Economic Geology
Vol. 97, 2002, pp. 801–818

Lode Gold and Epithermal Deposits of the Mallina Basin, North Pilbara Terrain, Western Australia

David L. Huston,† Richard S. Blewett,
Geoscience Australia, GPO Box 378, Canberra, ACT 2601, Australia

Brett Keillor,
P.O. Box 111, Muchea, WA 6501, Australia

Jon Standing,
Fluid Focus, 23 Milson Street, South Perth, WA 6151, Australia

R. Hugh Smithies,
Geological Survey of Western Australia, 100 Plain Street, East Perth, WA 6009, Australia

Alan Marshall,
Qestore, 21 Viewway, Nedlands, WA 6009, Australia

Terrence P. Mernagh, and Jullienne Kamprad
Geoscience Australia, GPO Box 378, Canberra, ACT 2601, Australia

Abstract

The Mallina basin, in the central west part of the North Pilbara terrain, is one of the more mineralized parts of the Pilbara craton. Three styles of Au mineralization are present in the region: (1) lode Au deposits associated with sericite-carbonate-pyrite alteration assemblages, (2) lode Au deposits associated with pyrophyllite-bearing alteration assemblages, and (3) lode Sb-Au deposits. Gold resources have been identified at the Withnell and Camel deposits just to the north of the east-trending Mallina shear zone. East-trending mineralized zones at the Withnell deposit are typical of turbidite-hosted lode Au deposits in that they are late tectonic (syn- to late- local D_3) and associated with extensive carbonate-sericite alteration. Gold mineralization occurs in planar quartz carbonate veins and with pyrite and arsenopyrite in the host rocks to the veins. Fluid inclusion analyses indicate mainly low-salinity, carbonic inclusions with moderate homogenization temperatures. The lode Sb-Au deposits have a similar structural setting and fluid characteristics. At the Camel 2 deposit Au is associated with syn- to late-D_3 pyrophyllitic shear zones that have overprinted an earlier carbonate alteration assemblage. Structural relationships and limited Pb isotope data suggest that the lode Au mineralization in this district formed at about 2900 Ma.

In addition to the lode Au and Sb-Au deposits, north-northwest–trending quartz veins have textures typical of low-sulfidation epithermal deposits. The lithogeochemistry of samples collected from these veins indicates local enrichment of Au, As, Sb, Ag, Te, and Hg, which is consistent with an epithermal origin. Based on geologic relationships and Pb isotope data, these deposits are interpreted to have formed in the Mallina basin at ca. 2750 Ma. If they are true epithermal deposits, then they are among the oldest known. Their presence suggests that preservation, not Archean age, is the key control on the temporal distribution of epithermal deposits.