



LUND UNIVERSITY

Reidite discovered in the Triassic distal impact ejecta deposit of southwest Britain

Plan, A.; Lindgren, P.; Erickson, T. M.; Söderlund, U.

2022

[Link to publication](#)

Citation for published version (APA):

Plan, A., Lindgren, P., Erickson, T. M., & Söderlund, U. (2022). *Reidite discovered in the Triassic distal impact ejecta deposit of southwest Britain*. Poster session presented at 85th Annual Meeting of The Meteoritical Society, 2022, Glasgow, United Kingdom.

Total number of authors:

4

Creative Commons License:

Unspecified

General rights

Unless other specific re-use rights are stated the following general rights apply:

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

Read more about Creative commons licenses: <https://creativecommons.org/licenses/>

Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

LUND UNIVERSITY

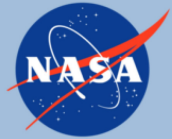
PO Box 117
221 00 Lund
+46 46-222 00 00

Reidite discovered in the Triassic distal impact ejecta deposit of southwest Britain



A. Plan¹; P. Lindgren²; T. M. Erickson³; U. Söderlund¹

¹Lund University, ²Geological Survey of Sweden, ³Jacobs—JETS, Astromaterials Research and Exploration Science Division, NASA Johnson Space Center



Aim of study

- Investigate the distribution potential of shock metamorphosed heavy minerals within a distal impact ejecta.
- The study will focus on shocked features in zircon and relate deformations to various P-T conditions. As high-T exposure has the potential to reset the zircon U-Pb isotopic system, the goal is to identify suitable candidates for U-Pb geochronological studies.

Conclusions

Here, we present the discovery of shocked zircons within the Wickwar ejecta layer. We further conclude that the distribution potential of reidite is greater than previously observed—up to c. 24 crater diameters. The discovery of reidite constrains a pressure excursion of >30 GPa, whilst ZrO_2 dissociation gives a minimum temperature excursion of 1673 °C [7].

Preliminary results

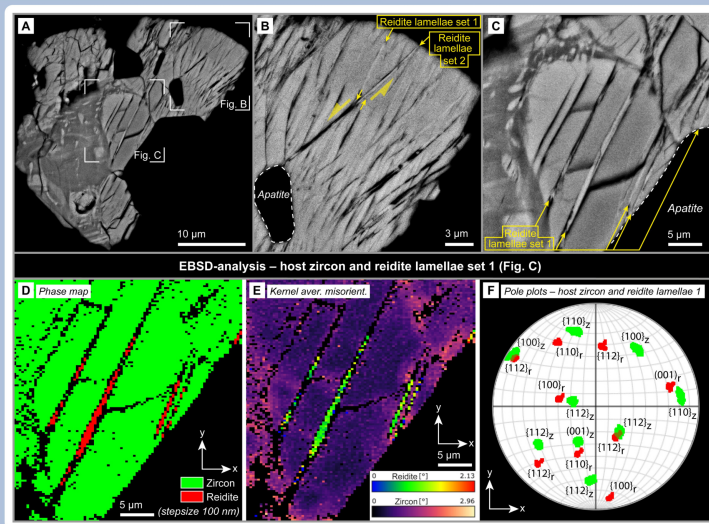


Fig. 1: SEM-BSE images (1A–1C) and EBSD data (1D–1F) of a reidite-bearing shocked zircon from the Wickwar impact ejecta deposit. 1A: a ~35 µm deformed grain with two sets of PFs. 1B: PF set 1 is offset by PF set 2. 1C: PF set 1 with lamellae reidite. 1D: EBSD analysis index lamellae as reidite. 1E: average misorientation. 1F: alignments of a $\{100\}_{\text{zircon}}$ to a $\{112\}_{\text{reidite}}$ and a $\{112\}_{\text{zircon}}$ to a $\{112\}_{\text{reidite}}$.

