# The Relationship Between Volcanic-Hydrothermal Breccias and Gold Mineralization at the Lihir Alkalic Gold Deposit, Papua New Guinea

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The 60-Moz Lihir gold deposit, located on Lihir Island in the New Ireland Province of Papua New Guinea, is the world's largest known alkalic epithermal gold deposit. The deposit is centered within the Luise Amphitheatre, a NNW-elongated elliptical sector collapse scar that is the remnant of an alkalic Plio-Pleistocene volcano. At the western, northern, and southwestern margins of the Lihir deposit, the host volcano-sedimentary stratigraphy has been crosscut by a cluster of seven large, composite volcanic-hydrothermal breccia bodies consisting primarily of discordant polymictic breccias, sandstones, and mudstones that contain abundant fine-grained rock flour matrix.

Six of the volcanic-hydrothermal breccia bodies (Far North, Kapit, Diwai, Saddle, Mamboo, and Ramp breccias) are interpreted as diatreme breccia pipes, the feeder structures of now eroded maar volcanic edifices, and the seventh breccia body (Karot Breccia) is interpreted to be a phreatic breccia pipe. A distinctive facies association comprising coherent andesite, jigsaw-fit andesite breccia, and matrix-rich breccias that contain wispy to blocky juvenile andesite clasts define the root zones of the diatremes. Within the Far North, Kapit, Saddle and Mamboo Breccias, phreatomagmatic base surge and fallout deposits are preserved as slumped megablocks within the upper portions of the diatreme pipes. The volcanic-hydrothermal breccias contain clasts of porphyry-stage anhydrite-cemented breccias and epithermal-stage pyrite-cemented breccias, implying that a hydrothermal system was active prior to fragmentation. The hydrothermal fluids associated with volcanic-hydrothermal brecciation did not produce high-grade gold mineralization and acted to dilute gold grades on the peripheries of the major ore zones. The Diwai and Kapit Breccias are spatially associated with NE-trending, overprinting high-grade gold mineralization consisting of drusy calcite-pyrite-cemented breccias and veins at 100 to 150 m below sea level, demonstrating a late-mineralization timing for these breccias.