收稿日期：2017-06-06
改回日期：2017-07-14

基金项目：国土资源大调查数字国土工程项目（编号：S3.7.1.1-28、 19951831012015-065）。

doi: 10.12029/gc2019Z201

论文引用格式：李晨阳，刘锋英，李军，何春珍，王新春，王芳. 2019. 全国矿产地数据库 [J].中国地质，46(S2):1−8.

数据集引用格式：李晨阳; 刘锋英; 李军; 何春珍; 王新春; 王芳. 全国矿产地数据库 (V1).中国地质调查局发展研究中心;中国地质调查局;山东省国土资源厅信息中心 [创建机构]，1995. 全国地质资料馆 [传播机构], 2019-12-30. 10.23650/data.C.2018.NGA120770.K1.1.1.V1; http://dcc.cgs.gov.cn/data/doi/10.23650/data.C.2018.NGA120770.K1.1.1.V1

全国矿产地数据库

李晨阳[1] 刘锋英[2] 李军[3] 何春珍[1] 王新春[2] 王芳[3]

(1. 中国地质调查局发展研究中心，北京 100037；2. 中国地质调查局，北京 100037；
3. 山东省国土资源厅信息中心， 山东 济南 250014)

摘要：全国矿产地数据库是新一轮国土资源大调查数字国土工程的重要项目之一，是地质调查信息化工作中的基础性数据库。数据库包含了全国 29 个省（市、区），232 类矿种达 27 569 个矿产地的矿产资源信息。工作范围覆盖了全国，较全面地反映了中国地矿部系统建国以来矿产资源勘查工作的成果。全国矿产地数据库全程包含质量监控，全国汇总过程中又进行了全面的复核、纠错，基本上达到了资料收集齐全、内容准确、数据录入完整准确，数据结构、数据精度都符合有关技术标准，总体质量可靠。全国矿产地数据库是一个矿种齐全、覆盖面广，内容丰富、数据量大且时间跨度大的大型数据库，为矿产资源调查评价、科研教学、矿业开发、规划管理提供了十分重要的基础信息。

关键词：矿产地；数据库；矿产资源勘查工程；中国

数据服务系统网址：http://dcc.cgs.gov.cn

1 引言

矿产地数据库是适应国土资源主管部门和地质勘查、矿产开发管理部门需要而建的。其目的是能够快捷、方便的查询、检索矿产有关资料，同时可以有效地保存地质矿产勘查资料，避免地质资料内在价值的流失，提高矿产地质资料利用价值，使得区域性矿产资料系统化，实现地质基础信息共享及信息社会化服务，也为 GIS 推广应用准备条件（杨东来等，2001；陆华里和黄宗霞，2006）。

在社会高度信息化的今天，矿产资源潜力评价信息化技术发展迅猛（黄文斌等，2011；赵增玉等，2012，2013；丁永月等，2013；李青元等，2013；武国忠等，2015）。任何矿产勘查、研究类项目的开展都必须建立统一的数据库结构（孙秀波等，2012），对数据库的要求是属性填写的可操作性、属性记录的全面性、与其他库的可衔接性、应用时的便利性以及属性数据间的逻辑性等（汪新庆和冯磊，2013）。全国矿产地数据库是广泛使用的、含有空间位置信息的属性数据库，在矿产资源规划、管理、开发、评价

第一作者简介：李晨阳，男，1964 年生，教授级高级工程师，从事地质资料数据管理；E-mail: chenyang@cgs.gov.cn。

工作中有着重要的意义（汪新庆等，2014）。本文从数据库的角度介绍全国矿产地数据库组成，为矿产资源调查评价、科研教学、矿业开发、规划管理提供了十分重要的基础信息。数据库基本信息见表1。

表1　数据库（集）元数据简表

条目	描述
数据库（集）名称	全国矿产地数据库
数据库（集）作者	李晨阳，中国地质调查局发展研究中心 刘锋英，中国地质调查局 李　军，山东省国土资源厅信息中心 何春珍，中国地质调查局发展研究中心 王新春，中国地质调查局 王　芳，山东省国土资源厅信息中心
数据时间范围	1995—2003年
地理区域	全国范围
数据量	10.4 MB
数据格式	Access
数据服务系统网址	http://dcc.cgs.gov.cn
基金项目	国土资源大调查数字国土工程项目 （编号：S3.7.1.1-28、19951831012015-12015-065）
语种	中文
数据库（集）组成	全国矿产地数据库包括全国29个省（区、市）、232个矿种、27 569个矿产地信息

2　数据采集和处理方法

2.1　数据源

全国矿产地数据库是针对中国地质矿产系统各种地质勘查工作，所获得的矿床（点）信息成果资料的数字化建库。数据源包括不同比例尺的区域地质调查、矿产勘查、矿产储量及各种专项地质科研等所获得的矿产地成果资料。全国矿产地数据库建设是以省区为单位进行数据采集（表2），资料来源主要是各省区域矿产总结、1∶200 000和1∶50 000区调矿产资料及各省矿产储量报告、矿产勘查报告和历年累计填写的矿产地卡片等。

在全国矿产地数据库建设初期，首先进行的是各省《大中型矿产地数据库》建设，运用当时安徽地矿局提供的大中型矿产地卡片和软件，进行填卡和数据录入。各省所填写的卡片和录入的数据，由于卡片式样、数据格式等与《矿产地数据库建设工作指南》要求差距较大，资料详细情况达不到要求，需要进行认真细致的分析整理，查阅原始资料进行必要的补充，使其符合《矿产地数据库建设工作指南》要求。

相关总结报告等资料。根据区域矿产总结或矿产储量表等相关资料，收集整理各省所有的矿产地，并根据矿种进行分类整理，依据矿产地名称收集更加详细的矿产地情况资料。各省区域矿产总结：①各省（区）1∶200 000区调图幅的矿产资料；②各省（区）1∶50 000区调图幅的矿产资料；③各省（区）矿产储量登记表；④各省（区）已经汇交的矿产勘查报告。

