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西藏班公湖－怒江成矿带荣嘎斑岩型钼矿床的发现及意义

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摘要:西藏班公湖－怒江成矿带为近十年来找矿突破明显的一个矿带,矿床类型主要包括斑岩－浅成低温热液型和斑岩－矽卡岩型,矿种以铜金为主,总体研究程度尚低.荣嘎矿床位于班公湖－怒江缝合带南缘西段,为2016年新发现的首例具大型远景的斑岩型钼矿床,其辉钼矿Re-Os同位素加权平均年龄为99.3±0.1 Ma(MSWD＝0.2,n＝8),等时线年龄为99.2±0.4 Ma(MSWD＝0.2,n＝8),表明该矿床成矿时代为晚白垩世早期,成矿发生在班公湖－怒江洋盆闭合后的拉萨－羌塘地体碰撞造山阶段.该矿床的发现丰富了班－怒带成矿理论认识,填补了该带钼矿资源的空白,对已有的成矿模型提出了新的挑战,预示着班－怒缝合带还存在一期斑岩钼成矿事件,并为该带进一步寻找相似的钼矿床提供了例证及理论支撑.

关键词:辉钼矿Re-Os测年;斑岩型钼矿床;荣嘎;班公湖－怒江成矿带;西藏;矿床.

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The Discovery and Significance of Rongga Porphyry Mo Deposit in the Bangong-Nujiang Metallogenic Belt, Tibet

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Abstract: The Bangong-Nujiang metallogenic belt is a new discovery with obvious prospecting breakthrough in the last ten years, mainly including porphyry-skarn and porphyry-hypothermal types Cu-Au deposits, which are poorly studied. The Rongga deposit located at the western segment of south Bangong-Nujiang suture zone, is the first porphyry Mo deposit discovered in 2016 that has a perspective large scale in the Bangong-Nujiang metallogenic belt. The Rongga deposit yielded a molybdenite Re-Os weighted mean age of 99.3±0.1 Ma (MSWD＝0.2, n＝8), consistent with the isochron age of 99.2±0.4 Ma (MSWD＝0.2, n＝8), which indicated the mineralization occurred at early stage of Late Cretaceous during the collision between Lhasa and Qiangtang terranes when the subducted Bangong-Nujiang oceanic crust has closed. This discovery of Rongga deposit has en-

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riched the knowledge of metallogenic theory, filled the gap of Mo resources in this region, and the existed models are challenged in the Bangong-Nujiang belt. This discovery of Rongga deposit show the potential for porphyry Mo mineralization along the Bangong-Nujiang suture zone, and provide an example illustration and theoretical support for further exploration of porphyry Mo deposit in this belt.

Key words: molybdenite Re-Os dating; porphyry Mo deposit; Rongga; Bangong-Nujiang metallogenic belt; Tibet; ore deposits.

0 引言

西藏冈底斯造山带夹持于羌塘和喜马拉雅地体之间，经历了洋壳俯冲、拉萨－羌塘碰撞、印－亚陆陆碰撞，伴随地壳加厚、生长和青藏高原的隆升剥蚀，形成了该带多期次、多类型的岩浆作用和矿化类型，一直是国际地学领域研究的热点（图 1a；Yin and Harrison，2000；潘桂堂等，2006；Zhu *et al*.，2013；Hou *et al*.，2015）. 近十多年来，随着青藏专项及商业性勘查项目的实施，地处青藏高原腹地的班公湖－怒江成矿带显示较大的找矿潜力，一大批重要的矿产地陆续被发现和评价，如西藏改则县多龙、革吉县尕尔穷－嘎拉勒等铜金矿集区的找矿突破，该带被认为是继玉龙铜矿带和冈底斯铜矿带之后发现的第 3 条斑岩铜矿带（图 1b；秦克章等，2006；曲晓明等，2015；冷秋锋等，2016；唐菊兴等，2016）. 相比较而言，班公湖－怒江成矿带基础地质工作薄弱、研究程度较低，已发现的矿床主要有多不杂、波龙、铁格隆南、拿若斑岩－浅成低温热液型铜金矿床（李光明等，2007；佘宏全等，2009；祝向平等，2011，2015；唐菊兴等，2016；丁帅等，2017），尕尔穷、嘎拉勒斑岩－矽卡岩型铜金矿床（郑有业等，2005，西藏冈底斯斑岩铜矿带成矿规律及勘查选区研究报告；唐菊兴等，2013），雄梅斑岩型铜金矿床（曲晓明等，2012），舍索矽卡岩型铜矿床（赵元艺等，2009，2011）. 2009—2016 年期间，在对 1∶20 万姜麦、盐湖幅水系沉积物化探（江革拉北：Hs-19）异常进行查证时发现了荣嘎斑岩型钼矿床. 该矿床位于班公湖—怒江缝合带西段南缘，为该带新发现的首例斑岩型钼矿床. 荣嘎矿床的发现丰富了班－怒带成矿作用和矿化类型，有助于加深对区域成矿规律的认识，对该带斑岩型钼矿床的勘查评价有重要的指导意义. 本文主要从矿化、蚀变等方面阐述了荣嘎矿床的基本地质特征，开展了成矿年代学研究，分析了成矿构造背景，讨论了区域找矿指示意义.

