

·综述与进展·

柴达木盆地北缘锡铁山副片麻岩所记录的多期构造热事件

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摘要 在柴达木盆地北缘中段的锡铁山地区, 夹有榴辉岩或退变榴辉岩透镜体的2个副片麻岩样品的锆石被用于SHRIMP U-Pb测定。2个片麻岩样品具有类似的特征, 主要由石榴子石、夕线石、长石、黑云母和石英组成, 这些矿物组合形成的变质条件为0.6~0.9 GPa和710~820℃, 显示两处片麻岩经历了中压麻粒岩相条件的变质作用。锆石的SHRIMP U-Pb测定显示, 2个样品均获得近一致的早古生代变质年龄(分别为437 Ma±6 Ma和441 Ma±15 Ma), 代表早古生代的高温变质作用时代。样品XTS-1还获得890 Ma±14 Ma的年龄, 所测定的锆石具有明显的变质作用成因特征, 代表了新元古代早期的变质事件, 反映了这些副片麻岩在早古生代造山旋回之前可能还经历了晋宁期的变质作用。

关键词 柴达木盆地北缘 锡铁山 副片麻岩 锆石SHRIMP U-Pb定年 多期构造热事件

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Zhang J X, Meng F C, Tung K A. Polyphase tectonothermal event recorded in the Xitieshan paragneisses at the northern margin of the Qaidam basin, China. *Geological Bulletin of China*, 2007, 26(6) 631-638

Abstract: Two paragneiss samples containing eclogite or retrograde eclogite lenses from the Xitieshan area in the central segment of the northern margin of the Qaidam basin were used for SHRIMP U-Pb zircon dating. The two samples have similar mineral assemblages composed predominantly of garnet, sillimanite, plagioclase, K-feldspar, quartz and biotite. The p - T conditions were 0.6–0.9 GPa and 710–820℃, suggesting a middle-pressure granulite facies metamorphism. SHRIMP U-Pb dating of zircons from two samples, combined with CL and BSE images of zircons, indicates that the two samples give similar Early Paleozoic ages (437±6 Ma for sample XT-36 and 441±15 Ma for sample XTS-1), representing the age of Early Paleozoic high-temperature granulite-facies metamorphism. The age of 890±14 Ma obtained from sample XTS-1 is interpreted as the age of early Neoproterozoic high-grade metamorphism and implies that these paragneisses may have undergone the Jin-nianing orogeny before the Early Paleozoic orogenic cycle.

Key words: northern margin of the Qaidam basin; Xitieshan; paragneiss; zircon SHRIMP dating; polyphase tectonothermal event

北喜马拉雅及藏南伸展构造综述

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摘要 :印度与欧亚大陆碰撞发生于 65 Ma 左右, 造山作用则开始于中新世初期, 该造山运动形成南喜马拉雅的逆冲推覆体系, 导致喜马拉雅山脉的隆起。然而, 与造山作用的同时, 北喜马拉雅及藏南地区却经历了广泛的伸展作用, 所形成的伸展构造包括 : ①北喜马拉雅地区, 开始于 24 Ma 左右的藏南拆离系 (STDS) ; ②北喜马拉雅及藏南地区, 开始于 14 Ma 左右的南北向裂谷 ; ③北喜马拉雅穹隆带, 形成时间大致与南北向裂谷相同 ; ④广布于青藏高原、开始于中新世末期、随机分布的高角度正断层。上述不同阶段的伸展构造形成于不同机制, 并在喜马拉雅造山带的发展过程中起着不同的地质作用。其中, 北喜马拉雅穹隆是一种特殊的伸展构造, 并可能形成于多种机制。

关键词 :印度与欧亚大陆碰撞 ; 青藏高原 ; 喜马拉雅造山带 ; 藏南 ; 伸展构造 ; 形成模式

中图分类号 : P542⁺.4 **文献标志码** : A **文章编号** : 1671-2552(2007)06-0639-11

Zhang J J. A review on the extensional structures in the northern Himalaya and southern Tibet. *Geological Bulletin of China*, 2007, 26(6) 639-649

Abstract : India-Asia collision occurred at ~65 Ma ; while mountain-building began in the early Miocene, which gave rise to a thrust system in the southern Himalaya, causing the Himalayan Mountains to be uplifted. However, in the process of the orogeny, the northern Himalaya and southern Tibet experienced extensive extension. The structures formed by the extension include : (1) the southern Tibetan detachment system in the northern Himalaya, which began to form at ~24 Ma ; (2) the north-south-trending rifts in the northern Himalaya and southern Tibet, which began to form at ~14 Ma ; (3) the northern Himalaya domes, which formed simultaneously with the N-S trending rifts ; and (4) high-angle normal faults distributed randomly in the Qinghai-Tibet, which began to form at the end of the Miocene. The extensional structures at the different stages formed by different mechanisms and played different geological roles in the process of development of the Himalaya orogen. Among other thing, the northern Himalaya domes belong to a special type of extensional structure and probably formed by different mechanisms.

