Comparison and refinement of numerical Flac3D models of three gold deposits in the Walhalla-Woods Point Goldfield in southeastern Australia has aided the understanding of regional to mine-scale structural controls for gold mineralization.

The purpose of this research was to use the capabilities of coupled deformation and fluid flow modeling in order to contrast and compare the structural and lithological controls for fault dilation and maximum fluid flow in representative gold deposits, and to establish where gold-bearing fluids are likely to have focused during deformation.

The Lagrangian finite-difference code Flac3D can couple fluid flow and mechanical deformation in three dimensions. Mechanical behavior of the model is determined by an elastic-plastic constitutive model governed by the Mohr-Coulomb yield function, whereas fluid flow behavior is controlled by Darcy’s Law.

The Tabberaberran Orogeny (390 – 400 Ma) generated the dominant NW-trending structures throughout the goldfield by simple east-west shortening. Subsequent E-W to NE-SW compression led to deformation of the ca. 380 Ma dyke swarm and resulted in orogenic dyke- and metasedimentary rock-hosted gold mineralization.

The deposit-scale Flac3D model results illustrated that the orientation of shortening theoretically most conducive to dilation and maximum fluid flow, occurred when the field stresses were perpendicular to the local structural fabric.

The far more prospective dyke-hosted gold deposits formed within the central region of the goldfield, characterised by a NW-SE trending structural grain, as the far field stresses in this region were perpendicular at the time of gold mineralisation.