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东北亚南部地区成矿区带数据集

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摘要：东北亚南部地区成矿区带数据集是以研究区最新地学资料为基础，根据区域地质构造特征及成矿特点，综合区内 1 590 个境内外矿产地信息资料，依据区内主要金属矿床的分布特征、矿床类型、成矿时代及成矿规律，将东北亚南部地区划分为 3 大成矿域、9 个成矿省、43 个成矿带及 11 个成矿亚带。包括成矿省、成矿带及成矿亚带名称，成矿带及成矿亚带的主要成矿元素、主要成矿期、主要构造单元及主要矿产地信息等数据。该数据集将为开展中国与俄罗斯、蒙古国和朝鲜毗邻地区跨境成矿带的成矿对比研究提供基础地质资料，对东北亚南部地区地质找矿工作具有指导意义。

关键词：东北亚南部；成矿区带；矿产地信息

数据服务系统网址：http://dcc.cgs.gov.cn

1　引言

成矿区带（成矿带）是具有较丰富矿产资源及其潜力的成矿地质单元，在此区带内具有主导的成矿地质环境、地质演化历史（区域成矿谱系）及与之相应的区域成矿作用（成矿旋回）、成矿信息和特定时代形成的已知矿床集中的分布空间（组成四维空间）（宋相龙等，2017）。成矿区域划分主要依据区域成矿的地质构造环境及区域成矿作用之性质、产物、强度等矿化信息（陈毓川等，2006；朱裕生等，2013）。

东北亚南部地区大地构造演化复杂，总体上经历了前南华纪古陆（块）形成阶段（阜平构造旋回、五台构造旋回、扬子构造旋回）、南华纪—中三叠世古亚洲洋构造域演化阶段（兴凯构造旋回、加里东构造旋回、华力西构造旋回）和晚三叠世以来的滨太平洋构造域阶段（印支构造旋回、燕山构造旋回、喜山构造旋回）。特别是自晚印支构造旋回以来，东北亚南部地区构造格局发生了显著的变化，进入了滨太平洋构造域发展阶段，使得东北亚南部地区均成为滨太平洋陆缘构造—岩浆活动区。

由于本区构造复杂多样，导致区内各类矿产资源丰富，矿床分布较广泛。仅就中国东北地区而言，发现各类金属、非金属及能源矿产地（矿床、矿点）3 000 多处，其中大中型矿产地 700 多处，主要煤矿产地 300 多处。根据“俄罗斯远东经济区矿物原料基地现状”资料，远东地区共有探明矿床 1 100 个，经济评价矿床 280 个，矿点 9 300 个，

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通讯作者简介：柴璐，女，1981 年生，高级工程师，主要从事东北亚地质矿产等方面研究；E-mail：10056269@qq.com。

矿化点和地球化学异常成千上万个，各种矿产地的砂矿床 3 300 个，是俄罗斯最大的矿物原料基地（朱群等，2014）。

本文以东北亚南部地区为研究范围，中国境内包括：东北三省、内蒙古自治区东部及河北东北部（110°E 以东）；周边国家包括：俄西伯利亚联邦区后贝加尔边疆区及远东联邦区阿穆尔州、犹太自治州、哈巴罗夫斯克边疆区、滨海边疆区（110°E 以东；64°N 以南）、蒙古东部（108°E 以东）及朝鲜半岛（图 1）。通过对研究区境内外以往地质、矿产、地球物理、地球化学、科研成果等资料的收集与综合研究工作，对研究区进行成矿区带划分，有助于深化对跨境成矿带地质特征和成矿规律的认识，为开展中国与俄罗斯、蒙古国和朝鲜毗邻地区跨境成矿带的成矿对比研究提供了基础地质资料。

注：红框为研究区范围

图 1　东北亚南部地区成矿区带划分研究区位置示意图

东北亚南部地区成矿区带数据集的基本信息简介见表 1。

表 1　数据库（集）元数据简介

条目	描述
数据库（集）名称	东北亚南部地区成矿区带数据集
数据库（集）作者	朱　群，中国地质调查局沈阳地质调查中心 柴　璐，中国地质调查局沈阳地质调查中心 刘　斌，中国地质调查局沈阳地质调查中心
数据时间范围	2003—2010 年
地理区域	东北亚南部地区 中国境内包括：东北三省、内蒙古自治区东部及河北东北部（110°E 以东）；周边国家包括：俄西伯利亚联邦区后贝加尔边疆区及远东联邦区阿穆尔州、犹太自治州、哈巴罗夫斯克边疆区、滨海边疆区（110°E 以东；64°N 以南）、蒙古东部（108°E 以东）及朝鲜半岛。
数据格式	*.xlsx, *.wl, *.wt, *.wp
数据量	1 485.7 KB
数据服务系统网址	http://dcc.cgs.gov.cn
基金项目	国家重点研发计划“典型矿集区三维地质结构与矿体定位”（2017YFC0601300-05）和中国地质调查局国土资源大调查项目“东北亚地区地质矿产综合图件编制”（编号：1212010561504）
语种	中文
数据库（集）组成	东北亚南部地区划分为 3 个成矿域、9 个成矿省、43 个成矿带及 11 个成矿亚带，成矿带及成矿亚带信息包括成矿带名称、主要成矿元素、主要成矿期、主要构造单元及主要矿产地信息等。 东北亚南部地区成矿区带数据集包括两种类型数据： 东北亚南部地区成矿区带图，MapGIS 矢量数据，数据量 1 442 KB 东北亚南部地区成矿区带数据总表，xlsx 属性数据，数据量 43.7 KB

2　数据采集和处理方法

2.1　数据基础

本次研究工作尽可能收集和利用了东北亚地区内现有最新的地质矿产图件和矿产地资料，主要参考了《1∶150 万东北地区地质图及说明书》（沈阳地质矿产研究所，2006）、《1∶125 万俄罗斯阿穆尔州地质矿产图》（俄罗斯自然资源部阿穆尔地质企业，阿穆尔洲国立大学资源利用实验室，2005）、《1∶100 万俄罗斯哈巴罗夫斯克边疆区地质图》（哈巴罗夫斯克地质企业，2005）、《1∶100 万滨海边区地质图》（苏联地质部，B.A. 巴然诺夫等编，1989）、《1∶100 万蒙古国地质图》（蒙古国矿产资源调查局，蒙古国科学院地质矿产研究所，1998）、《1∶100 万朝鲜半岛地质图及其说明书》（朝鲜自然资源部矿产资源部中央地质调查局，1994）、《1∶100 万朝鲜半岛地质图》（朝鲜科学院地质研究所，1995），以及辽宁、吉林、黑龙江 3 省和内蒙古有关 1∶20 万和 1∶5 万区调资料、科研成果等。

在综合研究东北亚南部地区各国及地区地质调查和科研取得的新成果、新进展、新认识的基础上，结合区内 1 590 个境内外矿产地资料（国内 742 个，国外 848 个），研究与归纳了东北亚南部地区主要金属矿床的分布特征、矿床类型、成矿时代及成矿规律，将本区划分为3个成矿域、9个成矿省、43个成矿带及11个成矿亚带（图2、表2）。

