

# In-situ U-Pb dating of 1.75 Ga garnet from the Mary Kathleen Domain, Mount Isa Inlier, Australia

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## INTRODUCTION & AIM

The Dugald River Zn-Pb-Ag, Mary Kathleen U-REE and Tick Hill Au deposits distribute in the Mary Kathleen Domain (MKD), Mount Isa Inlier, Australia. Thus, investigating the magmatic-hydrothermal processes in this region is a key step toward a better understanding of how these deposits formed. Previous studies have well established the zircon ages and distribution of magmatic rocks in this region (Spence et al., 2022; Cocker et al., 2025). However, the timing of skarn formation in this region has received limited attention, despite its critical role as an indicator for mineral deposits.

## METHOD

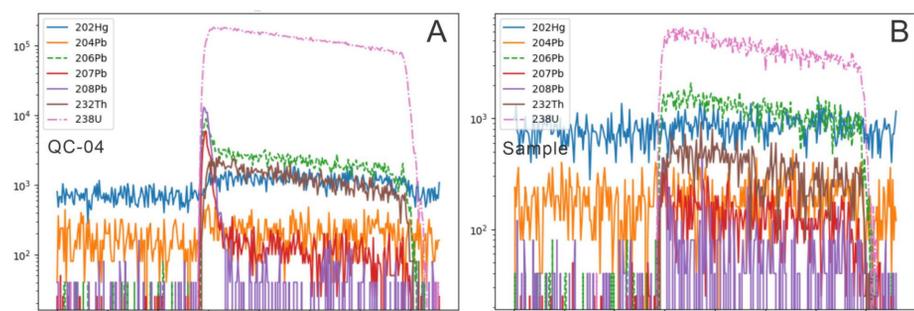


Fig. 1 Garnet standards(QC-04) and sample LA-ICP-MS signal spectrogram

The apparent Pb spike is attributed to the use of Pb-containing polishing paste during the sample preparation process, and this segment of the signal was excluded during data processing (Fig. 1).

## RESULTS & DISCUSSION

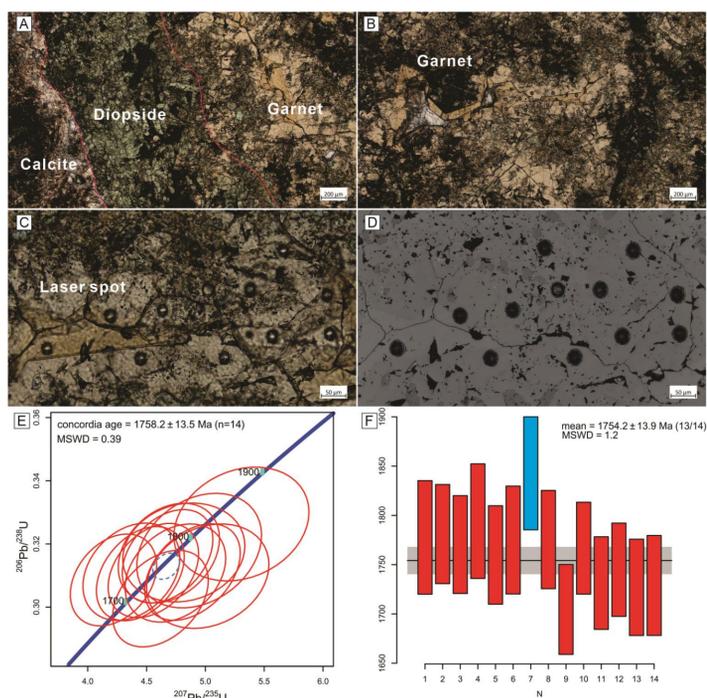


Fig. 2 Garnet, Diopside, and Calcite image in sample thin section from Mount Isa area (A, B), laser spot on the Garnet (C, D reflect light), and age plot (E, F).