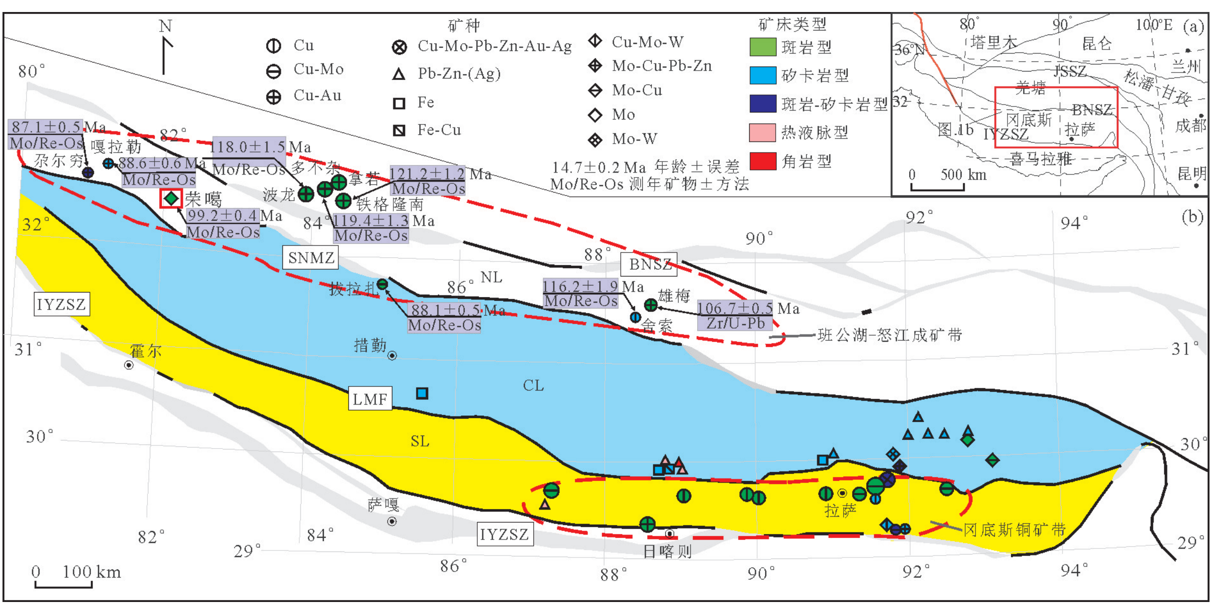

图 1 青藏高原构造格架（a）和西藏冈底斯主要矿床分布（b）

Fig.1 Tectonic framework of the Tibetan Plateau (a) and distribution of major ore deposits in the Gangdese belt, Tibet (b)

图 a 据 Yin and Harrison（2000），图 b 据 Zheng *et al*.（2015）和曲晓明等（2015）修改. JSSZ. 金沙江缝合带；BNSZ. 班公湖－怒江缝合带；SNMZ. 狮泉河－永珠－嘉黎蛇绿混杂岩带；LMF. 洛巴堆－米拉山断裂；IYZSZ. 雅鲁藏布江缝合带；SL. 南部拉萨地体；CL. 中部拉萨地体；NL. 北部拉萨地体

1　区域地质背景

班公湖－怒江成矿带位于班－怒缝合带南北两侧，东西向延伸长达 2 000 多千米（图 1b）．在缝合带及邻区，主要分布规模巨大的蛇绿岩套及混杂岩带，呈近东西向带状断续展布（Srimal，1986；Matte *et al*.，1996）；燕山早期陆缘火山岩，为一套含火山碎屑岩的以安山质为主的玄武－安山－流纹岩组合；白垩纪中酸性侵入岩，一般呈岩株或小岩基沿东西向呈带状分布（西藏地质矿产局，2000；耿全如等，2011）．该带除了形成斑岩型和矽卡岩型铜金矿床外，还伴生铋、钢等多种金属矿产（赵元艺等，2010a，2010b；曲晓明等，2015）．荣嘎矿床地处班公湖－怒江缝合带西段，盐湖断裂带与吓那错断裂带之间的阿翁错陆缘火山－岩浆弧带（图 2）．区域构造多呈北西西至近东西向展布，主要包括盐湖断裂、阿翁错断裂、吓拉错断裂、聂耳错断裂等．区域地层主要为上三叠统聂耳错岩群（T_3JN）变质砂岩、粉砂岩、板岩，下白垩统去申拉组（K_1q）中基性－中酸性火山岩、碎屑岩夹灰岩，上白垩统竞柱山组（K_2j）砾岩、砂岩、泥岩、灰岩，古近系牛堡组（$E_{1\text{-}2}n$）砾岩，砂岩夹粉砂岩、泥岩．吓拉错断裂以南

