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

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

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## 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

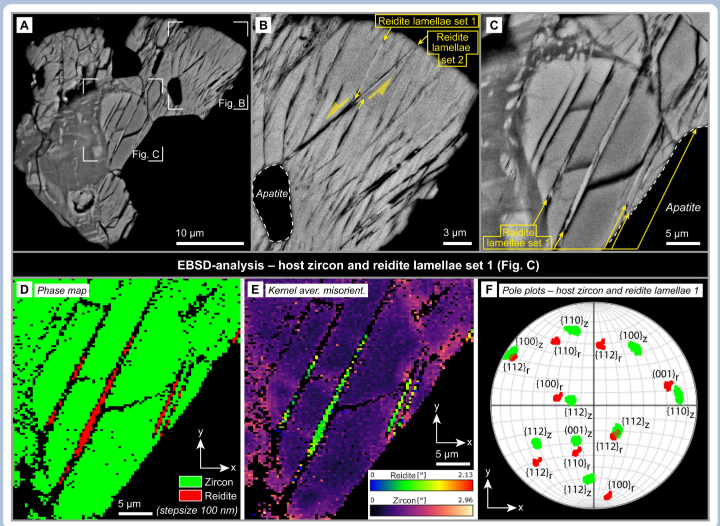


*Fig. 1: SEM-BSE images (**1A–1C**) and EBSD data (**1D–1F**) of a reidite-bearing shocked zircon from the Wickwar impact ejecta deposit. **1A:** a ~35 µm deformed grain with two sets of PFs. **1B:** PF set 1 is offset by PF set 2. **1C:** PF set 1 with lamellae reidite. **1D:** EBSD analysis index lamellae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

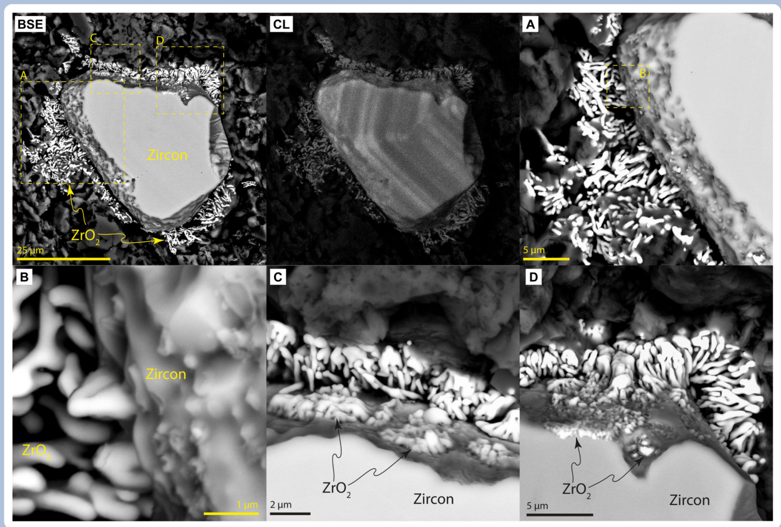


*Fig. 2: SEM-BSE-CL images including high-magnification BSE-images on the dissociation rim (**2A–4D**). **BSE:** surrounded by a qz-fds impact melt matrix resides a c. 30 µm zircon grain with a vermicular $ZrO_2$ rim. **CL:** distinct oscillatory zonations within the host-zircon. **2A:** interaction between vermicular $ZrO_2$ and the surrounding melt rock **2B:** close-up on $ZrO_2$ vermicules. **2C–4D:** 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.

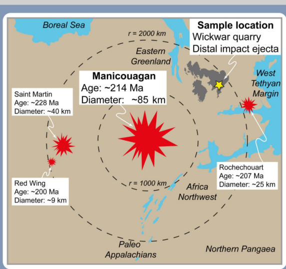


*Fig. 3: Paleo-geographical map with the U.K. position outlined at Triassic times (grey color). Triassic impact structures nearby the ejecta deposit are marked with red. At the time of impact, the distance between the proposed source crater, the Manicouagan, and the Wickwar ejecta was c. 2000 km. Materials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

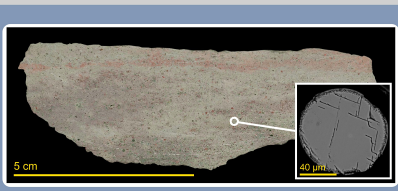


*Fig. 4: Polished slab from the ejecta layer that includes an abundance of up to 1 mm-sized spherules (inset figure). During post-depositional conditions, the spherulitic glass was completely replaced by various clay and calcium minerals.*

## 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.

## References and acknowledgments

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