Key words : India-Asia collision ; Qinghai-Tibet Plateau ; Himalayan orogen ; southern Tibet ; extensional tectonics ; formation model

·学术讨论·

以海原断裂甘肃老虎山段为例浅析 走滑断裂古地震记录的完整性 ——兼论古地震研究中的若干问题

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摘要 在简单介绍海原断裂老虎山段松山探槽点古地震工作的基础上, 分析了制约走滑断裂上古地震记录完整性的因素。松山探槽点跨断裂开挖的2个探槽揭示颜色和粒度不同的地层互层的沉积序列呈近水平面状展布。在断裂带内地层发生错断、旋转和拖曳等变形现象。多个层位上的这种变形表明该点揭示了6次古地震事件。炭屑的¹⁴C年龄限定了6次事件均发生在距今3500~3900年以来, 其中最新的4次事件从老到新分别为0~410 aAD、890~1000年之后不久、1440~1640 aAD和1990年景泰-天祝Mw5.8级历史地震。该序列及其他例子表明连续的、高沉积速率的微构造环境是走滑断裂上探槽选取的重要原则。

关键词 走滑断裂 古地震 探槽位置选择 高沉积速率环境 海原断裂 甘肃

中图分类号 P315.2

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Liu J, Xu X W, Li Y F, Ran Y K. On the completeness of paleoseismic records of strike-slip faults: an example from the Laohushan segment of the Haiyuan fault in Gansu, China, with a discussion of several problems in the paleoearthquake study. *Geological Bulletin of China*, 2007, 26(6) 650-660

Abstract: In this paper, taking for example the paleoseismic investigation of the Laohushan segment of the Haiyuan fault, the authors analyze the constraints on the completeness of paleoseismic records. Two fault-perpendicular trenches at the Songshan trench site have revealed that nearly horizontally-bedded sedimentary layers with alternating colors and grain sizes are offset, rotated and sheared. Such deformations in multiple stratigraphic horizons demonstrate the occurrence of six paleoseismic events. ¹⁴C dating of charcoal from the trenches determines that all the six events occurred during the past 3500-3900 years, of which the youngest four events took place, from the oldest to youngest, during 0-410a A.D., shortly after 890-1000a A.D., during 1440-1640a A.D. and in 1990 when the Jingtai-Tianzhu Mw=5.8 earthquake took place. This record and other examples suggest that the structural environment with few or no depositional hiatuses and high rates of sedimentation are the best sites for trenching in a strike-slip fault.

Key words: strike-slip fault; paleoearthquake; trench site selection; location with high rates of sedimentation; Haiyuan fault

·基础地质·

青海同仁县隆务峡地区首次发现镁铁质—超镁铁质岩带

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摘要 在青海省同仁县隆务峡南段的二叠纪地层中首次发现了北西—南东向分布的镁铁质—超镁铁质岩带, 命名为隆务峡镁铁质—超镁铁质岩带。该岩带的岩石组合包括纯橄岩、辉石橄榄岩、辉长岩、辉绿岩、枕状玄武岩等。从超镁铁岩—下部堆晶岩—辉绿岩—上部堆晶岩, 其稀土元素总量逐渐增加, 稀土元素配分型式总体一致, 从超镁铁岩的Eu正异常到上部辉长岩的Eu负异常, 显示了各岩石间的同源性。根据对其两侧沉积岩中化石的研究, 推测该镁铁质—超镁铁质岩带的形成时代为二叠纪。该岩带位于西秦岭造山带与祁连造山带的接合部, 对于揭示秦岭和祁连接合部的大地构造演化有重要意义。

关键词 隆务峡镁铁质—超镁铁质岩 二叠纪 西秦岭 南祁连 青海

中图分类号 P588.12⁺⁴ P588.12⁺⁵ P595 **文献标志码** A **文章编号** 1671-2552(2007)06-0661-07

Zhang K X, Zhu Y H, Lin Q X, Kou X H, Fan G M, Chen F N, Luo G M. Discovery of a mafic-ultramafic belt in the Rongwoxia area, Tongren, Qinghai, China. *Geological Bulletin of China*, 2007, 26(6) 661-667

Abstract: A NW-SE-trending mafic-ultramafic belt has been found in Permian strata in the southern segment of the Rongwo Gorge, Tongren County, Qinghai Province, which is named the Rongwoxia mafic-ultramafic belt in this paper. The rock association of this mafic-ultramafic belt include dunite, harzburgite, gabbro, diabase and pillow basalt. The gradual increase of the total REE content from ultramafic rocks→lower cumulates→diabase→upper cumulates, general consistent REE distribution patterns and change from Eu positive anomalies of ultramafic rocks at the base to negative anomalies of gabbro in the upper part—all these suggest the cogenesis of these rocks. Based on the study of the fossils taken from sedimentary rocks at both sides of the belt, it is inferred that this age of the belt Permian. The Rongwoxia mafic-ultramafic belt is located in the junction zone between the West Qinling orogenic belt and Qilian orogenic belt and has great significance for revealing the exact tectonic evolution of the junction zone of the Qinling and Qilian.

Key words: Rongwoxia mafic-ultramafic belt; Permian; West Qinling; South Qilian; Qinghai

青海南部杂多地区超镁铁质—镁铁质岩石的特征及Ar—Ar定年

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摘要 通过野外地质研究和室内岩相学、岩石地球化学研究, 在位于青藏高原中部的青海杂多地区的双湖—澜沧江结合带中发现了一套超镁铁质岩、镁铁质岩。该超镁铁质岩、镁铁质岩沿北西—南东向区域构造线多呈岩脉状侵入在早石炭世杂多群中, 局部呈构造透镜体分布在断裂带中或呈包体分布在白垩纪花岗岩中, 出露规模不大, 局部侵入体具有层状侵入杂岩体的特征。主要岩石类型为辉石橄榄岩、辉长岩、辉长辉绿岩, 岩石地球化学具高Ti、Fe、Al、Ga和LREE中等富集的特征。橄榄岩中角闪石的 $^{40}\text{Ar}/^{39}\text{Ar}$ 同位素测年得到 $275.3 \text{ Ma} \pm 1.9 \text{ Ma}$ 的坪年龄, 表明这套超镁铁—镁铁质岩石可能为早、中二叠世弧后盆地拉张的产物。

