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Preservation of gold deposits in Jiaodong , China: constraints from biotite geobarometry and apatite Fission track data

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The exhumation process of mineral deposits is critical both to understand their distribution regularities and to regional mineral exploration, especially for those deposits formed in orogenic tectonic setting, where mineral deposits is prone to be eroded. Within an area less than 0.2% of China's territory, more than one fourth of the whole China gold was produced in the Jiaodong peninsula, making the Jiaodong peninsula the most important gold production base in China (Zhou et al., 2003; Yang et al., 2014). More than 90% of the gold deposits occurred in the so-called Linglong granitic complex, which is composed by the Linglong granite (ca. 155 Ma), the Luanjiahe granite (ca. 155 Ma), the Guojialing granite (ca. 128) (Wang et al., 1998) and the Aishan granite (ca 115Ma) (Goss et al., 2010). Gold mineralization has been dated in a small range of 115-123 Ma (Li et al., 2003; Goldfarb and Santosh, 2013; Li et al., 2015), which is similar to the intrusive age of the Guojialing granite. Thus the gold deposits and the Linglong granitic complex underwent the same evolutional process after the formation the gold deposits.

Taking the Linglong granitic complex and gold deposits occurred in the complex as an example, regional gold ore-forming depths are investigated in detail through recalculation of former research data, emplacement depths of the Linglong granitic complex are acquired through Al-in-biotite barometer (Uchida E et al. 2007), denudation rate and denudation thickness are discussed quantitatively through fission track analysis on apatite separated from granites of the complex. Research results show that gold deposits of the Northwestern Jiaodong peninsula are mesothermal lode gold deposits formed in shallow-moderate depth. Gold ore-forming temperature concentrated about 250 ^{o}C and ore-forming depth is about 2-3km. 20 data from Al-in-biotite barometer show that average emplacement depth of the complex is about 5.32km, while the latest Aishan intrusion are located at about 2.37km depth. 54 apatite fission track data suggests the average denudation rate of the complex is about 0.0254mm/a, indicating 2.79km average denudation thickness since 110Ma. Considering that Goldfarb et al (2005) proposed a range of 2 to 20 km for orogenic gold deposits and argued that Phanerozoic orogenic gold deposits are commonly formed at 2 to 5 km, denudation amount of the Liinglong complex is quite equivalent with that of the ore-forming depth indicates that preservation conditions of the gold deposits in Jiaodong area is rather well and there is great gold resource potential in the deep. This totally new scientific practice reveals that comparison between ore-forming depth and post-ore denudation will led better understand of post-ore change and preservation of ore deposits. Fission track method combining with fluid inclusion study will become a practical approach to post-ore change and preservation in the study of ore deposit geology. It is of theoretic and practical importance both to recognize regional ore-forming regularities and scientific mineral exploration.

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