Detrital zircon from the Witwatersrand Supergroup: reasons for discordance

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U-Pb age information ± Lu-Hf data from detrital zircon is now routinely used to address questions regarding sediment sources, transport pathways and recycling, based on the perceived robustness of zircon against weathering processes. However, the radiation that zircons receive from decay of U+Th causes metamictisation, and such zircons lose their radiogenic Pb more easily, yielding discordant ages. The amount of radiation received is a combined effect of the age of the zircon and its U+Th content, so Archaean rocks are expected to be more prone to yielding discordant zircon populations.

Our data for zircon from the ca. 2.9 Ga Witwatersrand Supergroup show surprising inter-sample distinctions in quality of U-Pb data. Eight samples are sandstones from surface exposures; three samples are gold-bearing conglomerates from drillcore and mines. For the exposed sandstones, 89% was more than 10% discordant; for the underground conglomerate samples, 13% was discordant. For both data sets, there appears to be a correlation between U concentrations and discordance: zircons at > 1000 ppm U show a greater proportion of badly discordant analyses. However, zircons with < 100 ppm U are mostly concordant in the conglomerates, but ca. 20% discordant for the surface samples. Surface weathering is the most likely explanation for the discrepancy between the two sample sets, showing that (Archaean) zircon may not be as robust as often assumed. Data from the underlying Dominion Group shows that depositional environment (conglomerate vs sandstone) likely plays a role too.