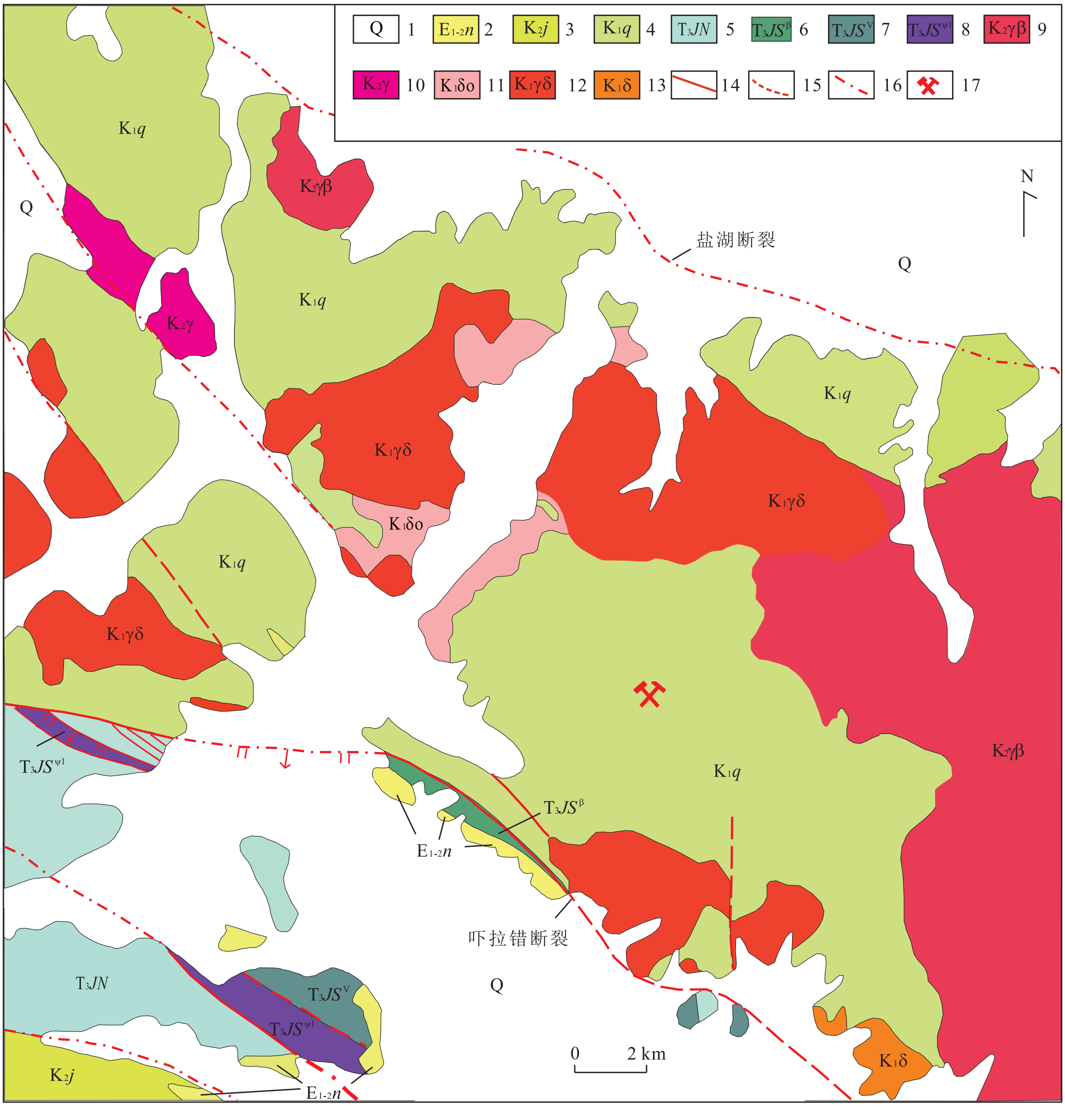

图 2　荣嘎区域地质图

Fig.2　Regional geological sketch of Rongga district

1.第四系；2.古新统－始新统牛堡组；3.上白垩统竞柱山组；4.下白垩统去申拉组；5.上三叠统聂耳错岩群；6.上三叠统狮泉河蛇绿岩群基性枕状熔岩；7.上三叠统狮泉河蛇绿岩群基性堆晶岩；8.上三叠统狮泉河蛇绿岩群超基性堆晶岩；9.晚白垩世黑云母花岗岩；10.晚白垩世花岗岩；11.早白垩世石英闪长岩；12.早白垩世花岗闪长岩；13.早白垩世闪长岩；14.断层；15.推测断层；16.隐伏断层；17.荣嘎矿床位置；据汪友明等（2013）修改

还分布少量狮泉河蛇绿岩群(T_3JS)基性、超基性岩.区域岩浆岩分布较为广泛,主要有早白垩世石英闪长岩、花岗闪长岩、闪长岩,晚白垩世黑云母花岗岩、花岗岩等(图2).

2　矿床发现过程

西藏革吉县荣嘎钼矿床是西藏地勘局第二地质大队通过综合研究、优选靶区、联合攻关发现的.2005年,经过选区研究向中国地质调查局申请到1∶20万姜麦、盐湖幅水系沉积物地球化学测量项目.2006—2007年,该项目实施过程中在江革拉北一带圈定Hs-19异常,该异常以Mo、W为主,异常套合较好,Mo元素异常面积达83.73 km^2,异常强度较高,浓集中心明显.随后通过1∶5万水系沉积物加密、1∶1万土壤及岩石地化综合剖面测量工作,发现异常重现性好、强度更高,荣嘎一带显示很好的找矿潜力.2009—2010年,西藏地勘局第二地质大队依托西藏地勘局地质找矿专项资金对荣嘎矿区开展了预查工作,初步查明了矿区地层、岩浆岩等分布特征及蚀变发育情况,在异常浓集区附近发现石英－辉钼矿脉和辉钼矿化转石,随后通过少量的探槽控制,初步圈定1处矿化体.2014—2016年,西藏地勘局第二地质大队利用西藏地勘局地质找矿专项资金在预查工作基础上对荣嘎矿区进行了调查评价,新发现2处斑岩体,重点对Ⅰ号斑岩体进行了探槽揭露和钻探验证,共发现原生矿体8个,Mo平均品位为0.091%,单个矿体最大厚度达128.35 m,矿体厚度由南向北逐渐变大.综合已有工程、地质条件分析荣嘎矿床具大型斑岩钼矿床的远景.

3　矿床地质特征

荣嘎矿床位于阿里地区革吉县盐湖乡境内,矿区出露的地层为下白垩统去申拉组,岩性为一套浅变质的陆源碎屑岩,以变余粉砂岩、石英砂岩、岩屑砂岩为主.矿区岩浆岩发育,包括二长花岗岩、花岗斑岩、二长花岗斑岩、花岗细晶岩、镁铁质细粒包体、闪长玢岩等(图3).金属矿物主要为浸染状或脉状辉钼矿、裂隙面辉钼矿,团块状、脉状黄铁矿,少量黄铜矿(图4a～4e).蚀变类型主要包括白云母化、硅化、绢云母化、粘土化、绿泥石化、绿帘石化等(图4f～4i).2016年,共计施工完成钻孔5个,发现原生Mo矿体8个,矿体产出标高在5 046～5 413 m,控制倾向延伸长约320 m,倾向北西,倾角较缓.其中钻孔ZK001见矿视厚度281.15 m,Mo品位为0.03%～0.44%,平均0.081%;ZK101见矿视厚度407.07 m,Mo品位为0.03%～0.23%,平均0.058%;ZK002见矿视厚度395 m,Mo品位为0.031%～1.69%,平均0.156%;ZK003见矿视厚度175 m,Mo品位为0.031%～0.26%,平均0.075%.如图5所示,浅部含矿岩体为二长花岗斑岩,矿体较连续;深部岩体变为花岗斑岩,矿化断续层状分布.黄铜矿化主要呈浸染状,粒径1～2 mm,矿化总体较弱.