关键词 青藏高原; 双湖—澜沧江结合带; 早二叠世; 超镁铁质—镁铁质岩; 岩石地球化学; Ar—Ar定年

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Wang Y Z, Qi S S, An S W, Xu C Q. Characteristics and Ar—Ar dating of ultramafic—mafic rocks in the Zadoi area, southern Qinghai, China. *Geological Bulletin of China*, 2007, 26(6) 668–674

Abstract A suite of ultramafic—mafic rocks was found in the Shuanghu—Lancangjiang junction zone in the Zadoi area, central Qinghai—Tibet Plateau through the field geological study and laboratory petrographic and geochemical studies. The ultramafic—mafic rocks of this suite mostly occur as dikes injected into the Early Carboniferous Zadoi Group along the NW—SE lineament and locally occur as structural lenses in the fault one or as xenoliths in Cretaceous granites. Their outcrops are of small scale and locally the intrusions have the features of stratiform intrusive complexes. The dominant rock types are harzburgite, gabbro and gabbro—diabase and chemically the rocks have higher Ti, Fe, Al and Ga contents and are moderately LREE—enriched. $^{40}\text{Ar}/^{39}\text{Ar}$ dating of hornblende from peridotite yielded a plateau age of $275.3 \pm 1.9 \text{ Ma}$ and an isochron age is $275.6 \pm 3.1 \text{ Ma}$, which indicates that this suite of ultramafic—mafic rocks is probably the product of Early—Mid Permian back—arc basin extension.

Key words Qinghai—Tibet Plateau; Early Permian; Ar—Ar dating; ultramafic—mafic rocks; geochemistry; Shuanghu—Lancangjiang junction zone

青藏高原北羌塘盆地杂多地区晚二叠世—早三叠世 陆相火山岩的地球化学特征及其意义

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摘要 在北羌塘盆地东部杂多县特龙赛等地首次厘定出晚二叠世—早三叠世火山岩。该火山岩形成于陆相环境,由4个爆发—溢流相火山韵律组成一个完整的火山旋回。这些火山岩主要由强蚀变杏仁状橄榄玄武岩、岩屑晶屑凝灰岩、杏仁状安山岩等组成, TiO_2 含量 (1.33%~1.76%) 与峨眉山低Ti玄武岩相当, MgO 含量较低 (2.23%~7.52%, 平均为5.02%), 富集轻稀土元素 (LREE/HREE=4.16~13.44, 平均为6.5), 无明显的Eu异常 ($\delta\text{Eu}=0.85\sim1.02$, 平均0.96), Nb、Ta轻度负异常, 地球化学特征与大陆拉斑玄武岩相似。各种微量元素判别图解显示这些火山岩形成于大陆拉张带或陆内裂谷区。结合区域研究成果, 晚古生代时整个羌塘地区很可能处于一种伸展背景。

关键词 北羌塘盆地 晚二叠世—早三叠世 陆相火山岩 陆内裂谷环境

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LI S P, Wang Y Z, Shen C X, Xu C Q, Qi S S, Zeng X P. Geochemical characteristics of Late Permian–Early Triassic continental volcanic rocks in the Zadoi area, northern Qiangtang, Qinghai–Tibet Plateau. *Geological Bulletin of China*, 2007, 26(6) 675–681

Abstract: Late Permian–Early Triassic volcanic rocks were for the first time defined in the Telongsai area, Zadoi County, in the eastern part of the northern Qiangtang basin. The volcanic rocks formed in a continental environment and four explosive–effusive volcanic rhythms make up a complete volcanic cycle. These volcanic rocks consist predominantly of strongly altered amygdaloidal olivine basalt, lithic and crystal tuff and amygdaloidal andesite. They are characterized by low TiO_2 contents (1.33–1.76%, equivalent to that of the low-Ti Emeishan basalt), low MgO contents (2.23–7.52%, with a mean of 5.02%), enrichment of LREE (4.16–13.44, with a mean of 6.5), no pronounced Eu anomaly ($\delta\text{Eu} = 0.85\sim1.02$, with a mean of 0.96) and weak negative Nb and Ta anomalies. These geochemical characteristics are similar to those of continental tholeiite. Discrimination diagrams of various trace elements indicate that these volcanic rocks formed in a continental extensional zone or intracontinental rift zone. The above-mentioned characteristics, combined with the regional research results, suggest that the whole Qiangtang area was very likely to lie in an extensional environment during the Late Paleozoic.

Key words Qiangtang basin; Late Permian–Early Triassic; continental volcanic rocks; intracontinental rift environment

藏北南羌塘陆块北缘晚三叠世弄佰组火山岩的特征及构造环境

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摘要 藏北南羌塘陆块北缘发育一套晚三叠世火山岩, 命名为弄佰组。该组火山岩以玄武岩为主。岩石化学成分以低 TiO_2 、 $\text{FeO}+\text{Fe}_2\text{O}_3$ 、 K_2O 为特征。 $\sum \text{REE}$ 介于 162.91×10^{-6} ~ 383.4×10^{-6} 之间, $\sum \text{Ce}/\sum \text{Y}$ 介于1.83~3.00之间, δEu 介于0.47~0.97之间, 平均为0.73, 负Eu异常较明显。微量元素Sr、K、Rb、Ba、Th、Ce、Sm强烈富集, Ta、Nb、P、Ti、Cr相对亏损。岩石学和岩石地球化学特征表明弄佰组火山岩形成于消减带岛弧区。弄佰组火山岩出露于龙木错-双湖结合带的南侧, K-Ar同位素年龄值为 $223 \text{ Ma} \pm 5 \text{ Ma}$, 与双湖带中蓝片岩和绿片岩相变质岩系的形成年龄(220~235 Ma)基本一致, 时空关系的紧密相连, 说明其形成可能与晚三叠世龙木错-双湖古特提斯洋的南向俯冲消减事件有关。

