

SEG 100 Conference: Celebrating a Century of Discovery

G15 The Fosterville Gold Deposit, its Geology and Place Amongst the World's Best Orogenic Goldfields

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The transformation of the Fosterville gold mine from a burning Phoenix into a majestic Swan has been the most significant gold story in the past 100 years of mining in Victoria, Australia.

Located just 20 km east of the world-class Bendigo 22 Moz goldfield, and within a wider Central Victorian province of historical production over 80 Moz, the Fosterville mines were economically rated poorly as recently as 2014 when gold production was slightly over 100 koz pa and Mineral Reserves just 182 koz. In that year, Victoria's total gold production was only 225 koz from just four operating mines, with geological research and exploration investment at extremely low levels.

By the start of 2020, however, an exploration pegging rush had seen all available ground surrounding Fosterville taken, and exploration expenditures increased more than 10 times! The change in mineralization at this single mine has wildly driven international corporate and investor interest, forever changing the perceptions of Victorian gold potential! What geologically changed in less than 5 years of exploration?

Shallow intersections of visible gold were sporadic and isolated and seen as an interesting geological phenomenon rather than as a precursor to recent deep discoveries. This was largely influenced by the initial belief that Fosterville was a sulphide-only gold system, even proposed as a closer analogue to Carlin than Bendigo or Ballarat (now disproven). Sparse visible gold occurrences continued until 2015, when coarse gold-in-vein drill intercepts increased in regularity, particularly where reverse faults intersected an anticline footwall to the Fosterville Fault. Before this, most gold won from arsenopyrite- and pyrite-altered wallrock disseminations were associated with thrust faults and a vein-stockworked syncline. Amazingly, a refractory orebody with grades of 4-5 g/t Au gained a well-defined shear vein orogenic system containing disseminated coarse gold, commonly less than 3mm, at multi-ounce-per-tonne grades and with low nugget effect!

When drill intersections including 1429 g/t Au across 15.15 m were announced in 2017, the newly named Swan orebody was born, and Fosterville transformed into one of the world's most profitable gold mines worth multi-billions. Annual production in 2020 increased to 640,467 oz at a phenomenal grade of 33.9 g/t Au and saw an expanded Mineral Reserve for the Swan zone of 1.25 Moz at 30.6 g/t Au.

The emergence of ultra-high grades in a structural style of multi-phase quartz-carbonate veins was a challenging change for mine geologists where not even very small quartz volumes of ore can go unmined, and small distances have markedly different vein textures, volumes, and orientations affecting gold grades. Mining and ongoing internal geoscience studies are revealing a range of local and internal structural controls and contrasts to other deposits in Central Victoria, especially geochemically. Swan barely covers 500-m strike x 300-m height, and yet generates optimism for all explorers that perseverance in a marginal sulfide gold system at depths about 1 km from surface can ultimately lead to one of the highest-grade gold deposits in the world, and a tier-one gold asset, as it did for Kirkland Lake Gold at Fosterville.

