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西藏冈底斯矿带成矿作用及远景分析

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摘　要:冈底斯带矿床众多,类型复杂,主要有斑岩型铜(金-钼)矿床、矽卡岩型铁铜-铅-锌(银)矿床、层控铅-锌-银矿床、火山岩型金-银矿床及雄村式铜-金矿床。矿床地质特征和同位素年龄表明,冈底斯带南部的矿床与新特提斯洋壳向北俯冲-陆陆碰撞及碰撞期后的构造岩浆事件有关;冈底斯带北部的矿床与班公湖-怒江洋壳向南俯冲-陆陆碰撞及碰撞期后构造岩浆事件有关。冈底斯带与洋壳的俯冲-碰撞有关的岩浆活动强烈,成矿条件优越。西藏高原在碰撞后发生了快速抬升剥蚀,部分矿床顶部出现低温组合矿化,多数矿床保存良好。

关　键　词:矿床成因;岩浆活动;冈底斯带;西藏

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Study on the Metallogenesis and Resource Perspective of the Gangdisi Ore Deposit Belt in Tibet

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Abstract: A lot of different types of ore deposits have been found in the Gangdisi belt in Tibet, including porphyry Cu (Au, Mo) deposits, skarn Fe-Cu-Pb-Zn (Ag) deposits, strata-bound mineral deposits, epithermal deposits, and the Xiongcun type Cu-Au deposit. Geological characteristics and a new set of isotope ages of deposits reveal that the deposits found the southern Gangdisi belt have been resulted from the a series of structural-magmatic processes such as the southward subduction of the new Tethyan ocean crust, the collision of Indian plate toward the Asia plate, following by the post-collision. The deposits located in the northern Gangdisi belt are corresponded to the southward subduction of the Bangonghu-Nugiang ocean crust and then the collision of the Qiangtang terrane with the Lhasa terrane. There are a lot of mamatic rocks in the southern and northern borders of the Gangdisi belt resulted from the ocean crust subduction and the afterward continental collision. The strong magmatic activities provided excellent conditions for the formation of different types of ore deposits in the Gangdisi belt. The Tibet Plateau has undergone quick uplift and denudation after Indian-Asia collision. The upside of the most ore deposits croping out in the Gangdisi belt are characterized by relatively low temperature mineral assemblage, suggesting that the most of the deposits protect from denudation.

Key words: ore genesis; magmatic activity; Gangdisi belt; Tibet

西藏冈底斯带位于雅鲁藏布缝合带与班公湖-怒江缝合带之间。近年来其南部找矿工作取得了重大进展,发现了大量斑岩铜(金)矿床,空间上形成了斑岩铜矿带(图1);斑岩铜矿带北侧发现了大量的铜-铅-锌多金属矿床、矽卡岩型铁矿床、金-银矿床,形成了一条东西方向长约600 km,南北宽100多km的铁-铜-铅-锌-金-银多金属成矿带;在斑岩铜矿带南缘发现了一系列矽卡岩型铜-金(钼)矿,形成了