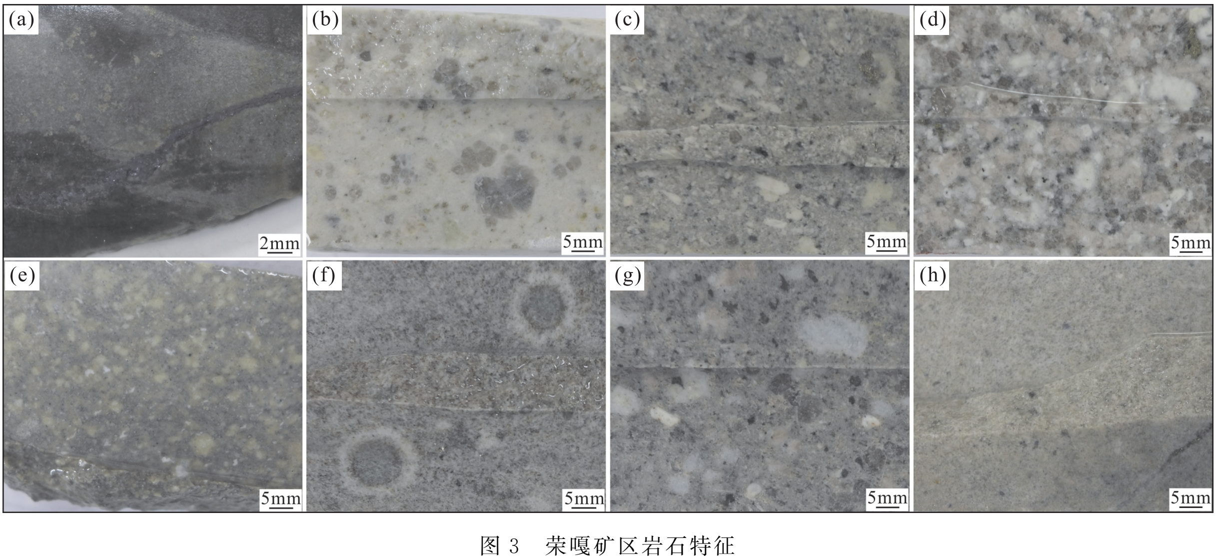

图3　荣嘎矿区岩石特征

Fig.3　Characteristics of rocks in the Rongga orefield

a.去申拉组砂岩;b.花岗斑岩;c.中细粒二长花岗斑岩;d.二长花岗岩;e.闪长玢岩;f.细粒闪长岩;g.二长花岗斑岩;h.花岗细晶岩

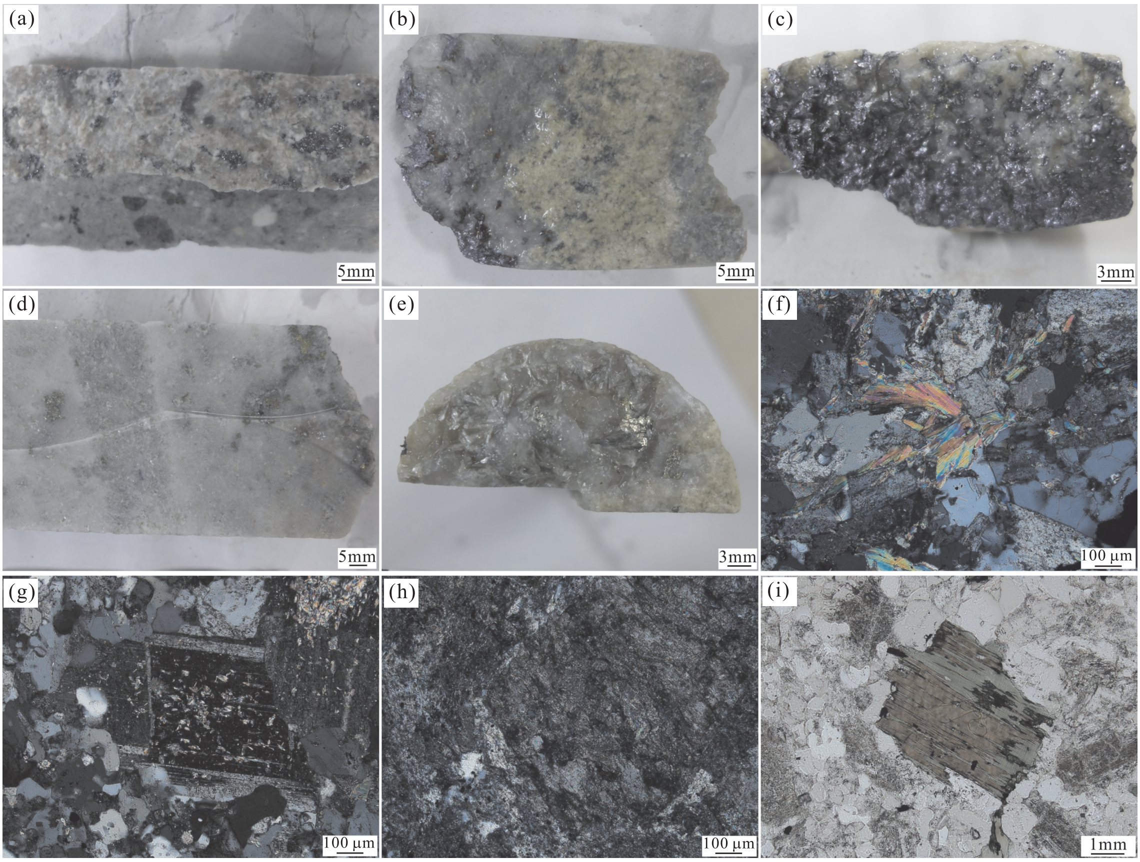

图 4　荣嘎矿床蚀变矿化特征

Fig.4　Characteristics of alteration and mineralization in the Rongga deposit

a.浸染状辉钼矿化；b.石英＋辉钼矿脉；c.裂隙面辉钼矿＋黄铁矿化；d.白云母化和硅化蚀变，团块状黄铁矿化；e.石英＋白云母＋黄铁矿脉；f.白云母化蚀变；g.长石的绢云母化蚀变；h.粘土化蚀变；i.黑云母的绿泥石化蚀变