中国境内分布有 5 个成矿省、21 个成矿带（含 6 个成矿亚带）。

表 2　东北亚南部地区成矿区划表

成矿省（Ⅱ级）	成矿带（Ⅲ级）	代表性矿床
贝加尔成矿省（B）	B_1 贝加尔—巴托姆成矿带	苏霍伊—洛格（Sukhoy Log）大型金，铂矿床
	B_2 贝加尔—维季姆成矿带	霍洛德宁（Kholodninskoye）大型铅锌铜矿床
维尔霍扬—科雷马成矿省（VK）	VK_1 谢岱—达班成矿带	萨尔丹纳（Sardana）大型铅锌矿床
	VK_2 哈雷亚山成矿带	山湖（Gornoye Ozero）大型钽，铌，稀土元素矿床
	VK_3 鄂霍茨克成矿带	哈康德（Хаканджин）金银矿床
	VK_4 上任吉格尔成矿带	
阿尔丹—斯塔诺夫成矿省（外兴安岭成矿省）（AS）	AS_1 勒拿—玛娅成矿带	
	AS_2 阿尔丹成矿带	Olimpiyskoe 大型铁矿床
	AS_3 奥列克敏成矿带	乌多坎（Udokanskiy）超大型铜矿床
	AS_4 斯塔诺夫成矿带	卡瓦克特大型钛铁矿—磷灰石矿床
	AS_5 朱戈朱尔山成矿带	巴吉（Bogidenskoe）大型钛铁矿—磷灰石矿床
蒙古—鄂霍茨克成矿省（ME）	ME_1 谢林津—雅布洛诺夫成矿带	奥泽尔诺耶（Ozernoye）铅锌（铜）矿床
	ME_2 涅尔恰—奥廖克姆成矿带	奥里基特康（Orekitkanskoye）大型钼矿床
	ME_3 达乌尔—阿金成矿带	扎维京（Завитинское）超大型锂矿床
	ME_4 克鲁伦—满洲里成矿带	查干布拉根大型铅锌矿床
	ME_5 额尔古纳—上黑龙江—岗仁（俄）成矿带	库尔图明（Култумин）超大型铜金矿床
	ME_6 结雅—科尔宾成矿带	苏塔姆大型金矿床
	ME_7 乌德—尚塔尔成矿带	米尔康（Milkanskoe）大型铁矿床
南蒙古—大兴安岭成矿省（MD）	MD_1 南蒙古成矿带	谢尔塔拉铁矿床
	MD_2 乌奴尔—阿龙山—加林（俄）成矿带	基姆坎—苏塔尔超大型铁矿床
	MD_3 南戈壁（蒙古）—东乌珠穆沁旗—嫩江成矿带	
	MD_{3-1} 南戈壁（蒙古）—东乌珠穆沁旗成矿亚带	朝不楞铁，锌，铋矿床
	MD_{3-2} 多宝山—黑河成矿亚带	多宝山超大型铜矿床
	MD_4 白乃庙—锡林浩特成矿带	白乃庙大型铜，钼，金矿床
	MD_5 突泉—翁牛特成矿带	浩布高大型铅锌矿床
吉黑成矿省（JH）	JH_1 小兴安岭—张广才岭成矿带	东安大型金矿床
	JH_2 布列因—佳木斯—兴凯成矿带	团结沟大型金矿床
	JH_3 四平—永吉成矿带	二道甸子大型金矿床

续表 2

成矿省（Ⅱ级）	成矿带（Ⅲ级）	代表性矿床
	JH$_4$ 汪清—珲春成矿带	小西南岔金矿床
	JH$_5$ 延边—咸北成矿带	三惠铜镍矿床
锡霍特—阿林成矿省(SA)	SA$_1$ 巴特热洛—亚姆—阿林成矿带	共青城大型锡矿床
	SA$_2$ 下阿穆尔成矿带	白山（Белыегоры）大型金矿床
	SA$_3$ 完达山—中锡霍特—阿林成矿带	东方 -2 号（Vostok-2）大型钨矿床
	SA$_4$ 东锡霍特—阿林成矿带	格鲁霍（Глухое）大型金矿床
中朝成矿省（ZC）	ZC$_1$ 铁岭—靖宇—冠帽（朝）成矿带	茂山大型铁矿床
	ZC$_2$ 营口—长白—惠山（朝）成矿带	利原大型铁矿床
	ZC$_3$ 瓦房店—旅顺成矿带	瓦房店金刚石矿床
	ZC$_4$ 狼林成矿带	大榆洞大型金矿床
	ZC$_5$ 华北地块北缘东段成矿带	
	ZC$_{5\text{-}1}$ 内蒙隆起东段成矿亚带	金厂沟梁金大型金矿床
	ZC$_{5\text{-}2}$ 冀北—北票成矿亚带	野猪沟铁矿床
	ZC$_{5\text{-}3}$ 冀东—绥中成矿亚带	滦县司家营铁矿床
	ZC$_{5\text{-}4}$ 北镇成矿亚带	排山楼大型金矿床
	ZC$_6$ 华北地块北缘西段成矿带	布连河古营子小型铁矿床
	ZC$_7$ 山西断隆成矿带	三岔沟乡李清地中型银多金属矿床
	ZC$_8$ 朝鲜半岛中部平南成矿带	
	ZC$_{8\text{-}1}$ 沙里院成矿亚带	笏洞大型金多金属矿床
	ZC$_{8\text{-}2}$ 肃州—海州成矿亚带	殷栗中型铁矿床
	ZC$_{8\text{-}3}$ 元山—开城成矿亚带	富平小型银矿床
朝鲜半岛南部成矿省（SK）	SK$_1$ 朝鲜半岛南部金刚山—春川—水原成矿带	满川大型金矿床
	SK$_2$ 朝鲜半岛南部宁越—全州成矿带	Sangdong 钨矿床
	SK$_3$ 朝鲜半岛南部永川—顺天成矿带	
	SK$_{3\text{-}1}$ 小白成矿亚带	Tongyoung 小型金银矿床
	SK$_{3\text{-}2}$ 洛东成矿亚带	Haman-Gunpuk 中型铜铅锌多金属矿床

