

ARTICLE

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Relationships between gold concentration and structure in quartz veins from the Hodgkinson Province, northeastern Australia

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Abstract The Hodgkinson Province is a tract of multiply deformed Silurian-Devonian rocks in north Queensland, Australia. Gold-bearing quartz veins from the West Normanby Goldfield in the northern Hodgkinson Province were emplaced during the Permian D₄ event, broadly coeval with regional granite emplacement. Taylors Fault, a major structure that formed during D₂, hosts the veins which infill dilatational jogs opened during sinistral-normal reactivation of the fault in D₄. Veins contain graphitic laminations that formed when fault planes segmented wallrocks adjacent to the veins, producing tabular clasts that were tectonically sliced into the reefs. Laminations are the result of progressive shear strain, associated with continued movement on the faults, which caused strain-enhanced dissolution of silicate minerals and residual graphite enrichment in the clasts. This process produced graphite-coated shear planes that delimit zones of grain size reduction in the veins. Laminations commonly contain stylolites, which nucleated on pronounced sinuosities of the shear planes due to progressive shortening during D₄. Gold particles have preferentially nucleated in zones of relatively coarser-grained quartz adjacent to the shear planes, where shortening strain caused microfracturing and allowed fluid access. Gold may have been introduced with

the quartz, but was redistributed within the reefs and localized along the laminations by the effects of synchronous, progressive deformation. Regionally, gold deposits show close spatial relationships with granite plutons of the Permian Whypalla Supersuite. Relationships in the West Normanby Gold Field support a regional model of reef emplacement and gold mineralization during the Permian D₄ event.

Introduction

The Hodgkinson Province of north Queensland, Australia, is an extensive north-northwest trending trough of multiply deformed Siluro-Devonian sediments and volcanics within the Tasman orogenic system (Tasmanides) and is dominated areally by the multiply deformed Hodgkinson Formation. Hodgkinson Formation comprises a thick, monotonous succession of turbiditic greywacke-siltstone-shale, slate, minor volcanics, conglomerate, chert and rare limestones of deep marine origin (Arnold and Fawckner 1980; Bultitude et al. 1990). These rocks have been intruded by a number of granitic bodies of variable size (Fig. 1), generally of Early Permian age, which have been grouped geochemically into supersuites (Bultitude and Champion 1992).

Many areas within the Hodgkinson Province, particularly within the Silurian-Devonian Hodgkinson Formation, have been exploited for gold (e.g. de Keyser and Lucas 1968), much of which has been alluvial. The presence of gold hosted by in situ veins is relatively restricted and has confined previous studies of primary controls on gold mineralization to several areas within the Hodgkinson Province where hardrock mining has been undertaken. The most detailed of these studies was by Peters et al. (1990) and focused on several mines in the Hodgkinson Gold Field (Fig. 1) in the centre of the province. Similar studies for the northern portion of the Hodgkinson Province have not been published. The most significant northern deposits in Hodgkinson Formation are located within the West Normanby Goldfield

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