表 2　全国矿产地数据库分省矿种统计表

省级行政区	分类矿种数量									分省总计
	黑色金属	有色金属	贵金属	稀有金属	稀土	分散元素	能源矿产	非金属矿产	水气矿产	
北京市	46	8	10	–	–	–	27	110	–	201
天津市	–	–	–	–	–	–	–	–	–	0
河北省	204	148	121	1	–	–	4	235	–	713
山西省	435	354	71	10	6	25		573	–	1 474
内蒙古自治区	283	555	227	32	9	1	10	387	–	1 504
辽宁省	121	126	77	5	2	–	181	216	2	730
吉林省	39	93	95	–	–	–	–	126	–	353
黑龙江省	21	56	146	5	–	–	133	180	–	541
上海市	–	–	–	–	–	–	–	–	–	0
江苏省	224	238	64	2	4	1	7	96	–	636
浙江省	457	677	300	23	5	–	–	758	–	2 220
安徽省	128	104	34	5	1	10	119	253	–	654
福建省	235	472	98	43	131	–	272	1 217	–	2 468
江西省	365	665	76	78	21	1	11	63	1	1 281
山东省	69	47	344	7	2	–	224	240	–	933
河南省	100	142	89	11	–	3	290	256	–	891
湖北省	201	283	115	57	10	2	279	334	–	1 281
湖南省	151	207	29	9	9	1	135	252	–	793
广东省	66	425	67	52	45	–	–	135	–	790
广西壮族自治区	195	245	97	6	7	8	170	285	–	1 013
海南省	23	14	4	25	6	1	3	53	–	129
重庆市	4	5	–	3	–	–	10	43	–	65
四川省	150	632	220	27	5	1	123	297	–	1 455
贵州省	17	83	15	–	1	–	140	148	–	404
云南省	70	323	46	9	3	–	34	159	–	644
西藏自治区	–	2	1	–	–	–	–	–	–	3
陕西省	105	153	89	1	–	–	22	201	–	571
甘肃省	652	808	250	30	7	–	258	737	–	2 742
青海省	227	273	86	9	2	–	59	183	–	839
宁夏回族自治区	4	3	5	–	–	–	50	53	–	115
新疆维吾尔族自治区	254	252	197	118	6	4	149	869	–	1 849
台湾省	13	6	16	1	10	–	66	165	–	277
矿种分类小计	4 859	7 399	2 989	569	292	58	2 776	8 624	3	–
总计										27 569

2.2　数据采集

区域矿产研究需要收集矿产地数据库，而目前的矿产地数据库并不完善，填写率不高，属性项设置也不全面，造成进行地学研究时，仍需查阅大量的原始勘查报告。区域矿产研究在查阅数据库的同时，有义务填写矿产地成果数据库，因此需要录入大量原始

资料（李林，2006；陆华里和黄宗霞，2006）。同时，全国矿产地数据库数据采集应符合相关技术要求[1]（陈毓川等，2010），数据质量合格。

全国矿产地数据库是分省（市、区）进行采集，然后进行综合整理建立全国数据库。在分省（市、区）进行数据采集时主要分为资料的收集与分类整理、矿产地卡片的填写、数据录入建库三大步骤。大中型矿产地是由项目初期建设的《大中型矿产地数据库》转换过来后，进行数据资料的补充修改。

数据采集流程见图 1。

3 数据样本描述

3.1 数据内容

全国矿产地数据库总共包括 18 列数据实体，它们分别为：矿产地编号、矿种、矿

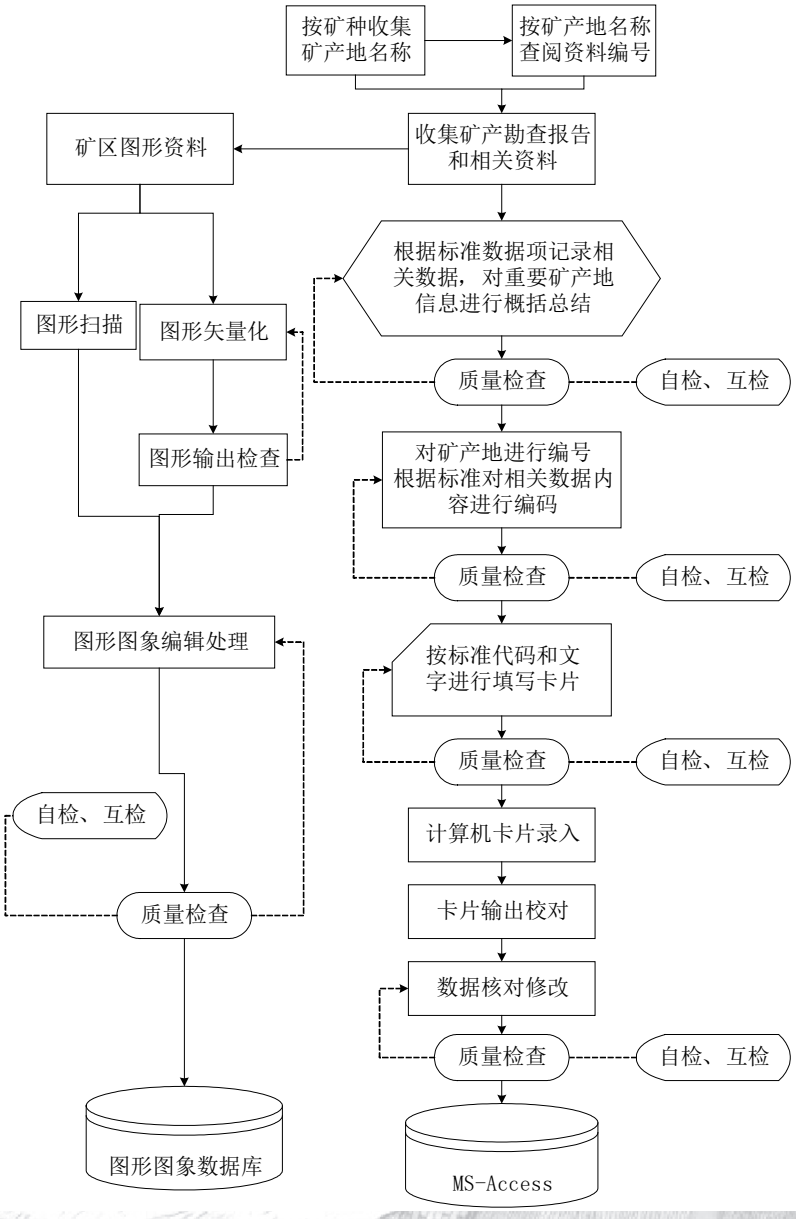

图 1 分省数据采集流程

产地名、交通位置、地理经度、地理纬度、矿床成因类型、共生矿、伴生矿、矿床规模、成矿时代、四级成矿带、地质工作程度和开采情况。详细情况见表 3。

表 3　矿产地基本信息属性表

序号	数据项名称	数据项代码	单位
1	矿产地编号	KCAAA	
2	矿种	KCC	
3	矿产地名	JJDAJ	
4	交通位置	JJGLA	
5	地理经度	DWAAC	度分秒
6	地理纬度	DWAAD	度分秒
7	矿床成因类型	KCBA	
8	共生矿	KCCA	
9	伴生矿	KCCB	
10	矿床规模	PKGKB	
11	成矿时代	KCAOC	
12	四级成矿带	KCAOAF	
13	地质工作程度	PKD	
14	开采情况	JJDCBF	