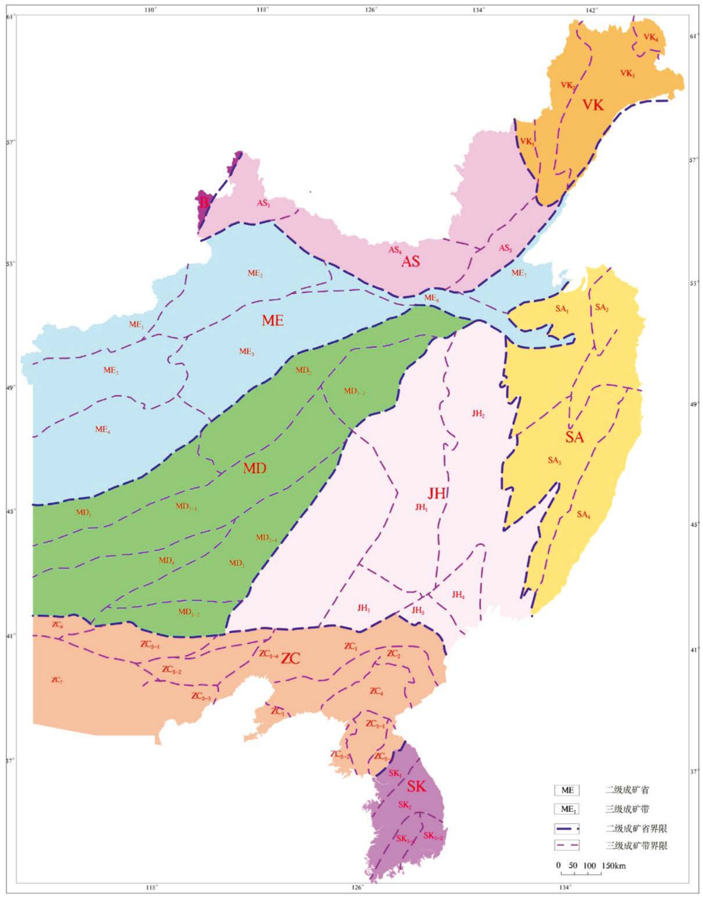

图 2　东北亚南部地区成矿区带图

2.2　成矿区带划分原则

不同研究者对内生金属区域成矿区划的认识和依据并不一致，如在Ⅰ级成矿单元——成矿域的划分方面，郭文魁曾将东北地区笼统地划归为滨太平洋成矿域（郭文魁，1987）；陈尔臻等则认为东北地区为由古亚洲洋和滨太平洋两大成矿域构成❶；陈毓川主编的《中国主要成矿区带矿产资源远景评价》一书，将中国的成矿单元划分为 5 级：Ⅰ级——全球成矿区（带）——成矿域，往往对应的是全球性构造域；Ⅱ级——是Ⅰ级成矿单元内的次级成矿区带，与大地构造单元对应或跨越几个大地构造单元，成矿作用形成于几个或一个大地构造—岩浆旋回的地质历史时期；Ⅲ级——是Ⅱ级成矿单元内的次级成矿区带，它是一种或多种矿化集中分布区，成矿受控于某一构造—岩浆带、岩相带、区域构造或变质作用（陈毓川，1999）。在Ⅲ级成矿区带内还可划分出Ⅳ级（矿化集中区）和Ⅴ级（矿田）成矿单元等，徐志刚、陈毓川等在《中国成矿区带划分方案》一书中按照上述原则对全国重要成矿区带再次进行了研究和划分（徐志刚等，2008）。

本文根据东北亚南部地区成矿区带的划分原则，在划分级别上，按照全球性的成矿域，到大区性的成矿省，区域性的成矿区带及地区性的成矿亚区，将成矿单元划分为 4 级。

Ⅰ级成矿单元，为全球性的构造—成矿域，在东北亚南部地区分别对应于古亚洲洋构造域和滨太平洋构造域。综合近年来国内外学者对东北亚地区的研究进展，认为东北

亚地区地壳形成演化大体可分为 3 个演化阶段，即前寒武纪古陆（块）形成阶段（Ar—Pt，或前南华纪）、古亚洲洋构造域阶段（Pz，或南华纪—中三叠世）和滨太平洋构造域阶段（Mz—Kz，或晚三叠世以来）。据内生金属成矿与构造—岩浆作用的紧密成生关系这一基本要素，考虑成矿的地质构造背景，将东北亚地区内生金属成矿域划分为 3 个，即前寒武纪古陆（块）成矿域、古亚洲洋成矿域和滨太平洋成矿域，其中滨太平洋成矿域叠覆于前两个成矿域之上。考虑到成矿域的叠置关系，编图中将滨太平洋构造域内带区域和成矿期相对单一且成矿作用主要受中生代构造—岩浆活动控制的地域划归为滨太平洋成矿域，其余均划归为前寒武纪古陆（块）或古亚洲洋成矿域。

Ⅱ级成矿单元，为大区性的成矿省，属于Ⅰ级成矿域内的次级成矿区域，在东北亚南部地区一般对应于Ⅱ级构造单元，即为成矿域在东北亚地区具体的成矿区域。

Ⅲ级成矿单元，为成矿省内更次一级的成矿区（带），其划分则是依据矿床空间展布的集中性、主要成矿期的一致性、含矿层（体）—成矿系列的共同性以及具体的构造—岩浆活动特征和区域地质构造背景的制约等原则来划分。其中，对于分布面积较大的Ⅲ级成矿带，依据矿床的分布特征进一步划分出Ⅳ级成矿单元——成矿亚带。

3 数据样本描述

东北亚南部地区成矿区带数据集主要包括以下几个方面：成矿省、成矿带及成矿亚带名称，成矿带及成矿亚带的主要成矿元素、主要成矿期、主要构造单元、主要矿产地信息。其中成矿区带数据总表涵盖 43 个成矿带及 11 个成矿亚带的主要矿产地信息，如矿产地数量、矿种、矿床规模、矿床类型等信息（表 3、表 4）。

表 3 东北亚南部地区成矿区带数据总表

序号	字段名称	数据型	实例
1	成矿带名称	字符型	额尔古纳—上黑龙江—岗仁（俄）成矿带（ME_5）
2	主要成矿元素	字符型	Au-Ag-Cu-Pb-Zn-Mo-W-U- 萤石
3	主要成矿期	字符型	中侏罗世—早白垩世
4	主要构造单元	字符型	中蒙古—额尔古纳造山带的东北段； 克鲁伦—近额尔古纳构造—岩浆带
5	主要矿产地信息	字符型	本成矿带矿床（矿产地）共 86 个，其中超大型 3 个，大型 13 个，中型 29 个，小型 33 个，规模未知的 8 个。确定成因类型的矿床（矿产地）77 个，主要为岩浆热液型（17 个）、斑岩型（11 个）、火山热液交代型（11 个）、火山热液型（6 个）、变质热液型（4 个）、沉积型（4 个）、次火山热液型（3 个）、接触交代型（2 个）、热液型（2 个）、伟晶岩型（2 个）。

表 4 东北亚南部地区成矿区带总表之主要矿产地信息表

矿种	超大型（个）	大型（个）	中型（个）	小型（个）	规模未知（个）	合计（个）
金		2	6	17	2	27
银		1				1
金银			1			1
铜	2	3	3	3	2	13
铅			1	5		6
铅锌		2	12	3	1	18
钼		1	2		2	5