4　成矿年代学

荣嘎矿区 8 件辉钼矿样品采自钻孔二长花岗斑岩、花岗斑岩以及围岩地层去申拉组砂岩，采样对象均为含辉钼矿的石英脉或裂隙面辉钼矿化，并分多点间隔采样.辉钼矿单矿物挑选在双目镜下完成，纯度达 98%以上.辉钼矿 Re-Os 同位素年龄测试在英国杜伦大学放射性同位素实验室利用 TRITON 质谱仪分析完成.辉钼矿 Re-Os 模式年龄计算公式为：$t=\ln(^{187}\mathrm{Os}/^{187}\mathrm{Re}+1)/\lambda$，其中^{187}Re 衰变常数 $\lambda=1.666\times10^{-11}\,\mathrm{a}^{-1}$(Smoliar *et al*.，1996；Selby *et al*.，2007).详细的 Re-Os 同位素化学分离过程和分析测试方法见 Selby and Creaser(2001).

荣嘎矿床辉钼矿样品的 Re 含量变化于$33.83\times10^{-6}\sim82.85\times10^{-6}$，^{187}Re 含量为 $21\,264.26\times10^{-9}\sim52\,072.76\times10^{-9}$，^{187}Os 含量为 $35.16\times10^{-9}\sim86.19\times10^{-9}$(表 1).荣嘎矿床辉钼矿模式年龄非常接近，变化于 99.1～99.4 Ma，8 件样品在辉钼矿^{187}Re/^{188}Os-^{187}Os/^{188}Os 图解上构成了一条良好的线性等时线，获得的等时线年龄为 99.2±0.4 Ma(MSWD＝0.2，图 6a)，加权平均年龄为 99.3±0.1 Ma(MSWD＝0.2，图 6b)，代表了钼矿的形成年龄.

一般而言，Cu 和 Au 元素主要来源于地幔楔，而 Mo 元素主要来源于上覆加厚的地壳(Farmer and DePaolo，1984).Re 与 Mo 的离子半径相等，表现出相似的地球化学性质，Re 常在辉钼矿中呈类质同象的形式替代 Mo，通常与地幔成矿物质有关的辉钼矿有较高的 Re 含量，而与地壳成矿物质有关的辉钼矿 Re 含量较低(Fleischer，1959；Terada *et al*.，1971；Stein *et al*.，2001；Berzina *et al*.，2005).Mao *et al*.(1999) 系统对比了中国主要含钼矿床中辉钼矿的 Re 含量，提出从幔源、壳－幔混源到壳源，辉钼矿中的 Re 含量各降低一个数量级.本文对比了冈底斯成矿带、班公湖－怒江成矿带不同时代、不同背景、不同矿种的斑岩矿床中辉钼矿 Re、

