

***In-situ* U–Pb dating of hydrothermal xenotime by LA–ICP–MS: A chronological insight into Finnish Lapland orogenic gold**

ALEXANDER W. MIDDLETON*, FERENC MOLNÁR AND HUGH O'BRIEN

Geological Survey of Finland, P.O. Box 96, FI-02151 Espoo, Finland.

(*correspondence: alexander.middleton@gtk.fi)

The Central Lapland Greenstone Belt (CLGB) hosts orogenic gold deposits along the Sirkka and Kiistala Shear Zones, including the world class Suurikuusikko deposit (>2Moz at >5g/t; [1]). Despite numerous studies, the timing of Svecofennian orogenic deformation events (1.90–1.77 Ga) and associated mineralisation remains speculative with evidence resting on cross-cutting relations and single-grain analyses [2]. Xenotime is an ideal candidate for U–Pb dating by LA–ICP–MS due to its high U but minimal common Pb content. By undertaking *in-situ* U–Pb of hydrothermal xenotime, with strict control on its textural settings, this study provides better temporal constraints on mineralisation of orogenic gold in the CLGB.

The Iso-Kuotko deposit is located on a bifurcating fault intersection along the Kiistala Shear Zone, 20 km north of the Suurikuusikko deposit. It is characterised by two phases of gold mineralisation including arsenopyrite+pyrrhotite-rich quartz-carbonate breccia zones (A_1) and high-grade carbonate-quartz veins with minor disseminated sulphides and native bismuth (A_2). Xenotime hosted by A_1 gives an age range from 1740–1884 Ma. Assuming two periods of mineralisation, gaussian deconvolution of this range produces error-weighted $^{207}\text{Pb}/^{206}\text{Pb}$ age populations of 1772 ± 4 Ma and 1840 ± 5 Ma. However, xenotime grains from A_2 give a $^{207}\text{Pb}/^{206}\text{Pb}$ age, consistent with xenotime from A_1 , of 1759 ± 10 Ma (2σ ; $n = 23$) reflecting the second period of fluid flow and high-grade Au mineralisation.

In-situ U–Pb dating of hydrothermal xenotime by LA–ICP–MS produced distinct ages attributed to repeated fluid flow along the same shear zone during Svecofennian tectonism. An age of 1840 ± 5 Ma is coincident with collision of Fennoscandia and Laurentia, while an age of 1759 ± 10 Ma is consistent with voluminous post-orogenic granitoid magmatism across Fennoscandia [3]. This work was supported by the Academy of Finland, project No. 281670.

- [1] Patison (2007) *Geol Surv Finl Spec Pap* **44**, 107–125. [2] Mänttäri (1995) *Geol S Finl Bull* **391**, 70. [3] Korja et al. (2006) *Geo Soc Mem* **32**, 561–578.