续表 4

矿种	超大型（个）	大型（个）	中型（个）	小型（个）	规模未知（个）	合计（个）
钨			1	2		3
锡			1			1
锑				1		1
铁			1			1
锰			1			1
稀有金属		4		1		5
铀	1			1	1	3

注：以额尔古纳—上黑龙江—岗仁（俄）成矿带（ME_5）为例

东北亚南部成矿区带图（图 2）采用 MapGIS 软件进行制图，投影参数如下：

椭球体：北京 54

地图投影：兰伯特等角圆锥投影坐标系

比例尺：1：1, 500, 000

单位：毫米 (mm)

第一标准纬度：480 000

第二标准纬度：580 000

中央子午线经度：1 270 000

投影原点纬度：484 000

按照中国地质调查局《全球地质矿产数据库建设指南》要求，完成 MapGIS 文件的属性内容（表 5）。

表 5　成矿省面元属性表结构

字段名称	字段类型	字段长度	小数位数	约束条件
ID	L	8		必选
面积	D	15	6	必选
周长	D	15	6	必选
成矿省名称	C	50		必选
构造特征	C	100		必选
主要矿床	C	30		必选
备注	C	254		可选

4　数据质量控制和评估

东北亚南部地区成矿区带数据集是以研究区各国家及地区区域编图、地质调查和科研取得的新成果、新进展、新认识为基础，重新划分了东北亚南部地区的构造单元，根据区域地质构造特征，综合了区内 1 590 个境内外矿产地资料，依据区内主要金属矿床的分布特征、矿床类型、成矿时代及成矿规律，划分出 3 大成矿域、9 个成矿省、43 个成矿带及 11 个成矿亚带。采用的资料详实可靠，编图和数据库建设标准规范，且编图工作中运用了地学的新理论、新方法。

此次工作由于涉及地域大、地质演化时序长，所收集邻国的地质矿产资料详细程度不一，尤其缺乏朝鲜部分的资料，而各国地质工作者对区域构造演化、构造层划分等方面的认识不完全统一，且研究中缺少足够的成岩、成矿作用的时代对比数据，因此在成

矿带划分上仍存在一定差异，跨境成矿带的对接方面存在简单对接的问题。

5 结论

东北亚南部地区成矿区带数据集由东北亚南部地区成矿区带图和东北亚南部地区成矿区带总表 2 类数据组成，东北亚南部地区成矿区带图将研究区划分为 3 个成矿域、9 个成矿省、43 个成矿带及 11 个成矿亚带，东北亚南部地区成矿区带总表包括成矿省、成矿带及成矿亚带名称，成矿带及成矿亚带的主要成矿元素、主要成矿期、主要构造单元及主要矿产地信息等。本次工作是以研究区最新地质矿产类资料为基础，根据区域地质特征和成矿特点，对研究区进行了成矿区带划分，深化了对跨境成矿带地质特征和成矿规律的认识，对东北亚南部地区地质找矿工作具有指导意义。

致谢：此项目实施过程中得到了中国地质调查局科技外事部的具体指导和大力支持，同时也得到了内蒙古自治区、黑龙江省、吉林省、辽宁省等诸地调院及其所承担的地调项目有关部门的支持和帮助。俄罗斯赤塔州自然资源委员会、阿穆尔州地质企业、俄科学院远东分院构造和地球物理研究所、俄科学院远东分院远东地质研究所等，提供了其辖区的地质图和资料，在此一并表示感谢。

注释：

❶ 陈尔臻 , 彭玉鲸 , 韩雪 . 2001. 中国主要成矿区（带）研究（吉林省部分）[R].

参考文献

陈毓川 . 1999. 中国主要成矿区带矿产资源远景评价 [M]. 北京 : 地质出版社 .

陈毓川 , 朱裕生 , 肖克炎 , 张晓华 , 梅燕雄 , 闫升好 , 刘亚玲 , 宋国耀 , 李纯杰 , 王勇毅 , 董建华 , 李厚民 , 丁建华 . 2006. 中国成矿区（带）的划分 [J]. 矿床地质 , 25: 1−6.

郭文魁 . 1987. 中国内生金属成矿图说明书（1：4 000 000）[M]. 北京 : 地质出版社 .

宋相龙 , 肖克炎 , 丁建华 , 范建福 , 李楠 . 2017. 全国重要固体矿产重点成矿区带数据集 [J]. 中国地质 , 44(S1): 72−81

徐志刚 , 陈毓川 , 王登红 , 陈郑辉 . 2008. 中国成矿区带划分方案 [M]. 北京 : 地质出版社 .

朱群 , 刘斌 , 柴璐 . 2014. 东北亚南部地质与矿产 [M]. 北京 : 中国地质大学出版社 .

朱裕生 , 肖克炎 , 马玉波 , 丁建华 . 2013. 中国成矿区带划分的历史回顾和现状 [J]. 地质学刊 , 37(3): 345−357.

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The Dataset of Metallogenic Provinces (Belts) in Southern Northeast Asia

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Abstract: The Dataset of Metallogenic Provinces (belts) in Southern Northeast Asia (SNA) is based on the latest geosciences data of the area understudy. It takes into account the regional geo-tectonic features and metallogenic characteristics, while synthesizing the data of 1, 590 mineral occurrences in the country and abroad. In addition, it classifies the SNA as 3 metallogenic mega-provinces, 9 provinces, 43 belts, and 11 sub-belts, according to the distribution of major metallic ore deposits, types of ore deposit, metallogenic epochs, and metallogenic regularities. This dataset covers name of metallogenic provinces, belts and sub-belts,and main mineralizing elements, principle mineralizing epochs, major tectonic units, and main mineral occurrences information of metallogenic belts and sub-belts. Furthermore, this dataset provides basic geological information for trans-boundary correlative researches of metallogenesis between China and Russia, Mongolia, and North Korea bi-laterally. Meanwhile, it can also guide geological researches and mineral resources exploration in the SNA.
Key words: Southern Northeast Asia, SNA, metallogenic provinces (belts), mineral occurrences
Data service system URL: http://dcc.cgs.gov.cn

1 Introduction

A metallogenic region (belt) is a special geological unit that holds relatively abundant mineral resources and potentials, within which there occurs a dominant regional metallogenesis (cycle) given exclusive geological settings and geological evolutional tracks favorable for metallogenesis (or regional metallogenic lineage). Such a region also offers rich information related to metallogenesis, and holds enough temporal-spatial dimensions (4D) for the evolution of known ore deposits formed in certain geological epochs (Song Xianglong et al., 2017). The classification scheme of metallogenic provinces (belts) is mainly according to the geo-tectonic settings and mineralization information, such as the features, products, and intensities of the regional metallogenesis (Chen Yuchuan et al., 2006; Zhu Yusheng et al., 2013).

