2-NP in this study (n=8) is 4% for Na/Ca, 1% for Mg/Ca and 2% for Sr/Ca. We have also added the variability in MAC-3 in the revised version of our manuscript. "Calibration was performed against USGS MACS-3 (synthetic calcium carbonate) pressed powder standard with ⁴³Ca as an internal standard."

Line 117: It seems that 2-3 analysis were placed in the final chamber (Fig. 2). Please add this information here.

We have added this (lines 127-128) to the new paragraph that describes the analytical procedure in more detail (lines 118-132).(141)

Line 135: the package

Added.

Line 136: Dot before "Identified" missing.

Inserted.

Line 157: over a the

'the was removed' (now line 175).

Line 159: please also mention the water temperatures, as temperatures are more relevant than the water depth (correlation between Mg/Ca and temperature, not water depth).

Bottom water temperatures are now added to Table 1.

Line 206: variability in the chemical composition

This was also noted by the other reviewer: it now reads: 'variability in the element-to-calcium ratio'

Lines 206 – 218: please add some discussion of past seawater Mg/Ca and the implication on 'deep-time'

We have added a small section on changes in sea water chemistry on geological time scales and potential impacts on Mg/Ca- T reconstructions. This section now starts with the added cautionary note on preservation of the original signal in Nodosarids (or in foraminiferal calcite in general) from consecutively old ages.

Line 225 for seawater

Added.

Line 242 range instead of change?

Added.

In addition, I strongly recommend that the authors upload their data to a open-access database such as Pangaea.de.

Royal NIOZ has a strict data access policy following the FAIR principles. The NIOZ has its own repository and a DOI will be providing full access to the data published.