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中国重要金属矿产资源现状、供需、进出口数据集

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摘要：金属矿产是经济社会发展的物质基础。本数据集采集了 16 种对国民经济发展有重要影响的大宗紧缺矿产（铁、锰、铜、铝、金、铅、锌、镍、铬）、优势矿产（钨、钼、锡、锑）及战略新兴矿产（锂、钴、钛）2006—2017 年的世界及中国资源储量、原矿产量、消费量、贸易量及贸易金额等数据。数据集为 Excel 表格型数据，包含 6 个 sheet 表（世界资源量、中国查明资源储量、中国基础储量、中国原矿产量、中国原矿消费量、中国进出口量），旨在分析研究我国在工业化进程中后期阶段所需重要金属矿产的资源现状和供需趋势。数据集显示：①我国大宗紧缺矿产如铁、锰、铜、金等查明资源储量虽稳步增长，但开采消耗量大，使得基础储量增速缓慢；未来需求总量仍将维持高位，国内保障程度不足，进口量持续攀升。优势矿产资源钨、锑储采比低，后备资源接替不足，优势程度下降；②战略新兴矿产锂、钴、钛资源量、基础储量增长缓慢或呈下降态势，国内资源品质较差，难利用资源多；产量、消费量近十年快速增长，且未来将持续高增长，国内资源储量增长缓慢，供需矛盾凸显。该数据集对已有金属矿产供需数据的收集和总结，为今后金属矿产勘查及战略部署提供参考。

关键词：重要金属矿产；资源量数据；供需数据；贸易数据

数据服务系统网址：http://dcc.cgs.gov.cn

1　引言

矿产资源是人类生产生活不可或缺的重要物质基础，我国 90% 以上的能源和 80% 以上的工业原料来源于矿产资源，矿产资源支撑了我国 GDP 70% 的国民经济运转（马伟东，2008）。近年来为促进本国矿业发展，世界各国纷纷进行与金属矿产相关的研究，美国、欧盟、日本等发达国家在对金属矿产的资源保障、供需格局充分研究后先后发布了关键矿产名录，并将其纳入国家发展战略。随着中国工业化、城镇化的加快推进，我国工业化进程已进入中后期或后期阶段，正面临着金属矿产资源的需求结构、消费量及增长速度发生重大变化的转型期，具体表现为金属矿产消费结构分异严重，传统

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大宗矿产增速下降而战略新兴矿产需求增速迅猛上升（陈其慎等，2016）。铁、锰等矿产需求已经达到顶峰，铜、铅、锌、铝等有色金属矿产需求正在接近高峰拐点，但是跨越峰值拐点后，我国大宗矿产的需求体量仍将高位运行，我国还将是支撑全球矿业发展的中坚力量（王安建等，2010）。

党的十八大以来，随着找矿突破战略行动的持续推进，国内重要金属矿产资源储量大幅增长，供需矛盾有所缓解，但为实现全面建成社会主义现代化强国的百年目标，在未来一段时间里，我国都将维持对矿产资源的强劲需求，需要安全、可靠、持续、稳定的能源资源保障。在此背景下，亟需梳理对我国国民经济发展具有重要影响的金属矿产资源的资源量变化、生产开发、消费及贸易情况等，结合新兴领域发展及产业转型升级的需要，厘清重要金属矿产供需情况，综合分析资源战略形势，提出有针对性的保障措施。

本数据集针对我国金属矿产的资源情况及其所处的政治、经济、军事战略重要性等，收集整理了对国民经济发展具有重要作用的大宗紧缺矿产（铁、锰、铜、铝、金、铅、锌、镍、铬）、优势矿产（钨、钼、锡、锑）及战略新兴矿产（锂、钴、钛）共计 16 种金属矿产的相关数据。收集内容包括各金属矿产 2006—2017 年的世界及中国资源储量、原矿产量、消费量、贸易量及贸易金额等数据，数据来源为国家门户网站公开发表的数据信息，数据集为 Excel 表格型数据，包含 6 个 sheet 表，该数据集可为预测我国未来对重要金属矿产的消费趋势提供依据，为下一阶段找矿部署工作提供参考。

