New U/Pb Geochronology from the Proterozoic Penokean Orogen, Wisconsin: Implications for VMS Metallogeny

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This study presents new U/Pb and trace element data from zircons obtained from volcanic and intrusive rocks from the Pembine-Wausau terrane of the Paleoproterozoic Penokean Orogen in northern Wisconsin. This terrane is best known for hosting almost 150 Mt of volcanogenic massive sulfide (VMS) mineralization. However, challenging socio-political obstacles preventing mining and exploration activities coupled with extensive overlying Paleozoic and Quaternary deposits has limited the study of the terrane. The current need for critical minerals highlights the importance of improving our understanding of this underexplored and poorly exposed orogen. This study aims to provide a better tectonostratigraphic understanding of the volcanic terranes to improve regional tectonic and metallogenic models for base and precious metals. Samples were collected from within the Ladysmith-Rhinelander and Eau Claire volcanic belts, and zircons from these samples were then analyzed at Laurentian University (Sudbury, Ontario, Canada) via Split-Stream Laser Ablation Inductively Coupled Plasma Mass Spectrometer (LASS-ICP-MS) to obtain U-Pb, Hf-Lu, and trace element data. Preliminary results reveal complex age relationships and basement architectures that were previously unrecognized. The samples obtained from the Eisenbrey deposit within the Ladysmith-Rhinelander belt temporally correlate with felsic rocks from the Back Forty deposit in Michigan revealing a previously unrecognized wide-spread younger VMS forming event. Samples from the Lynne deposit reveal the presence of a co-eval subvolcanic intrusion in the presence of Archean basement. Samples from the Eau Claire volcanic complex reveal ages that correlate with other VMS-forming strata across the Pembine-Wausau terrane. Therefore, tectonic models for the development of the Penokean Orogen and the formation of VMS deposits need to be revisited.