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Ediacaran-Cambrian Fluid Flow Imprint on Archean Gold Deposits: U-Pb SHRIMP Evidence from the Quadrilátero Ferrífero Metallogenic Province, Brazil

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The constraints on the timing of orogenic lode-gold mineralization in the Quadrilátero Ferrífero (QF), an important metallogenic province located in southeastern Brazil, have been hotly debated in the literature. The main gold deposits in QF, their tectonic evolution spanning a long history from Archean to Proterozoic orogenic cycles, are hosted in the Rio das Velhas Greenstone Belt (RVGB), including the world-class Cuiabá and Morro Velho deposits. Gold mineralization is classically interpreted to be related to the late stages of Archean deformation and metamorphism, at ca. 2.7 Ga. However, geochronological data obtained from hydrothermal monazite suggests an imprint of the late Ediacaran-Cambrian Brasiliano orogeny. *In situ* U-Pb SHRIMP dating was conducted on hydrothermal monazite from three orogenic gold deposits: Cachorro Bravo (CB), Carvoaria (CV), and Pilar (PL). These deposits form a 15-km-long gold camp in the eastern portion of the QF, are controlled by a NE-trending strike-slip shear zone, and are characterized by different mineralization styles. The CB deposit is dominated by replacement-style mineralization, with abundant arsenopyrite, and constrained by mafic dykes. In contrast, the CV deposit is characterized by vein-style mineralization, defined by auriferous quartz lodes with "free" gold and low content of sulfide minerals, and subordinate sulfosalts. The PL deposit occurs mainly as stratabound mineralized bodies, hosted by an iron formation and comprising bands of massive sulfides and quartz-carbonate veins, or in silicified sulfide-schists. The U-Pb on monazite SHRIMP II (B) analyses (Sensitive High Resolution Ion MicroProbe) were conducted at Curtin University, Western Australia. Hydrothermal monazite in mineralized metapelites from CV yielded a discordia in the U-Pb diagram with intercepts at 2514 ± 22 and 555 ± 19 Ma. Three younger, age-equivalent crystals are concordant and yield a U-Pb concordia age of 540 ± 18 Ma, identical within uncertainty to the lower intercept age. Monazite from the CB deposit, inter-grown with arsenopyrite, yielded a robust U-Pb concordia age of 535 ± 11 Ma. Monazite from the silicified sulfide-schist from the Pilar deposit is depleted in U, precluding the calculation of robust U-Pb ages. On the other hand, the Th contents are relatively high, and disclosed a mean $^{208}\text{Pb}/^{232}\text{Th}$ age of 508 ± 6.4 Ma, coherent with the results obtained from the other deposits. The results demonstrate the growth of hydrothermal monazite both in the Archean, during ore formation, and during Cambrian hydrothermal alteration. The 2.5 Ga upper intercept age could be linked to the opening of the Paleoproterozoic Minas platform basin imposed on the Archean paleocontinent and associated isotopic resetting of monazite, an event also marked by the intrusion of the Lavras mafic dike swarm dated (U-Pb SHRIMP) at 2.55 Ga. These new ages add to the recently growing body of data which suggest Archean and Cambrian ages for xenotime and monazite in gold and iron deposits throughout the QF. The results also reveal the possible influence of hydrothermal fluid flow through the QF mineral systems during the Cambrian, possibly due to gravitational collapse of the Araçuaí orogenic system.