中国重要金属矿产资源现状、供需、进出口数据集元数据简表见表 1。

表 1　数据库（集）元数据简表

条目	描述
数据库（集）名称	中国重要金属矿产资源现状、供需、进出口数据集
数据库（集）作者	赵立群，中国冶金地质总局矿产资源研究院 张　敏，中国冶金地质总局矿产资源研究院 陈　彤，中国冶金地质总局矿产资源研究院
数据时间范围	2006—2017年
地理区域	全国
数据格式	*.xlsx
数据量	37.1 KB
数据服务系统网址	http://dcc.cgs.gov.cn
基金项目	中国地质调查局地质调查项目“整装勘查区找矿预测与技术应用示范（121201004000160901）”子项目“矿产资源勘查开发基地区划与重要矿种在国家经济发展战略中的应用评价”资助
语种	中文
数据库（集）组成	该数据集是由1个Excel表格组成，表格名称“重要金属矿产数据集”；包含6个sheet工作表，分别为：世界资源量、中国查明资源储量、中国基础储量、中国原矿产量、中国原矿消费量、中国进出口量。

2　数据采集和处理方法

2.1　样品采集

本次工作立足于国家矿产资源规划及战略性新兴产业发展规划，以国家紧缺及具有重要意义的战略新兴矿产为着眼点，收集包含铁、锰、铜、铝、金、铅、锌、镍、钨、钼、锡、锂、铬、钴、锑、钛在内的 16 个重要金属矿种，数据起止日期为 2006 年 1 月

至 2017 年 12 月，数据来源为自然资源部《中国土地矿产海洋资源统计公报》、原国土资源部信息中心《世界矿产资源年评》、《国家统计局统计公报》（中国国家统计局，2018）、中华人民共和国海关总署统计资讯网（http://www.customs.gov.cn）（中华人民共和国海关总署，2018）、美国地质调查局矿产资源数据库、安泰科金属报价网（www.atk.com.cn）、国内外相关研究报告等关于资源勘查、开发、供需、贸易等类目的数据信息（Wind, 2018）。根据以上公开数据库及权威网站资料，更新重要金属矿种近十年来的资源储量等数据，综合分析重要金属矿产战略资源形势，评价其在国家经济发展战略中的应用情况，为国家大型资源基地主攻矿种选择和新时代矿产资源勘查规划部署提供依据。

2.2 处理方法

重要金属矿产数据集经过资料查询、数据提取、入库、自查及他查等处理流程，整个过程确保数据的准确性和原始性，杜绝二次加工或直接从加工处理过的来源摘取等现象。具体流程如下：查阅数据发布的权威及初始来源资料，选定所需数据并输入到数据表格中记录，各项数据均记录引用来源，方便后期数据追溯。在数据表格记录完毕后，数据收集人从起始处逐一追溯比对数据来源，经查证无误后改用他人查证方式检验数据准确性，具体方法为非数据收集人外的他人随机选取数据集中的数据进行查证，查证数据量为总数据量的 30%。若他查过程中出现数据错误，则数据修改后返回自查过程重新检验，直至他查数据无误后终止。

3 数据样本描述

数据表格名称“重要金属矿产数据集”，包含 6 个工作表（sheet），分别为世界资源量、中国查明资源储量、中国基础储量、中国原矿产量、中国原矿消费量、中国进出口量。

世界资源量、中国查明资源储量、中国基础储量包含以下内容：序号、矿种、矿石类型、单位、各年份（2006—2016）储量、数据来源（表 2）。

中国原矿产量及中国原矿消费量数据表包含以下内容：序号、矿种、矿石类型、单位、各年份（2007—2017）产量、数据来源、备注（表 3）。

中国进出口量包含以下内容：序号、矿种、矿石类型、单位、年份（2007—2017）、进口量、进口金额、出口量、出口金额、数据来源（表 4）。

4 数据质量控制和评估

在数据提取分析过程中，针对同一类目尽量收集统一来源的数据，确保数据内容的整体一致性。其中资源量及储量数据主要来源于自然资源部、美国地质调查局官方发布的年鉴及报告，产量数据来源于美国地质调查局，由于官方资料更新问题，部分金属矿产近几年来的产量为官方发布的预测数据，消费量数据没有官方统一发布来源，收集困难较大，主要来自各行业及产业网站发布的数据。贸易数据来源于中国国家海关总署发布的月度数据累加值，数据质量可靠。针对数据的质量问题，后续还需继续保证数据集的更新和维护机制，及时更新和对比发布的最新数据。