关键词 晚三叠世 弄佰组 火山岩 构造环境 南羌塘陆块北缘 龙木错-双湖结合带 藏北

中图分类号 P534.51 P588.14

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Wang Y S, Qu Y G, Sun Z G, Zheng C Z, Xie Y H, Lu Z L. Characteristics and tectonic setting of volcanic rocks of the Late Triassic Nongbai Formation at the northern margin of the south Qiangtang block, northern Tibet, China. *Geological Bulletin of China*, 2007, 26(6) 682-691

Abstract : A suite of Late Triassic volcanic rocks is developed at the northern margin of the south Qiangtang block, northern Tibet. It is named the Nongbai Formation. The volcanic rocks in this formation consist predominantly of basalt and are characterized by low TiO_2 , $\text{FeO}+\text{Fe}_2\text{O}_3$ and K_2O . $\sum \text{REE}$ ranges between 162.91×10^{-6} and 383.4×10^{-6} , $\sum \text{Ce}/\sum \text{Y}$ between 1.83 and 3.00, and δEu from 0.47 to 0.97 with an average of 0.73, exhibiting a negative Eu anomaly. The rocks are strongly enriched in the trace elements Sr, K, Rb, Ba, Th, Ce and Sm and depleted in Ta, Nb, P, Ti and Cr. The petrological and geochemical characteristics suggest that the volcanic rocks in the area formed in an island arc environment of a subduction zone. The volcanic rocks of the Nongbai Formation are exposed at the south side of the Lungmu Co-Shuanghu junction zone. Their K/Ar age is $223 \pm 5 \text{ Ma}$, which is in the main consistent with the age (220~235 Ma) of the blueschist and greenschist metamorphic schist in the Shuanghu junction zone. The close temporal-spatial relation suggests that their formation was probably related to the southward subduction of the Late Triassic Lungmu Co-Shuanghu Paleo-Tethys Ocean.

Key words : Nongbai Formation ; Late Triassic ; volcanic rocks ; tectonic setting ; northern margin of the south Qiangtang block ; Lungmu Co-Shuanghu junction zone ; northern Tibet

滇西鹤庆地区六合透辉石正长斑岩锆石 SHRIMP U-Pb 年龄及其意义

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摘要: 鹤庆县六合透辉石正长斑岩中的锆石有 2 种成因类型: 一是岩浆锆石, 二是具有老核新壳的岩浆复合锆石。用锆石 SHRIMP U-Pb 定年法, 测定了岩浆锆石和岩浆复合锆石的新壳 2 部分, 其年龄为 $37.8 \text{ Ma} \pm 1.1 \text{ Ma}$, 属于喜马拉雅早期, 相当于早渐新世。结合前人的资料, 对斑岩的属性、源区及岩浆复合锆石的老核等问题进行了探讨。

关键词: 锆石 SHRIMP U-Pb 年龄 透辉石正长斑岩 滇西鹤庆地区

中图分类号: P588.13+3 P597+.3

文献标志码: A

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Xia B, Geng Q R, Zhang Y Q. Zircon SHRIMP U-Pb age of diopside syenite-porphyry at Liuhe, Heqing, western Yunnan, China. *Geological Bulletin of China*, 2007, 26(6): 692-697

Abstract: Zircons from diopside syenite-porphyry at Liuhe, Heqing, western Yunnan, have two genetic types: magmatic zircons and inherited zircons with old cores and new growth zones. SHRIMP U-Pb zircon dating of the magmatic zircons and the new growth zones of the inherited zircons shows that the age of the rock is $37.8 \pm 1.1 \text{ Ma}$, indicating an early Himalayan age, which corresponds to the early Oligocene. According to the age data, combined with the previous study, the attributes and source of the porphyry and the old cores of the magmatic inherited zircons with growth zones are discussed.

Key words: zircon SHRIMP U-Pb age; diopside syenite-porphyry; Heqing, western Yunnan

藏北羌塘地块中部蓝片岩中捕获锆石 SHRIMP U-Pb定年及其意义

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摘要 羌塘中部2个蓝片岩样品中锆石的SHRIMP U-Pb定年结果表明, 锆石属于残留锆石, 不是蓝片岩相变质作用形成的新生锆石, 这些年龄代表源区原岩的年龄或原岩捕获锆石的年龄, 是不同构造-热事件的响应。首次在藏北羌塘地区获得了锆石SHRIMP U-Pb年龄2533 Ma, 说明这颗锆石来自新太古代, 虽然不一定源自本地, 但至少暗示羌塘地区新太古代曾经可能发生构造-热事件。

关键词 锆石SHRIMP U-Pb年龄 蓝片岩 羌塘地块中部 西藏

中图分类号 P588.34⁺4 P597⁺.3

文献标志码 A

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Deng X G, Zhang J J, Zhang Y Q, Liu D Y. SHRIMP U-Pb dating of zircons from blueschist in the central part of the Qiangtang block, northern Tibet, China, and its implications. *Geological Bulletin of China*, 2007, 26(6): 698-702

Abstract: SHRIMP U-Pb dating of zircons from two blueschist samples in central Qiangtang, northern Tibet, suggests that the zircons in blueschist are relict ones rather than neogenic ones formed by blueschist facies metamorphism. These ages stand for those of protoliths in source regions or those of zircons captured by protoliths and are responses to different tectonothermal events. The SHRIMP U-Pb zircon age of 2533 Ma obtained for the first time in the central Qiangtang area, northern Tibet, indicates that the zircon originated from the Late Archean rocks, and although the zircon may not necessarily have originated in the study area, its age at least implies that a tectonothermal event may have occurred in the Qiangtang area in the late Archean.

