Uranium-bearing, oscillatory-zoned hematite: assessing closed system behaviour for U-Pb systematics

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Oscillatory-zoning with respect to U in mineral geochronometers requires nanoscale assesesment as such patterns may reflect an overprinting event. Addition/loss of elements (open-system behaviour) disturb isotopic ratios used for U-Pb systematics. $^{207}Pb/^{206}Pb$ isotope mapping of coarse hematite from the Olympic Dam deposit, South Australia, shows ~1.6 Ga age homogeneity across oscillatory-zoned, U-bearing domains [1]. ID-TIMS analysis carried out on material micro-sampled from one such grain, up to ~1 mm apart, give approximately identical $^{207}Pb/^{206}Pb$ ages (unpubl. data). To asses open or closed system behaviour for U-Pb systematics, the same grain was chemically mapped (Fig. 1a) prior to HAADF-STEM study carried-out on a FIB-prepared foil cut across U-bands. The sample is free of inclusions (Fig. 1b) and atomic-resolution imaging shows crystallinity with no lattice damage induced by α-decay (Fig. 1c). We conclude such grains preserve a near closed system from crystallization at ~1.6 Ga.

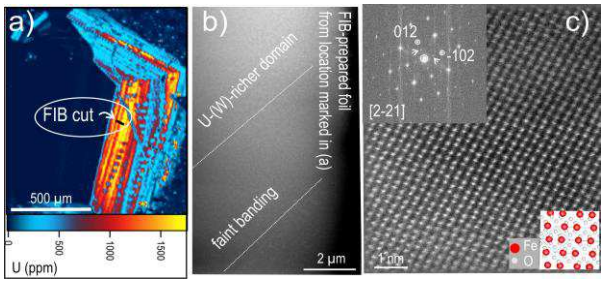

Fig. 1. (a) LA-ICP-MS map for U in hematite and location of FIB-cut. HAADF-STEM images shows a lack of inclusions (b) or α-decay induced damage. SAED for (c) in upper inset; atom model for hematite on the same [2-21] zone axis. Images at 200 Kv (Titan Themis, Adelaide Microscopy).

[1] Courtney-Davies, L. et al. (2017) Goldschmidt conference abstract