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星星峡石英闪长质片麻岩的锆石年代学:对天山造山带构造演化及基底归属的意义

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摘要:

天山造山带是中亚造山带(CAOB)的主要组成部分,对于其前寒武纪古老基底的起源、古生代构造单元划分和造山作用过程的认识还存在很大分歧。本文对分布在星星峡镇西的石英闪长质片麻岩开展了系统地岩相学观察和锆石U-Pb年龄、Hf同位素及全岩地球化学分析。根据矿物组成推测它们的原岩为石英闪长岩,两个样品中的锆石具有基本一致的内部结构特征,均发育黑色、均一的边部和具震荡环带的核部,部分保留有更早的继承锆石核。分析结果表明,它们的原岩形成于~425Ma,变质作用年龄为约320~360Ma,继承锆石的年龄为1381~1743Ma。原岩结晶锆石具有正的且变化较大的 $\epsilon_{\text{Hf}}(t)$ 值(0.9~17.8),继承锆石的 t_{DM2} 模式年龄变化于1.54~2.44Ga。在全岩地球化学组成上,石英闪长质片麻岩具有明显富集Rb、Ba、Th、K等大离子亲石元素和Pb、U元素,亏损Nb、Ta、Ti等高场强元素的特点。结合区域上已有的前寒武纪基底、高级变质岩、蛇绿混杂岩、岩浆岩的研究资料,获得以下认识:中天山地块的前寒武纪基底的起源与塔里木板块没有明显的相关性,可能是中元古代时期,由东欧板块边缘的弧增生造山作用形成;中天山地块东部在早古生代为大陆边缘弧的构造环境,可能形成于南天山洋向中天山板块的俯冲作用;南天山洋在天山造山带的东部和西部可能具有一致的闭合时间。

英文摘要:

The Tianshan orogen is the major component of the Central Asian Orogenic Belt (CAOB). There has been a continued debate on the derivation of the old Precambrian crustal basements and Paleozoic tectonic divisions and evolutions of the orogen. In this paper we present petrological characteristics, zircon U-Pb ages and Hf isotope compositions as well as the whole rock geochemistry of the quartz dioritic gneisses from west of the Xingxingxia Town. Based on the mineral assemblages, their protoliths are speculated to be quartz dioritic. Zircon grains from two collected samples have similar internal structures identified on the cathodoluminescence (CL) images, which is characterized by CL-dark, homogeneous rims surrounding the oscillatory zoning cores with rare inherited inner cores. Zircon U-Pb dating results indicate that their protoliths were formed in Early Paleozoic time at ~425Ma, and were metamorphosed during Early Carboniferous at approximately 320~360Ma. The inherited zircon cores yield a wide age range of ca. 1381~1743Ma. The crystallization zircons from the protolith show positive and varying $\epsilon_{\text{Hf}}(t)$ values (from 0.9 to 17.8), and the inherited zircon cores give t_{DM2} model ages of 1.54Ga to 2.44Ga. The quartz dioritic gneisses are characterized by marked positive Rb, Ba, Th and K anomalies and depletion in Nb, Ta and Ti on the primitive mantle-normalized spider diagrams. Through integration of these new data with the previous results of Precambrian basements, high-grade metamorphic rocks, ophiolitic mélanges and igneous rocks from the Tianshan orogen, we suggest that: 1) the Precambrian crustal basements in the Tianshan orogen don't have much affinity with the Tarim Block, and are inferred to be formed through a magmatic arc accretionary orogen along the margins of Baltica during the Mesoproterozoic; 2) the eastern segment of Central Tianshan was an active continental margin during the Early Paleozoic, due to the subduction of the South Tianshan Ocean; 3) the closure of the South Tianshan Ocean may be synchronous in its eastern and western segments.

关键词: [石英闪长质片麻岩](#) [早石炭世](#) [中元古代](#) [星星峡](#) [中天山地块](#)

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