2024

# China Mineral Resources

**Prepared by**
**Ministry of Natural Resources, PRC**

GEOLOGICAL PUBLISHING HOUSE
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# Foreword

Under the guidance of Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era, China has continuously promoted the reform of mineral resources management and green development in mining industry and solidly promoted new round of strategic actions on breakthroughs in mineral exploration. In order to make people at home and abroad who care about and support natural resources conditions understand Chinese policies and reform progress of mineral resources management, the Ministry of Natural Resources (MNR) organized the compilation of the *China Mineral Resources* (hereinafter referred to as the Report).

This Report focuses on new progress since 2023 in the geological and mineral survey and evaluation, mineral resource exploration and development, mine ecological restoration, green mine construction, new changes in mineral resource policies and regulations, new measures in mineral resource management, new situations in scientific and technological innovation, as well as the new achievements of the international geological and mineral cooperation.

Till the end of year 2023, a total of 173 kinds of minerals had been discovered in China, including 13 kinds of energy minerals, 59 kinds of metallic minerals, 95 kinds of nonmetallic minerals and 6 kinds of water and gases. China's oil & gas and non-oil-gas mineral geological exploration investments had achieved positive growth for three consecutive years. In 2023, 124 mineral deposits were newly discovered. In terms of the oil and gas exploration, major breakthroughs had been made in the new bed series, new types and new zones in large oil and gas basins such as Tarim, Junggar and Bohai Bay. For the non-oil-gas mineral exploration, significant progress had been achieved in coal, copper, gold, lithium and phosphorite, etc.

Basic geological survey work was further improved, and new progress was made in the survey and evaluation of important mineral resources. The degree of 1: 50,000 regional geological surveys increased to 46.1%. The 1: 50,000 mineral geological surveys delineated 96 ore-prospecting targets. The annual evaluation of national groundwater resources and the survey of storage changes were completed. Basic geological surveys and mineral resources surveys of sea areas, and oceanic geological surveys were promoted continuously.

Fixed asset investment in China's mining industry has been growing for three consecutive years. The supply of major mineral products rose steadily, and the energy output reached a record high. The energy consumption structure continued to be optimized. From 2013 to 2023, the proportion of coal consumption in total primary energy consumption dropped from 67.4% to 55.3%, and the proportion of clean energy increased from 10.2% to 17.9%. The economical, intensive and comprehensive utilization of mineral resources has been steadily advanced.

Mine ecological restoration was implemented as a whole, and green development got accelerated. The working mechanism of mine ecological restoration improved, central financial support was increased, and demonstration projects were taken as the guide to promote the ecological restoration of legacy mines during the "14th Five-Year Plan", and key projects were implemented in a coordinated manner. The construction of investigation, monitoring and evaluation system for ecological restoration of mines were strengthened and typical cases of ecological restoration of mines were published. The application demonstration of green exploration equipment was strengthened and the application of green and low-carbon advanced applicable technologies got accelerated.

Mineral resources laws, regulations and management systems further improved. The 10th session of the Standing Committee of the 14th National People's Congress reviewed the second draft of the revised *Mineral Resources Law (Revised Draft)*. The working mechanism of green mine construction was improved, a normalized investigation and evaluation system for the development and utilization level of mineral resources established, the interim and post-event supervision of exploration and mining activities of mining right holders standardized, relevant legal responsibilities further clarified and a fair competitive market environment created.

The level of mineral resources management continued to be improved. The mid-term evaluation of the implementation of the national mineral resources plan during the "14th Five-Year Plan" period was completed. The supervision and management of geological

exploration activities and safety operation of geological exploration were strengthened. Quality control was strengthened, and statistics, evaluation and filing of mineral reserves were promoted. The disclosure of exploration and mining information of mining right holders, "Random Selection and Public Release" spot check and credit management continued to be promoted. The integrated research, sharing and utilization of geological data were further promoted, online order services for geological data were comprehensively carried out, and social service levels got continuously improved. The establishment of a joint force for the supervision of paleontological fossils was actively explored, and the assessment of concentrated producing areas of national key protected paleontological fossils was completed.

Remarkable scientific and technological achievements were made in the field of mineral resources, and a number of important results got achieved. The implementation of national key research and development plans and other national science and technology plan projects was actively promoted, and new breakthroughs were made in the regional mineralization and prospecting theory and the research and development of key technology and equipment. 10 national standards and 59 industry standards in the field of geology and mineral resources were newly issued and implemented.

International exchanges and cooperation were carried out in the field of mineral resources through various means, to actively maintain contacts with relevant energy resource countries and international organizations, and the practical cooperation in the field of geology and mineral resources was promoted through international exchange platforms such as the China Mining Conference and Exhibition, to further consolidate friendly cooperative relations.

Statistics in the Report are mainly from the MNR and the National Bureau of Statistics of the People's Republic of China. Statistics from the Hong Kong Special Administration Region, the Macao Special Administrative Region and Taiwan Province are not included in the Report.

