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Lithological and Structural Controls on the Form and Setting of Vein Stockwork Orebodies at the Mount Charlotte Gold Deposit, Kalgoorlie

JOHN RIDLEY
GEMOC, Department of Earth and Planetary Sciences, Macquarie University, New South Wales 2109, Australia

AND FARON MENGLER
Centre for Strategic Mineral Deposits, University of Western Australia, Nedlands, Western Australia 6907, Australia

Abstract

The Mount Charlotte quartz vein gold deposit comprises a series of steeply plunging, pipelike vein stockwork orebodies in massive metagabbro. The orebodies are strata bound to the most differentiated unit of the host sill and are typically adjacent to major steeply dipping faults that cut the sill. The stockworks have two sets of veins with a dihedral angle of about 50° that developed as hydraulic fractures, filled simultaneously, and are generally approximately equally developed. Veins crosscut major faults and parallel minor faults of two sets but are cut along reactivated fault surfaces. The fault sets were inactive during mineralization and are neither veined nor are loci of zones of intense alteration. Rare faults of a third set are in part veined and are loci of zones of mineralization. Two interpretations of the stress regime during vein formation are based on different models of fracture formation. For both stress regimes, the major fault sets are relatively unfavorably oriented for slip or dilation, and predicted movement vectors do not fit fault-plane lineations. The lack of fault activity during ore fluid flow promoted formation of vein stockworks at Mount Charlotte rather than shear zone or fault-hosted veins. Fluid flow paths and orebody siting are controlled by stress-guide effects due to the rheology of the host gabbro, and by the three-dimensional geometry of impermeable faults and of fault-bounded blocks of rock.