Key words: SHRIMP U-Pb zircon age; blueschist; central Qiangtang block; Tibet

青藏高原羌塘盆地重磁剖面异常与基底构造特征

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摘要 :以穿越羌塘盆地的实测重磁剖面数据为基础,密切结合平面重磁异常资料,通过对重磁异常特征进行分析,采用位场转换和正反演拟合计算方法,推断了羌塘盆地的基底埋深、断裂构造及盆地样式,并对盆地的油气远景进行了探讨。认为南羌塘基底埋深浅,呈台阶状,且构造复杂,北羌塘埋深深,其间的龙木错-双湖构造带有明显的重磁异常显示。

关键词 :重磁异常 ;基底构造 ;油气资源 ;羌塘盆地。

中图分类号 :P631.1 P631.2

文献标志码 :A

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Yuan S C, Yu G M, Tian Q N. Gravity and magnetic anomaly profiles and characteristics of basement structure in the Qiangtang basin, Qinghai-Tibet Plateau. *Geological Bulletin of China*, 2007, 26 (6) 703-709

Abstract : Based on the data from the gravity and magnetic profiles across the Qiangtang basin, combined with the data of plan gravity and magnetic anomalies, through an analysis of the features of the gravity and magnetic anomalies and by using the method of potential-field transformations and forward-inverse fitting, the authors deduce the burial depth of the basement, fault structure and style of the Qiangtang basin and discuss the petroleum prospects of the basin. They think that the basement of southern Qiangtang has a shallow burial depth and occurs as steps with complex structure, while the basement of northern Qiangtang is deeply buried. The Lungmu Co-Shuanghu Lake structural belt between the northern and southern Qiangtang have conspicuous gravity and magnetic indications.

Key words : gravity and magnetic anomalies ; basement structure ; petroleum resources ; Qiangtang basin

西昆仑康西瓦北侧蒙古包—普守一带早古生代花岗岩锆石SHRIMP U-Pb测年

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摘要 依据1:25万康西瓦幅区域地质调查成果, 重点对西昆仑康西瓦北侧蒙古包—普守一带早古生代花岗岩的岩石学、岩石地球化学及同位素年代学进行了综合研究。岩石学和地球化学特征表明, 该花岗岩为高钾钙碱性花岗岩类, 锆石SHRIMP U-Pb年龄为 $443.1 \text{ Ma} \pm 2.3 \text{ Ma}$ 和 $430.7 \text{ Ma} \pm 2.6 \text{ Ma}$, 形成时代为晚奥陶世—早志留世。该成果的获得, 为进一步系统地研究蒙古包—普守早古生代蛇绿混杂岩带及与其配套的早古生代花岗岩提供了直接的时代证据, 为进一步深入地研究西昆仑造山带的地质构造演化提供了新的实际资料。

关键词 西昆仑; 康西瓦北部; 早古生代花岗岩; 锆石SHRIMP U-Pb测年

中图分类号 P588.12*1 P597*3 **文献标志码** A **文章编号** 1671-2552(2007)06-0710-10

Cui J T, Wang J C, Bian X W, Zhu H P, Luo Q Z, Yang K J, Wang M C. Zircon SHRIMP U-Pb dating of Early Paleozoic granite in the Menggubao-Pushou area on the northern side of Kangxiwar, West Kunlun. *Geological Bulletin of China*, 2007, 26(6) 710-719

Abstract According to the results of regional geological survey of the 1:250000 Kangxiwar Sheet, an integrated petrological, geochemical and isotope chronological study was conducted on the Early Paleozoic granite in the Menggubao-Pushou area on the northern side of Kangxiwar, West Kunlun. Petrological and geochemical characteristics show that the granite belongs to calc-alkaline granitoids and has zircon SHRIMP U-Pb ages of 443.1 ± 2.3 and $430.7 \pm 2.6 \text{ Ma}$, indicating a Late Ordovician-Early Silurian age for its formation. The results provide direct age evidence for a further detailed and systematic study of the Early Paleozoic Menggubao-Pushou ophiolitic mélange zone and Early Paleozoic granite and furnish new actual material for the further and intensive study of the tectonic evolution of the West Kunlun orogenic belt.

Key words: West Kunlun; northern Kangxiwar; Early Paleozoic granite; zircon SHRIMP U-Pb dating

西昆仑康西瓦西北部库尔良早古生代角闪闪长岩 花岗闪长岩锆石 SHRIMP U-Pb 测年

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摘要 依据 1:25 万康西瓦幅区域地质调查成果, 重点对库尔良早古生代深成岩的同位素年代学进行了详细的研究, 获得了裂解期细粒黑云母角闪闪长岩锆石 SHRIMP U-Pb 年龄均值 $506.8 \text{ Ma} \pm 9.8 \text{ Ma}$, 中粒似斑状花岗闪长岩单颗粒锆石 U-Pb 法年龄 $500.2 \text{ Ma} \pm 1.2 \text{ Ma}$, 表明其形成时代均为中寒武世。该同位素年龄的获得, 为进一步详细地研究库地-其曼于特早古生代构造-岩浆岩带的裂解时限提供了直接的时代证据。

关键词 西昆仑; 康西瓦西北部; 早古生代深成岩; 锆石 SHRIMP U-Pb 年龄; 单颗粒锆石 U-Pb 年龄

中图分类号 P588.12⁺² P597⁺³

文献标识码 A

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Zhang Z W, Cui J T, Wang J C, Bian X W, Zhu H P, Luo Q Z, Wang M C. Zircon SHRIMP U-Pb dating of Early Paleozoic amphibolite and granodiorite in Korliang, northwestern Kangxiwar, West Kunlun. *Geological Bulletin of China*, 2007, 26(6): 720-725

Abstract According to the results of regional geological survey of the 1:250000 Kangxiwar Sheet, an intensive isotope chronological study of the Early Paleozoic Korliang pluton was performed and the authors obtained a zircon SHRIMP U-Pb age of $506.8 \pm 9.8 \text{ Ma}$ for the fine-grained biotite amphibolite of the break-up phase and a single-zircon U-Pb age of $500.2 \pm 1.2 \text{ Ma}$ for the medium-grained porphyritic granodiorite, indicating a Middle Cambrian age. The availability of these isotope ages provides direct age evidence for the time interval of the break-up of the Early Paleozoic Kuda-Qimanyute tectono-magmatic belt.