该数据集在中国地质调查局发展研究中心组织的中期质量检查及最终成果验收中通过了专家组评审，数据来源清晰，质量可靠。

表 2　资源量及储量数据表

序号	矿种	年份矿石类型	单位	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	数据来源
浮点型	字符型	字符型	字符型	浮点型	浮点型	浮点型	浮点型	浮点型	浮点型	浮点型	浮点型	浮点型	浮点型	浮点型	字符型
实例															
序号	矿种	年份矿石类型	单位	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	数据来源
1	铁	铁矿	亿吨	607	613	623	646	727	744	775	799	843	851	841	中国土地矿产海洋资源统计公报
2	锰	锰矿	亿吨	767	7.93	8.47	8.7	8.86	7.7	9.47	10.3	12.2	14	16	中国土地矿产海洋资源统计公报

表 3　原矿产量及消费量数据表

序号	矿种	年份矿石类型	单位	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	数据来源	备注
浮点型	字符型	字符型	字符型	浮点型	浮点型	浮点型	浮点型	浮点型	浮点型	浮点型	浮点型	浮点型	浮点型	浮点型	字符型	字符型
实例																
序号	矿种	年份矿石类型	单位	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	数据来源	备注
1	铁	铁矿石	百万吨	707	824	880	1 070	1 330	1 310	1 450	1 510	(Usable ore)375	(Iron content)348	(Iron content)340[e]	USGS	e：为估计值
2	锰		千吨	2 000[e]	2 200[e]	2 400[e]	2 600[e]	2 800	2 900	3 000	3 000	3 000	2 330	2 500	USGS	

表 4　贸易量及金额数据表

序号	矿种	年份矿产类型	单位	2007				……	2017				数据来源
				进口量	进口金额	出口量	出口金额		进口量	进口金额	出口量	出口金额	
浮点型	字符型	字符型	字符型	浮点型	浮点型	浮点型	浮点型	浮点型	浮点型	浮点型	浮点型	浮点型	字符型
实例													
序号	矿种	年份矿产类型	单位	2007				……	2017				数据来源
				进口量	进口金额	出口量	出口金额		进口量	进口金额	出口量	出口金额	
1	铁	铁矿砂及其精矿	万吨/万美元	38 348.00	3 381 208.80	7.80	0.09		107 541.00	7 595 987.10	545.07	4.22	海关总署
2	锰	锰矿	吨/亿美元	6 643 479.58	12.99	3 908.11	0.01		19 104 148.11	39.92	36 316.65	0.08	海关总署

5 结论

（1）重要金属矿产数据集包含了2006—2017年16种重要金属矿产所有的资源量、产量、消费量及贸易数据，共收集数据1 457条。数据收集过程中采用100%本人自查和30%他查方式对数据结果进行检验，若他查过程中出现数据错误，则数据修改后返回自查过程重新检验，直至他查数据无误后终止。该数据集通过了专家评审，数据来源清晰，质量可靠。

（2）通过数据分析，我国大宗紧缺矿产如铁、锰、铜、金等查明资源储量虽稳步增长，但开采消耗量大，使得基础储量增速缓慢，未来需求总量仍将维持高位，国内保障程度不足，进口量持续攀升。优势矿产资源钨、锑储采比低，后备资源接替不足，优势程度下降。战略新兴矿产锂、钴、钛资源量、基础储量增长缓慢或呈下降态势，国内资源品质较差，难利用资源多；产量、消费量近十年快速增长，且未来将持续高增长，国内资源储量增长缓慢，供需矛盾凸显。下一步有必要进一步加强国内重要金属矿产的勘查力度。

（3）通过对重要金属矿产数据集内容的分析，可梳理对我国国民经济发展具重要影响的金属矿产资源近十年来的资源及供需情况，可为预测我国未来对重要金属矿产的消费趋势提供依据，为下一阶段找矿部署工作提供参考。

参考文献

Wind. 万得数据库 [DB/OL][2018-12-20]: http://www.wind.com.cn/.

陈其慎, 于汶加, 张艳飞. 2016. 点石−未来20年全球矿产资源产业发展研究 [M]. 北京: 科学出版社.

