

High-Precision U-Pb Zircon Chronostratigraphy of the Mount Read Volcanic Belt in Western Tasmania, Australia: New Results and Implications for VHMS Exploration

Michael J. Vicary,^{1*} James K. Mortensen,² Andrew W. McNeill,¹ J. Bruce Gemmell,³ and Richard M. Friedman²

¹Mineral Resources Tasmania, Hobart, Tasmania, 7018, Australia

²Pacific Centre for Isotopic and Geochemical Research, University of British Columbia, Vancouver, V6T 1Z4, Canada

³CODES, ARC Centre of Excellence in Ore Deposits, University of Tasmania, Hobart, 7001, Australia

*E-mail, andrew.mcneill@stategrowth.tas.gov.au

The Middle Cambrian Mount Read Volcanics (MRV) of western Tasmania, Australia, host several world-class polymetallic volcanic-hosted massive sulfide (VHMS) deposits, representing a wide range of deposit styles. Rapid lateral and vertical facies changes within the MRV, and a complex fault architecture that has been reactivated during subsequent Late Cambrian and Devonian deformation, have made it impossible to confidently correlate stratigraphy across the belt, and to determine the relative stratigraphic position of the various deposits.

We have carried out high precision (<1 m.y. 2σ) U-Pb zircon dating, employing chemical abrasion ID-TIMS methods, of extrusive and intrusive rocks from throughout the MRV, both in the central MRV and in extensions of the belt to the south and north. The goals of this work have been as follows: first, to develop a detailed chronostratigraphic framework for the central MRV, and establish the precise timing of VHMS deposit formation within that framework; and secondly, to track the specific stratigraphic horizon(s) that are considered to be most prospective for containing significant VHMS mineralization regionally, thereby helping target future exploration.

A total of 18 U-Pb ages that were previously reported from the central MRV documented a minimum age range of 12.7 m.y. (including 2σ error) for MRV volcanism, and constrained the timing of VHMS mineralization at Rosebery-Hercules, Hellyer, and Mt. Lyell to a very narrow time interval of $\sim 500 \pm 1$ Ma. Although it is still unclear why this time interval (the so-called “Holy Host”) was so prolific in terms of VHMS deposit generation within the MRV, it nonetheless represents a critical target for regional VHMS exploration elsewhere in the MRV.

In this contribution we report U-Pb crystallisation ages of an additional 24 samples, which were selected to test other poorly constrained stratigraphic correlations within the central MRV, to constrain the age of VHMS mineralisation at Henty, Red Hills, and Elliott Bay, and to assess the age range of units from the northern and southern MRV. In the central MRV, a pumice breccia from just south of the Henty mine has an age of 502.2 ± 0.9 Ma, consistent with that obtained from the footwall pumice breccia at the Rosebery and Hercules deposits, and which suggests that an overlying Pb-Zn massive sulfide clast-bearing mass flow breccia may have been deposited at the same time as the main mineralizing event, although more work is required to confirm this. In the southern MRV, limited analyses indicate that an intrusive phase of the Noddy Creek Volcanics from the Thomas Creek Cu-Au prospect intruded at approximately 500.7 ± 1.2 Ma, whereas rhyolite lava from the footwall of the VHMS horizon at Wart Hill has been dated at 498.5 ± 0.6 Ma. In the northern MRV, a rhyolite from within the Cethana alteration zone, a potential VHMS horizon, has been dated at 499.9 ± 0.9 Ma. The results indicate that the main VHMS mineralizing event, at approximately 500 Ma in the central MRV, also occurred in both the southern and northern MRV. The VHMS mineralization at Wart Hill may relate a slightly younger mineralizing event. All these results have implications for prospectivity and can be used to focus future exploration effort.