Key words West Kunlun; northwestern Kangxiwar; Early Paleozoic pluton; zircon SHRIMP U-Pb age; single-zircon U-Pb age

西昆仑康西瓦北部冬巴克片麻状英云闪长岩 锆石 SHRIMP U-Pb 测年

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摘要 西昆仑冬巴克寒武纪片麻状英云闪长岩是 1:25 万康西瓦幅、岔路口幅等 4 幅区域地质调查项目, 首次从原划古元古界埃连卡特岩群中解体出来的一套侵入岩。重点对该套侵入岩的岩石学 and 同位素年代学进行了研究, 获得了高精度锆石 SHRIMP U-Pb 同位素年龄 $502 \text{ Ma} \pm 9 \text{ Ma}$, 其形成时代为中寒武世。该同位素资料的获得, 为进一步深入详细地研究塔里木陆块与西昆仑造山带的地质构造演化提供了新的实际资料。

关键词 西昆仑, 古元古界, 埃连卡特岩群, 寒武纪英云闪长岩, 锆石 SHRIMP U-Pb 年龄

中图分类号 P588.12² P597^{+.3} **文献标志码** A **文章编号** 1671-2552(2007)06-0726-04

Cui J T, Wang J C, Bian X W, Luo Q Z, Zhu H P, Wang M C, Chen G C. Zircon SHRIMP U-Pb dating of the Dongbake gneissic tonalite in northern Kangxiwar, West Kunlun. *Geological Bulletin of China*, 2007, 26(6) 726-729

Abstract The Dongbake gneissic tonalite in northern Kangxiwar, West Kunlun, is a suite of intrusive rocks disintegrated for the first time from the Paleoproterozoic Ailiankate Group-complex in four 1:250000 sheets such as Kangxiwar and Chalukou sheets. The focus of this study was placed on the petrology and isotope chronology of this suite of intrusive rocks and a highly precise zircon SHRIMP U-Pb age of $502 \pm 9 \text{ Ma}$ has been obtained, which indicates that the suite of intrusive rocks formed in the Middle Cambrian. The availability of the isotope data provides new actual material for the further and intensive study of the tectonic evolution of the Tarim block and West Kunlun orogenic belt.

Key words West Kunlun; Paleoproterozoic; Ailiankate Group-complex; Cambrian tonalite; zircon SHRIMP U-Pb age

西藏日土北部松西—胜利山一带燕山期高钾钙碱性花岗岩的地球化学特征及构造环境

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摘要 西藏羌塘北部松西—胜利山一带的花岗闪长岩和黑云母二长花岗岩属高钾钙碱性岩石系列。其重稀土元素亏损, 花岗闪长岩的LREE/HREE比值在8.67~33.08之间, 平均16.62, 黑云母二长花岗岩在9.16~30.97之间, 平均21.76, 二者的Eu负异常均不明显。微量元素具有富集Rb、Th和亏损Ba、Sr、Zr、Ti的地球化学特点。花岗闪长岩和黑云母二长花岗岩总体上显示I型花岗岩的特点, 其形成的构造环境很可能与冈底斯和羌塘地块在晚侏罗世—早白垩世发生的碰撞作用有关。

关键词 西藏; 日土北部; 高钾钙碱性花岗岩; 构造环境

中图分类号 P588.12¹ P595

文献标志码 A

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Zhong H M, Tong J S, Lu R K, Xia J. Geochemical features and tectonic setting of Yanshanian high-K calc-alkaline granite in the Songxi-Shenglishan area, northern Rutog, Tibet, China. *Geological Bulletin of China*, 2007, 26 (6) 730-738

Abstract: Granodiorite and biotite monzogranite in the Songxi-Shenglishan area, north Qiangtang, Tibet, belongs to a high-K calc-alkaline series. The rocks are HREE-depleted. The LREE/HREE ratios of granodiorite range from 8.67 to 33.08, with an average of 16.62, and those of biotite monzogranite range from 9.16 to 30.97, with an average of 21.76. The Eu anomalies of the two types of rock are neither pronounced. For the trace elements, the rocks are enriched in Rb and Th and depleted in Ba, Sr, Zr and Ti. Granodiorite and biotite monzogranite generally exhibit the features of I-type granite and their tectonic environment is very likely to be related to collision between the Gangdise and Qiangtang blocks during the Late Jurassic to Early Cretaceous.

