Evaluating the anomalous palaeomagnetic field behaviour in the Ediacaran with new palaeointensity data from Laurentia and Baltica

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1. Introduction

Palaeomagnetic investigations of the geomagnetic field directions in the Ediacaran period (635-541 Ma) suggest an anomalous behaviour of the field, leading to interpretations ranging from an equatorial dipole configuration\(^1\) to rapidly reversing field\(^2\) to inertial interchange true polar wander.\(^3\) To date, no definitive explanation for the field behaviour has been accepted. In addition, recent palaeomagnetic and palaeointensity studies revealed that the field in the Ediacaran was extremely weak.\(^4\) However, it is not clear if the field itself was an equatorial dipole or if it was instead a rapidly reversing field. The aim of this study is to evaluate the anomalous palaeomagnetic field in the Ediacaran using new palaeointensity data from Laurentia and Baltica.

2. Workflow

3. Results

All palaeointensity experiments result in extremely low values for the Ediacaran field strength. The new whole-rock palaeointensity values from fast-cooled units are in good agreement with the time-averaged single-crystal results.\(^5\)

4. Discussion

5. Conclusion

The geomagnetic field in the Ediacaran shows unusual behaviour over prolonged periods of time. The addition of palaeointensity data and the statistical analysis of the published directions lead to progress, but the anomalous field remains a mystery.

6. Future Work

- further palaeointensity studies - especially in the time period between 600 and 700 Ma - would be needed to constrain the distribution of the ultra-low palaeointensity period.
- estimates of reversal frequencies in the Ediacaran would be an extremely valuable addition to the known properties of the field.
- a better approach to evaluate palaeosecular variation is needed to be able to understand the anomalous field behaviour.
- the new data can be used as additional constraints for numerical geodynamo simulations. These could give further insight into deep Earth evolution at this unique time.

References