The SNA has experienced a complicated tectonic evolution, which is generally summarized as the following (from old to new): the conception stage of pre-Nanhua Old

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Land (Fuping, Wutai, and Yangzi tectonic cycles), the evolutionary stage of Paleo Asia Ocean Tectonic Domain in the Nanhua – Middle Triassic (Xingkai, Caledonian, Variscan tectonic cycles), and the stage of marginal-Pacific tectonic domain since Late Triassic (Indosinian, Yanshanian, Himalayan tectonic cycles). Especially since the Late Indosinian tectonic cycle, the SNA has changed its tectonic framework remarkably, entering the evolutionary stage of marginal-Pacific tectonic domain. As a whole, it has become the marginal-Pacific epicontinental tectonic-magmatic active region.

A number of mineral resources are distributed widely because of the diversity in structures in the region. In northeastern China, more than 3,000 localities (ore deposits and occurrences) of various metallic, non-metallic and energy resources has been discovered, among which more than 700 localities are large to medium scale, while 300 and more are main coal beds. According to Russian Far East Economic Area Mineral Raw Materials Outlines, there are 1, 100 proven ore deposits, 280 economically evaluated ore deposits, 9, 300 mineral occurrences, thousands of mineralized localities and geochemical anomalies, as well as 3, 300 sand-type deposits. The Far East Region is Russia's biggest mineral material base (Zhu Qun et al., 2014).

Note: Red frame is the scope of the study area.

Fig.1 Location Map of the Study Area of the Division of Metallogenic Provinces (Belts) in the SNA

As studied in the paper, SNA has a vast trans-boundary geographical coverage. It covers Liaoning, Jilin and Heilongjiang provinces, eastern part of Inner Mongolia Autonomous Region, and northeastern part of Hebei province (east to 110°E) within the Chinese territory. Meanwhile, its coverage in the neighboring countries is spread across the Russia's Post-Baikal region, Siberian Federal District, Amurskaya Oblast, Jewish Autonomous Oblast, Khabarovskiy Kray, Maritime Kray, and Far East Federal District (east to 110°E, and south to 64°N) (Fig. 1) . It also covers eastern Mongolia (east to 108°E) and the Korea Peninsular. The research team has collected and synthesized geological, mineral resources, geochemical, and geophysical data as well as the scientific research results in the studied area. The team has also classified the metallogenic provinces (belts). These achievements have deepened knowledge about the geological features and regularities of the trans-boundary metallogenic provinces (belts), and offered basic geological data for the trans-boundary correlation between China, Russia, Mongolia, and Korea.

Table 1 lists basic information of the dataset of metallogenic provinces (belts) in SNA.

Table 1 Metadata table of Database (Dataset)

Items	Description
Database (dataset) name	The dataset of metallogenic provinces (belts) in southern Northeast Asia
Database (dataset) authors	Zhu Qun, Shenyang Center of Geological Survey,China Geological Survey Chai Lu, Shenyang Center of Geological Survey,China Geological Survey Liu Bin, Shenyang Center of Geological Survey,China Geological Survey
Data acquision time	2003—2010
Geographic area	Southern Northeast Asia: (1) China: Liaoning, Jilin, Heilongjiang provinces, the eastern part of Inner Mongolia Autonomous Region, and the northeastern part of Hebei province (east to 110°E); (2) Russia: Post-Baikal, Siberian Federal District, and Amurskaya Oblast, Jewish Autonomous Oblast, Khabarovskiy Kray, and Maritime Kray, Far East Federal District (east to 110°E, and south to 64°N); (3) Eastern Mongolia (east to 108°E); (4) Korea Peninsular.
Data format	*.xlsx, *.wl, *.wt, *.wp
Data size	1485.7 KB
Data service system URL	http://dcc.cgs.gov.cn
Fund project	National Key Research & Development Program '3D Geological Structures and Orebody Allocation in Typical Ore-concentrated Area' (2017YFC0601300-05) and the Land & Resources Geological Survey Project of 'Compilation of Comprehensive Geology and Mineral Resources Maps of Northeast Asia' (No. 1212010561504) sponsored by China Geological Survey.
Language	Chinese
Database (dataset) Composition	The Southern Northeast Asia is classified as 3 metallogenic mega-provinces, 9 provinces, 43 belts, and 11 sub-belts. The information of metallgenic belts (sub-belts) includes the names, main elements, principal epochs, main tectonic units, and main ore localities.

Continued table 1

Items	Description
Database (dataset) Composition	It includes two types of data: (1) Map of Metallogenic Provinces (Belts) in SNA, MapGIS Vector Data, Data Volume: 1442 KB; (2) A Summary Data Table of Metallogenic Provinces (Belts) in SNA, .xlsx Attribute Data, Data Volume: 43.7 KB

2 Data Acquisition and Processing Method

2.1 Base of Data

This research has collected and utilized the newest geological and mineral resource maps as well as mineral occurrences data in SNA's entirety. They mainly include the following: *A Geological Map of Northeast China* (1:1, 500, 000 with explanatory notes, compiled by Shenyang Institute of Geology & Mineral Resources, 2006), *A Geology and Mineral Resources Map of Amurskaya Oblast, Russia* (1:1, 250, 000, compiled by Amurskaya Geology Enterprise of Ministry of Natural Resources, Russia; and Resources Utilization Laboratory, Amurskaya National University, 2005), *A Geological Map of Khabarovskiy Kray, Russia* (1:1, 000, 000, compiled by Khabarovskiy Kray Geology Enterprise, 2005), *A Geological Map of Maritime Kray, USSR* (1:1, 000, 000, compiled by B. A. Bagranov, USSR Ministry of Geology, 1989), *A Geological Map of Mongolia* (1:1, 000, 000, compiled by Mongolia Mineral Resources Survey, Geology & Mineral Resources Institute of Mongolia Academy of Sciences, 1998), *A Geological Map of Korea Peninsula* (1:1, 000, 000 with explanation notes, compiled by the Central Geological Survey, Ministry of Mineral Resources and Ministry of Natural Resources, Democratic People's Republic of Korea, 1994), and *A Geological Map of Korea Peninsula* (1:1, 000, 000, compiled by Institute of Geology, Korea Academy of Sciences, 1995), together with the 1:200, 000 and 1:50, 000 regional geological survey results and geological research achievements from China's Liaoning, Jilin, and Heilongjiang provinces and Inner Mongolia Autonomous Region.

This research has absorbed the latest accomplishments, advancements and knowledge from the geological survey results and geosciences research results in the SNA. It has synthesized 1, 590 ore occurrences data (China, 742 localities; non-China, 848 ones), summarized the distribution features, ore types, metallogenic epochs and regularities of the main metallic ore deposits in the area under study, and finally classified the studied area as 3 metallogenic mega-provinces, 9 provinces, 43 belts, and 11 sub-belts (Table 2, Fig. 2). China holds 5 metallogenic provinces and 21 metallogenic belts (including 6 sub-belts).