3.2　数据格式

分省采集数据时，矿产地数据库采用 MS Access 数据格式。

数据综合建立全国数据库采用大型网络数据库 SQL Server 和先进的 GIS 平台 ArcGIS 进行数据管理。图形化显示空间数据，采用空间数据库引擎 (SDE) 访问空间数据，提供了对空间数据、非空间数据进行高效率操作的数据服务。

4　数据质量控制和评估

4.1　质量控制

数据质量的好坏直接影响数据库使用的可靠性，在数据综合处理过程中，质量的控制尤其重要。在数据处理时首先保证原始数据资料信息的不丢失，再做进一步的完善和修改，缺失数据的补充，特别是矿产地坐标的补充，保证有效数位的正确性。

在“原始”、“复核”与“维护”3 套数据库中进行数据选取时的方法控制。在 3 套数据库中填加识别码，然后将 3 套数据库合并成 1 个，根据矿产地名称、交通位置和矿产地编号进行排序，对比同一矿产地数据项内容，选取内容相对完善的保留，不好判断时同时保留并输出由矿产技术人员进行综合处理。

建立完整的质量监控流程，制定工作日志、自检、互检和组检制度。

所有参加数据处理的工作人员，必须填写工作日志，对工作中遇到的问题，处理的数据问题进行记录，并记录问题处理的方法。工作日志由数据处理组长定期检查，并签字认可。

作业员完成 1 个作业任务后，进行 100% 的自检，对检查出来的问题进行修改，并填写自检表由组长签字认可。

作业员完成 1 个作业任务并自检后，由其他作业员进行 100% 的互检，对检查出来

的问题进行修改，并填写互检表由组长签字认可。

由检查员对经过自检和互检后的数据进行不低于 20% 的抽检，对检查出来的问题由作业员进行修改，并填写组检表由组长签字认可。

该数据集参加人员单位及质量控制人员名单见表 4。

表 4　全国矿产地数据库建设主要项目工作人员

	成员
总项目	李晨阳、杨东来、何春珍、李军、王新春、刘锋英、王芳、肖志坚、何义权、陈运科、刘伟、王敬洁、丁慧、魏运桂、王新萍、左爱莉、池京云、孔昭煜、曹瑞欣等
北京	姜守玉、刘学清、曹弘
河北	劳晓光、荣桂林、李素荣
山西	李效广、孙春娟、商培林、白智玲、武建斌、张猛、李振国、乔金花、董清雷、李德胜、杨亲民、闫政兴
内蒙古	张梅、霍玫兰、张丽莉
辽宁	李树羽、韩光、曾红、李颖、王晓鸥、乌爱军、单洋天
吉林	戴薪义、陈雷
黑龙江	刘云侠、张重光、付玮、于援邦、程美亭、程继彦、侯敏、王喜臣
江苏	王季顺、赵立鸿、王滨
浙江	袁航、傅浩权、陈潞芳、何忠耀、徐忠连、白世强、张永山、钱鼎兴、蔡子华、潘松林、刘军保、邹霞
福建	温友梦、黄廷淦、王玉文、刘剑凡、蔡明荣、王其连、张明辉、文斐成、李学燮、吴族春、张引娥
江西	赖新平、唐维新、叶景平、赵赣、李中兰、梅勇文、曾祥福、黄常立、顾敏、刘军、滑舸、徐涛、赵鸣雍、林伟平、崔学军、高维敬、范文顺、喻晓平、楼法生、黄长生、刘邦秀
安徽	姚尚志、楼金伟、褚进海、沈荷生、胡亚娟、许巨平、沈荷生、王徽、杨承雄、刘继荣、王义梅
山东	史辉、任志康、刘福魁、孔艳、张相峰、张帆、梁凤英、李广伟、鞠茂盛、苗喜、王鹤力、史辉、李军、任志康
河南	宋锋、王卫、强立志、戴耕、杜春彦、林世芳、关保德、朱学立、燕长海
湖北	毛晓梅、于庆阳、杨首亚、胡清乐、李萍、胡运芝、李江洲、谭秋明、杨志甫、刘忠明、张万平、孟宪均、熊意林
湖南	贺安生、权正钰、潘莉、彭朝冰、郭征、周友利、周杨、秦晓莉、李倩、黎波、刘普、张建新、赵强
广东	杨慧、邓勇、揭江、罗剑
广西	李文鑫、马隆文、刘明章、陈屹、黄志强、史亚玲、刘筱华、黄宗霞、郑莉莉、何翠云、李文鑫、张亚才、宁雄荣
海南	吴丹、陈育文、黄正壮
四川	周绍东、胡明明、文辉
贵州	张泽标
云南	周耀军、李定平
陕西	沙江、付周启、谌艳玲、王根宝、谢晓波、付周启、肖爱芳、丰文庆
甘肃	徐东、杜录平、李文胜、刘建宏、李通国、单永杰
青海	周光第、孙崇仁、曹生秀、蔡秋青、许长青、刘永安、王占昌、付宝侠
宁夏	杨光道、王振藩、朱鸿宾、李军、吴耀光、孟方、沈玉玲、刘惠敏
新疆	肖志坚、姜云辉、胡建卫、冯京、程建新、孙卫东、姜云辉、潘朝霞、郑启平、冯京、王庆明
台湾	连天萍、陈月仙、江剑丽、吴克隆

4.2 质量评述

全国矿产地数据库综合处理前，各省提交的矿产地数据库质量好坏不一，存在着各种各样的错误或误差，主要是矿产地坐标、交通位置、矿产地编号、地质描述、代码、数据表之间的关系等。

经过综合处理最大程度地修改了数据错误，减少了数据误差，提高了数据质量。通过综合处理对数据中的地质描述进行了合理化修改，对缺失的坐标根据交通位置和其它资料进行了补充，对不合理的代码进行替换，对数据表之间的关系进行了修改，使综合处理过的数据符合标准要求。

5 结论

全国矿产地数据库系统地展示了全国各个矿床综合信息，包括矿产地基本情况、矿区地质情况、矿体特征、开发技术条件等等，信息量巨大。全国矿产地数据库作为国家重要基础地质数据库，有效的保存了国家地质矿产勘查成果资料，内容涵盖行业系统中各单位完成的固体矿产、能源矿产（不含油气矿产）、化工原料非金属矿产、建筑材料非金属矿产等大、中、小型矿产地、矿点及矿化点的详细信息。全国矿产地数据库的建库工作对于中国资源潜力评价和矿产资源预测具有重要的参考价值，同时为中国矿产资源研究提供重要科学数据基础。

