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东秦岭花山复式岩基中蒿坪与金山庙花岗岩体岩石地球化学、锆石U-Pb年代学和Lu-Hf同位素组成

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摘要：

蒿坪与金山庙花岗岩体位于华北陆块南缘,是熊耳山地区花山复式岩基的重要组成部分。锆石LA-ICP-MS U-Pb定年显示,蒿坪岩体两个样品年龄为128.7±1.0Ma 和129.3±2.4Ma,金山庙岩体一个样品年龄为127.6±1.6Ma,均为早白垩世岩浆作用的产物。蒿坪岩体以发育碱性长石大斑晶为主要特征,主要组成矿物为碱性长石、斜长石、石英、黑云母和少量角闪石等,而金山庙岩体矿物组合则为碱性长石、斜长石、石英和黑云母。化学组成上二岩体均具高硅准铝、富碱高钾及富铁贫镁的特征,轻重稀土元素分馏显著,Eu异常较弱或无明显Eu异常,Eu/Eu^*为0.69~1.26,富集Cs、Rb、Ba、Sr等大离子亲石元素,亏损Nb、Ta、Ti、Y等高场强元素,在成因类型上可归为I型花岗岩,其中金山庙岩体经历了更高程度的分离结晶作用(D.I.=96.6~97.3),应属高分异I型花岗岩。锆石Lu-Hf同位素分析结果显示,蒿坪岩体$\varepsilon_{Hf}(t)$为-10.2~-13.3,t_{DM2}为1.8 Ga~2.0 Ga,金山庙岩体$\varepsilon_{Hf}(t)$为-13.3~-17.5,t_{DM2}为2.0~2.2Ga,表明二者的源区很可能是遭受了幔源或新生地壳改造的太华群古老基底物质。根据区域地质和全岩地球化学组成及产出动力地质背景的全面分析,表明蒿坪与金山庙岩体应形成于扬子陆块与华北陆块碰撞造山后的陆内伸展引张环境,是古特提斯构造域向古太平洋构造域转换体制下岩浆作用的产物。在成岩过程中,蒿坪和金山庙岩浆体系释放出大量富挥发组分(如F, Cl)的热液流体(特别是高分异的金山庙岩体),萃取富集了围岩中的成矿物质或是叠加改造了先期(印支期或燕山早期)形成的金矿床,使之运移至构造交汇部位规模性成矿。

英文摘要：

The Haoping and Jinshanmiao granitic plutons occurred in the southern margin of the North China Craton, are the important components of the Huashan complex batholith in Xiong’ershan region. Zircon LA-ICP-MS U-Pb dating yields ages of 128.7±1.0Ma to 129.3±2.4Ma for Haoping pluton, and of 127.6±1.6Ma for Jinshanmiao pluton, suggesting that they were all formed in Early Cretaceous. The Haoping pluton consists of alkali-feldspar, plagioclase, quartz, biotite and minor amphibole, and is mainly characterized by development of megaphyric alkali-feldspar, whereas the mineral assemblages of the Jinshanmiao pluton are alkali-feldspar, plagioclase, quartz and biotite. Chemically, these two plutons are both metaluminous, and characterized by rich in silicon and alkaline, poor in magnesium, and have high $FeO^T/(FeO^T+MgO)$ ratios. These rocks are all enriched in Cs, Rb, Ba and Sr, etc., and depleted in Nb, Ta, Ti and Y, etc., and display a significant fractionation between LREEs and HREEs, with weakly negative Eu anomalies or no Eu anomalies ($Eu/Eu^*=0.69~1.26$). Therefore, the Haoping and Jinshanmiao plutons could be grouped into I-type granites, and the latter should be further categorized to the highly fractionated granites due to the higher degree of differentiation (D.I.=96.6~97.3). The Lu-Hf isotopes shows that the $\varepsilon_{Hf}(t)$ values of the Haoping pluton range from -10.2 to -13.3, with t_{DM2} ages between 1.8Ga and 2.0Ga, while the $\varepsilon_{Hf}(t)$ values of the Jinshanmiao range from -13.3 to -17.5, with the t_{DM2} ages of 2.0Ga to 2.2Ga, indicating that these two plutons might be derived from the ancient materials of Taihua Group basement which was reformed by the mantle or the juvenile crust during the long-time geological evolvement. Integration of regional geology, whole-rock geochemistry and geodynamic considerations suggests that the Haoping and Jinshanmiao plutons should be emplaced in the intracontinental extensional environment followed by the end of the collision between the Yangtze and the North China blocks, which implies that they were formed during the tectonic transition from the Paleo-Tethys subduction-collision system to the Paleo-Pacific regime. During this diagenetic process, large amount of hydrothermal fluids with abundant volatile components (e.g., F, Cl) derived from the Haoping and Jinshanmiao magmatic systems, extracted and gathered the metallogenic materials from the country rocks, or superimposed and reformed the preexisting (Indosinian or Early Yanshanian) gold deposits, and then transported them to the intersection of many tectonic systems and formed large scale mineralization.

关键词：年代学 岩石地球化学 Lu-Hf同位素 金成矿效应 花山复式岩基 东秦岭

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