Located along the southern part of the Yarlung Zangbo suture zone in the southern Tibet, Bangbu is the largest gold deposits in Tibet. Auriferous sulfide-bearing quartz veins are controlled by second- or third-order brittle fractures associated with the regional Qusong-Cuogu-Zhemulang brittle-ductile shear zone. The shear zone is an E-W-striking sinistral fault, with a length of >40 km and a width of >1 km. Mafic dikes were emplaced along the shear, suggesting it is probably a very deep fault. Most of the orebodies in the Bangbu gold deposit are controlled by the NNW- and NE-striking second- to third-order brittle structures of the main shear zone. The strata surrounding the gold deposit is mainly that of the Late Triassic Langjiexue Group, which include marine argillites and greywackes that are mostly metamorphosed to lower greenschist facies. Most of the ore at Bangbu is present as limonite-, pyrite-, and galena-bearing auriferous quartz veins, with additional ore in pyrite-, galena-, sphalerite-, and chalcopyrite-bearing altered wallrock. Gold occurs within quartz grains, adjacent to sulfide grains, and in fractures or as inclusions within the sulfides. The diameter of the native gold grains is mainly 0.1-0.4 mm. The major gangue minerals include quartz, sericite, epidote and carbonate.

Fluid inclusion studies show that the auriferous quartz contains aqueous inclusions, two-phase and three-phase CO₂-bearing inclusions, and pure gaseous hydrocarbon inclusions. The CO₂-bearing inclusions have salinities of 2.2-9.5%NaCléq, and homogenization temperatures(Th) of 167-336°C. The δD and δ¹⁸O of the Bangbu ore-forming fluids are -44.4 to -42.5‰ and 4.7 to 9.0‰, respectively, indicating that the ore-forming fluid is mainly of metamorphic origin, with also some mantle-derived contribution. The fluid extracted from the inclusions in the quartz veins is -2.2 to -5.1‰, indicating that the CO₂ is mainly mantle-derived, with minor CO₂ from lower crust. The ⁳⁷He/⁴⁰Ar ratio of ore-forming fluids is 0.174 to 1.010Ra, and ⁴⁰Ar/³⁸Ar ranges from 311.9 to 1724.9. Calculations indicate that the percentage of mantle-derived He in fluid inclusions from Bangbu is 6.3-16.7%. These geochemical features are similar to those of most orogenic gold deposits. Dating by ⁴⁰Ar/³⁹Ar of hydrothermal sericite collected from auriferous quartz veins in Bangbu yielded a plateau age of 44.8±1.0 Ma, with normal and inverse isochronal ages of 43.6±3.2Ma and 44±3Ma. This indicates that the gold mineralization was contemporaneous with the main collisional stage between India and Eurasia, which resulted in formation of Yalung Zangbu suture zone and the subsequent near-vertical lithospheric shear zones. The shear zone is a large-scale ultra-crust deep fault, thus its activity and the subsequent crust-mantle interaction may have triggered the release of large amounts of ore-forming fluids from the deformed and metamorphosed host rocks, the lower crust, and even the upper mantle. At around 44 Ma, the middle and lower crust in the Bangbu area suffered high-temperature and high-pressure metamorphism because of ductile deformation and upwelling upper mantle magmas. The ore forming fluids enriched in CO₂ and ³⁷He, generated by granulite facies metamorphism and baking by upwelling upper mantle magmas, were transported to the middle to upper crust along the ductile shear zone, and finally precipitated auriferous sulfide-quartz veins in brittle structures because of declining temperature, pressure, and subsequent unmixing.

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