致谢：全国矿产地数据库是在原地质矿产部地质调查局、中国地质调查局领导下，由各省地质勘查、地质调查信息化工作部门以及中国地质调查局发展研究中心有关项目组共同努力下完成的（各省区市主要人员名单见表 4）。全国矿产地数据库成果凝聚了先后参加工作近 200 名同志的心血和汗水。

本项目组在执行过程中，先后引用了叶天竺、黄崇轲项目组的 1∶500 000 和 1∶2 500 000 地质图/地理图空间数据库，王全明、朱裕生项目组的成矿区带数据。在数据综合过程中，得到了山东省国土资源信息中心及其他单位的大力支持，先后有王天君、辛正运、陈运科等参加了最后阶段的工作。本项目得到了发展研究中心领导和职能部门的大力支持，为项目组解决了设备、资金、人力资源调整等难题。还得到了李裕伟、黄崇轲等老一辈专家的无私帮助，得到了陈辉、黄笑梅、朗宝平等同志的指导与帮助。

在此，全国矿产地数据库项目组对先后参加与支持过的同志表示衷心感谢。

注释：

❶ 陈郑辉. 2015. 全国省（自治区、直辖市）矿产地质与区域成矿规律综合研究（矿产地质志）技术要求 [R]. 北京: 中国地质科学院矿产资源研究所, 1−30.

参考文献

陈毓川, 王登红, 陈郑辉, 徐志刚, 李建康, 芮宗瑶, 盛继福, 徐钰, 袁忠信, 白鸽, 朱明玉, 李厚民, 高兰, 李华芹, 屈文俊, 陈文,王彦斌, 张永生, 叶会寿, 应立娟, 王成辉, 刘善宝, 付旭杰. 2010. 重要矿产和区域成矿规律研究技术要求 [M]. 北京: 地质出版社, 1−16.

丁永月, 陈建国, 马秋石, 王成彬. 2013. 证据权法在西藏尼木铜多金属矿产资源潜力评价中的应用 [J]. 地质学刊, 37(4): 577−584.

黄文斌, 肖克炎, 丁建华, 李楠. 2011. 基于 GIS 的固体矿产资源潜力评价 [J]. 地质学报, 85(11):

1834−1843.

李林. 2006. 简述基于 MapGIS 建立华南地区矿产地数据库工作方法 [J]. 华南地质与矿产, 22(2): 69−72.

李青元, 张丽云, 魏占营, 孙黎明. 2013. 三维地质建模软件发展现状及问题探讨 [J]. 地质学刊, 37(4): 554−561.

陆华里, 黄宗霞. 2006. 矿产地数据库的建设及应用 [J]. 南方国土资源, 30(9): 28−30.

孙秀波, 刘茂华, 王建华. 2012. 基于 GIS 构建矿产地数据库的理论研究与实现 [J]. 科技信息, 396(4): 237−239.

汪新庆, 冯磊. 2013. 基于数据字典的 MapGIS 属性数据逻辑检查: 以全国矿产资源潜力评价基础成果数据检查为例 [J]. 地质学刊, 37(3): 478−481.

汪新庆, 王翔, 常力恒, 康承旭. 2014. 全国矿产地数据库对预测评价数据的支撑应用研究 [J]. 矿床地质, 33(S1): 749−750.

武国忠, 李婷婷, 贾黎黎, 罗雪丰, 赵艺. 2015. 矿产地数据库建设若干问题分析 [J]. 地质学刊, 39(3): 395−399.

杨东来, 唐永成, 何义权, 姚尚志, 王文联, 楼经纬, 高章红. 2001. 矿产地数据库建设工作指南 [M]. 中国地质调查局: 1−5.

赵增玉, 金毅, 陈火根, 贾根, 李光宇. 2013. 不同特征矿体的三维建模方法研究 [J]. 地质学刊, 37(4): 611−615.

赵增玉, 潘懋, 郭艳军, 金毅, 屈红刚. 2012. 三维矿产资源潜力评价中 GIS 空间分析的应用研究 [J]. 地质学刊, 36(4): 366−372.

Received: 06-06-2017
Accepted: 14-07-2017

Fund Project:
Digital Land Project of Geological Survey Program of China Geological Survey (S3.7.1.1-28、 1995183101 2015-065).

doi: 10.12029/gc2019Z201

Article Citation: Li Chenyang, Liu Fengying, Li Jun, He Chunzhen, Wang Xinchun, Wang Fang. 2019. National Mineral Deposit Database of China[J]. Geology in China, 46(S2):1−10.
Dataset Citation: Li Chenyang; Liu Fengying; Li Jun; He Chunzhen; Wang Xinchun; Wang Fang. National Mineral Deposit Database of China(V1). Development and Research Center of China Geological Survey; China Geological Survey; Shandong Provincial Information Center of Land and Resources[producer], 1995. National Geological Archives of China[distributor], 2019-12-30. 10.23650/data.C.2018.NGA120770.K1.1.1.V1; http://dcc.cgs.gov.cn/en/data/doi/10.23650/data.C.2018.NGA120770.K1.1.1.V1

National Mineral Deposit Database of China

LI Chenyang [1], LIU Fengying [2], LI Jun [3], HE Chunzhen [1], WANG Xinchun [2], WANG Fang [3]

(1. *Development and Research Center of China Geological Survey*, *Beijing* 100037, *China*;
2. *China Geological Survey*, *Beijing* 100037, *China*;
3. *Shandong Provincial Information Center of Land and Resources*, *Jinan* 250014, *China*)

Abstract: As the basic database of geological survey work in the country, the National Mineral Deposit Database of China is an important project in the new round of digital land resources surveys. The database contains information about 232 types of mineral resources in 27 569 deposits in 29 provinces (cities, districts). The scope of this database covers the entire country, thus reflecting the results of mineral exploration in China since the founding of the Ministry of Geology and Mineral Resources. The database was created under stringent quality control measures covering the entire work process and was also revised and corrected through the review process. The database boasts comprehensive data collection, accurate documentation, and accurate data entry. In addition, the data structure and accuracy in this work meets relevant technical standards and its overall quality is reliable. All in all, the database is large and comprehensive featuring ore species, wide coverage, rich content, massive data, and large time span. It provides an important basis for mineral resources survey and evaluation, academic research, mining development, and municipal planning and management.