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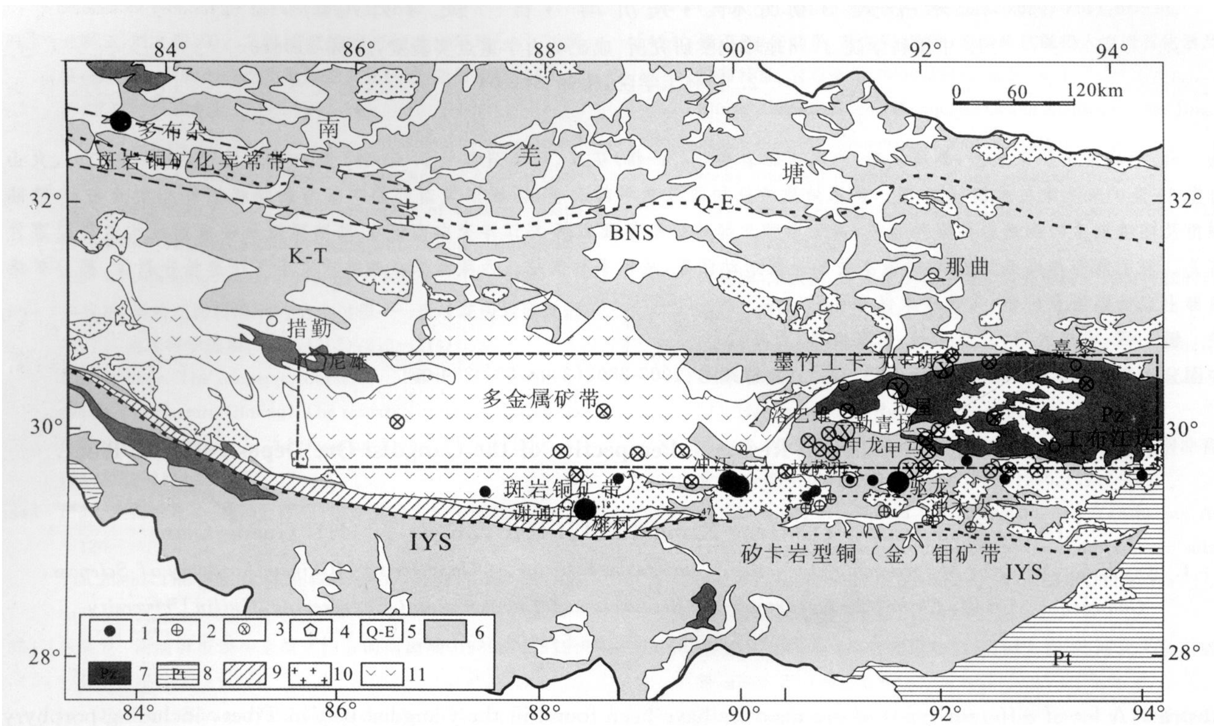
一条东西向长超过 100 km 的矽卡岩矿带。这表明冈底斯带不仅是一条巨型斑岩铜矿成矿带,亦是一条资源潜力巨大的铁-铜-铅-锌-金-银多金属成矿带。此外,在冈底斯带北缘也发现了大型的多布杂斑岩铜矿床,有望取得重大突破,成为我国重要的矿产资源基地。国家 973 项目及国土资源大调查项目对冈底斯带的矿床作了大量的研究及勘探工作。目前多数研究者认为它们是碰撞期后形成的[2~11]。本文初步总结冈底斯矿带矿床特征并分析其形成的构造环境。



1. 斑岩铜矿床;2. 矽卡岩型铜矿床;3. 铜多金属矿;4. 铁矿;5. 新生代地层;6. 中生代地层;7. 古生代地层;8. 元古代地层;9. 日喀则弧前盆地;10. 花岗岩;11. 古近纪-新近纪火山岩;IYS. 印度河-雅鲁藏布江缝合带;BNS. 班公湖-怒江缝合带;据文献[1]修改

1. porphyry deposits; 2. skarn deposits; 3. copper polymetal deposits; 4. iron deposits; 5. Cenozoic strata; 6. Mesozoic strata; 7. Paleozoic strata; 8. Proterozoic strata; 9. Rikaze fore. arc basin; 10. granite; 11. Tertiary volcanic rocks; IYS. Indian river-Yalu. Zangbo suture zone; BNS. Bangonghu-Nujinag suture zone; modified after ref. [1]

图 1　西藏冈底斯带地质及矿床分布简图

Fig. 1　Simplified geological and mineral ore distribution map for the Gangdisi belt in Tibet

