The Jiguanzui copper-gold skarn deposit in the Daye Fe-Cu-Au area of the Middle-Lower Yangtze River metallogenic belt has genetic association with an early Cretaceous stock consisting of quartz diorite and porphyritic diorite that intrude marine carbonate sequences of the Lower Triassic Daye Group. The Cu-Au mineralization is mostly hosted in the contact zone between the quartz diorite and the carbonates broadly parallel to stratigraphic boundaries. Field and petrographic relationships indicate four mineralizing stages, including the prograde skarn stage (stage 1), retrograde skarn stage (stage 2), quartz-sulfides stage (stage 3) and carbonate stage (stage 4). Ore minerals include pyrite, chalcopyrite, and bornite that were mostly precipitated in the quartz-sulfides stage.

There are abundant primary fluid inclusions in garnet, epidote, quartz and calcite. They are dominated by daughter mineral-bearing inclusions, with lesser amounts of liquid-rich aqueous inclusions. The homogenization temperature of both types of inclusions in garnet and epidote range from 420 to >500 ºC and the calculated salinities are 15~25 wt.% NaCl equiv. for the aqueous fluid inclusions and 40 to >55 wt.% NaCl equiv for the daughter mineral-bearing varieties. Quartz from the stage 3 assemblage hosts gas-rich and liquid-rich aqueous inclusions coexisting with daughter mineral-bearing inclusions. Those three types of fluid inclusions have comparable homogenization temperature of 300~450 ºC but their salinities are distinctly different, being 16~24 wt.% NaCl equiv. for the aqueous inclusions and 40~54 wt.% NaCl equiv. for the daughter mineral-bearing inclusions. The homogenization temperatures and salinities of the fluid inclusions in quartz are interpreted in terms of fluid immiscibility during the main stage of mineralization precipitating the gold and copper minerals.

Widespread presence of hydraulic breccias within the ore bodies is consistent with the fluid immiscibility inferred from the fluid inclusion data. Calcite from the stage 4 hosts liquid-rich aqueous two-phase inclusions and liquid-only aqueous inclusions, homogenized to liquid at 140~165 ºC with very low salinities of 0.1~0.5 wt.% NaCl equiv.

Scanning electron microscopy and electron microprobe analysis shows that Au is presented mainly as visible gold minerals, with minor amounts of invisible Au in sulfides minerals. Visible gold occurs as interstitial electrum grains in pyrite or as stringers filling microfractures in pyrite. The invisible gold is likely dominated by gold nanoparticles in pyrite. Electrum commonly coexists and is texturally equilibrated with naumannite and clausthalite that are paragenetically late phases relative to hessite and argentite. Abundant Te-Bi-S assemblages are also recognized as inclusions in pyrite, indicating their formations predating the selenides and Au and Ag minerals.

The fluid inclusion data confirms that ore-fluids were derived from exsolution of the crystallizing magma and fluid immiscibility has been the important mechanism precipitating the Au-Cu ores, while the mineralogical data demonstrate that Bi, Se, and Te have been important in scavenging Au. The paragenetic sequences permit an inference for the sulfur, tellurium, and selenium fugacities under which the Bi-Te-S assemblages, tellurides, selenides, and gold and silver minerals were precipitated. The fluid inclusion data confirms that ore-fluids were derived from exsolution of the crystallizing magma and fluid immiscibility has been the important mechanism precipitating the Au-Cu ores, while the mineralogical data demonstrate that Bi, Se, and Te have been important in scavenging Au. The paragenetic sequences permit an inference for the sulfur, tellurium, and selenium fugacities under which the Bi-Te-S assemblages, tellurides, selenides, and gold and silver minerals were precipitated. The Te-Bi-S assemblages formed at -12<lg f_{Se}<-8, -10<lg f_{Te}< -5 and 12<lg f_{Se}<-15, whereas hessite and argentite were precipitated at -14<lg f_{Te}<-9 and -12<lg f_{Se}<-7 (Afifi et al. 1988a, b; Simon and Essene, 1996, 1997). With the precipitation of sulfides and Ag-Te-Bi-S minerals leading to significant changes of sulfur, tellurium, and selenium fugacities of the ore-fluid, Au and Ag precipitated as native gold, electrum and kustelit...
intergrown with selenides at \( \log f_{Te2} < -18 \) and \( -14 < \log f_{Se2} < -10 \) (Seward, 1984; Douglas, 2000; Cockerton and Tomkins, 2012).

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**References**