Key words: mineral deposits; database; mineral resources exploration engineering; China
Data service system URL: http://dcc.cgs.gov.cn

1 Introduction

The National Mineral Deposit Database was created to meet the needs of the Ministry of Land and Resources and the institutions of geological exploration and mineral resources development and management in China. The purpose of this project is to quickly and conveniently visit and retrieve minerals-related data and preserve geological mineral exploration data, so as to avoid the loss of the intrinsic value of and improve the utilization value of geological data on mineral resources. It also serves to systemize regional mineral data,

About the first author: LI Chenyang, male, born in 1964, professor of engineering, majors in geological data administration; E-mail: chenyang@cgs.gov.cn.

thereby promoting the sharing of fundamental geological information and relevant social information services and providing a solid ground for the spread and application of GIS (Yang DL et al., 2001; Lu HL and Huang ZX, 2006).

Information technology aimed at evaluating the potential of mineral resources is developing rapidly in a world that is getting increasingly informatized (Huang WB et al., 2011; Zhao ZY et al., 2012, 2013; Ding YY et al., 2013; Li QY et al., 2013; Wu GZ et al., 2015). In this context, it is essential to establish a unified database structure for the development of any mineral exploration and research project (Sun XB et al., 2012). The database requirements include operability of attribute inputs, comprehensiveness of attribute recording, ability to connect with other libraries, convenience of application, and logicality in attributes (Wang XQ and Feng L, 2013). The National Mineral Deposit Database is a widely used attribute database that contains spatial location information. It has great significance to the fields of planning, management, development and evaluation of mineral resources (Wang XQ et al., 2014). This paper introduces the composition of the National Mineral Deposit Database from the perspective of the database, which provides an important basic information for research and evaluation of mineral resources, academic research, mining development, and planning and management. The basic information of the database is as shown in Table 1.

2 Data Collection and Processing

2.1 Data Source

The National Mineral Deposit Database is a digital database of results collected from

Table 1 Metadata Table of Database (Dataset)

Items	Description
Database(dataset) name	National Mineral Deposit Database of China
Database(dataset) authors	Li Chenyang, Development and Research Center of China Geological Survey; Liu Fengying, China Geological Survey; Li Jun, Shandong Provincial Information Center of Land and Resources; He Chunzhen, Development and Research Center of China Geological Survey; Wang Xinchun, Development and Research Center of China Geological Survey; Wang Fang, Shandong Provincial Information Center of Land and Resources;
Data acquisition time	1995—2003
Geographic area	Nationwide of China
Data format	Access
Data size	10.4 MB
Data service system URL	http://dcc.cgs.gov.cn
Fund project	Digital Land Project of Geological Survey Program of China Geological Survey (S3.7.1.1-28、19951831012015-065)
Language	Chinese
Database(dataset) composition	Deposit information of 232 types of mineral resources and27 569 deposits in 29 provinces (cities, districts).

mineral deposits (mineralized points). It is based on various geological exploration works carried out by the geological and mineral resources institutions in China. Data sources include mineral resources data obtained from different scales, such as regional geological survey, mineral exploration, mineral reserves, and various special geological research. The establishment of the National Mineral Deposit Database is based on data collection by provinces and districts (Table 2). The sources of data mainly include the mineral resources summaries provided by provinces and districts, the 1∶200 000 and 1∶50 000 regional mineral resources reports, provincial mineral reserves reports, mineral exploration reports, and mineral deposit cards accumulated over the years.

The establishment of the National Mineral Deposit Database started with the creation of the "Large and Medium Scale Mineral Deposit Database" by the provinces. In the initial phase, the database used large and medium scale mineral deposit cards and software provided by the Anhui Geological and Mineral Resources Bureau to fill the cards and input data. As there is a significant difference between the card patterns and formats of data entered by the provinces and the requirements of the *Guidelines for the Establishment of Mineral Deposit Database*, data details do not meet the requirements. Therefore, it is necessary to carry out a careful analysis and review original data to make supplements so that it conforms to the requirements of those guidelines.

Relevant Summaries and Other Information. Based on the summaries of regional mineral resources or reserves, submissions by provinces were collected, classified, and collated. Later on, details about each deposit were collected per respective names. Regional mineral resources summaries by provinces include: (1) mineral resources data in the 1∶200 000 regional survey maps by provinces (districts); (2) mineral resources data in the 1∶50 000 regional survey maps by provinces (districts); (3) the mineral reserves statistics tables by provinces (districts); and (4) the delivered mineral exploration reports by provinces (districts).

2.2 Data Acquisition

It is necessary to establish a deposits database in order to conduct researches on regional mineral resources. However, the current mineral deposit database is not yet complete; its filling rate is low and attributes have an incomplete setting. In this situation, there is a need to consult a large number of original exploration reports during the earth science research. Moreover, while researching on regional mineral resources, it is essential to fill in the vacancies in mineral deposit database when the library is consulted. At the same time, it is necessary to input a large amount of original data (Li L, 2006; Lu HL and Huang ZX, 2006). Meanwhile, the data acquisition for the National Mineral Deposit Database should meet the relevant technical requirements (Chen YC et al., 2010; Chen ZH, 2015) and the data quality should be qualified.

Data acquisition for the National Mineral Deposit Database was conducted by provinces (cities and districts), and then a nationwide database was integrated and established. There were three main steps to collect the data: data collection and sorting, mineral deposit card filling, and data entry into the database. Large and medium scale mineral deposit data were transferred and amended from the "Large and Medium Scale Mineral Deposit Database",

Table 2 Statistics of Deposits by Provinces in the National Mineral Deposit Database