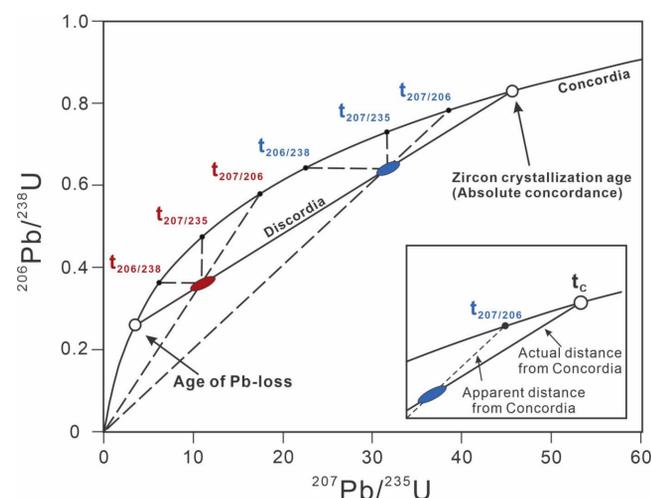


Fig. 3 Schematic diagram of U-Pb dating principle, mainly illustrating the results caused by discordance in the U-Pb system.

We interpret that the formation of the sampled skarns is primarily related to the Wonga or Burstall magmatic event (Page, 1983). Based on the degree of discordance observed in zircon (Spence et al., 2022), we propose that the chronological constraints on regional geological processes can be further refined by conducting geochronology of U-rich minerals such as garnet in regional skarns (Fig. 2).

Even for a single discordant zircon age that forms a relatively good discordia line, determining the upper intercept age still requires confirmation by concordant ages within the sample, as the single discordant age tends to be younger than the true age (Fig. 3).

## CONCLUSION

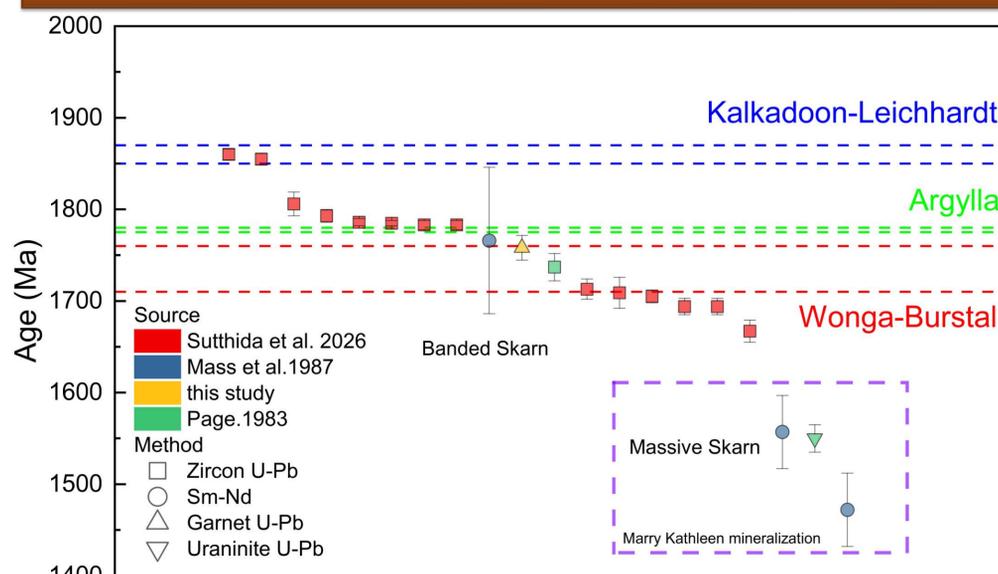


Fig. 4 Comprehensive diagram of zircon dating in comparison with the formation ages of regional granites and ore deposits.

The Mary Kathleen U-REE deposit developed within extensive garnet-rich skarns, and the confirmed age reveals a clear temporal discrepancy between felsic dike (U-Pb age:  $1737 \pm 15$  Ma) and mineralization ( $1550 \pm 15$  Ma) (Page, 1983). Although the genetic relationship between these skarns (Sm-Nd age:  $1472 \pm 40$  Ma) and uranium mineralization has long been debated, this debate gradually faded as the deposit ceased to be explored (Maas et al., 1987). This study demonstrates that the various occurrences of garnet in this deposit may represent different formation ages and genetic types.