Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.10902

In situ Rb-Sr biotite dating constrains gold alteration in a shear zone in the Eastern Goldfields, Western Australia

MR. ANDREAS ZAMETZER[1], CHRIS L. KIRKLAND[1], MILO BARHAM[1], MICHAEL I H HARTNADY[1] AND ADAM B BATH[2]

[1]Timescales of Mineral Systems Group, School of Earth and Planetary Sciences, Curtin University
[2]Commonwealth Scientific and Industrial Research Organisation (CSIRO) Earth Science and Resource Engineering

Presenting Author: andreas.zametzer@postgrad.curtin.edu.au

Neoarchean structurally controlled gold deposits constitute a considerable proportion of Earth's gold resources, yet their alteration histories are notoriously difficult to date. The large-scale structural architecture, as well as the chemical conditions for the transport and deposition of economic amounts of leachable gold have been investigated in numerous deposits. However, timing, rates, durations, and zonation of mineralizing processes are less well constrained. In an effort to understand the alteration history of the gold-bearing Zuleika Shear Zone in the Eastern Goldfields Superterrane, Yilgarn Craton, Western Australia, we determined Rb-Sr hydrothermal biotite ages for 13 drill core samples, using a laser ablation collision cell triple quadrupole mass spectrometer. Where available, co-occurring apatite was also analyzed. Initial Sr ratios suggest that biotite and apatite equilibrated from a homogeneous Sr source reservoir, consistent with a mixed mantle-crustal growth fluid. Rb-Sr biotite(-apatite) isochrons are not over-dispersed and show no correlation with grain size, but rather correlate well with the relative chronology of alteration assemblage. Hence, these biotite isochrons appear to date biotite crystallization. Linking the isochrons to characteristic mineral assemblages temporally constrains four different alteration stages within a long-lived (~150 Ma) system. Biotite Ti temperatures imply conditions between ~540 and 615 °C, indicating that biotite is able to preserve growth ages well above its nominal blocking temperature. Apparent temperatures rise to a peak during the main gold event at 2630 Ma. These results support a polyphase mineralization model where fluid conduits became sealed after alteration, with new adjacent pathways developing within the same long-lived zone of crustal weakness.