Province	Number of classified mineral deposits									Subtotal
	Ferrous metal	Non-ferrous metal	Precious metal	Rare metals	Rare earths	Disperse elements	Energy resources	Nonmetallic deposit	aqueous gas	
Beijing	46	8	10	–	–	–	27	110	–	201
Tianjin	–	–	–	–	–	–	–	–	–	0
Hebei	204	148	121	1	–	–	4	235	–	713
Shanxi	435	354	71	10	6	25		573	–	1 474
Inner Mongolia Autonomous Region	283	555	227	32	9	1	10	387	–	1 504
Liaoning	121	126	77	5	2	–	181	216	2	730
Jilin	39	93	95	–	–	–	–	126	–	353
Heilongjiang	21	56	146	5	–	–	133	180	–	541
Shanghai	–	–	–	–	–	–	–	–	–	0
Jiangsu	224	238	64	2	4	1	7	96	–	636
Zhejiang	457	677	300	23	5	–	–	758	–	2 220
Anhui	128	104	34	5	1	10	119	253	–	654
Fujian	235	472	98	43	131		272	1 217	–	2 468
Jiangxi	365	665	76	78	21	1	11	63	1	1 281
Shandong	69	47	344	7	2		224	240		933
Henan	100	142	89	11		3	290	256		891
Hubei	201	283	115	57	10	2	279	334		1 281
Hunan	151	207	29	9	9	1	135	252		793
Guangdong	66	425	67	52	45			135		790
Guangxi Zhuang Autonomous Region	195	245	97	6	7	8	170	285		1 013
Henan	23	14	4	25	6	1	3	53		129
Chongqing	4	5		3			10	43		65
Sichuan	150	632	220	27	5	1	123	297		1 455
Guizhou	17	83	15		1		140	148		404
Yunan	70	323	46	9	3	–	34	159		644
Tibet Autonomous Region		2	1							3
Shaanxi	105	153	89	1			22	201		571
Gansu	652	808	250	30	7		258	737		2 742
Qinghai	227	273	86	9	2		59	183	–	839
Ningxia Hui Autonomous Region	4	3	5	–	–	–	50	53	–	115
Xinjiang Uygur Autonomous Region	254	252	197	118	6	4	149	869	–	1 849
Taiwan	13	6	16	1	10	–	66	165	–	277
Subtotal	4 859	7 399	2 989	569	292	58	2 776	8 624	3	
Total										27 569

which was built in the early stage of the project.

See Fig. 1 for the workflow of data acquisition.

3 Description of Data Samples

3.1 Data Content

The following 18 data attributes have been included in the National Mineral Deposit Database: Deposit Number, Ore Species, Deposit Name, Location, Longitude, Latitude, Genetic Type of Deposit, Paragenetic Mineral, Associated Mineral, Deposit Scale, Ore-forming age, Fourth-Order Mineralogenetic Belt, Level of Geological Survey, and Mining Situation. The details are shown in Table 3.

3.2 Data Format

During data acquisition by provinces, the mineral deposit database adopted the MS Access data format.

As to the integration and creation of the nationwide database, the large network database SQL Server and the advanced GIS platform ArcGIS have been used for data management. To

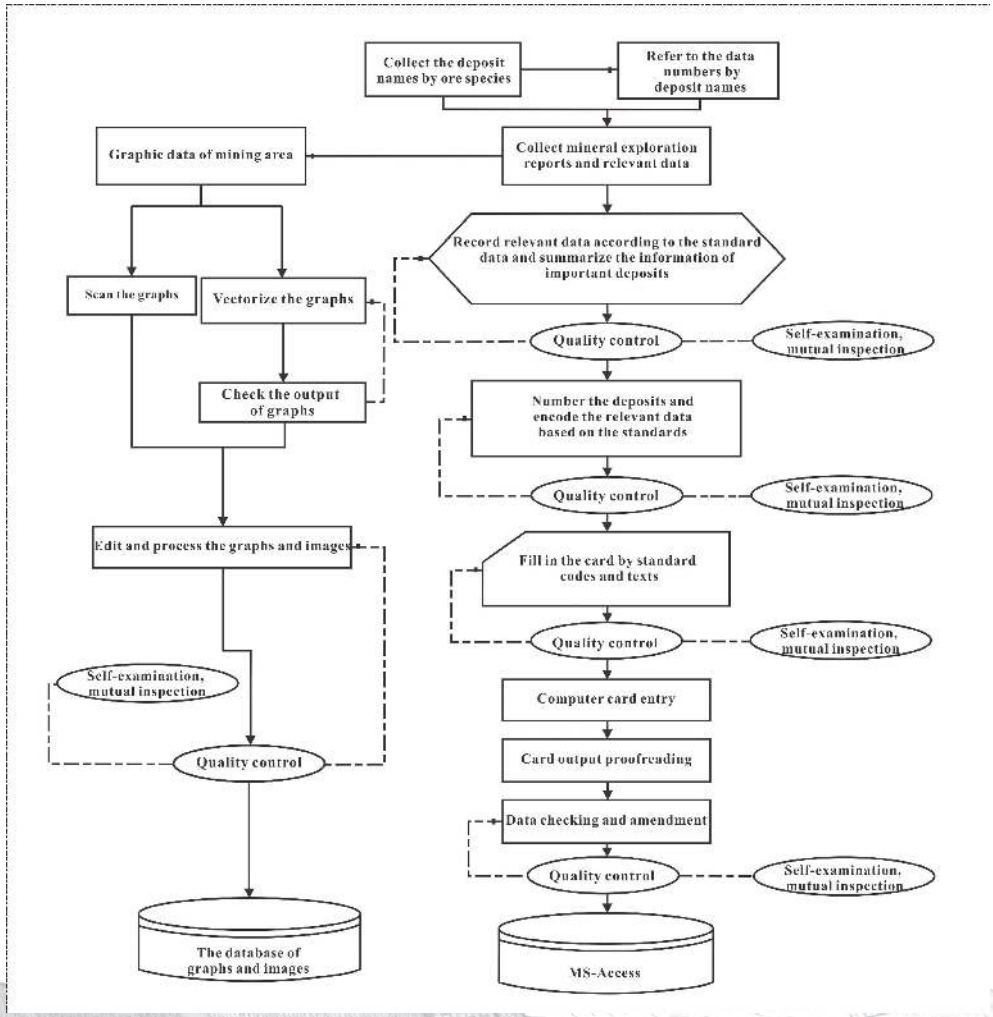

Fig. 1 Workflow of Data Acquisition by Provinces

Table 3 Basic information attribute table of the mineral deposits

No.	Data item name	Data item code	Unit
1	Deposit Number	KCAAA	
2	Ore Species	KCC	
3	Deposit Name	JJDAJ	
4	Location	JJGLA	
5	Longitude	DWAAC	degrees (°), minutes ('), seconds (")
6	Latitude	DWAAD	degrees (°), minutes ('), seconds (")
7	Genetic Type of Mineral Deposit	KCBA	
8	Paragenetic Mineral	KCCA	
9	Associated Mineral	KCCB	
10	Deposit Scale	PKGKB	
11	Ore-forming Age	KCAOC	
12	Fourth-Order Mineralogenetic Belt	KCAOAF	
13	Level of Geological Survey	PKD	
14	Mining Situation	JJDCBF	

access graphic spatial data, the spatial database engine (SDE) has been adopted to provide highly efficient data services to spatial data and non-spatial data.

4 Data Quality Control and Evaluation

4.1 Quality Control

Data quality directly affects the reliability of the database and it is of particular significance in the process of integrated data processing. During data processing, it was first ensured that no original data information was lost. Later on, further improvements and modifications were made and missing data was supplemented, especially the coordinates of deposits, to ensure the correctness of the effective numbers.