Table 2 Classification of Metallogenic Provinces (Belts) in SNA

Metallogenic Province (II grade)	Metallogenic Belt (III grade)	Representative deposit
Baykal (B)	B_1 Baykal–Bardom Metallogenic Belt	Sukhoi Log large gold, platinum deposit
	B_2 Baykal–Vidim Metallogenic Belt	Large lead–zinc copper deposit in Kholodenko

Continued table 2

Metallogenic Province (II grade)	Metallogenic Belt (III grade)	Representative deposit
Verhoyan-Corema (VK)	VK_1 Sette–Daban Metallogenic Belt	Large lead–zinc deposit in Sardana
	VK_2 Harea mountain Metallogenic Belt	Large tantalum, niobium and REE desposits in Gornoye Ozero
	VK_3 Okhotsk Metallogenic Belt	Hakande (Хаканджин) gold and silver deposit
	VK_4 Upper Renguier Metallogenic Belt	
Aldan-Stanov (Wai Hinggan Mountains) (AS)	AS_1 Lena–Maya Metallogenic Belt	
	AS_2 Aldan Metallogenic Belt	Olimpiyskoe large iron deposit
	AS_3 Olekmin Metallogenic Belt	Udo Kanski super large copper deposit
	AS_4 Stanov Metallogenic Belt	Kawakite large ilmenite–apatite deposit
	AS_5 Jughur Hill Metallogenic Belt	Large ilmenite–apatite deposit in Bogidenskoe
Mongolia-Okhotsk (ME)	ME_1 Sheringzin–Yabulonov Metallogenic Belt	Ozernoye lead–zinc (copper) deposit
	ME_2 Nercha–Olekm Metallogenic Belt	Orekitkanskoye large molybdenum deposit
	ME_3 Daour–Ajin Metallogenic Belt	Zavitinsky (Завитинское) super large lithium deposit
	ME_4 Herlen–Manzhouli Metallogenic Belt	Chagan Bragan large lead–zinc deposit
	ME_5 Ergun–Upper Heilongjiang Region–Gonzha (Russia) Metallogenic Belt	Kurtuming (Култумин) super large copper–gold deposit
	ME_6 Zeya–Corbin Metallogenic Belt	Sutam Large Gold Deposit
	ME_7 Uda–Shantar Metallogenic Belt	Large iron deposit in Milkanskoe
Southern Mongolia-Da Hinggan Ling (MD)	MD_1 Southern Mongolia Metallogenic Belt	Sheltala iron deposit
	MD_2 Onor–Alongshan–Alin (Russia) Metallogenic Belt	Kimkun–Sutal super large iron deposit
	MD_3 South Gobi (Mongolia–Dong Ujimqin–Nenjiang Metallogenic Belt	
	MD_{3-1} South Gobi (Mongolia–Dong Ujimqin Metallogenic Sub–belt	Chaobuleng iron, zinc, tin deposits
	MD_{3-2} Duobaoshan–Heihe Metallogenic Sub–belt	Duobaoshan Super large copper deposit
	MD_4 Boin Sum–Xilinhot Metallogenic Belt	Bai Nai Temple Large copper, molybdenum, gold deposit
	MD_5 Tuquan–Ongniud Metallogenic Belt	Haubo Large lead–zinc deposit

Continued table 2

Metallogenic Province (II grade)	Metallogenic Belt (III grade)	Representative deposit
Jilin-Heilongjiang (JH)	JH_1 Xiao Hinggan Ling–Zhangguangcailing Metallogenic Belt	Dong'an large gold deposit
	JH_2 Bulieyin–Jiamusi–Xingkai Metallogenic Belt	Tuanjiegou large gold deposit
	JH_3 Siping–Yongji Metallogenic Belt	Erdaodianzi large gold deposit
	JH_4 Wangqing–Hunchun Metallogenic Belt	Xiaoxinancha Gold Deposit
	JH_5 Yanbian–North Haman Metallogenic Belt	Sanhui Copper–Nickel Deposit
Sikhote Alin (SA)	SA_1 Butzhelo–Yam–Alin Metallogenic Belt	Gongqingcheng large tin deposit
	SA_2 Lower Amur Metallogenic Belt	Baishan (Белые горы) large gold deposit
	SA_3 Wandashan–Middle Sikhote–Alin Metallogenic Belt	Vostok–2 large tungsten deposit
	SA_4 Sikhote–Alin Metallogenic Belt	Gluho (Глухое) large gold deposit
Sino-Korea (ZC)	ZC_1 Tieling–Jingyu–Kwanmo (DPRK) Metallogenic Belt	Maoshan large iron deposit bed
	ZC_2 Yingkou–Changbai–Hyesan (DPRK) Metallogenic Belt	Liyuan large iron deposit
	ZC_3 Wafangdian–LvShun Metallogenic Belt	Wafangdian Diamond Deposit
	ZC_4 Langlin Metallogenic Belt	Dayudong large gold deposit
	ZC_5 East Segment of North Rim of North China Landmass Metallogenic Belt	
	ZC_{5-1} East Segment of Inner Mongolia Uplift Metallogenic Sub–belt	Jinchanggouliangjin large gold deposit
	ZC_{5-2} Northern Hebei–Beipiao Metallogenic Sub–belt	Wild pig ditch iron deposit
	ZC_{5-3} Eastern Hebei–Suizhong Metallogenic Sub–belt	Sijiaying iron deposit in Luanxian
	ZC_{5-4} Beizhen Metallogenic Sub–belt	Paishanlou large gold deposit
	ZC_6 West Segment of North Rim of North China Landmass Metallogenic Belt	The small buried iron deposit in the Guyingzi of the Bulian River
	ZC_7 Shanxi Fault–Uplift Metallogenic Belt	Liqingdi medium sized silver polymetallic deposit in Sanchagou Township
	ZC_8 Central Korean Peninsula Phyongnam Metallogenic Belt	
	ZC_{8-1} Sariwon Metallogenic Sub–belt	Hudong large gold polymetallic deposit

Continued table 2

Metallogenic Province (II grade)	Metallogenic Belt (III grade)	Representative deposit
	$ZC_{8\text{-}2}$ Soju–Haeju Metallogenic Sub–belt	Yinli Medium Iron Deposit
	$ZC_{8\text{-}3}$ Wonsan–Kaesong Metallogenic Sub-belt	Fuping Small Silver Deposit
Southern Korea Peninsula (SK)	SK_1 South Korean Peninsula Kumgang mountain–Chunchon–Suwon Metallogenic Belt	Manchuan large gold deposit
	SK_2 South Korean Peninsula Youngwol–Chonju Metallogenic Belt	Sangdong tungsten deposit
	SK_3 South Korean Peninsula Yongchon –Sunchon Metallogenic Belt	
	$SK_{3\text{-}1}$ Sobaeksan Metallogenic Sub–belt	Tongyoung Small Gold and Silver Deposit
	$SK_{3\text{-}2}$ Naktong Metallogenic Sub–belt	Haman–Gunpuk medium copper lead–zinc polymetallic deposit

