Gold ore-forming fluids and metallogeny in the Zhaoyuan-Laizhou concentration region of Jiaodong peninsula, Eastern China

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Zhaoyuan-Laizhou gold concentration region in the Jiaodong Peninsula of Eastern China is currently the most important gold producer in China. Several world-class gold deposits (>100 t gold) have been discovered in the region. There are two main types of gold deposits, namely quartz vein-style (Linglong type) and fault-zone hosted disseminated/stockwork-style (Jiaojia type).

Detailed fluid inclsuion studies have been carried out in the Linglong and Jiaojia type deposits in the region. Three types of fluid inclusions have been distinguished from quartz in gold lodes: (A) H_2O-CO_2 inclusions, (B) CO_2-H_2O±CH_4 inclusions, and (C) aqueous H_2O inclusions. The pre-gold H_2O-CO_2 fluid inclusions occur isolated in samples of the early milk-white quartz and are assumed to have been trapped during crystallization of the earliest quartz. Fluid inclusions associated with gold mineralization contain mostly CO_2-H_2O-NaCl±CH_4 fluids, and occur isolated, and sometimes in healed fractures particularly in smoke-grey quartz with variable CO_2 and CH_4 contents. There are similar changes of molar volumes of H_2O-CO_2 and CO_2-H_2O±CH_4 inclusions with 50 - 70 cm^3/mole from the depsoits. Estimated fluid trapping pressures of pre-gold and gold-stage are 1.0 - 3.5 kbar and 0.7 - 2.5 kbar, respectively. The pressure is tending towards depression along with fluid evolution.

Obtained Rb-Sr and Ar-Ar isochron ages from the Zhaoyuan-Laizhou gold concentration region give gold mineralization time around 120 Ma. Gold deposits in the region are formed in the same mineralizing-geodynamic circumstance, and related with Mesozoic tectonic transition in the eastern North China craton.

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Genesis of carbonatite from Hannuoba and Yangyuan, North China

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Most of the mantle-derived magmas are silicate melt, with very few others, such as carbonate magmas. However these rare carbonate magmas tell quite different but important stories on mantle evolution. Here we report a new case of mantle-derived carbonate magma found in the Cenozoic basalts in Hannuoba and Yangyuan, North China. The carbonate melts occur in small veins, which cut through the basalts and mantle peridotite xenoliths. The carbonatite veins are mainly dominated by calcite (>90%), with a little amount of mantle minerals, e.g. olivine, clinopyroxene, orthopyroxene and spinel. The xenoliths are altered by the carbonate melt, and their colors changed from originally yellow or green to purplish brown-amarance, with grayish white network stringers of carbonatite cut through. Whole rock chemical compositions reveal that the carbonatite veins have low rare earth elements (ΣREE =8.7-13.7×10^{-6}) and trace elements, with slightly enriched LREE patterns. Stable isotopes of C and O in the carbonatite veins are $\delta^{13}C$=-11.2~-12.3‰ and $\delta^{18}O$=22.6~22.8‰, respectively. Only a few fresh samples from Hannuoba have mantle carbonatite C and O isotopic ratios ($\delta^{13}C$ = -5.7~-7.3‰ , $\delta^{18}O$ = 8.5~10.1‰), while most samples show significant characteristics of weathering. Radioactive isotopes of Sr, Nd, Pb are $^{87}Sr/^{86}Sr$= 0.7078-0.7079, $^{143}Nd/^{144}Nd$=0.5129, $^{206}Pb/^{204}Pb$=18.0, $^{207}Pb/^{204}Pb$=15.5, $^{208}Pb/^{204}Pb$=38.0, respectively. ε_{Nd} of two samples in Hannuoba vary in 5.3-5.5, and reveal their DM mantle origin. The carbonatite indicate that they have the same origin of depleted mantle as the basalt, but weathering after magma eruption modifies the carbonatite.

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