With regard to data selection approach, identification codes were first assigned in the three databases during the process of creating, checking, and maintaining the said databases. Later on, they were combined into a single database and data was sorted by deposit name, location, and deposit number. At the same time, similar deposit contents were compared and the most complete ones were saved. Moreover, when it was difficult to make a judgment, multiple contents were saved and respective outputs were generated for further consideration by mining technicians.

Furthermore, a complete quality control workflow and systems of logging, self-examination, mutual inspection, and group inspection were established.

All the data processing staff filled in work logs, recorded emerging problems, and documented methods used to deal with the problems. The working log was periodically checked, signed and approved by the data processing team leader.

After the completion of an assignment, the operator performed 100% self-examination, amended the inspected problems, filled in a self-examination form, and submitted the same to

the team leader for approval.

Subsequently, other operators performed 100% mutual inspection, amended the problems, filled in the mutual inspection form, and submitted the same to the team leader for approval.

After self-examination and mutual inspection, at least 20% of data were randomly checked by inspectors, who also amended the problems, filled in the group inspection form, and submitted the same to the team leader for approval.

See Table 4 for the team members and QC staff of the database.

Table 4 Team Members of the National Mineral Deposit Database Project

	Names
Total Projects	Li Chenyang, Yang Donglai, He Chunzhen, Li Jun, Wang Xinchun, Liu Fengying, Wang Fang, Xiao Zhijian, He Yiquan, Chen Yunke, Liu Wei, Wang Jingjie, Ding Hui, Wei Yungui, Wang Xinping, Zuo Aili, Chi Jingyun, Kong Zhaoyu, and Cao Ruixin, etc.
Beijing	Jiang Shouyu, Liu Xueqing and Cao Hong
Hebei	Lao Xiaoguang, Rong Guilin and Li Surong
Shanxi	Li Xiaoguang, Sun Chunjuan, Shang Peilin, Bai Zhiling, Wu Jianbin, Zhang Meng, Li Zhenguo, Qiao Jinhua, Dong Qinglei, Li Desheng, Yang Qinmin and Yan Zhengxing
Inner Mongolia	Zhang Mei, Huo Meilan and Zhang Lili
Liaoning	Li Shuyu, Han Guang, Zeng Hong, Li Ying, Wang Xiao'ou, Wu Aijun and Shan Yangtian
Jilin	Dai Xinyi and Chen Lei
Heilongjiang	Liu Yunxia, Zhang Chongguang, Fu Wei, Yu Yuanbang, Cheng Meiting, Cheng Jiyan, Hou Min and Wang Xichen
Jiangsu	Wang Jishun, Zhao Lihong and Wang Bin
Zhejiang	Yuan Hang, Fu Haoquan, Chen Lufang, He Zhongyao, Xu Zhonglian, Bai Shiqiang, Zhang Yongshan, Qian Dingxing, Cai Zihua, Pan Songlin, Liu Junbao and Zou Xia
Fujian	Wen Youmeng, Huang Tinggan, Wang Yuwen, Liu Jianfan, Cai Mingrong, Wang Qilian, Zhang Minghui, Wen Feicheng, Li Xuexie, Wu Zuchun and Zhang Yin'e
Jiangxi	Lai Xinping, Tang Weixin, Ye Jingping, Zhao Gan, Li Zhonglan, Mei Yongwen, Zeng Xiangfu, Huang Changli, Gu Min, Liu Jun, Hua Ge, Xu Tao, Zhao Mingyong, Lin Weiping, Cui Xuejun, Gao Weijing, Fan Wenshun, Yu Xiaoping, Lou Fasheng, Huang Changsheng and Liu Bangxiu
Anhui	Yao Shangzhi, Lou Jinwei, Chu Jinhai, Shen Hesheng, Hu Yajuan, Xu Juping, Shen Hesheng, Wang Hui, Yang Chengxiong, Liu Jirong and Wang Yimei
Shandong	Shi Hui, Ren Zhikang, Liu Fukui, Kong Yan, Zhang Xiangfeng, Zhang Fan, Liang Fengying, Li Guangwei, Ju Maosheng, Miao Xi, Wang Heli, Shi Hui, Li Jun and Ren Zhikang
Henan	Song Feng, Wang Wei, Qiang Lizhi, Dai Geng, Du Chunyan, Lin Shifang, Guan Baode, Zhu Xueli and Yan Changhai
Hubei	Mao Xiaomei, Yu Qingyang, Yang Shouya, Hu Qingle, Li Ping, Hu Yunzhi, Li Jiangzhou, Tan Qiuming, Yang Zhifu, Liu Zhongming, Zhang Wanping, Meng Xianjun and Xiong Yilin
Hunan	He Ansheng, Quan Zhengyu, Pan Li, Peng Chaobing, Guo Zheng, Zhou Youli, Zhou Yang, Qin Xiaoli, Li Qian, Li Bo, Liu Pu, Zhang Jianxin and Zhao Qiang
Guangdong	Yang Hui, Deng Yong, Jie Jiang and Luo Jian
Guangxi	Li Wenxin, Ma Longwen, Liu Mingzhang, Chen Yi, Huang Zhiqiang, Shi Yaling, Liu Xiaohua, Huang Zongxia, Zheng Lili, He Cuiyun, Li Wenxin, Zhang Yacai and Ning Xiongrong

Continued table 4

	Names
Hainan	Wu Dan, Chen Yuwen and Huang Zhengzhuang
Sichuan	Zhou Shaodong, Hu Mingming and Wen Hui
Guizhou	Zhang Zebiao
Yunnan	Zhou Yaojun and Li Dingping
Shaanxi	Sha Jiang, Fu Zhouqi, Shen Yanling, Wang Genbao, Xie Xiaobo, Fu Zhouqi, Xiao Aifang and Feng Wenqing
Gansu	Xu Dong, Du Luping, Li Wensheng, Liu Jianhong, Li Tongguo and Shan Yongjie
Qinghai	Zhou Guangdi, Sun Chongren, Cao Shengxiu, Cai Qiuqing, Xu Changqing, Liu Yong'an, Wang Zhanchang and Fu Baoxia
Ningxia	Yang Guangdao, Wang Zhenfan, Zhu Hongbin, Li Jun, Wu Yaoguang, Meng Fang, Shen Yuling and Liu Huimin
Xinjiang	Xiao Zhijian, Jiang Yunhui, Hu Jianwei, Feng Jing, Cheng Jianxin, Sun Weidong, Jiang Yunhui, Pan Zhaoxia, Zheng Qigping, Feng Jing and Wang Qingming
Taiwan	Lian Tianping, Chen Yuexian, Jiang Jianli and Wu Kelong

4.2 Quality Review

Before the integrated processing of the National Mineral Deposit Database, the quality of mineral deposit data submitted by the provinces varied significantly. There were a large number of faults and errors, mainly in the documents of coordinates of deposits, locations, deposit numbers, geological descriptions, codes, and connections between data tables.

