

The Role of Carbonaceous “Indicator” Slates in the Genesis of Lode Gold - Mineralization in the Western Lachlan Orogen, Victoria, Southeastern Australia

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Abstract

“Indicator” slates have long been considered to represent a useful exploration guide for turbidite-hosted mesothermal lode gold mineralization in central Victoria. This assumption has been based on an apparent close spatial relationship between high gold grades and the proximity of thin, commonly pyritic and carbon-rich marker units. Detailed studies in a number of gold deposits throughout central Victoria, however, reveal that highest gold grades do not necessarily coincide with the presence of carbonaceous units. In many places where gold mineralization is associated with carbon-rich matter, the high C accumulations are the result of epigenetic remobilization during hydrothermal alteration and ore genesis. Petrographic, geochemical, and stable isotope (C, O, S) investigations into the origin and nature of the carbonaceous matter—mainly amorphous bitumens and pyrobitumen of organic origin, with biological fragments and rare graphite of both detrital and metamorphic origin—demonstrate that black shales within the Cambro-Ordovician succession in central Victoria lacked the vital constituents to provide (1) a primary sink for precious metals, and (2) whereas the presence of carbonaceous matter was likely to affect the evolution of epigenetic hydrothermal fluids and, locally, may have facilitated gold enrichment, carbon-rich sedimentary rocks were not crucial for ore genesis on the deposit scale. Instead, the size of the hydrothermal cell, physicochemical conditions of the ascending fluids, and dynamic fault-valve behavior played far more significant roles in controlling gold precipitation. The importance of these processes has implications for exploration targeting sediment-hosted, lode- and disseminated-style gold mineralization in the western Lachlan orogen and in slate belt provinces elsewhere.