FLUID EVOLUTION IN SHEAR-ZONE HOSTED MESOTHERMAL GOLD DEPOSITS: EXAMPLES FROM THE YILGARN CRATON AND LACHLAN FOLD BELT, AUSTRALIA. P. K. Seccombe, S. C. Dick, and Z. Jiang, Department of Geology, The University of Newcastle, Callaghan, New South Wales, Australia 2308 (psec@geology.newcastle.edu.au).

Structurally controlled mesothermal vein deposits represent major gold ± copper resources in Archean and Paleozoic metamorphic terrains of Australia. Similarities in ore fluid compositions and controls on gold deposition are evident, despite regional variations in host rock composition and metamorphic grades.

Gold mineralization at the Revenge mine in the Archean Yilgarn Craton of Western Australia, is linked to dilation zones developed along second- and third-order, NNW-trending, reverse faults propagating from the terrain-bounding Boulder-Lefroy Fault. Visible gold is confined to quartz breccia vein systems established within gabbroic host rocks, which are variably altered to assemblages dominated either by albite (proximal to veins), biotite+albite or chlorite+biotite+calcite (distal alteration).

Ore-forming fluids at Revenge are typically multiphase H2O-CO2 mixtures of variable density and salinity. Fluid inclusion microthermometry constrains depositional conditions for gold mineralisation to the range P = 1675 to 2075 bars and T = 425° to 525°C.

Interpreted fluctuations in fluid pressure at the time of trapping are consistent with a fault-valve model of fluid flow through the confining structures. Unmixing of CO2-H2O-NaCl fluids, due to episodic pressure decrease accompanying shear failure, was the dominant mechanism influencing gold deposition in quartz veins. Gold deposition was also influenced by sulfidation reactions in the gabbroic host rock.

Gold-copper ± (zinc-lead-silver) veins at the Peak mine, Cobar in the Paleozoic Lachlan Fold Belt of eastern Australia are confined to shear zones developed within a package of multiply deformed slates and metagraywackes of Early Devonian age and along sheared contacts between metasediments and felsic metavolcanics (flow-banded and brecciated rhyolite).

Fluid inclusion microthermometry at Peak indicates that both T and salinity increase during the paragenesis, corresponding to the introduction of Au-Cu, followed by Pb-Zn ores. Fluids involved with the major Au-Cu event (Stage 2 of the paragenesis) are hotter (ranging from 283° to 364°C) and more saline (6.0 to 8.6 wt% NaCl equivalent) than earlier, barren fluids. Temperatures of nearly 400°C are reached during deposition of the major lead-zinc sulfide veins during Stage 4 of the paragenesis.

Bulk analysis of inclusion fluids indicate a dramatic rise in the concentration of CO2 during the initial Cu-Au event and the later Pb-Zn event at Peak. F and Cl levels are elevated in the fluids associated with the Pb-Zn event. By contrast, high CH4 contents (and low CO2/CH4 ratios) characterize intervening and later stages of barren quartz deposition. Gas-phase compositions are confirmed by microthermometric data and laser Raman spectroscopy on individual fluid inclusions.

Fluid mixing is implicated as a control on ore deposition at Peak. Thermal and salinity cycles are likely to be linked to reactivation on the major thrusts and transient supply of fluid from basin and basement lithologies. An explanation for the additional base metals present in the Peak ores may involve differences in the host rocks among the two districts, rather than physicochemical factors during ore deposition.