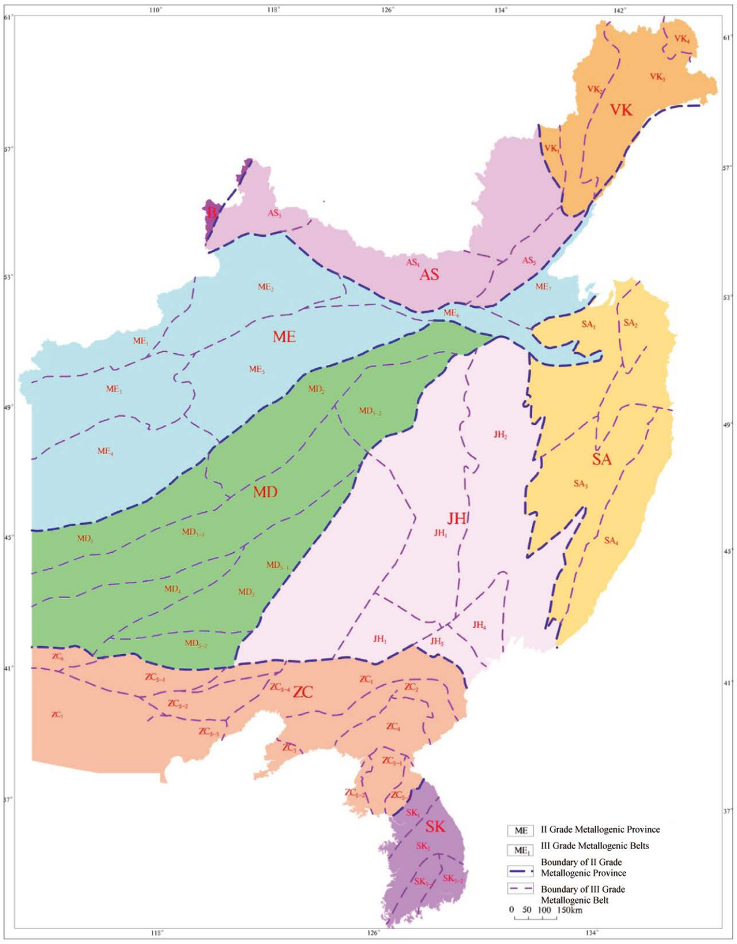

Fig. 2 Map of the Metallogenic Provinces (Belts) in SNA

2.2 Principles for Classifying Metallogenic Provinces (Belts)

Scholars hold different opinions about the criteria for classifying regional metallogenesis of endogenous metallic mineralization. For instance, with respect to classifying the I grade metallogenic unit – the metallogenic mega-province, Prof. Guo Wenkui had once generally classified the China's northeast part as the Marginal-Pacific Metallogenic Domain (Guo Wenkui, 1987). However, Chen Erzhen et al. [1] recognized it as the combination of the Paleo Asian Ocean and the Marginal-Pacific Metallogenic Domains (Chen Erzhen et al., 2001). Moreover, in his monograph *Mineral Resources Perspective Evaluation of China's Main Metallogenic Domains*, Prof. Chen Yuchuan has offered a 5-graded classification scheme: I grade is the Global Metallogenic Province (Belt), i.e., Global Metallogenic Domain, which corresponds with the global tectonic domain; II grade is subjected to the Global Metallogenic Domain and corresponds to one or more tectonic units, wherein metallogenesis has experienced an evolving geological history of several tectonic-magmatic cycles or an even larger one; and III grade is secondary to the II grade as a concentrated distribution area of one or more types of mineralization, wherein the metallogenesis is controlled by a certain structural-magmatic belt, lithofacies belt, regional tectonics, or metamorphism (Chen Yuchuan, 1999). In addition, the III grade metallogenic belt can still be classified as the IV grade (concentrated mineralization area) and V grade (ore field) metallogenic unit. Moreover, Prof. Chen Zhigang and Prof. Chen Yuchuan later co-authored the monograph *China Metallogenic Domains Classification Scheme*, in which they have implemented the aforementioned principles to detail the classification of China's key metallogenic belts (Xu Zhigang et al., 2008).

However, this paper adopts the following 4-graded classification scheme for the metallogenic provinces (belts) of SNA: (1) Global Mega-province, (2) Province, (3) Region (Belt), and (4) Sub-Region (Sub-Belt).

I grade metallogenic unit is a global-scale tectonic-metallogenic mega-province. In SNA, it is correspondent to the Paleo Asian Ocean Tectonic Domain and Marginal-Pacific Tectonic Domain. After synthesizing the latest research advancements of scholars in SNA, this paper's research team has roughly concluded the crustal evolution in this area as three episodes: (1) Pre-Cambrian Old Land (Block) Formation Stage (Ar—Pt, or, Pre-Nanhuan Period); (2) Paleo Asian Ocean Tectonic Domain Stage (Pz, or Nanhuan Period—Middle Triassic); (3) Marginal-Pacific Tectonic Domain Stage (Mz—Kz, or, since Late Triassic). According to the close genetic relation between the endogenous metallic mineralization and the tectonic-magmatic activities, while taking the geological settings into consideration, this team has classified the endogenous metallogenic domain in SNA in the following three categories: (1) Pre-Cambrian Old Land (Block) Metallogenic Province, (2) Paleo Asian Ocean Metallogenic Province, and (3) Marginal-Pacific Metallogenic Province. Therein, the last one is superimposed onto the former two. Owing to the superimposed nature of the relationship, this team has picked out, in the map compilation, the inner tract of the Marginal-Pacific Tectonic Domain and those with relatively singular metallogenesis and mainly controlled by the Mesozoic tectonic-magmatic activities. They are altogether classified in the paper as Marginal-Pacific Metallogenic Province. The rest parts are classified as either Pre-Cambrian Old Land (Block) Metallogenic Province or Paleo Asian Ocean Metallogenic Province.

Furthermore, II grade metallogenic unit is of large-scale metallogenic province, subject to the secondary units under I grade. In SNA, II grade generally corresponds to the II grade tectonic unit, i.e., they are the original-sized concrete metallogenic province in the studied area.

Meanwhile, III grade metallogenic unit comprises further secondary ones, with their classification principles mainly focused on the concentration of ore deposit's spatial distribution, consistency of main metallogenic epochs, commonality of ore-bearing layers (bodies) – metallogenic series, and the concrete features of tectonic-magmatic activities and the constraints of regional geological settings. As for the III grade metallogenic region (belt) with bigger area, they can be further classified according to their distribution features as IV grade unit – sub-belt.

3 Description of Data Samples

The dataset of the SNA metallogenic provinces (belts) mainly contains the following: the names of metallogenic provinces, belts, and sub-belts; the main metallogenic elements and principal epochs; major tectonic units; and main ore localities of the belts and sub-belts. Among these data, the general data table of metallogenic provinces (belts) covers the main information about ore localities in 43 belts and 11 sub-belts, together with the quantum of ore localities, mineral commodities, scales of ore deposit, and ore deposit types (Table 3, Table 4).