After the integrated processing, the research team did its best to eliminate faults, reduce errors, and improve data quality. By reasonably modifying geological descriptions in the data through integrated processing, the missing coordinates were filled in according to the locations and other data. At the same time, invalid codes were replaced and connections between data tables were modified to meet the standard requirements.

5 Conclusion

The National Mineral Deposit Database features systematic and integrated information about all mineral deposits in the country, including the basic situation of deposits, geological conditions of ore deposits, characteristics of ore bodies, conditions of extraction techniques, and other information. As an important national geological database, it effectively documents the results of national geology and mineral resources exploration. The database covers the results of each team in the industry, including solid minerals, energy resources (excluding oil & gas), chemical raw materials of non-metallic minerals, building materials of non-metallic minerals, details of large, medium and small-scale deposits, mineral occurrences, and mineralization outcrops. The National Mineral Deposit Database supports the assessment of potential resources and mineral resources prediction in China. It also provides the scientific basis for future mineral resources research in China.

Acknowledgements: Under the leadership of the former Geological Survey of the Ministry of Geology and Mineral Resources and the China Geological Survey (before 2001), the National Mineral Deposit Database of China was completed by the joint efforts of

provincial geological survey groups, provincial geological data information departments, and relevant project groups of the Development and Research Center of China Geological Survey (see appendix for the name list of major provincial leaders). This database is a product of efforts of nearly 200 collaborators who participated in the work. Moreover, while executing this project, we used and cited the 1∶500 000 and 1∶2 500 000 geological map/geographic map and spatial database of Ye Tianzhu and Huang Chongke group and the mineral deposit belts data of Wang Quanming and Zhu Yusheng group. In the process of data integration, this project was strongly supported by the Shandong Provincial Land and Resources Information Center and other institutions. Wang Tianjun, Xin Zhengyun and Chen Yunke participated in the last stage of the project. This project was also strongly supported by the leaders and functional departments of the Development and Research Center of CGS, who helped solve the problems of equipment, capital and human resources for the project group. This project group also received help from senior experts such as Li Yuwei and Huang Chongke, and was instructed and assisted by peers and collaborators such as Chen Hui, Huang Xiaomei and Lang Baoping. Here, the National Mineral Deposit Database project group expresses its heartfelt thanks to the comrades who have participated and supported us. Susan Turner (Brisbane) assisted with English.

References

Chen Yuchuan, Wang Denghong, Chen Zhenghui, Xu Zhigang, Li Jiankang, Rui Zongyao, Sheng Jifu, Xu Yu, Yuan Zhongxin, Bai ge, Zhu Mingyu, Li Houming, Gao Lan, Li Huaqin, Qu Wenjun, Chen Wen, Wang Yanbin, Zhang Yongsheng, Ye Huishou, Ying Lijuan, Wang Chenghui, Liu Shanbao, Fu Xujie. 2010. Technical Requirements for Research on Important Mineral and Regional Metallogenic Regularities[M]. Beijing: Geological Publishing House, 1−16 (in Chinese).

Chen Zhenghui. 2015. The Technical Requirements of the National Comprehensive Study (Mineral Geology Log) of Mineral Geology and Regional Mineralogenic Regularity by Provinces (Districts, Cities)[R]. Beijing: *Institute of Mineral Resources of the Chinese Academy of Geological Sciences*: 1−30 (in Chinese).

Ding Yongyue, Chen Jianguo, Ma Jiushi, Wang Chenbin. 2013. Application of weights of evidence for Nimu copper polymetallic minerals potential evaluation in Tibet[J]. Journal of Geology, 37(4): 577−584 (in Chinese with English abstract).

Huang Wenbin, Xiao Keyan, Ding Jianhua, Li Nan. 2011. Potential assessment of solid mineral resources based on GIS[J]. Acta Geologica Sinica, 85(11): 1834−1843 (in Chinese with English abstract).

Li Lin. 2006. Brief description of technological procedure about the south China mineral land data base by Mapgis[J]. Geology and Mineral Resources of South China, 22(2): 69−72 (in Chinese with English abstract).

Li Qingyuan, Zhang Liyun, Wei Zhanying, Sun Liming. 2013. On 3D geological modeling software development and discussions on several issues[J]. Journal of Geology, 37(4): 554−561 (in Chinese with English abstract).

Lu Huali, Huang Zongxia. 2006. Mineral deposit database construction and application[J]. Southern Land Resources, 30(9): 28−30 (in Chinese with English abstract).

Sun Xiubo, Liu Maohua, Wang Jianhua. 2012. Theoretical research and realization of constructing mineral deposit database based on GIS[J]. Science & Technology Information, 396(4): 237−239 (in Chinese with English abstract).

Wang Xinqing, Feng Lei. 2013. On Map GIS attribute data logic check based on data dictionary: a case study of fundamental results of potential evaluation on national mineral resources[J]. Journal of Geology, 37(3): 478−481 (in Chinese with English abstract).

Wang Xinqing, Wamg Xiang, Chang Liheng, Kang Chengxu. 2014. Research on support application of forecast data of National Minerals Database[J]. Mineral Deposits, 33(S1): 749−750 (in Chinese with English abstract).

Wu Guozhong, Li Tingting, Jia Lili, Luo Xuefeng, Zhao Yi. 2015. Analysis of some questions on database construction about mineral resource areas[J]. Journal of Geology, 39(3): 395−399 (in Chinese with English abstract).

Yang Donglai, Tang Yongcheng, He Yiquan, Yao Shangzhi, Wang Wenlian, Lou Jingwei, Gao Zhanghong. 2001. Mineral area database construction guide [M]. Beijing: China Geological Survey: 1−5 (in Chinese).

Zhao Zengyu, Jin Yi, Chen Huogen, Jia Gen, Li Guangyu. 2013. Study on three dimensional modeling methods for ore body with different features[J]. Journal of Geology, 37(4): 611−615 (in Chinese with English abstract).

Zhao Zengyu, Pan Mao, Guo Yanjun, Jin Yi, Qu Honggang. 2012. Application study of GIS spatial analysis in three dimensional potential assessments of mineral resources[J]. Journal of Geology, 36(4): 366−372 (in Chinese with English abstract).