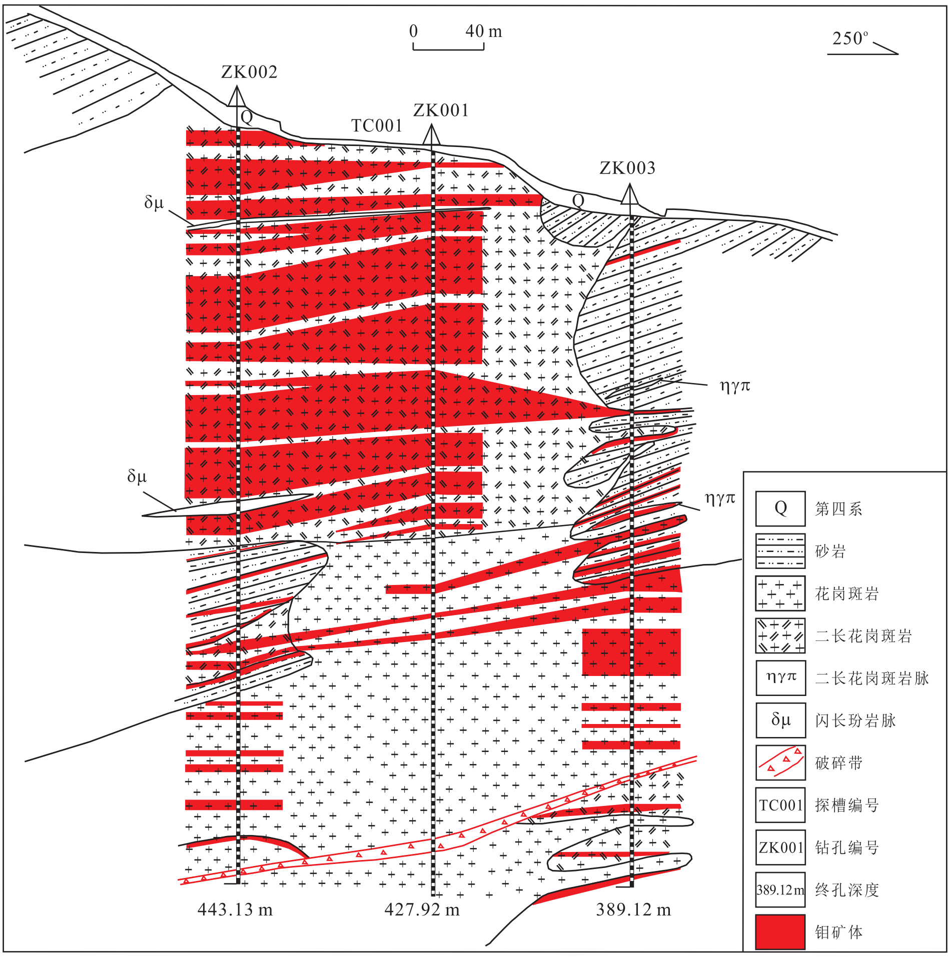

图5 荣嘎矿区0号勘探线剖面

Fig.5 Geological cross section for No.0 exploration line of the Rongga orefield

表1 荣嘎矿床辉钼矿 Re-Os 同位素分析数据

Table 1 Data of Re-Os isotopic dating of molybdenite from Rongga deposit

样名	样重(g)	Re(10^{-6})	^{187}Re(10^{-9})	^{187}Os(10^{-9})	模式年龄(Ma)
001-66	0.008 49	68.73±0.39	43 198.26±247.14	71.50±0.38	99.27±0.41
002-51	0.050 18	33.83±0.11	21 264.26±70.72	35.16±0.09	99.16±0.40
002-126	0.051 52	75.28±0.25	47 314.49±154.12	78.39±0.20	99.37±0.40
002-181.5	0.053 42	75.51±0.25	47 458.41±154.22	78.44±0.20	99.13±0.40
002-301.2	0.049 46	66.29±0.22	41 667.11±136.46	68.97±0.18	99.27±0.40
101-81.5	0.063 48	82.85±0.27	52 072.76±167.85	86.19±0.22	99.27±0.40
101-193	0.051 76	65.11±0.21	40 923.34±133.53	67.68±0.18	99.19±0.40
101-284.4	0.050 89	35.30±0.12	22 185.65±73.48	36.76±0.10	99.39±0.41

^{187}Re、^{187}Os含量的变化.如图7所示,岛弧背景形成的雄村斑岩型Cu-Au、陆缘弧背景形成的班公湖-怒江斑岩-浅成低温热液型Cu-Au、后俯冲背景形成的冈底斯斑岩Cu-Mo矿床中辉钼矿的Re、^{187}Re、^{187}Os含量多大于100,致矿岩浆源区多为地幔或新生的地壳,且含量具逐渐降低的趋势.相反,荣嘎矿床辉钼矿Re含量变化于$33.83\times10^{-6}\sim82.85\times10^{-6}$,明显低于Cu-Au、Cu-Mo矿床中辉钼矿的Re含量,与沙让斑岩Mo和汤不拉斑岩Mo(Cu)矿床相似,辉钼矿Re含量均小于100×10^{-6},表明相似的金属源区,成矿物质与壳源岩浆相关.由此可见,辉钼矿中Re含量的变化与矿床的形成背景和矿化类型具一定的关联,可用于指示成矿物质的源区条件.

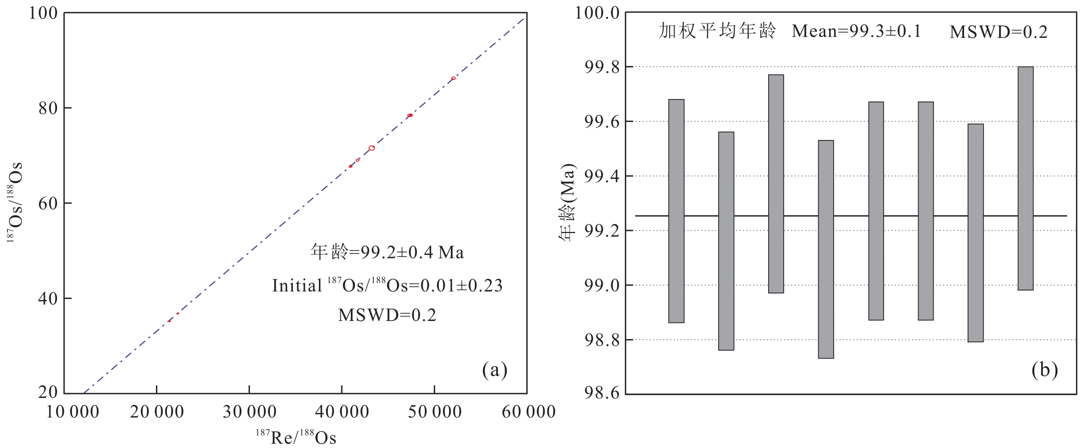

图 6　荣嘎矿床辉钼矿 Re-Os 等时线图(a)和年龄加权平均图(b)

Fig.6　Molybdenite Re-Os isochron age (a) and weighted mean age (b) of Rongga deposit