Table 3 General Data Table of Metallogenic Provinces (Belts) in the SNA

No.	Entry Names	Data Type	Actual Examples
1	Name of metallogenic provinces (belts)	Character	Ergun-Upper Heilongjiang Region—Gonzha (Russia) metallogenic belt (ME5)
2	Main metallogenic elements	Character	Au−Ag−Cu−Pb−Zn−Mo−W−U−fluorite
3	Principal metallogenic epochs	Character	Middle Jurassic—Early Jurassic
4	Major tectonic units	Character	Northeastern Segment of Middle Mongolia—Ergun Orogenic Belt; Herlen—Peri-Ergun Tectonic-Magmatic Belt
5	Information of main ore localities	Character	This metallogenic belt has hold 86 ore deposits (localities), 3 of them are of super-large scale, 13 are of large-scale, 29 middle-scale, and 33 small-scale, with the scales of 8 localities being unknown. 77 ore deposits (localities) have proven their genetic types, mainly including magmatic hydrothermal type (17), porphyry type (11), volcanic hydrothermal metasomatic type (11), volcanic hydrothermal type (6), metamorphic hydrothermal type (4), sedimentary type (4), sub-volcanic hydrothermal type (3), contact metasomatic type (2), hydrothermal type (2), and pegmatite type (2).

Table 4 Main Ore Localities Cited in Table 3

Mineral Commodities	Number of Super-Large Scale	Number of Large Scale	Number of Middle Scale	Number of Small Scale	Number of Unknown Scale	Number of Total
Au		2	6	17	2	27
Ag		1				1
Au+Ag			1			1
Cu	2	3	3	3	2	13
Pb			1	5		6
Pb+Zn		2	12	3	1	18
Mo		1	2		2	5
W			1	2		3
Sn			1			1
Sb				1		1
Fe			1			1
Mn			1			1
Rare Metals		4		1		5
U	1			1	1	3

Note: Taking the Ergun-Upper Heilongjiang Region—Gonzha (Russia) metallogenic belt (ME_5) as an example.

The Map of Metallogenic Provinces (Belts) in SNA (Fig. 2) adopts MapGIS to finish the map compilation. Its projection parameters are as follows:

Ellipsoid: Beijing 54

Cartographic Projection: Lambert Conformal Conic Projection Coordinates

Scale: 1:1, 500, 000

Unit: mm

The First Standard Latitude: 480, 000

The Second Standard Latitude: 580, 000

Central Meridian Longitude: 1, 270, 000

Latitude of Projection Origin: 484, 000

In pursuance to the *Construction Guidance on Global Geology & Mineral Resources Database*, issued by China Geological Survey, Table 5 features map compilation to construct the attribute contents of MapGIS files.

Table 5 A Structural Description of the Bin Attributes of Metallogenic Provinces

Syllable Names	Syllable Types	Syllable Length	Decimal Digits	Constraints
ID	L	8		Required
Area	D	15	6	Required
Perimeter	D	15	6	Required
Name of Metallogenic Province	C	50		Required
Features of Structures	C	100		Required
Main Ore Deposits	C	30		Required
Notes	C	254		Required

4 Controlling and Evaluation of Data Quality

The Dataset of Metallogenic Provinces (Belts) in SNA is based on latest results, advancements, and knowledge attained through compilation of regional maps, geological surveys, and geological scientific researches in related countries and regions. The tectonic units in SNA have been classified for the second time. This paper studies the regional tectonic features, distribution, types, epochs, and regularities of metallic ore deposits, and summarizes the information extracted form 1, 590 ore localities within the trans-boundary studied area, before finally classifying SNA as 3 metallogenic mega-provinces, 9 provinces, 43 belts and 11 sub-belts. All the adopted raw data are detailed and reliable. The map compilation and database construction are up to specifications and have been standardized. Especially, latest theories and a new methodology have been used in map compilation.

The SNA has a vast territory and a long geological evolution. All the data and information collected from the neighboring countries are of different levels of specificity. Especially, the data from North Korea are deficient. Meanwhile, the understanding of scholars from different countries with respect to regional tectonic evolution, structural layer classification, and many other aspects vary remarkably. Moreover, lack of temporal correlation data on diagenesis and metallogenesis has resulted in discrepancies in classifying metallogenic provinces and belts. Furthermore, the connection of adjoining trans-boundary metallogenic provinces and belts has been inappropriately simplified to some extent.

5 Conclusions

The Dataset of Metallogenic Provinces (Belts) in the SNA consists of two types of data: the Map of the Metallogenic Provinces (belts) in the SNA and the General Data Table of Metallogenic Provinces (Belts) in the SNA. The map has classified SNA into 3 metallogenic mega-provinces, 9 provinces, 43 belts, and 11 sub-belts, while the table features the names of metallogenic provinces, belts, and sub-belts, the main metallogenic elements, principal metallogenic epochs, major tectonic units and main ore localities of the metallogenic belts and sub-belts. This dataset has used the latest geological and mineral resources information to synthesize the regional geological and metallogenic features, before classifying the metallogenic provinces (belts). All these achievements have deepened the academic circle’s recognition of geological characteristics and metallogenic regularities of the trans-boundary metallogenic belts, and will guide the ore exploration in SNA significantly.

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Notes:

❶ Chen Erzhen, Peng Yujing, Han Xue. 2001. A Study of China's Main Metallogenic Provinces (Belts) (Jilin Province) [R] (unpublished data).

References

Chen Yuchuan. 1999. Prospective Evaluation of Mineral Resources in Major Metallogenic Belts in China [M]. Beijing: Geological Publishing House (in Chinese).

Chen Yuchuan, Zhu Yusheng, Xiao Keyan, Zhang Xiaohua, Mei Yanxiong, Yan Shenghao, Liu Yaling, Song Guoyao, Li Chunjie, Wang Yongyi, Dong Jianhua, Li Houmin, Ding Jianhua. 2006. Division of Minerogenic Provinces (belts) in China [J]. Mineral Deposits, 25:1−6 (in Chinese with English abstract).

Guo Wenkui. 1987. Guide to the Metallogenic Map of Endogenic Ore Deposits of China (1:4, 000, 000) [M]. Beijing: Geological Publishing House (in Chinese).

Song Xianglong, Xiao Keyan, Ding Jianhua, Fan Jianfu, Linan. 2017. Dataset of major mineralization belts of China's key solid mineralresources[J]. Geology in China, 44(S1):89−99.

Xu Zhigang, Chen Yuchuan, Wang Denghong, Chen Zhenghui. 2008. The Scheme of the Division of Minerogenetic Belts in China [M]. Beijing: Geological Publishing House (in Chinese).

Zhu Qun, Liu Bin, Chai Lu. 2014. Geology and Mineral Resources in Northeast Asia. [M]. Wuhan: China University of Geosciences Press (in Chinese).

Zhu Yusheng, Xiao Keyan, Ma Yubo, Ding Jiahua. 2013. Review and status of mineralization belt study in China [J]. Journal of Geology, 37(3):345−357 (in Chinese with English abstract).