

徐耀明, 蒋少涌, 朱志勇, 周巍, 孔凡斌, 孙明志. 2012. 九瑞矿集区山上湾矿区石英闪长玢岩和花岗闪长斑岩的年代学、地球化学及成矿意义. 岩石学报, 28(10): 3306-3324

九瑞矿集区山上湾矿区石英闪长玢岩和花岗闪长斑岩的年代学、地球化学及成矿意义

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基金项目: 本文受科技部973项目(2012CB416706); "十二五"国家科技支撑计划(2011BAB04B03)和国家自然科学基金项目(41072055)联合资助

摘要:

山上湾矿区位于九瑞矿集区西南部的大浪水库附近,区内地表出露有数条近东西向的岩脉,发现有较强的蚀变作用及铜矿化,有可能成为九瑞矿集区的一个新的成矿远景区。因此,我们对这些岩脉开展了详细的岩相学和矿物化学研究及锆石U-Pb定年、主微量元素及Sr-Nd-Hf同位素研究工作,对岩石成因及成矿意义进行了初步探讨。山上湾矿区出露的岩脉分别为石英闪长玢岩及花岗闪长斑岩,对岩石中黑云母和斜长石斑进行电子探针分析后发现,黑云母均属富镁黑云母,由黑云母化学成分所反映的岩浆岩氧逸度位于赤铁矿-磁铁矿缓冲线之下,低于武山花岗闪长斑岩体。斜长石斑晶均为中长石,并具有韵律环带。北面两条岩脉(II, III)锆石LA-ICP-MS U-Pb定年结果分别为 149.2 ± 2.7 Ma和 148.5 ± 1.4 Ma,最南面一条岩脉(I)年龄稍小,为 139.0 ± 1.3 Ma。该区岩浆岩地球化学特征如下:SiO₂为58.8%~63.0%,Al₂O₃为14.9%~16.2%。岩石样品在K₂O-SiO₂图中落于高钾及中钾钙碱性岩范围内。样品A/CNK值为0.86~1.15, A/NK值为1.72~1.85,在A/CNK-A/N图解中落于准铝质和过铝质范围。岩石富集大离子亲石元素(Sr= 380×10^{-6} ~ 555×10^{-6} , 平均 463×10^{-6}),富集相容元素(Cr、Co、Ni、V),亏损高场强元素(Y= 8.91×10^{-6} ~ 11.22×10^{-6} , Nb= 4.87×10^{-6} ~ 5.73×10^{-6} , Ta= 0.36×10^{-6} ~ 0.43×10^{-6}),无Sr负异常。轻稀土富集,重稀土亏损,(La/Yb)_N=14.31~18.96,稀土总量为 89.36×10^{-6} ~ 118.8×10^{-6} , Eu/Eu* = 0.98~1.13, 平均1.05, 无Eu负异常。岩石的初始⁸⁷Sr/⁸⁶Sr值变化在0.7060~0.7092之间,平均0.7074, ε_{Nd}(t)值在-2.9~-2.0之间,平均-2.3。利用两阶段模式计算出的Nd同位素模式年龄t_{DM}^C为1.1~1.2 Ga。锆石初始¹⁷⁶Hf/¹⁷⁷Hf值在0.282359~0.282758之间, ε_{Hf}(t)值在-11.8~2.3之间,平均-1.1。计算的t_{DM}^C值为1.0~1.9 Ga。根据上述岩石地球化学和同位素数据,初步认为山上湾地区的岩浆岩很可能是由加厚的下地壳拆沉入软流圈地幔后,发部分熔融,熔体在上升过程中又与地幔发生了强烈相互作用,最终形成了具有明显壳幔混源特征的石英闪长玢岩及花岗闪长斑岩。目前我们已在山上湾矿区北面两条岩脉(II, III)的地表露头上发现了多种蚀变现象以及铜的矿化,加之它们的成岩年龄及岩石成因与九瑞其他成矿花岗闪长斑岩相同,我们推测,在该区深部岩体中,岩体与奥陶系灰岩的内外接触带上,以及岩体附近的奥陶系与志留系地层接触界面部位,均存在成矿可能性,值得投入更大力量,争取该区找矿新突破。

英文摘要:

In order to constrain petrogenesis and corresponding mineralization significance, a detailed study on geochronology, mineral chemistry, major and trace elemental and Sr-Nd-Hf isotope geochemistry was performed for the quartz diorite porphyry and granodiorite porphyry in the Shanshangwan area of the Jiurui ore district, Jiangxi Province. The titanite phenocrysts of the samples are all eastonite, and their compositions indicate a f_{O_2} lower than HM buffer line. All the plagioclase phenocrysts are andesine and characterized by oscillatory zoning texture. Zircon LA-ICP-MS U-Pb dating suggests emplacement ages of 149.2 ± 2.7 Ma and 148.5 ± 1.4 Ma for the two northern dykes (II and III), and 139.0 ± 1.3 Ma for the southernmost dyke (I). Shanshangwan intrusive rocks are characterized by SiO₂ and K₂O contents of 58.8% to 63.0%, and 1.9% to 2.4%, respectively, enrichment in light rare earth elements (LREE) and large ionophile elements (LILE), and relative depletion in Nb, Ta, Y and Yb. They show no negative Eu anomalies (Eu/Eu* = 0.98~1.13, with an average of 1.05) and no negative Sr anomalies. The initial Sr ((⁸⁷Sr/⁸⁶Sr)_i) = 0.7060~0.7092, with an average of 0.7074, Nd (ε_{Nd}(t) = -2.9~-2.0, with an average of -2.3) and zircon Hf (ε_{Hf}(t) = -11.8~2.3, with an average of -1.1) isotopic compositions of the Shanshangwan intrusive rocks and their slightly higher MgO contents (ranging from 2.0% to 2.8% with an average of 2.5%), high Mg[#] value (ranging from 42 to 51 with an average of 48) and high compatible trace element (Cr, Ni and V) contents exhibit that the magma may have experienced intense interaction

with mantle. Comprehensive geochemical and Sr-Nd-Hf isotopic data demonstrate that the Shanshangwan intrusive rocks may have originated from partial melting of thickened lower crust delaminated into mantle. In addition, several kinds of alteration minerals and Cu mineralization have already been found within the Shanshangwan intrusions, and the petrogenesis of this district is identical with the other mineralization-related granodiorite porphyries in the Jiurui district. Therefore we suggest that the contact zone between carbonate rocks of Ordovician and intrusive rocks, and the interface between carbonate strata of Ordovician and siltstone of Silurian would host high potential to form ore deposits of economic significance.

关键词：[锆石U-Pb定年](#) [Hf同位素](#) [地球化学](#) [浅成侵入岩](#) [山上湾矿区](#) [九瑞矿集区](#)