1　主要矿床类型

冈底斯带北部的工作相对较少,目前发现的矿床主要位于中南部(图 1)。据前人的工作及我们考察,冈底斯带矿床主要有下列类型。

1.1　斑岩型铜矿床

矿带南缘的斑岩铜矿床,如超大型的驱龙斑岩铜矿床、大型的冲江斑岩铜矿床及一系列中小型矿床和矿化点,形成了斑岩铜矿床带。北缘的班公湖-怒江带也发现了大型的多布杂斑岩铜矿床和一系列矿化点;斑岩铜矿化标志规模很大,有望取得重大突破。

1.2　矽卡岩型矿床

冈底斯矿带南部矽卡岩型矿床较发育,按元素组合,可分为下述四种类型:

(1) 矽卡岩型铁矿床:主要有措勤尼雄铁矿床、恰功铁矿床、林周县甲龙铁矿床(点)及一系列矿化点。

(2) 矽卡岩型铜(钼)矿床:如冲木达铜矿床、克鲁铜金矿床、知不拉铜矿床、日阿铜矿床、双布结热铜矿床、沙布多铜矿床及一系列铜矿化点。

(3) 矽卡岩型铜-铅-锌多金属矿床:如甲马铜-铅-锌-多金属矿床、拉屋铜-铅-锌-多金属矿床、洛巴堆铜-铅-锌-多金属矿床、帮浦铜-铅-锌矿床。

(4) 矽卡岩型钨(钼)矿床:如多底沟钨钼矿床(点)。

1.3　层控型铅-锌矿床

如林周县勒青拉铅-锌矿床、新嘎果铅-锌(铜)

矿床、轮朗铅-锌矿床、当雄铅-锌-银矿床、洞中拉铅-锌-铜矿床、黑弋铅-锌矿床和尤卡朗铅-锌矿床。

1.4 火山岩型金(铜)银矿床

如撒当金-银矿床(点)及纳木村铜-铅-银矿点。

1.5 特殊类型矿床

谢通门雄村特大型铜-金矿床。该矿床主要产于火山岩中,但缺乏浅成低温热液矿床特征蚀变矿物组合,却显示斑岩型铜矿床矿化和蚀变分带特征。可能是一种特殊类型的斑岩型铜矿床,初步定为雄村式斑岩铜-金矿床。

2 矿床形成机理

目前西藏地区矿床的研究工作主要集中于冈底斯矿带南部碰撞期后斑岩铜矿床[11～13],其他类型矿床工作相对不多。冈底斯矿带铁、铜-铅-锌-银多金属矿床主要产于石炭系、二叠系、侏罗系、白垩系灰岩、大理岩、白云岩和砂岩破碎带及其与岩体的接触带,多数矿床矿体出露地表,易开采。孟祥金等[10]据帮浦铜铅-锌矿床 Re-Os 年龄(15.3 ±0.8 Ma)和斑岩铜矿的矿化时代(12～17 Ma)基本一致,指出铜-铅-锌多金属矿床和含铜斑岩体有密切关系,两者矿化类型的差异取决于各自的围岩性质。前者的围岩主要是火山-沉积岩和碳酸盐岩,后者的围岩则为花岗闪长岩岩基。郑有业等[14]认为,铜-铅-锌-多金属矿床属喷流成因。李光明等[15]认为矿床的形成与新特提斯洋壳板块有关的岩浆活动和弧内拉张盆地有关。

