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东秦岭二郎坪群长英质火山岩成因及其对VMS型矿床成矿环境的制约

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摘要:

东秦岭二郎坪群位于宽坪群和秦岭群之间,是一套海相火山岩-沉积岩建造,形成于早古生代。二郎坪群火山岩中发育有火山成因块状硫化物矿床,该类矿床主要赋存于东二郎坪群刘山岩组和西二郎坪群火神庙组的长英质火山岩(变石英角斑岩、变凝灰岩)中。长英质火山岩富集LILE、亏损HFSE(Nb、Ta),高的Th/Ta(平均值为24.0),显示岛弧型火山岩地球化学特征,反映源区受到俯冲作用的影响。二郎坪群火山岩的 $^{147}\text{Sm}/^{144}\text{Nd}$ 为0.107754~0.154978, $^{143}\text{Nd}/^{144}\text{Nd}$ 为0.512465~0.512895, $\epsilon_{\text{Nd}}(t \geq 467\text{Ma})$ 为+0.83~+7.63,表明它们源于亏损的地幔源区。镁铁质岩浆上升到中地壳(10~15 km),经过AFC演化形成长英质岩石。通过蚀变指数AI(alteration index)和CPI(chlorite-carbonate-pyrite index)对二郎坪群长英质火山岩的蚀变特征进行研究,表明矿体下盘的长英质火山岩明显受到热液蚀变的影响,有别于区域成岩蚀变的岩石,反映成矿热液流体上升对围岩的热液蚀变作用。因此,有效区分热液蚀变或者区域成岩蚀变,可以指导找矿工作。根据东、西二郎坪群火山岩Zr/Y比值、Sr同位素的差异,认为西二郎坪群矿床(水洞岭和上庄坪)形成于初始的弧后盆地,受陆源物质影响较大,形成富Pb的矿床(类似于黑矿型);而东二郎坪群矿床(刘山岩)可能形成弧后盆地的成熟阶段,类似于斐济盆地,形成富Cu的矿床。

英文摘要:

The Early Paleozoic Er'langping Group is composed of volcanic rocks and sedimentary rocks, and exposes between the Kuanping Group and Qinling Group in the East Qinling Orogenic Belt. The volcanogenic massive sulfide (VMS) deposits are mainly hosted by the felsic volcanic rocks of the Er'langping Group. The felsic volcanic rocks are enriched in LILE, depleted in HFSE (Nb, Ta), high Th/Ta ratios (average being 24.0), typical subduction-related signature. The characteristics of $^{147}\text{Sm}/^{144}\text{Nd}$ (0.107754 to 0.154978), $^{143}\text{Nd}/^{144}\text{Nd}$ (0.512465 to 0.512895), and $\epsilon_{\text{Nd}}(t \geq 467\text{Ma})$ (+0.83 to +7.63) demonstrate that they were generated from depleted mantle. We propose that the felsic volcanic rocks formed by fractional crystallization of mafic magmas at mid-crustal levels (10~15km) associated with minor crustal assimilation. Alteration indexes, the alteration index (AI) against the chlorite-carbonate-pyrite index (CCPI), termed the "alteration box plot". This "alteration box plot" was used to characterize the different alteration trends related to massive sulfide ores, and to assist in the distinction of Er'langping Group related hydrothermal alteration from regional diagenetic alteration. According to the difference of Zr/Y ratios and Sr isotopes between east Er'langping Group and west Er'langping Group, we propose that the Shuidongling and Shangzhuangping deposits in the west Er'langping Group probably formed in nascent back-arc environment. These deposits are enriched in Pb, Zn, Ba, similar to Kuroko-type deposit from Japan. The Liushanyan deposit in the east Er'langping Group, however, is enriched in Cu, Zn, probably formed in a mature back-arc environment (like Fiji Basin).

关键词: [东秦岭](#) [二郎坪群](#) [长英质火山岩](#) [VMS型矿床](#) [热液蚀变](#) [成矿环境](#)

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