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Excess scatter in U-Pb ages from the Ordovician 'Likhall' zircon bed resolved by new high precision CA-ID-TIMS data

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The zircon-rich 'Likhall' bed found in the Middle Ordovician (Darriwilian) 'Täljsten' interval, Sweden, is a rare phenomenon of a single zircon U-Pb age population preserved in a carbonate rock ('crypto-tephra' [1]). It is contextualised with biodiversification during the 'main phase' of the Great Ordovician Biodiversification Event (GOBE [2]) and the L-Chondrite Parent Body breakup meteorite bombardment. A causal connection between meteorite bombardment and marine biodiversification has been suggested due to putative synchrony of the two events. However, the two published zircon U-Pb ages (467.50 ± 0.28 and 465.76 ± 0.30 Ma; [3] and [4] respectively) are distinct at the typical precision level of high-precision Isotope Dilution – Thermal Ionisation Mass Spectrometry (ID-TIMS) dating.

This discrepancy causes significant uncertainty for the correlation of the GOBE with the meteorite breakup based on temporal coincidence. We therefore explore the existing data for discrepancies in analytical techniques, data selection and/or interpretation, and present a new dataset that benefits from the technical progress in chemical abrasion ID-TIMS U–Pb zircon dating techniques [5].

Following this treatment, our analyses show lower common Pb abundance and higher radiogenic/common ratio in analysis than the previously published ones. We thus assume that the partial dissolution step during the chemical abrasion procedure is not only preferentially removing domains of Pb-loss in the treated zircon crystals but also removes unwanted inclusions (mineral and/or melt), which we postulate to be responsible for the relatively high abundance of common Pb in the previous 'Likhall' zircon U-Pb data. The combined effect of the presence of relict domains of Pb-loss and mineral inclusions caused the age-offset between previously published data, which was further amplified by differences in data evaluation strategies.

In consideration of this, we calculate a new weighted mean age, which suggests an age intermediate to the previously published age estimates.

References:

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