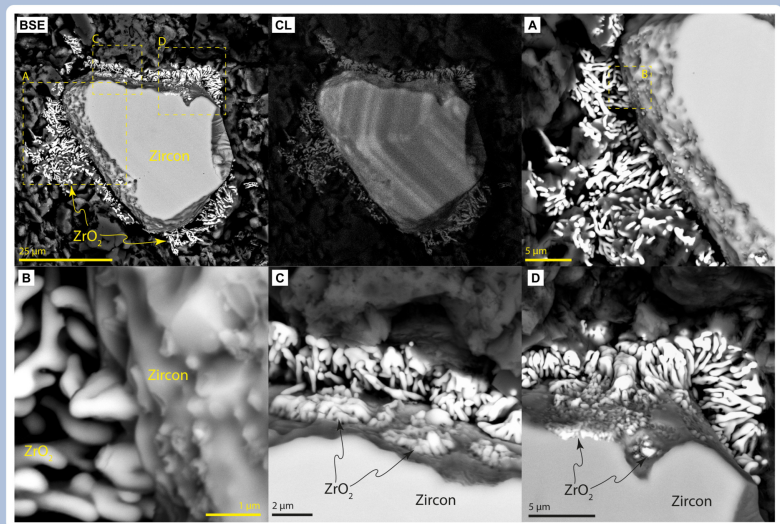


Fig. 2: SEM-BSE-CL images including high-magnification BSE-images on the dissociation rim (2A–2D). BSE: surrounded by a quartz-feldspar impact melt matrix resides a c. 30 µm zircon grain with a vermicular ZrO_2 rim. CL: distinct oscillatory zonations within the host-zircon. 2A: interaction between vermicular ZrO_2 and the surrounding melt rock. 2B: close-up on ZrO_2 vermicules. 2C–2D: micro metersized pools of vermicular ZrO_2 along the host zircon brim.

Discussion

Based on SEM-BSE-CL imagery, c. 10 % of the zircon population exhibit shock-induced features. The most common shock deformation are consecutive sets of planar fractures (PFs) that propagate in one or two orientations (fig. 1A–C). One grain has so far undergone EBSD-analysis (fig. 1D–F). This grain has two sets of PFs which offset, interpreted to represent a chronological formation order (fig. 1B). The BSE-bright lamellae are indexed as reidite (fig. 1D–E). The orientation relationship between zircon and reidite is consistent with previous studies (fig. 1F) [5,6]. One zircon is surrounded by a vermicular ZrO_2 corona (fig. 2). As zircon dissociates to ZrO_2 at 1673 °C [7], the observation suggests that the grain was subjected to an extreme temperature excursion—even as high as >2370 °C [cf. 7]. If the latter is proven by upcoming EBSD-work, this grain would thus retain evidence of the hottest melt record found in materials from an ejecta deposit.

Introduction

- The ejecta is located in the Wickwar quarry c. 10 km Northeast of Bristol (fig. 3, 4).
- Only three studies have investigated the layer materials [1,2,3].
- The c. 85 km wide Manicouagan crater has been pinpointed as the source (fig. 3) [3].
- Despite effort, no shocked zircons has yet been reported.

Fig. 3: Paleo-geographical map with the U.K. position outlined at Triassic times (grey color). Triassic impact structures nearby the ejecta deposit are marked with red. At the time of impact, the distance between the proposed source crater, the Manicouagan, and the Wickwar ejecta was c. 2000 km. Materials was thus transported c. 24 crater diameter away from the source crater.

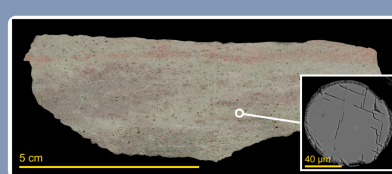
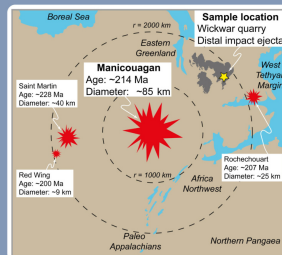


Fig. 4: Polished slab from the ejecta layer that includes an abundance of up to 1 mm-sized spherules (inset figure). During post-depositional conditions, the spherulitic glass was completely replaced by various clay and calcium minerals.

References and acknowledgments

[1] Walkden G. et al. (2002) Science 298:2185–2188. [2] Kirkham A. (2003) Proceedings of the Geologists' Association 114:11–21. [3] Thackrey S. (2009) Earth and Planetary Science Letters 285:163–172. [4] Schmider M. and Kring D. (2020) Astrobiology 20:91–141. [5] Plan A. et al. (2021) Meteoritics & Planetary Science 56:1795–1828. [6] Cavosie et al. (2020) Geology 49:201–205. [7] Timms E. et al. (2017) Earth and Planetary Science Letters 477:52–58. Our gratuities to Prof. John Parnell at the University of Aberdeen, U.K. for supplying the samples. A. P. and U. S. acknowledge support from Swedish Research Council (grant #201905330).

Methodology

Zircon separation, sample preparation, SEM-settings, and collection and post-processing of EBSD-data followed the analytical protocol of Plan et al. [5]. Zircon grains have been surveyed in thin and thick sections and mineral separates from the ejecta layer. So far, one zircon has undergone EBSD-analysis.

Lead author

Anders Plan
Ph.D. student
anders.plan@geol.lu.se
Department of Geology, Lund University, Sweden