马伟东. 2008. 金属矿产资源安全与发展战略研究 [D]. 长沙: 中南大学.

王安建, 王高尚, 陈其慎, 于汶加. 2010. 矿产资源需求理论与模型预测 [J]. 地球学报, 31(2): 137−147.

中国国家统计局. 矿石原矿产量 [EB/OL][2018-12-20]: http://data.stats.gov.cn/easyquery.htm?cn=A01&zb=A020901&sj=201811.

中华人民共和国海关总署. 进出口主要商品量值 [EB/OL][2018-01-23]: http://www.customs.gov.cn/customs/302249/302274/302276/1421206/index.html.

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Dataset of Present Status, Supply and Demand, and Import-Export Volume of Important Metal Mineral Resources in China

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Abstract: Metal mineral resources serve as the material basis for economic and social development. In this paper, the data such as reserves, production and consumption of raw ore, as well as trade volume (including trade amount), of 16 kinds of metal mineral resources in the world and China from 2006 to 2017 that have an important impact on the economic development of China were collected. The 16 kinds of resources include bulk minerals in short supply (iron Fe, manganese Mn, copper Cu, aluminium Al, gold Au, lead Pb, zinc Zn, nickel Ni, and chromium Cr), dominant minerals (tungsten W, molybdenum Mo, tin Sn, and antimony Sb), and strategic emerging minerals (lithium Li, cobalt Co, and titanium Ti). The dataset consisting of the data collected is in Excel format and comprises six sheets (including *Resources in the World, Identified Resource Reserves in China*, *Reserves Base in China*, *Raw Ore Production in China*, *Raw Ore Consumption in China*, *and Import-Export Volume of China*), aiming to analyze the present status as well as the supply and demand trends of the important metal minerals required in the middle and late stages of the industrialization process of China. The following information is shown from the dataset. In terms of bulk minerals in short supply such as Fe, Mn, Cu, and Au, although identified resource reserves have increased steadily, the basic reserves have grown slowly due to the large volume of exploitation and consumption. With the total demand for bulk minerals in short supply still remaining high in the future, the import volume will continue to climb as a result of low resource guarantee degree in China. In terms of dominant minerals such as W and thorium (Th), they are no longer as dominant as before owing to low reserves-to-production ratio and insufficient backup resources. In terms of strategic emerging minerals including Li, Co and Ti, the resources and basic reserves have grown slowly or declined. The quality of these minerals in China is poor, making it difficult to utilize many of them. Moreover, the production and consumption of these minerals have grown rapidly in the past ten years and will continue to grow at a high rate in the

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future, whereas domestic reserves grow slowly, resulting in a prominent contradiction between supply and demand. The supply and demand data of the existing metal minerals are examined and summarized in this dataset, in order to provide references for exploration and strategic deployment of metal mineral resources in the future.
Key words: Important metal minerals; Resources data; Supply and demand data; Trade data
Data service system URL: http://dcc.cgs.gov.cn

1 Introduction

Mineral resources function as an indispensable material basis for human production and living. In China, more than 90% of energies and more than 80% of industrial raw materials are derived from mineral resources, and the national economy, up to 70% of GDP is supported by mineral resources (Ma WD, 2008). In recent years, in order to promote the development of the domestic mining industry, many countries around the world have carried out much research related to metal minerals. The developed countries such as the United States, member countries of the European Union, and Japan have successively issued key mineral lists after fully researching the resource guarantee as well as the supply and demand patterns of metal minerals and then included the lists in their national development strategies. In China, with the acceleration of industrialization and urbanization, the industrialization process is in its middle-late or late stage when the demand structure of metal mineral resources, as well as the volume and growth rate of consumption of the resources, are changing dramatically. This means that serious differentiation takes place in the consumption structure of metal minerals in China, and the growth rate of demand for traditional bulk minerals declines while the demand for strategic emerging minerals is rapidly accelerating (Chen QS et al., 2016). The demand for such minerals as iron and manganese has reached its peak while the demand for non-ferrous metal minerals such as copper, lead, zinc, and aluminium is approaching the inflexion point of peak. However, the demand for bulk minerals in China will still remain high after the inflection point of peak and thus China will remain the backbone in the development of the mining industry in the world (Wang AJ et al., 2010).