Key words: Songxi-Shenglishan, northern Rutog, Tibet; high-K calc-alkaline granite; tectonic setting

滇西南昌宁-孟连构造带晚泥盆世枕状玄武岩和层状硅质岩的特征

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摘要 滇西南耿马地区回爱剖面发育有昌宁-孟连构造带最早的枕状玄武岩, 与其共生的放射虫硅质岩、硅质泥岩含有晚泥盆世放射虫和牙形石化石。对硅质岩和玄武岩的地球化学研究表明, 玄武岩的化学成分具有高P、Ti的特点, 轻稀土元素富集, 在稀土元素球粒陨石标准化模式图上表现为明显的右倾, 微量元素中K、Rb、Ba等大离子亲石元素与Nb、Ta、Zr等高场强元素富集。化学投图结果表明玄武岩形成于洋岛环境。硅质岩的 $Al/(Al+Fe+Mn)$ 比值大部分介于0.5~0.7之间, $Al_2O_3/(Fe_2O_3+Al_2O_3)$ 位于0.41~0.8之间, 大部分硅质岩的 Ce/Ce^* 比值小于1, 具弱的Ce负异常, 总体表现为大陆边缘型硅质岩的特征。这说明研究区晚泥盆世为邻近大陆边缘的洋盆环境, 具洋壳性质的昌宁-孟连古特提斯盆地在晚泥盆世已经形成。

关键词 晚泥盆世 洋岛玄武岩 硅质岩 昌宁-孟连构造带 滇西南

中图分类号 P588.14⁺⁵ P588.24⁺⁴

文献标志码 A

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Yang W Q, Feng Q L, Duan X D. Late Devonian pillow basalt and bedded chert in Changning-Menglian tectonic belt of southwestern Yunnan, China. *Geological Bulletin of China*, 2007, 26(6) 739-747

Abstract : The earliest pillow basalt of the Changning-Menglian tectonic belt was found at the Hui'ai section, Gengma area, southwestern Yunnan. Radiolarian chert and siliceous mudstone associated with the pillow basalt contain Late Devonian radiolarians and conodonts. Geochemical study of chert and basalt indicates that the composition of the pillow basalt is characterized by high P and Ti and enrichment in LREE. The chondrite-normalized REE patterns are apparently right-inclined and the trace elements show enrichment in the large-ion lithophile elements such as K, Rb and Ba and high-field strength elements such as Nb, Ta and Zr. Chemical data plots indicate that the pillow basalt formed in an oceanic island environment. The chert in the Hui'ai section is characterized by high ratios of $Al/(Al+Fe+Mn)$ (0.5-0.7) and $Al_2O_3/(Fe_2O_3+Al_2O_3)$ (0.41-0.8) and a weak negative Ce anomaly with most Ce/Ce^* ratios <1, which implies that the chert was deposited in a continental-margin basin. The above study indicates that study area was located in an oceanic basin environment adjacent to the continental margin in the Late Devonian and that the Changning-Menglian Paleo-Tethys ocean basin of oceanic crustal nature had already formed by that time.

Key words Late Devonian; oceanic island basalt; chert; Changning-Menglian tectonic belt; southwestern Yunnan

·工程地质水文地质·

滇藏铁路丽江玉峰寺隧道围岩岩爆刚度判据

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摘要 :从最小能量原理出发,探讨隧道围岩岩爆的刚度判据问题,并应用于滇藏铁路玉峰寺隧道工程。在滇藏铁路玉峰寺隧道代表性围岩岩样全应力应变刚压实验分析的基础上,结合地应力测量资料和数值模拟,分析玉峰寺隧道3种岩性不同围压条件下的变形破坏过程,得到隧道塑性破坏岩体和弹性岩体的刚度曲线,利用刚度判据,分析评价玉峰寺隧道3类岩体发生岩爆的危险性,玄武岩岩爆烈度最高,灰岩次之,砂岩最低,为隧道工程设计提供了参考依据。

关键词 :最小能量原理 岩爆 刚度判据 玉峰寺隧道 滇藏铁路

中图分类号 :TU458

文献标志码 :A

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Liu J R, Zhang Y S, Wu S R, Li D L, Liu C T. Rigidity criterion for rockburst in the Yufengsi tunnel in Lijiang City of the Yunnan-Tibet Railway, China. *Geological Bulletin of China*, 2007, 26(6) 748-755

Abstract : The rigidity criterion for rockburst of the tunnel wall is studied and applied in the Yufengsi tunnel of the Yunnan-Tibet Railway according to the minimum energy theory. On the basis of the rigid compression experiment for complete stress-strain of representative wall rock specimens from the tunnel, combined with the in-situ stress data and numerical simulation results, the failure processes of three rock types at different confining pressures are analyzed and the rigidity curves of the plastic rock mass and elastic rock mass in the tunnel are obtained. Finally, the rockburst hazards of the three types of rock in the tunnel are analyzed and evaluated using the rigidity criterion. The degree of rockburst hazards of basalt is highest, next comes that of limestone, and that of sandstone is lowest. This estimation can be used as reference for the tunnel design.

Key words : minimum energy theory; rockburst; rigidity criterion; Yufengsi tunnel; Yunnan-Tibet Railway

柴达木盆地北缘鱼卡河流域水资源的合理利用

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摘要 轮换式地于枯水期在鱼卡河冲洪积扇开采 $1.87 \times 10^4 \text{ m}^3/\text{d}$ 的地下水、丰水期在鱼卡河大桥上游取用 $1.87 \times 10^4 \text{ m}^3/\text{d}$ 的地表水, 对马海盆地水资源的影响很小, 但有可能引起开采区附近和下游马海盆地局部地区地下水位下降、局部泄出带流量减少、部分地段沼泽湿地轻微退化等与水资源有关的生态环境问题。当地下水位下降到“临界深度”以下时, 有利于马海盆地土壤盐渍化不治自愈。

关键词 柴达木盆地北缘 鱼卡河 水资源 生态环境

中图分类号 P641 X141

文献标志码 A

文章编号 1671-2552(2007)06-0756-08

Bai S H, Tian J C, Zhang S Q, Wang Y G, Xiao L, Li J, Kang Q. Rational utilization of water resources in the Iqe River drainage area on the northern margin of the Qaidam basin, China. *Geological Bulletin of China*, 2007, 26(6): 756-763

