

## The Role of Carbonaceous Material in Gold Deposition in Metasediment-Hosted Orogenic Gold Deposits

S. HU<sup>1,\*</sup>, K. EVANS<sup>1</sup>, D. CRAW<sup>3</sup>, K. REMPEL<sup>1</sup>, K. GRICE<sup>2</sup>

<sup>1</sup>Department of Applied Geology, Curtin University, GPO Box U1987, Perth, WA 6845, Australia (\*correspondence: siyu.hu@student.curtin.edu.au)

<sup>2</sup>Western Australia Organic and Isotope Geochemistry Centre, Department of Chemistry, The Institute for Geoscience Research, Curtin University, GPO Box U1987, Perth, WA 6845, Australia

<sup>3</sup>Geology Department, University of Otago, GPO Box 56, Dunedin 9054, New Zealand

Carbonaceous material (CM) is commonly found associated with gold and sulfides in metasediment-hosted orogenic gold deposits. However, the role of CM in Au deposition is still controversial. In-situ and/or ex-situ CM has been proposed to directly reduce Au-bisulfide complexes, or indirectly facilitate sulfidation, which destabilizes Au-bisulfide complexes with resultant Au deposition. Geochemical data from metasediment-hosted orogenic gold deposits in New Zealand, Australia, Canada and West Africa display relationships between the weight percent of sulfur and non-carbonate carbon in mineralized samples that imply a genetic link between sulfides, CM and mineralization. Thermodynamic simulations of mineralization with HcH software provide further evidence for the role of CM during Au precipitation. It is postulated that the coexistence of CM and pyrite is a consequence of their co-deposition from fluids, with a minor proportion of CM originally in-situ in the host rocks. Deposition of pyrite and CM decreases H<sub>2</sub>S concentration in hydrothermal fluids, which drives destabilization of Au(HS)<sub>2</sub><sup>-</sup> complexes and promotes Au precipitation. However, much of the CM in deposits does not coexist with pyrite, and is proposed to deposit as a result of interaction between CO<sub>2</sub> and CH<sub>4</sub> in the ore fluid. These findings are applicable to similar deposits worldwide. Figure The ratio of S/C from modelling (indicated by black lines) are consistent with that from gold deposits (dots).