Since the 18th National Congress of the Communist Party of China in 2012, the reserves of important metal mineral resources in China have increased substantially with the continuous advancement of National Exploration & Development Planning, and thus the contradiction between supply and demand has been alleviated to a degree. However, in order to achieve the centenary goal of building China into a modern powerful socialist country in all respects, the demand for mineral resources will remain high in the future and safe, reliable, sustainable and stable mineral resources security in China is required. Under this background, it is urgent to organize the resources changes, production and mining, consumption and trade of metal mineral resources that have an important impact on the national economic development of China; clarify the supply and demand of important metal minerals by combining the need for the development of emerging fields as well as the transformation and upgrading of traditional industries; comprehensively analyze the strategic situation of the resources, and propose

targeted measures of resource guarantee.

To determine the above aspects of metal mineral resources in China in combination with the political, economic and military strategic importance of the resources, related data of 16 kinds of metal minerals were collected and organized in this paper, including bulk minerals in short supply (iron, manganese, copper, aluminum, gold, lead, zinc, nickel, and chromium), dominant minerals (tungsten, molybdenum, tin, and antimony) and strategic emerging minerals (lithium, cobalt, and titanium). The data collected includes resource reserves, production and consumption of raw ore, and trade volume (including trade amount) in the world and China from 2006 to 2017. All the data came from the information published in related portal webs at the national level. The dataset, which is in Excel format and contains six sheets, will provide a basis for prediction of the future consumption trend of important metal minerals in China and also provide references for domestic prospecting deployment for the next stage.

The metadata of the dataset of the present status, supply and demand, and import–export volume of important metal mineral resources in China are shown in Table 1.

Table 1 Metadata Table of Database (Dataset)

Items	Description
Database (dataset) name	Dataset of Present Status, Supply and Demand, and Import–Export Volume of Important Metal Mineral Resources in China
Database (dataset) authors	Zhao Liqun, Institute of Mineral Resources Research, China Metallurgical Geology Bureau Zhang Min, Institute of Mineral Resources Research, China Metallurgical Geology Bureau Chen Tong, Institute of Mineral Resources Research, China Metallurgical Geology Bureau
Data acquisition time	2006—2017
Geographic area	China
Data format	*.xlsx
Data size	37.1 KB
Data service system URL	http://dcc.cgs.gov.cn
Fund project	The sub-subject “Zoning of Exploration and Development Bases of Mineral Resources and Application Evaluation of Important Minerals in National Economic Development Strategy” of China Geological Survey Project “Demonstration Project of Prospecting Prediction and Technical Application in Integrated Exploration Areas” (121201004000160901).
Language	Chinese
Database (dataset) composition	The dataset consists of one Excel file named “Dataset of important metal minerals”. The file includes the following six sheets: Resources in the World, Identified Resource Reserves in China, Reserves Base in China, Raw Ore Production in China, Raw Ore Consumption in China, and Import–Export Volume of China

2 Methods of Data Acquisition and Processing

2.1 Data Acquisition

Based on the planning of national mineral resources and the planning of the development of strategic emerging industries, the data acquisition focused on the minerals in short supply

and on the strategic emerging minerals in China. The data acquisition covered 16 kinds of important metal minerals including iron, manganese, copper, aluminium, gold, lead, zinc, nickel, tungsten, molybdenum, tin, lithium, chromium, cobalt, antimony, and titanium. The data were acquired between January 2006 and December 2017 from the *Statistical Bulletin of Land, Mineral and Marine Resources in China* published by the Ministry of Natural Resources of the People's Republic of China, *World Mineral Resources Annual Review* published by the former Information Center of the Ministry of Land and Resources of the People's Republic of China, *Statistical Bulletin* issued by the National Bureau of Statistics (National Bureau of Statistics of China, 2018), the statistical information website of the General Administration of Customs, P. R. China (http://www.customs.gov.cn) (General Administration of Customs, P. R. China, 2018), mineral resources database of the United States Geological Survey (USGS), Antaike, a metal quotation webs), related research reports at home and abroad, and other data on resource exploration, development, supply and demand, trade, etc (Wind, 2018). Based on the public database and data in authoritative websites such as mentioned above, the resource reserves and other data of the important metal minerals in the past ten years were updated. In addition, the status of the strategic resources of the important metal minerals was analyzed comprehensively, and the application of the important metal minerals in the strategy of national economic development was evaluated, thus providing a basis for the selection of major minerals in large-scale national resource bases as well as planning and deployment of new-era mineral resources exploration.loyment of new-era mineral resources exploration.

