

Palynofacies Analysis of the Sinemurian-Pliensbachian Boundary Event in the Prees 2C core (Cheshire Basin, UK)

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1. Introduction

- The **Sinemurian Pliensbachian Boundary Event (S-PBE)** in the Early Jurassic period was a major global carbon cycle perturbation, marked by a negative **Carbon Isotope Excursion (CIE)** (Silva et al., 2021).
- A CIE is a feature of the stable carbon isotope record ($\delta^{13}C$) that indicates sudden changes in the global cycle. It is considered negative when the change in the stable carbon isotopes ratio ($^{13}C/^{12}C$) results from an increase in "light" carbon (^{12}C) to an international standard. This is linked to increased atmospheric CO₂ input, e.g., via increased Large Igneous Province (LIP) volcanism or the dissociation of gas hydrates.

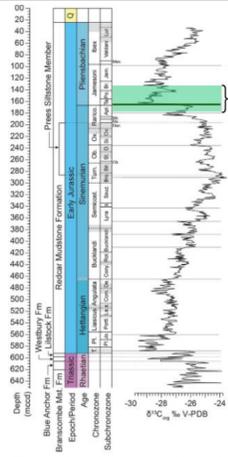


Figure 1. Prees 2C core succession with variation in $\delta^{13}C$ (Hesselbo et al. 2023).

2. Research Questions

1. What was the **impact of organic productivity** in the S-PBE CIE?
2. What was the **response of the biological systems** to the S-PBE CIE driver/processes?

3. Geological Setting

- The **Prees 2C core** was drilled within the Cheshire Basin by the Jurassic Earth System and Timescale project (Fig 1).
- The **Cheshire Basin** is a synformal Permo-Triassic sedimentary basin within a complex rift system (Plant, Jones, & Haslam, 1999).
- The section of interest is located within the Lower Jurassic **Redcar Mudstone Formation**, deposited during the S-PBE (Hesselbo et al., 2023).

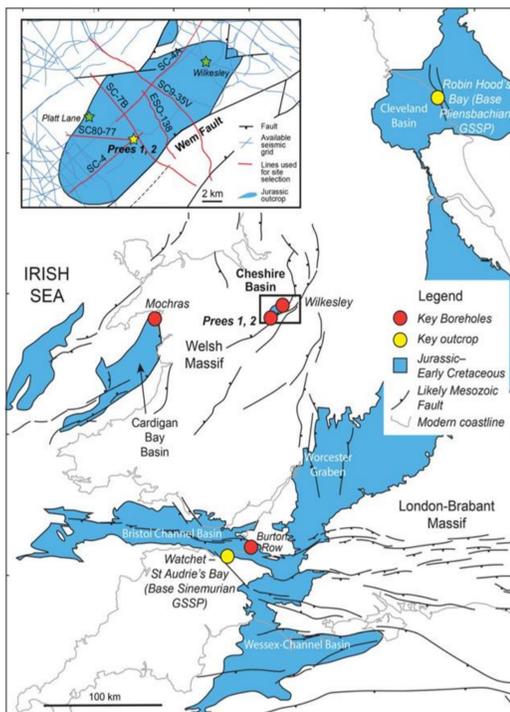


Figure 2. Geological map of Jurassic-Early Cretaceous strata in southern UK, with location of Prees 2 and other key boreholes and outcrops (Hesselbo et al., 2023)

4. Methods

Palynofacies Analysis

- Identify and count 300 kerogen particles in 45 strew-slides using Nikon Eclipse E400 Polarizing Light Microscope.
- Ensure counts are reasonable and consistent.

Data Analysis

- Normalize counts to 100 %.
- Construct a Phytoclast-Palynomorph-AOM ternary plot.
- Interpret the environment of deposition.
- Analyze trends throughout the Prees 2C core.

