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摘要:

威海-荣成地区混合岩化花岗质片麻岩为研究超高压地体折返过程中的部分熔融提供了理想的窗口。本文通过对荣成地区鲍村花岗质片麻岩中浅色条带野外观察、岩相学以及锆石的CL图像、U-Pb定年、微量元素和Lu-Hf同位素的系统研究表明,鲍村花岗质片麻岩中的浅色条带部分熔融的产物,其主要矿物组成为石英+斜长石+钾长石+黑云母。锆石CL图像显示清楚的核-边结构:继承岩浆核和新生岩浆边。继承核的 $^{206}\text{Pb}/^{238}\text{U}$ 协和年龄为 $620\pm 8\sim 784\pm 7\text{Ma}$ (Mean= $701\pm 33\text{Ma}$);具有典型的岩浆锆石的微量元素特征,如重稀土(HREE)和Y富集,强烈正Ce异常和负Eu异常,以及极低的 $(\text{Gd}/\text{Lu})_{\text{N}}$ 和Hf/Y比值; $\epsilon_{\text{Hf}}(t=700\text{Ma})$ 值为 $-13.0\sim -8.0$ (Mean= -10.9 ± 0.8),相应的 $t_{\text{DM}2}$ 为 $2120\sim 229\text{Ma}$ (Mean= $2303\pm 51\text{Ma}$)。新生边的 $^{206}\text{Pb}/^{238}\text{U}$ 协和年龄为 $211\pm 6\sim 244\pm 5\text{Ma}$ ($226\pm 10\text{Ma}$);虽然微量元素的含量低于继承核,但也具有岩浆锆石的微量元素特征,如稀土元素配分模式显示HREE明显上翘的特征,正Ce异常和负Eu异常,以及极低的 $(\text{Gd}/\text{Lu})_{\text{N}}$ 比值; $\epsilon_{\text{Hf}}(t=225\text{Ma})$ 值为 $-17.3\sim -14.2$ (Mean= -15.2 ± 0.6),相应的 $t_{\text{DM}2}$ 为 $2152\sim 2347\text{Ma}$ (Mean= $2214\pm 33\text{Ma}$)。上述特征表明,部分熔融的原岩是由古元古代(2.2~2.3Ga)的地壳物质在新元古代($701\pm 33\text{Ma}$)重熔而成,部分熔融可能发生在超高压地体折返早期的热折返阶段(辉岩相-高压麻粒岩相条件下),时代应为 $226\pm 10\text{Ma}$ 。威海-荣成混合岩化片麻岩内广泛发育的富含钾长石和石英的酸性岩脉(约220~210Ma),可能为折返晚期的角闪岩相冷凝阶段,部分熔融形成的熔体经历了结晶分异作用的产物。

英文摘要:

In order to decipher the partial melting time of the Sulu ultrahigh pressure (UHP) terrane during exhumation, we carried out a combined study of zircon internal structure, U-Pb age, trace element and Lu-Hf isotopic compositions coupled with fieldwork on leucosome of the Baocun granitic gneiss in Rongcheng region. Our works suggest that the leucosome, mainly composed of quartz, plagioclase, K-feldspar, and biotite, was the product of partial melting. Zircon from the leucosome display core-rim structure in cathodoluminescence (CL) images: inherited magmatic core and new growth magmatic rim. Most age data of the inherited cores are concordant with apparent $^{206}\text{Pb}/^{238}\text{U}$ ages ranging from $20\pm 8\text{Ma}$ to $784\pm 7\text{Ma}$ with a weighted mean age of $701\pm 33\text{Ma}$. The inherited cores have the characteristics of typical magmatic zircons, e.g., high HREE and Y contents, strong HREE enrichment on chondrite-normalized REE plot, very large positive Ce and negative Eu anomalies, and very low $(\text{Gd}/\text{Lu})_{\text{N}}$ and Hf/Y ratios. The inherited cores have $\epsilon_{\text{Hf}}(t=700\text{Ma})$ values of -13.0 to -8.0 (mean= -10.9 ± 0.8) and $t_{\text{DM}2}$ of 2120Ma to 2429Ma (mean= $2303\pm 51\text{Ma}$). The new growth rims have concordant $^{206}\text{Pb}/^{238}\text{U}$ ages ranging from $211\pm 6\text{Ma}$ to $244\pm 5\text{Ma}$ with a weighted mean age of $226\pm 10\text{Ma}$. Although the new growth rims are greatly different from the inherited cores in trace element compositions, they still display features of the magmatic zircon, e.g., strong HREE enrichment on chondrite-normalized REE plot, large positive Ce and negative Eu anomalies, and very low $(\text{Gd}/\text{Lu})_{\text{N}}$ and Hf/Y ratios. The new growth rims have $\epsilon_{\text{Hf}}(t=225\text{Ma})$ values of -17.3 to -14.2 (mean= -15.2 ± 0.6) and $t_{\text{DM}2}$ between 2152Ma and 2347Ma (mean= $2214\pm 33\text{Ma}$). These results suggest that protolith of the leucosome are Mid-Neoproterozoic ($701\pm 33\text{Ma}$) magmatic rocks which were from Paleoproterozoic (2.2~2.3Ga) continental crust. The partial melting is expected under eclogite-facies to granulite-facies conditions during the early stage hot exhumation of the Rongcheng UHP felsic gneisses, and the partial melting time might be $226\pm 10\text{Ma}$. The K-feldspar- and quartz-rich pegmatitic veins (ca. 220~210Ma) in the Weihai-Rongcheng region might be from fractional crystallization of the partial melts during late stage cool exhumation under amphibolite facies conditions.

关键词: [部分熔融](#) [花岗质片麻岩](#) [荣成](#) [苏鲁超高压地体](#)

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