Abstract: The rotational exploitation of $1.87 \times 10^4 \text{ m}^3/\text{d}$ of groundwater in the alluvial-diluvial fan of the Iqe River in the low-water season and drafting of $1.87 \times 10^4 \text{ m}^3/\text{d}$ of surface water from the upstream of the Iqe River Bridge in the high-water season has little influence on the water resources of the Mahai basin but is likely to cause eco-environmental problems related to water resources, such as the local drop of the groundwater level, decrease of flow in local discharge zones and slight degradation of swamp wetland in some places near the exploitation area and the Mahai basin in the lower reaches of the river. When the groundwater level drops below the “critical depth”, the salinized soils in the Mahai basin will be desalinized without treatment.

Key words: northern margin of the Qaidam basin; Iqe River; water resources; ecological environment

· 简 报 ·

青藏高原北羌塘盆地胜利河上侏罗统 海相油页岩的发现

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摘要 随着研究程度的深入, 藏北羌塘盆地的油气勘探潜力越来越受到国家的重视。但是由于自然地理条件的制约, 羌塘盆地内还有许多有待于发现的问题。2006年在胜利河西、玛尔果茶卡东南上侏罗统索瓦组中发现一套优质的油页岩, 该套油页岩有2层, 稳定延伸大于2.5 km。该套油页岩的发现, 不仅为分析北羌塘盆地晚侏罗世盆地演化和古地理格局具有重要意义, 而且丰富了羌塘盆地侏罗纪烃源岩的类型, 对进一步评价羌塘盆地的油气资源潜力具有重要意义。

关键词 青藏高原 北羌塘盆地 胜利河 上侏罗统索瓦组 海相油页岩

中图分类号 P618.12 **文献标志码** A **文章编号** 1671-2552(2007)06-0764-05

Wang Z J, Wang J, Chen W X, Fu X G. Discovery of the Late Jurassic Shenglihe marine oil shale in the northern Qiangtang basin, Qinghai-Tibet Plateau. *Geological Bulletin of China*, 2007, 26(6) 764-768

Abstract : Oil and gas potentials of the Qiangtang basin in northern Tibet are getting more and more attention of the country with deep-going research. However, constrained by harsh natural conditions, there are still many problems or facts in the basin to be found and understood. The authors found a set of high-quality oil shale in the Upper Jurassic Suowa Formation between the west of Shenglihe and the southeast of Margog Caka in May 2006. The oil shale consists of two beds, extending steadily for above 2.5 km, with a thickness of ~5 m. The discovery of the oil shale is not only important for analyzing the Late Jurassic evolution and reconstructing the paleogeographic framework of the northern Qiangtang basin but also adds a new Jurassic hydrocarbon rock type. This has great significance for the further evaluation of the potential of oil and gas resources in the Qiangtang basin.

Key words : Qinghai-Tibet Plateau ; northern Qiangtang basin ; Shenglihe ; Upper Jurassic Suowa Formation ; marine oil shale

·非主题来稿选登·

北京周口店豹皮灰岩的变形特征

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摘要 周口店地区广泛分布的寒武纪地层府君山组底部灰岩因其具典型的豹斑状构造而被称为豹皮灰岩。本文主要以出露于周口店黄院地区的豹皮灰岩为研究对象。组成豹皮灰岩的物质成分有2种, 一为白云质成分的豹斑, 其余部分为泥灰质。在露头尺度上, 豹皮灰岩中的豹斑发生了明显的旋转变形并具有一定的定向性, 而泥灰质成分则具有清晰的韧性变形特征, 为较典型的碳酸盐糜棱岩。在微观尺度上, 构成豹斑的白云石矿物未发生韧性变形, 而泥灰质成分中的方解石具有明显的细粒化、拉长和定向。豹皮灰岩变形发生时岩石所处的温度介于200~250℃之间。豹皮灰岩的形成经历了原岩形成和后期构造变形改造2个阶段, 于寒武纪由沉积作用形成了岩石的物质组分和原生层状构造, 在前印支期受水平剪切作用形成岩石的豹斑状构造。

关键词 北京周口店 豹皮灰岩 府君山组 寒武纪 韧性变形 碳酸盐糜棱岩

中图分类号 P588.24⁵ P313

文献标志码 A

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Chen Y F, Wu G G, Wang G H. Deformation characteristics of leopard limestone in Zhoukoudian, Beijing, China. *Geological Bulletin of China*, 2007, 26(6) 769-775

Abstract Limestone distributed widely at the bottom of the Cambrian Fujunshan Formation in the Zhoukoudian area is called leopard limestone because it has typical leopard-mottled structure. This study focuses on leopard limestone in the Huanyuan area, Zhoukoudian, Beijing. Leopard limestone is composed of dolomitic and marly materials. Mottles in leopard limestone have undergone rotational deformation and have certain preferred orientation, while the marly component shows distinct features of ductile deformation; it is relatively typical carbonate mylonite. At the microscopic scale, dolomite that forms leopard mottles has not undergone ductile deformation, but calcite in the marly component is obviously finely granulated, elongated and oriented. The temperatures at which leopard limestone was deformed ranged between 200 and 250℃. The formation of leopard limestone progressed through two phases: formation of the protolith and structural deformation and reworking in the late stage. In the Cambrian the material components and primary layered structure of the rock formed by sedimentation, and in the pre-Indosinian leopard structure formed by horizontal shear.

Key words Zhoukoudian, Beijing; Cambrian; Fujunshan Formation; leopard limestone; ductile deformation; carbonate mylonite