Pop-down tectonics, hydrothermal alteration, Sb mineralization: the Murchison Greenstone Belt, South Africa

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The 3.09–2.97 Ga Murchison Greenstone Belt (MGB) is one of several Archean volcano-sedimentary belts within the Kaapvaal Craton in southern Africa [1]. In the MGB, the structures are explained by pop-down tectonics of upper-crustal units within an underlying weak crust submitted to horizontal regional shortening [2, 3]. Among the diverse ore deposits found within the belt, a set of Sb-(±Au) deposits is located along a major brittle–ductile structure known as the Antimony Line. The structure is a steeply dipping deformation zone, marked by substantial sub-vertical crustal stretch.

The Antimony Line is marked by intense metasomatism with common talcificated, albitized, silicified and carbonated rocks associated to Sb-quartz-carbonate veins. Petrological and geochemical investigations indicate that albitization developed at the expense of a granodioritic protoliths under high fluid/rock ratios and that Sb enrichment was concomitant with albitization [4, 5]. Oxygen isotopes on albitites point to a crustal origin for the hydrothermal fluid responsible for the albitization process. Geochronology on zircon and hydrothermal monazite identifies a 2.97–2.92 Ga magmatic crystallization event, disconnected from a ca 2.8 Ga hydrothermal alteration, and a potential younger event around 2.0 Ga.

Microthermometric measurements on fluid inclusions hosted in Sb-mineralized quartz-carbonate veins, together with vein and host rocks paragenesis, indicate pressure-temperature of precipitation in metamorphic ambient conditions of about 350-450°C, 200-300 MPa, which are unusually high temperature for an antimony deposit [6]. Taken together, fluid inclusion and stable isotopes data point to a metamorphic origin for the fluids responsible for the mineralization, likely escaped from the nearby Sb-enriched greenstone lithologies, in a horizontal regional shortening context, akin to Archean lode-gold deposits.

[1] Poujol *et al* 1996, *Econ Geol.*, **91**, 1455-1461. [2] Jaguin *et al*. 2012, *S Afr J Geology*, **115**, 65-76. [3] Gapais *et al* 2014, *Tectonophysics*, in press. [4] Jaguin *et al*. 2012, *Min Deposita* **47**, 739-747. [5] Jaguin *et al* 2013, *Lithos*, **168-169**, 124-143. [6] Jaguin *et al* accepted, Am J of Sc.