Hydrothermal Cu-Co-Au ore formation during the Mesoarchean: Implications for Archean Cu-Co metallogenesis

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Through geological time, hydrothermal Cu-Co-Au mineralisation is generally limited to terranes of Proterozoic age or younger; occurring overwhelmingly in stratiform sediment-hosted Cu (SSC) deposits [1]. As Cu and Co are redox-sensitive metals, their mobility is strongly controlled by the availability of oxygen. Reflecting this, the rarity of significant Archean hydrothermal Cu-Co mineralisation is generally believed to reflect the absence of globally widespread oxygenated conditions prior to the Great Oxygenation Event (GOE) around 2.4 Ga [2,3]. Here we present isotopic, geochronological, and mineralogical evidence of the genesis of *Carlow Castle* Cu-Co-Au deposit (8 Mt @ 0.51% Cu, 0.08% Co, 1.6g/t Au) [4]. *Carlow Castle* is a recently discovered structurally-hosted Cu-Co-Au deposit within a sheared Paleoarchean volcano-sedimentary greenstone sequence in the Pilbara Craton of northwest Western Australia [5]. Our research indicates that *Carlow Castle* formed during a period of rifting in the northwest Pilbara Craton during the Mesoarchean. This suggests that the processes necessary to form significant Cu-Co-Au mineralisation did operate during the Archean, contrary to conventionally accepted models of Cu-Co-Au metallogenesis through geological time. This has important implications for our understanding of Cu-Co-Au metallogenesis through Earth history; suggesting that there is potential for the existence of other hitherto undiscovered hydrothermal Cu-Co-Au mineralisation in Archean greenstone terranes.

[1] Hitzman, et al. (2017), Cobalt—Styles of Deposits and the Search for Primary Deposits. U.S. Geological Survey. [2] Brown AC (2014). *Treatise on Geochemistry, 13*. [3] Lyons, Reinhard, Planavsky (2014). *Nature* 506, 307-315. [4] Artemis Resources Ltd. (2019), ASX: www.asx.com.au/asxpdf/20191120/pdf/44brd03vh31ncw.pdf [5] Fox, et al. (2019), *Economic Geology* 114(6), 1021-1031.