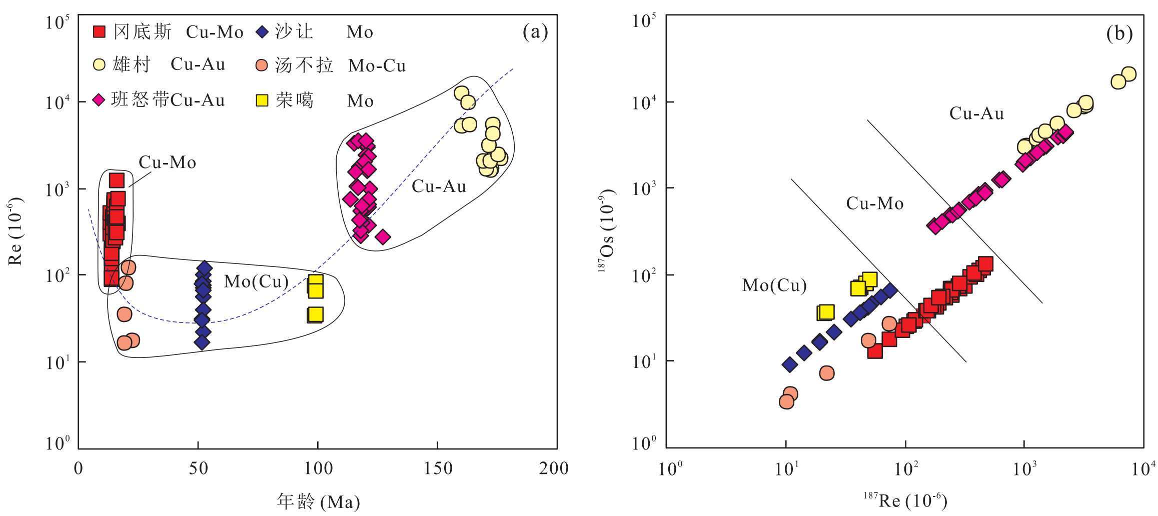

图 7　班公湖—怒江成矿带、冈底斯铜矿带主要矿床辉钼矿 Re 含量对比

Fig.7　Molybdenite Re content of main deposits in the Bangong-Nujiang metallogenic belt and Gangdese copper belt

数据来源:侯增谦等,2003;孟祥金等,2003;王亮亮等,2006;郑有业等,2007;佘宏全等,2009;赵元艺等,2009;王保第等,2010;祝向平等,2011;黄勇等,2013;Zhao *et al*.,2014;Lang *et al*.,2014;Zheng *et al*.,2014;Lin *et al*.,2017;Sun *et al*.,2017

5　成矿构造背景

斑岩型钼矿床依据其形成的大地构造背景可划分为俯冲型(Endako-type)、裂谷型(Climax-type)、碰撞型(Dabie-type)3 大类:俯冲型钼矿床形成于陆缘弧背景,成矿与钙碱性岩浆有关;裂谷型钼矿床形成于弧后或陆内裂谷,成矿与碱性岩浆有关;碰撞型钼矿床形成于同碰撞或后碰撞背景,成矿与高钾钙碱性—钾玄质岩浆有关(Chen *et al*.,2017).受制于班公湖—怒江缝合带闭合时限的争议,目前对于多龙地区~120 Ma 斑岩矿床的动力学背景尚无统一认识.段志明等(2013)基于班公湖—怒江缝合带北缘上三叠统—侏罗系增生杂岩的识别,且该带的铜金矿床在空间上多赋存于早白垩世花岗闪长斑岩体内部及其与侏罗系增生杂岩的内外接触带中,提出多龙矿集区是在增生楔背景下发育的岛弧型斑岩铜金矿床.另一种观点认为班公湖—怒江缝合带在早白垩世早中期仍处于俯冲消减阶段,多龙矿集区的成矿动力学背景为特提斯洋或班公湖—怒江洋北向俯冲有关的陆缘弧,主要根据成矿岩浆表现出富集的弧火山岩特征(Li *et al*.,2013,2017).也有学者发现上白垩统竟柱山组沉积—火山岩地层不整合发育在蛇绿混杂岩之上,约束班公湖—怒江洋盆的闭合时间为 101~83 Ma(Liu *et al*.,2014),或根据洋岛玄武岩形成时代的差异说明洋盆闭合是从东向西穿时进行(曲晓明等,2009),或通过岛弧岩浆岩的年龄

指示 110 Ma 洋盆仍处于俯冲状态(Pan *et al*.,2012;Li *et al*.,2014;Wang *et al*.,2016).Zhu *et al*.(2016) 综合分析了拉萨地体和羌塘地体已有的岩石地层、岩浆岩、变质岩资料,认为俯冲的班公湖—怒江洋盆闭合的时间为 140~130 Ma,明显早于铜金成矿时代(120~85 Ma),但深俯冲的洋壳随后发生回卷(rollback)和断离(breakoff)也可交代地幔楔产生系列弧岩浆作用(130~110 Ma).继而,部分学者提出班公湖—怒江矿带形成于缝合带闭合后的碰撞后地壳隆升阶段,与冈底斯铜矿床类似(曲晓明和辛洪波,2006;辛洪波等,2009;曲晓明等,2015).不同的是,冈底斯斑岩矿床以 Cu-Mo 为主,而班—怒带以 Cu-Au 为主.班公湖—怒江缝合带南侧盐湖地区早白垩世晚期火山岩大量出露(~110 Ma),被认为记录了陆陆碰撞过程中岩石圈伸展诱发的双峰式火山作用,进一步约束班公湖—怒江洋在早白垩世晚期已俯冲闭合(Sui *et al*.,2013).综合已有研究,笔者认为羌塘地体与拉萨地体很可能在早白垩世晚期已进入碰撞后伸展作用阶段.因此,荣嘎矿床为碰撞型斑岩钼矿床(~99 Ma),形成于碰撞造山背景.