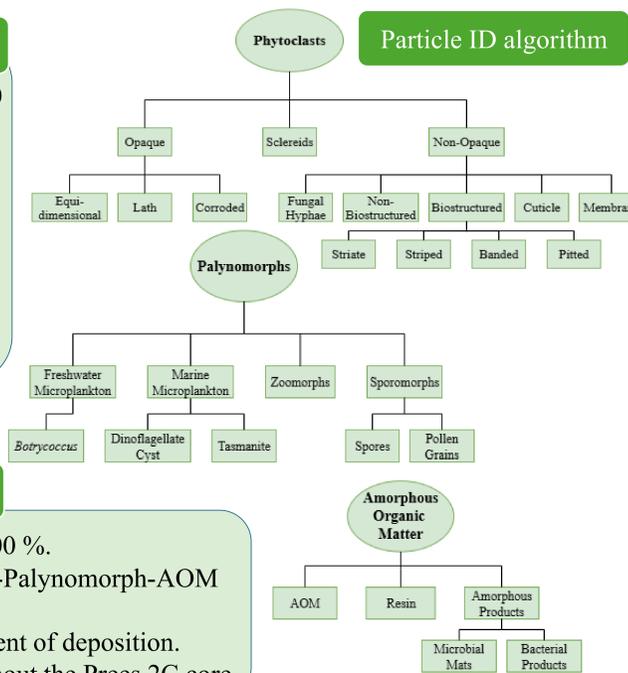


Figure 3. Diagrams of palynofacies classifications and subcategories (modified from Tyson, 1995).

5. Results

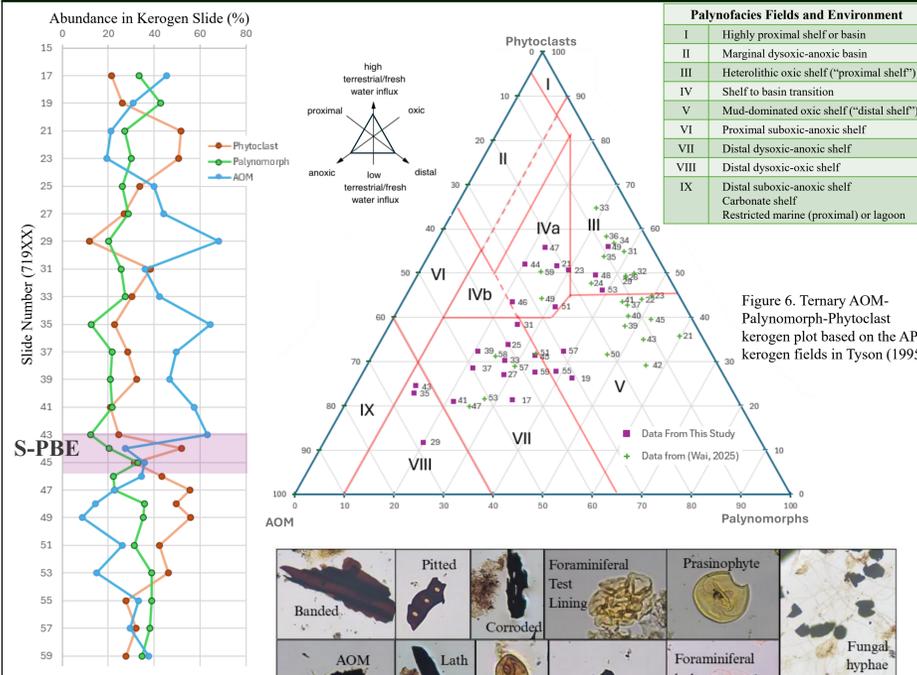


Figure 4. Graph indicating the changes in kerogen types moving vertically across the Sinemurian to Pliensbachian.

Figure 5. Identified palynofacies particulates under transmitted white light, based on classification from Mendonça Filho et al. (2011).

6. Discussion

- AOM abundance peaks at the top of the S-PBE and afterwards, suggesting that organic matter degradation increased in relation to the S-PBE and may indicate that the S-PBE is related to an anoxic event (Figs 4 and 5).
- A significant number of analyzed samples fall within the distal shelf fields (Figs 5 and 6). In contrast, previous research (Wai, 2025) in the Pliensbachian suggested a proximal-shelf environment, indicating that a regression characterized the interval between this study and the study farther up the Prees 2C core.
- Samples before the S-PBE fluctuate between proximal and distal shelf, before becoming distal after the S-PBE, indicating a transgressive event within the studied interval (Fig. 6).

7. Conclusion and Future Work

- Results of the palynofacies analysis of the Prees 2C core are indicative of a fluctuating environment between a distal dysoxic shelf and a proximal oxic shelf.
- Following the S-PBE, the environment is primarily a distal dysoxic-anoxic shelf with low terrestrial or fluvial influx and good AOM preservation.
- Future work will focus on new counts for the study interval and interpretation of the obtained data within the context of other regions

8. Challenges

- Clustering of particles made counting difficult and interfered with the proper counting procedure.
- Several interpretations of a particle's classification are possible.
- High levels of degradation interfere with particle classification.
- Contamination, both natural and human, is abundant in many samples. This includes textile and paper fibres (human), and modern fungal hyphae.

References

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