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Geology, geochemistry and geochronological constraints on the genesis of newly discovered Katebasu gold deposit, western Tien Shan, Xinjiang, NW China

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The Katebasu deposit is a major new, bulk-tonnage, gold discovery located 30 km south of Xinyuan County within the western Tien Shan belt in Xinjiang, NW China. The deposit was discovered in 2010 and by the end of 2014 contained a proved reserve of 87 t of gold at a cutoff grade of 3.84 g/t.

Gold mineralization at the deposit is principally hosted within a brittle and ductile fracture zone of Silurian volcano-sedimentary succession intruded by middle Carboniferous monzogranite along the northern margin of the Central Tien Shan continental arc, adjacent to the Nikolaev Line -- northern Nalati Fault. Gold mineralization occurs as shallowly dipping, east-northeast−trending, lenticular and tabular bodies within quartz+K-feldspar+sericite (in center) and epidote+chlorite (outer shell) alteration zones in monzogranite. Gold occurs in the form of electrum and native gold along the margins in chalcopyrite and pyrite or as “invisible gold” within pyrite grains. Zircon U−Pb dating of the ore-hosting monzogranite yielded a concordia age of 346.3±3.3 Ma, which is notably older than the Re−Os age of 310.9±4.2 Ma for five auriferous pyrite samples.

The deposit is genetically associated with moderate temperature (207~390°C), low-salinity (7~16 wt % NaCl equiv) and CO_2-rich fluid. Calculated composition for $\delta^{18}O_{H2O}$ on gold-bearing quartz veins are respectively 1.6 to 6.4‰ (at temperatures of 300°C) and and δD_{H2O} ranges from −64 to –107‰, suggesting a potential magmatic-metamorphic fluid mixing. The relatively high initial $^{187}Os/^{188}Os$ ratio (1.449±0.052) of the auriferous pyrite, in combination with the highly consistence of Pb-isotopic compositions between the pyrite samples ($^{206}Pb/^{204}Pb$ is from 18.129 to 18.773, $^{207}Pb/^{204}Pb$ form15.459 to 15.554, $^{208}Pb/^{204}Pb$ from 37.707 to 38.123) and their hosting monzogranite intrusion ($^{206}Pb/^{204}Pb$ is from 18.564 to 18.857, $^{207}Pb/^{204}Pb$ from 15.624 to 15.650, $^{208}Pb/^{204}Pb$ from 38.158 to 38.406) and Silurian volcanic rocks ($^{206}Pb/^{204}Pb$ from 18.564 to 18.857, $^{207}Pb/^{204}Pb$ from 15.624 to 15.650, $^{208}Pb/^{204}Pb$from 38.158to 38.406), indicates that the ore metals might be originated from the upper crust of the Central Tien Shan continental arc at the Katebasu field. Sulfur isotope compositions of pyrite and chalcopyrite samples give an interval of 6.92 to 12.15‰ (mean=9.48‰, n=13), suggesting a dominant marine sediments for the sulfur.

All deposit characteristics indicate that the Katebasu gold deposit was formed by the thrust-and-fold processes during the Late Carboniferous collision between the Tarim Craton and the Middle Tien Shan continental arc, and should belong to a member of the collision-related orogenic gold deposit class.