初步测定嘉黎县夏玛接触带型铅-锌矿含矿岩体锆石年龄为 114.7 ±1.1 Ma,甲龙矽卡岩铁矿含矿岩体锆石年龄为 60.6 ±0.6 Ma,赋金银矿床(点)火山岩锆石年龄为 62.5 ±0.5 Ma,冲木达-克鲁矿集区一个矽卡岩型铜矿点含矿岩体锆石年龄为 92.1 ±0.6 Ma,冲木达矽卡岩型铜-钼矿床含矿岩体锆石年龄为 28.6 ±0.2 Ma[9]。研究表明,拉屋矽卡岩型铜-铅-锌-多金属矿床区岩体的 K-Ar 年龄为 109 Ma[16],帮浦铜-铅-锌矿床 Re-Os 年龄为 15.3 ±0.8 Ma[10],雄村特大型铜-金矿床赋矿火山岩蚀变绢云母 Ar-Ar 为年龄 38.1 Ma[17],多底沟矽卡岩型钨-钼矿床辉钼矿 Re-Os 年龄为 62 Ma;总的来说,主要斑岩铜矿床含矿岩体时代为 12～17 Ma[2～8]。此外,甲马铜-铅-锌-多金属矿床具有喷流沉积矿床的一些特征[18];黑弋铅-锌矿床为层状产出,矿体与地层的产状基本一致,并具热水沉积矿床的特征。上述含矿岩体、矿床成矿时代和矿床地质特征表明,冈底斯矿带南部铜矿床、矽卡岩型铁矿床和金属矿床成岩成矿时代跨越较大,为 114～12 Ma。

晚侏罗世晚期,班公湖-怒江洋盆消亡,拉萨地体与羌塘地块碰撞[19],在冈底斯矿带北部出现印支 - 燕山早期的岩浆活动。新特提斯洋形成于早中侏罗世或晚三叠世[20],它边形成边消亡[19],到白垩纪中期,印度板块向北漂移,新特提斯洋壳向拉萨地体之下俯冲消减,形成了冈底斯岩浆弧和弧前盆地[21,22]。目前,对新特提斯洋最终消亡乃至印度板块与欧亚板块发生碰撞的时代仍有不同看法:从晚白垩世[23]、始新世中期[24]到晚始新世[25]或期后[26]都有可能。Lee 和 Lawver[27]则认为,印度板块与欧亚板块在约 65 Ma 时发生“软碰撞”,而在约 45 Ma 时发生“硬碰撞”。

因此,冈底斯矿带南部不但发育碰撞期后斑岩铜矿床和矽卡岩型多金属矿床,亦发育与新特提斯洋壳俯冲-碰撞构造岩浆事件有关的铁-铜-铅-锌-金-银多金属矿床,形成了十分完整的与洋壳俯冲-陆陆碰撞及碰撞期后构造岩浆作用有关的成矿谱系。

3 矿床远景分析

冈底斯矿带北部在晚侏罗世以前受班公湖怒江洋向南俯冲及其后的碰撞,矿带南部在中新生代发生新特提斯洋向北俯冲及其后的碰撞等构造岩浆事件。因此,成矿带北部矿床的形成主要受班公湖怒江洋向南俯冲及其后碰撞事件的控制,南部的矿床则受控于新特提斯洋壳向北俯冲及其后的碰撞构造事件。冈底斯矿带是研究板块运动、陆陆碰撞造山与成矿关系的窗口。

冈底斯矿带南北两侧在中生代和中新生代分别经受了两个洋壳俯冲及其后的陆陆碰撞构造岩浆热事件,洋壳俯冲过程中部分岩浆演化成有利于成矿元素迁移富集的岩浆(富水、矿化剂及高氧化性岩浆)。俯冲作用使岩浆加热,驱动地下水的热循环,溶解矿源层中成矿元素并在一定条件下发生大规模富集;同时,形成一系列弧内局限盆地和海底火山与热液活动,为成矿元素的聚集创造了良好的条件[14]。冈底斯带经历了洋壳俯冲-陆陆碰撞及碰撞期后的构造-岩浆热事件,成矿条件甚为优良,可望成为我国最具潜力的资源基地。

西藏由于印度板块与欧亚板块碰撞而发生快速抬升及期后的大规模剥蚀。目前冈底斯矿带斑岩铜矿床及众多铁-铜-铅-锌-金-银多金属矿床出露于地表。据笔者考察,一些重要矿床(如雄村特大型铜金矿床、拉屋多金属矿床)出露于地表部分主要是矿化顶部的低温蚀变组合。因此,矿体上部盖层被剥蚀,

表明绝大多数矿床保存良好,具有很好的找矿及开发前景。

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