2.2 Data Processing

The dataset of the important metal minerals was achieved through information query, data extraction, input of data into the database, data check including self-check and check conducted by others successively, ensuring all data were accurate and raw. It was forbidden to process raw data or directly extract data from sources processed. The data process is described in detail as follows: data collectors made data query from authoritative and original sources, and then selected the data required and input it into data tables with reference source being recorded for each data item for late data traceability. After that, the data were personally checked by both data collectors and people other than data collectors. The data collectors personally verified each of the collected data from the beginning by tracing the data sources. Then the people other than the data collectors randomly selected the data from the dataset with a selected data quantity of 30% of the total data. Once any errors were found, the related data would be modified and the self-check process would be initiated again. The data would be checked repeatedly in this way until all the data of the dataset were verified correctly without any errors.

3 Description of Data Samples

The dataset is an Excel file named the "Dataset of important metal minerals" and contains six sheets including *Resources in the World, Identified Resource Reserves in China, Reserves Base in China, Raw Ore Production in China, Raw Ore Consumption in China, and*

Import–Export Volume of China.

Among the six sheets, *Resources in the World, Identified Resource Reserves in China*, and *Reserves Base in China* consist of serial number, mineral type, ore type, unit, reserves per year (2006—2016), and data source (Table 2).

Raw Ore Production in China and *Raw Ore Consumption in China* include mineral type, ore type, unit, production per year (2007—2017), data source, and remarks (Table 3).

Import–Export Volume of China includes serial number, mineral type, ore type, unit, year (2007—2017), import volume, import amount, export volume, export amount, and data source (Table 4).

4 Data Quality Control and Assessment

During data extraction and analysis, the data of the same category were collected from a unified source as far as possible in order to ensure the overall consistency of the data. Among the data, the resources and reserves were mainly extracted from the yearbooks and reports issued by the Natural Resources of the People's Republic of China and the USGS. The production data came from the USGS. However, the production of some metal minerals in recent years was the predicted data issued officially since the update of the official data was delayed. It was difficult to collect consumption data since no unified official release sources were available. The main resources of consumption data were the data issued on the websites of various industries. The trade data came from the accumulated values of the monthly data released by the General Administration of Customs, P. R. China and, therefore, the data was credible. To keep high quality of the data, the updating and maintenance mechanism of the dataset must be guaranteed in the future, so that the data can be compared with the latest data released and can then be updated in time.

In the mid-term quality inspection and final result acceptance organized by the Development and Research Center of China Geological Survey, the dataset was approved by the expert group and thought to be clear and credible in terms of data sources and data quality.

5 Conclusions

(1) The dataset of important metal minerals contains all the resources, production, consumption and trade data of 16 important metal minerals from 2006 to 2017, with a total of 1 457 data items being collected. During the data collection, self-check was conducted for all data and 30% of the data were further checked by people other than data collectors so as to verify the data results. Once any errors were found by these people, related data would be modified and the self-check process would be initiated again. The data would thus be checked repeatedly until all data of the dataset are verified correctly without any errors. The dataset has passed through expert review and is thought to be clear and credible in terms of data sources and data quality.

(2) The following information is shown according to data analysis. In terms of bulk minerals in short supply such as iron Fe, manganese Mn, copper Cu, and gold Au, although

Table 2 Structure of Resources and Reserves Sheets

Serial number Float	Mineral type Char	Year Ore type Char	Unit Char	2006 Float	2007 Float	2008 Float	2009 Float	2010 Float	2011 Float	2012 Float	2013 Float	2014 Float	2015 Float	2016 Float	Data source Char
Example															
Serial number	Mineral type	Year Ore type	Unit	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Data source
1	Iron	Iron ore	0.1 billion tons	607	613	623	646	727	744	775	799	843	851	841	*Statistical Bulletin of Land, Mineral and Marine Resources in China*
2	Manganese	Manganese ore	0.1 billion tons	767	7.93	8.47	8.7	8.86	7.7	9.47	10.3	12.2	14	16	*Statistical Bulletin of Land, Mineral and Marine Resources in China*

