# Dating mafic-ultramafic intrusions by monazite in hornfels: the Kabanga instrusions in the Eastern African nickel belt

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Precise and accurate dating of mafic-ultramafic intrusive rocks has proved to be a formidable task, which has impeded our understanding of their genesis and nickel sulphide mineralization. We carried out a study focused on the Kabanga-Musongati mafic-ultramafic intrusions in the East African nickel belt, a suite of Bushveld-type layered intrusions emplaced in sedimentary sequences. We investigated metamorphic monazite crystals from the contact aureoles as well as those from the lower-grade metasedimentary rocks relatively distal to the intrusions, and undertook in situ (i.e., in polished thin section) U-Pb isotopic analyses utilizing a high-resolution ion microprobe (SHRIMP). The high- and low-grade monazites show striking contrasts in crystal morphology, chemical composition and U-Pb age. Monazite formed by contact metamorphism in response to emplacement of mafic-ultramafic melts is characterized by elevated Th and U contents, and yields a robust mean $^{207}Pb/^{206}Pb$ age of c. 1400 Ma, in accord with ages of igneous monazite and zircon from a differentiated component of the intrusion. The results indicate that the intrusion of mafic-ultramafic melts was substantially earlier than the prevailing 1375 Ma S-type granites in the region, calling for a reappraisal of the widely accepted model implicating coeval, bimodal magmatism [1]. Moreover, monazite in the metapelitic rocks records two growth events at c. 1375 Ma and 990 Ma [2], readily linked to metamorphism during emplacement of the S-type granites and tin-bearing granites, respectively. This study highlights the potential of using metamorphic monazite to determine ages of mafic-ultramafic intrusions, and to reconstruct post-emplacement metamorphic-hydrothermal history of the host terranes.

[1] Tack et al., 2010, *Precambrian Research* 180: 63-84
[2] Zi et al., 2019, *GSA Bulletin* 131: 1857–1870