6　找矿意义

班公湖—怒江缝合带构造演化历史复杂,成矿地质条件优越,但总体工作程度较低,已初步探明 333 类别及以上铜资源量超过 2 000 万 t,金 500 余吨,目前找矿突破的矿床主要为斑岩—浅成低温热液型铜金矿床,如多龙矿集区的铁格隆南(Cu>1 100万 t,品位 0.52%;Au>120 t,品位 0.08 g/t;唐菊兴等,2016).本文报道的荣嘎斑岩型钼矿床位于班—怒缝合带南侧西段,东距多龙矿集区 200 km 左右,是继冈底斯沙让斑岩型钼矿床之后(秦克章等,2008),在班公湖—怒江成矿带发现的首例斑岩型钼矿床.该矿床的发现,对班公湖—怒江成矿带已有的成矿认识、模型等提出了新的挑战,比如:精细的 Hf 同位素填图表明,地壳性质(新生地壳或古老成熟地壳)是控制成矿作用类型的关键因素,中部拉萨地体显示古老成熟地壳特征,主要形成矽卡岩型 Fe-Cu、花岗岩有关的 Pb-Zn 和斑岩型 Mo 矿床(如沙让);相反,南部和北部拉萨地体显示新生地壳特征,主要形成斑岩型铜矿床(Zhu *et al*.,2011;Hou *et al*.,2015),理应不具备斑岩型钼成矿潜力.然而,荣嘎矿床的发现证明在北部拉萨地体也可形成斑岩型钼矿床.因此,关于斑岩 Mo 成矿的关键控制因素还需进一步研究.荣嘎矿床的成矿时代为晚白垩世早期(~99 Ma),晚于多龙铜金矿集区成矿年龄(~120 Ma),早于尕尔穷—嘎拉勒铜金矿集区成矿年龄(~88 Ma;李志军等,2011;张志等,2014;宋扬等,2014;方向等,2015;曲晓明等,2015),预示在晚白垩世早期,区域上可能存在一期 Mo 成矿事件(图

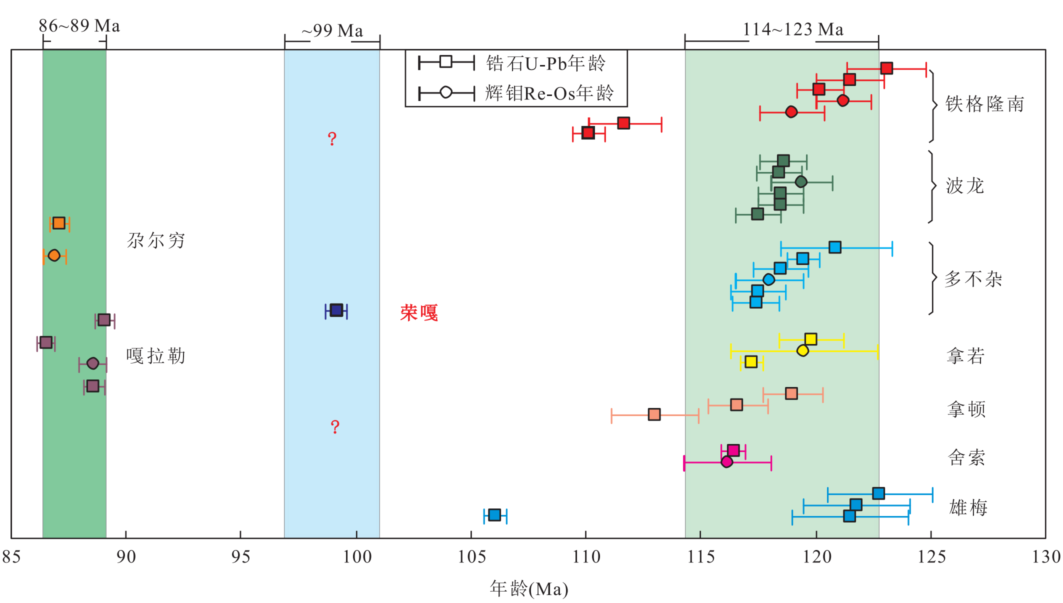

图 8　班公湖—怒江成矿带主要矿床锆石 U-Pb 和辉钼矿 Re-Os 年龄对比

Fig.8　Zircon U-Pb and molybdenite Re-Os ages of main deposits in the Bangong-Nujiang metallogenic belt

数据来源:佘宏全等,2009;赵元艺等,2009,2011;李志军等,2011;吕立娜等,2011;祝向平,2011;曲晓明等,2012;Li *et al*.,2014,2016;姚晓峰等,2013;张志等,2014;方向等,2015;王勤等,2015;王佳琦等,2016;Lin *et al*.,2017;Sun *et al*.,2017

8)，与拉萨、羌塘地体的碰撞密切相关.已有资料表明，荣嘎矿床的围岩为下白垩统去申拉组(K_1q)砂岩，含矿岩体为二长花岗斑岩，主要分布距地表 0～300 m 深度处，深部岩性变为花岗斑岩，含矿性不连续，因此荣嘎矿区后续找矿勘查工作应重点围绕二长花岗斑岩展开，如图 2 和图 5 所示.同时，在班－怒带工作程度薄弱地区进行区域基础地质和矿产地质调查时，应加强晚白垩世早期岩浆岩含矿性评价，分析其斑岩 Mo 成矿潜力.

7　结论

(1)通过对 1∶20 万水系沉积物化探异常查证，结合地质填图和钻孔验证，在班公湖－怒江缝合带南侧西段革吉县盐湖乡新发现了荣嘎斑岩型钼矿床.荣嘎矿床在班－怒带属首例斑岩型钼矿床，含矿岩体为二长花岗斑岩，发育白云母化、绢云母化、粘土化、青磐岩化蚀变，目前已探明原生矿体 8 个，Mo 平均品位为 0.091%，初步估算该矿床具有大型斑岩钼矿床的远景.

(2)荣嘎矿区 8 件辉钼矿样品 Re-Os 同位素定年，获得加权平均年龄为 99.3±0.1 Ma(MSWD＝0.2)，等时线年龄为 99.2±0.4 Ma(MSWD＝0.2)，表明该矿床形成于晚白垩世早期，成矿发生在班公湖－怒江洋盆闭合后的拉萨－羌塘地体碰撞造山阶段.

(3)荣嘎矿床的发现丰富了班公湖－怒江成矿带成矿作用和矿化类型，预示该带除了白垩纪斑岩型－浅成低温热液型 Cu-Au、矽卡岩型 Cu-Au 成矿作用外，在晚白垩世早期还存在一期斑岩 Mo 成矿事件.荣嘎矿床的找矿突破，对在班公湖－怒江成矿带进一步寻找斑岩型钼矿床具有重要的理论及现实意义.

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