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扬子克拉通北缘随(州)-枣(阳)地区新元古代变质岩浆岩的地球化学和SHRIMP锆石U-Pb年代学研究

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#### 摘要:

扬子克拉通北缘的随州-枣阳地区是整个秦岭-桐柏山-大别山-苏鲁造山带及其前陆地区受三叠纪(印支期)扬子板块向华北板块深俯冲并发生高压-超高压变质作用影响最小的地区,因而扬子板块北缘的前寒武纪基底在这里得到了较多的保存。它们不仅为研究扬子板块北缘新元古代构造环境和岩石圈性质提供了难得的样品,也为研究造山带内变质杂岩的原岩性质及高压-超高压变质作用过程中元素的地球化学行为提供了参照物。这里出露的前寒武纪基底包括新元古代的变质火山-沉积岩系(随州群)以及大量的超镁铁质-镁铁质岩床群。其中构成随州群的岩性包括变酸性火山岩、变沉积岩及少量的变基性火山岩。超镁铁质-镁铁质岩床群以橄长岩为主,少量辉长苏长岩和辉石岩。本文用SHRIMP锆石U-Pb法测得随州群中变质流纹英安质凝灰岩和变质粗面安山岩及超镁铁质-镁铁质岩床群中橄长岩的侵位年龄分别为 $763 \pm 7\text{Ma}$ 、 $741 \pm 7\text{Ma}$ 和 $632 \pm 6\text{Ma}$ 。随州群火山岩的年龄与桐柏山-大别山-苏鲁造山带内高压-超高压变质杂岩的原岩年龄类似,至于造山带内榴辉岩的原岩年龄是否有类似于橄长岩的侵位年龄( $631.5 \pm 6.1\text{Ma}$ ),尚需进一步研究。地球化学上,随县群的酸性火山岩表现出强烈亏损Sr和高场强元素Nb、Ta,富集Rb、Ba、U、Th、K等强不相容元素和轻稀土元素,轻、重稀土元素之间的分馏程度强( $(\text{La}/\text{Yb})_{\text{N}}=10.44$ )、弱负Eu异常( $\delta\text{Eu}=0.75$ ),总体特征类似于大别山-苏鲁造山带内大量出露的黑云斜长片麻岩和裂谷环境下形成的双峰式火山岩的酸性端元。随县群玄武岩的稀土元素之间几乎无分馏( $(\text{La}/\text{Yb})_{\text{N}}=1.78 \sim 1.79$ ),高场强元素Nb和Ta相对于La无明显的亏损,总的地球化学特征类似于造山带内大多数的榴辉岩。橄长岩以高 $\text{Al}_2\text{O}_3$ 和MgO含量、低 $\text{TiO}_2$ 和碱为特征,轻、重稀土元素之间的分馏程度较强( $(\text{La}/\text{Yb})_{\text{N}}=5.49$ ),尤以强的Ba、Sr及Eu正异常( $\delta\text{Eu}=1.22$ )为显著特征,表明其中有较多的富钙斜长石聚集。高场强元素Nb、Ta、U、Th(以及Zr和Hf)无明显的异常,表明其形成过程中未受到大陆地壳的混染,岩浆源区属富集型地幔。

#### 英文摘要:

The Suizhou-Zaoyang area (northern margin of the Yangtze craton), where is the least affected area of the whole Qinling-Tongbaishan-Dabieshan-Sulu orogen and their foreland by the deep subduction of the Yangtze Craton beneath to the North China Craton and HP-UHP metamorphism during Triassic, relative well preserved Precambrian basement of the northern Yangtze Craton. These low-rank metamorphosed Precambrian rocks not only provide an ideal opportunity to study the palaeo-tectonic setting of the northern Yangtze Craton and nature of the lithosphere, but also are rare-references for resumming protolithes of the metamorphic complex in the orogen and examining the element mobility during HP-UHP metamorphism. The Precambrian rocks exposed here include Neoproterozoic volcanic-sedimentary rock series (Suizhou Group) and voluminous Neoproterozoic ultramafic-mafic sill swarm. The Suizhou Group is composed of meta-acidic volcanic rocks, meta-basic volcanic rocks, and meta-sedimentary rocks. The ultramafic-mafic sill swarm is composed predominantly of two-pyroxene troctolites, with minor gabbro-norites and pyroxenites. In this work, we used zircon SHRIMP U-Pb technique accurately dating the rhyodacitic tuff and meta-trachyandesite of the Suizhou Group, as well as two-pyroxene troctolitic sill swarm, yielding an emplacement ages of  $763 \pm 7\text{Ma}$ ,  $741 \pm 7\text{Ma}$  and  $632 \pm 6\text{Ma}$ , respectively. The two former ages are similar to the emplacement ages of protolithes of the HP-UHP metamorphic rocks outcropped in the orogen, but it is still not sure whether there are any emplacement ages of protolith of the eclogite in the orogen are similar to the emplacement ages of the troctolitic sill swarm ( $632 \pm 6\text{Ma}$ ). Geochemically, the acidic volcanic rocks exhibit obvious depletion in Sr and high field strong elements (HFSEs) such as Nb and Ta, enrichment in strong incompatible elements such as Rb, Ba, Th, U and K as well as light rare earth elements (LREEs). This type of rocks also show characteristics of strong enrichment in LREE over the HREE ( $(\text{La}/\text{Yb})_{\text{N}}=10.44$ ), and weak negative Eu anomalies ( $\delta\text{Eu}=0.75$ ), similar to the biotite plagiogneisses widely distributed in the Dabie-Sulu orogen and acidic end-member of bimodal volcanic rocks developed in rift setting. The meta-trachyandesite of the Suizhou Group show no fractionation between LREE and HREE, no negative HFSEs anomalies such as Nb and Ta, similar geochemically to most eclogites in the orogen. The troctolitic sill swarm is characterized by high  $\text{Al}_2\text{O}_3$  and MgO contents, low  $\text{TiO}_2$  and alkali contents, strong enrichment of LREE over HREE ( $(\text{La}/\text{Yb})_{\text{N}}=5.49$ ), particular for strong positive Ba, Sr and Eu anomalies ( $\delta\text{Eu}=1.22$ ), indicating plagioclase crystallization/accumulation. No HFSEs such as Nb, Ta, U, Th, Zr and Hf anomalies for the troctolitic sill swarm show little contamination of crustal material during evolution of the magmas, and that the parent magma could be derived from partial melting of an enriched subcontinental lithospheric mantle.

关键词: [随州群](#) [双峰式火山岩](#) [镁铁质岩床群](#) [SHRIMP锆石U-Pb定年](#) [新元古代](#) [扬子克拉通北缘](#)

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