Table 3 Structure of Raw Ore Production and Raw Ore Consumption Sheets

Serial number Float	Mineral type Char	Year Ore type Char	Unit Char	2007 Float	2008 Float	2009 Float	2010 Float	2011 Float	2012 Float	2013 Float	2014 Float	2015 Float	2016 Float	2017 Float	Data source Char	Remarks Char
Example																
Serial number	Mineral type	Year Ore type	Unit	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Data source	Remarks
1	Iron	Iron ore	Million tons	707	824	880	1070	1330	1310	1450	1510	(Usable ore) 375	(Iron content) 348	(Iron content) 340[e]	USGS	e: estimated value
2	Manganese	Manganese ore	1000 tons	2000[e]	2200[e]	2400[e]	2600[e]	2800	2900	3000	3000	3000	2330	2500	USGS	

Table 4 Structure of Trade Volume and Trade Amount Sheet

Serial number Float	Mineral type Char	Year Ore type Char	Unit Char	2007				.....	2017				Data source Char
				Import volume	Import amount	Export volume	Export amount		Import volume	Import amount	Export volume	Export amount	
				Float	Float	Float	Float	Float	Float	Float	Float	Float	
Example													
Serial number	Mineral type	Year Mineral type	Unit	2007				.....	2017				Data source
				Import volume	Import amount	Export volume	Export amount		Import volume	Import amount	Export volume	Export amount	
1	Iron	Iron sand and iron concentrate	10,000 tons/10,000 dollars	38 348.00	3 381 208.80	7.80	0.09		107 541.00	7 595 987.10	545.07	4.22	General Administration of Customs, P. R. China
2	Manganese	Manganese ore	Ton/0.1 billion dollars	6 643 479.58	12.99	3 908.11	0.01		19 104 148.11	39.92	36 316.65	0.08	General Administration of Customs, P. R. China

identified resource reserves have increased steadily, the basic reserves have grown slowly due to the large volume of exploitation and consumption. With the total demand for bulk minerals in short supply still remaining high in the future, the import volume will continue to climb as a result of low resource guarantee degree in China. In terms of dominant minerals such as tungsten (W) and thorium (Th), they are no longer as dominant owing to the low reserves-to-production ratio and insufficient backup resources. In terms of strategic emerging minerals including lithium Li, cobalt Co, and titanium Ti, the resources and basic reserves have grown slowly or declined. The quality of these minerals in China is poor, making it difficult to utilize many of them. Moreover, the production and consumption of these minerals have grown rapidly in the past ten years and will continue to grow at a high rate in the future, whereas domestic reserves grow slowly, resulting in a prominent contradiction between supply and demand. Therefore, in the next step, it is necessary to further strengthen the exploration of domestic important metal minerals.

(3) Through the analysis of the dataset of important metal minerals, the resources, along with the supply and demand in the past ten years, of the metal mineral resources that have an important impact on the national economic development in China can be organized, thus providing a basis for prediction of the future consumption trend of important metal minerals in China and also providing references for domestic prospecting deployment in the next stage.

References

Chen Qishen, Yu Wenjia, Zhang Yanfei. 2016. Ore Review-Research on the Development of Global Mineral Resources Industry in Future 20 Years[M]. Beijing: Science Press (in Chinese).

General Administration of Customs, P. R. China. Value and Quantity of Main Import and Export Commodities[EB/OL][2018-01-23]: http://www.customs.gov.cn/customs/302249/302274/302276/1421206/index.html.

Ma Weidong. 2008. Study on the Security and Development Strategy of Metal Mineral Resources[D]. Changsha: Central South University (in Chinese with English abstract).

National Bureau of Statistics of China. Ore Production[EB/OL]. [2018-12-20]: http://data.stats.gov.cn/easyquery.htm?cn=A01&zbA020901&sj201811.

Wang Anjian, Wang Gaoshang, Chen Qishen, Yu Wenjia. 2010. The Mineral Resources Demand Theory and the Prediction Model[J]. Acta Geoscientica Sinica, 31(2): 137−147 (in Chinese with English abstract).

Wind. Wind Database[DB/OL][2018-12-20]: shttp://www.wind.com.cn/.