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Allanite U-Th-Pb Geochronology of IOCG and Zn-Ag-Pb Deposits in the Mount Isa Inlier, Australia

Luís Portela¹, Coralie Siéglé², Charlotte M. Allen³, Jim R. Austin⁴

1. University of Aveiro, Aveiro, Portugal, 2. Discovery Program, Mineral Resources, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australian Resources Research Centre, Perth, WA, Australia, 3. School of Earth and Atmospheric Sciences and Central Analytical Research Facility, Queensland University of Technology, Brisbane, QLD, Australia, 4. Potential Fields Geophysics, Mineral Resources, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Lindfield, NSW, Australia

The Mount Isa Inlier in Northwest Queensland (Australia) is renowned for containing multiple world-class ore deposits. The Inlier is composed of Early-Middle Proterozoic sedimentary, volcanic, and intrusive rocks, heterogeneously affected by polyphase metamorphism, deformation, and metasomatism spanning the Barramundi, Wonga, and Isan orogenies (1900-1500 Ma). Allanite is common in these deposits and, given its high closure temperature for the U-Pb system, presents a valuable opportunity to provide insights into the timing of ore-forming processes.

This study reports new LA-ICP-MS U-Th-Pb ages and compositions of allanites from several deposits from the Cloncurry District in the Mount Isa Eastern Succession, including IOCG (Brumby, Canteen and SWAN) and Broken Hill-type (BHT) Pb-Zn-Ag deposits (Altia and Cannington), and new ages for the Cameron River prospect (IOCG) in the Mary Kathleen Domain. Allanites show distinct composition in the studied deposits: (a) very low La/Sm and Th/U and positive Eu anomalies in Cannington; (b) low and homogeneous La/Sm (~10) and wide-ranging Th/U (up to 440) at Altia; (c) high La/Sm (>80) and low Th/U in SWAN and Canteen; (d) intermediate compositions at Cameron River and Brumby.

Allanites from the Cameron River prospect yield a well-defined age cluster at ca. 1.74 Ga, consistent with the emplacement of the nearby Wonga Suite. Allanites from deposits of the Eastern Succession revealed consistently younger results. Brumby, Canteen, SWAN, and Cannington allanite U-Pb ages converge to ~1.5 Ga, overlapping in time with the emplacement of the Williams Batholith (1516-1493 Ma). Altia allanites define a lower intercept age of ~1.35 Ga. The ages obtained for the BHT deposits are younger than expected age of 1.7-1.67 Ga and are interpreted to record the timing of a late skarn overprint and/or retrograde hydrous alteration. The ~1355 Ma ages yielded by Altia allanites are consistent with those reported for Mo-REE mineralisation in the district.