Shock Textures in Zircons Revealed by Synchrotron X-ray Nano-Imaging

J.-P. SUURONEN[1,2*] AND M. SAYAB[3]

[1] ESRF – The European Synchrotron, CS40220, 38043 Grenoble Cedex 9, France
[2] Université Grenoble-Alpes, Equipe Rayonnement Synchrotron et Recherche Medicale, Grenoble, France
[3] Geological Survey of Finland, P.O.B 96, FI-02151 Espoo, Finland
*correspondence: jussi-petteri.suuronen@esrf.fr

Because of the peculiar nano-scale textures preserved within shocked zircons, they can be useful pathfinders to recongize small or large-scale impact structures on Earth. The impact structures are often difficult to recognize in ancient Proterozoic terrains due to, for example, complex metamorphic and orogenic overprint. In the case of known impact structures, shocked zircons can be useful minerals to decipher impact-induced geological processes, and can be used to track pre-, syn- and post-meteoritic impact history. For this reason, separating different stages of zircon growth will require a holistic chemical, textural and 3D imaging approach.

We present the results of 3D imaging of the internal nanotexture, including zoning patterns, inclusions and shock-induced fractures in shocked zircons from the Sudbury impact structure in Ontario, Canada, using multimodal synchrotron nanotomography [1]. Characteristic impact-related textures like melt inclusions and conjugate fractures are easily distinguishable in 3D renderings of shocked grains (cf. figure). The high-resolution 3D images allow to select areas of interest for further studies, e.g. trace element distributions by traditional methods and dating experiments.

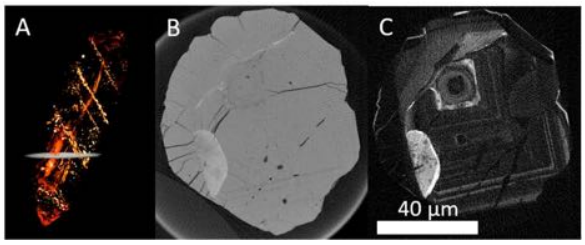

Figure 1: (A) 3D rendering of inclusions and fractures within a shocked zircon. (B) Pure X-ray attenuation tomography of the horizontal cross-section shown in (A). (C) Distribution of trace uranium in the same cross-section.

[1] Suuronen & Sayab (2018), *Sci. Rep.* 8, 4747