A Temporal Framework for the Genesis of the Carrapateena Iron Oxide Copper-Gold (IOCG) Deposit, Northern Gawler Craton, South Australia

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The Carrapateena Iron Oxide Copper-Gold (IOCG) deposit is located on the eastern margin of the Gawler Craton, approximately 475 km NE of Adelaide, South Australia. The deposit is hosted within the ca. 1860 Ma Donington Suite granite and encompasses polylithic breccias and various volcanic units. The Carrapateena deposit contains multiple stages of alteration/mineralisation, which in paragenetic order includes: (1) pre-mineralisation alteration; (2) hematite I; (3) Cu-Au mineralisation; (4) hematite II & REE mineralisation; (5) uranium mineralisation; (6) post-mineralisation alteration/veining. In order to establish a temporal framework of the deposit, multi-mineral U–Pb geochronology was conducted on a variety of lithologies within the deposit, as well as the various stages of alteration/mineralisation. Zircons from a porphyritic volcanic unit contain an age population with 207Pb/206Pb mean weighted ages of 1591 ± 19 Ma (MSWD = 0.58). These ages correlate with age populations from zircons from two samples composed of polylithic breccias, which produce 207Pb/206Pb mean weighted ages of 1595 ± 18 Ma (MSWD = 0.01) and 1593 ± 19 Ma (MSWD = 0.72). In both instances, the ca. 1590 Ma population is interpreted to represent the age of porphyritic volcanic crystallisation and polylithic breccia formation, correlating with a period of widespread magmatism throughout the Gawler Craton. U–Pb geochronology conducted on apatite, hematite and xenotime associated with various stages of mineralisation all produce ages of ca. 1585 Ma, indicating a major metallogenic event throughout the Gawler Craton. U–Pb geochronology performed on uraninite, apatite within a paragenetically late vein and hematite that displays a distinct “vuggy” texture records a second distinct hydrothermal event from ca. 600–500 Ma. This second event is interpreted to reflect the age of deposit-wide fluid circulation during the Delamerian Orogeny (520–470 Ma), resulting in the deposition and/or dissolution-reprecipitation of uraninite and post-mineralisation alteration/veining.