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# Chapter I
# Geological and Mineral Resources Surveys and Evaluations

In 2023, the basic geological survey was further improved. New discoveries were achieved in the surveys of minerals such as gold, copper, bauxite, lithium and potash. New progress was made in basic oil and gas geological survey in Sanmenxia Basin, Sichuan Basin and Tarim Basin. The annual assessment of national groundwater resources and storage change survey were completed. Basic marine geological surveys, offshore oil and gas geological surveys, and deep-sea geological surveys were continuously promoted.

## I. Basic Geological Survey

In 2023, 1 : 50,000 regional geological surveys of nearly 7,365 square kilometers, funded by the central financial funds, were carried out, with the degree of work increasing to 46.1%. The aerial gravity and magnetic comprehensive survey covered 12,960 square kilometers and 527 land magnetotelluric sounding points were completed.

Through conducting regional geological surveys, thematic geological surveys and comprehensive research, focusing on key basic geological issues such as the aggregation and dispersion of continental blocks and resource and environmental effects in China, the basic geological characteristics of the surveyed areas were identified, and a batch of high-quality basic geological maps and data were provided, understandings were obtained in geological structural evolution in Qinghai-Tibet Plateau, Yangtze continental block and the Central Asian Orogenic Belt, and a number of paleontological species were newly discovered.

The research of key basic geological problems related to the mineralization and oil formation of key metallogenic belts such as the Tongbai-Dabie metallogenic belt and the southwest Sanjiang metallogenic belt, as well as important petroliferous basins such as the Songliao Basin, Qaidam Basin and Hetao Basin was promoted.

## II. Mineral Resources Surveys and Evaluations

### 1. Geological survey and evaluation of solid minerals

In 2023, 1 : 50,000 mineral geological surveys of 11,000 square kilometers, funded by the central financial funds, were completed, 96 ore-prospecting targets were delineated, 67 exploration block proposals were submitted.

A number of significant discoveries were made in the geological survey and evaluation of solid minerals. A new batch of copper resources was added to resource bases such as Duolong and Juno in Tibet. The first high-sulfur epithermal gold deposit was discovered in the continental volcanic rock area of the Bangong Lake-Nujiang River metallogenic belt with the apparent thickness of the main ore body 55 meters and the average gold grade 17.97 g/t. Tengjia large-scale gold deposit was newly discovered in Zhaoyuan, Jiaodong, with an additional gold inferred resources of over 50 tons. 14 pegmatite-type lithium-beryllium ore bodies were delineated in the Altun metallogenic belt, and the apparent thickness of spodumene-bearing pegmatite veins was revealed by drilling to reach more than 90 meters. A large pegmatite-type lithium deposit, whose name is Gabo, was newly discovered in the

Himalayan metallogenic belt. The "integration of exploration and extract" Chaijia 1# Well was implemented in the Heibei Depression in the northern Qaidam Basin, and a daily output of 8,586 cubic meters of potassium-containing deep brine was intersected.

## 2. Oil and gas survey and evaluation

New progress was made in the survey and evaluation of conventional oil and gas resources in Henan and Xinjiang. Yuxiadi 1# Well in the Sanmenxia Basin initially tested a high-yield industrial oil flow of 56.14 cubic meters per day in the Paleogene, which is expected to lead oil and gas exploration in the group of small and medium-sized basins in the central and eastern China. Important progress was made in oil and gas geological surveys in Keping-Awati area, Xinjiang Autonomous Region. The gas test in the first layer of Xinsudi 2# Well achieved a daily production of 24 thousands cubic meters, and the industrial gas flow in the second layer achieved a daily production of 22 thousands cubic meters.

New progress was made in the survey and evaluation of shale gas resources in Hubei and Chongqing. New discoveries were made in shale gas from Permian Dalong Formation and oil and gas from Qixia Formation in western Hubei in Eheye 3# Well. Yuwudi 1# Well encountered good shale gas drilling in the Permian Dalong Formation, showing that vertical well fracturing tested a stable shale gas industrial gas flow of 4,234 cubic meters per day. A major breakthrough was achieved in the geological survey of shale gas in the Permian Dalong Formation in the complex structural area outside Sichuan Basin.

New progress was made in the survey and evaluation of coalbed methane resources in Xinjiang. Xinbaishan 1# Well on the northern edge of Tarim Basin encountered a gas measurement anomaly of 190 meters/26 layers, and the gas content on-site desorbed of the coalbed was 2.45-11.03 cubic meters per ton.

Preliminary understandings have been obtained in the national oil and gas resource evaluation during the "14th Five-Year Plan" period. Preliminary evaluation result showed that the national conventional oil resources rose steadily, the conventional gas resources were basically the same, and the unconventional oil and gas resources increased significantly.

## 3. Geothermal resource survey and evaluation

New progress was made in the survey and evaluation of geothermal resources in Yunnan and Sichuan. Geothermal geological surveys in Kunming and Tengchong of Yunnan Province, and Kangding and Litang of Sichuan Province were completed, and the geothermal thermal storage characteristics and lithospheric thermal structures along typical large geoscience sections in Southwest China were basically ascertained. 45 new sets of terrestrial heat flow measurements were added in Southwest China, achieving full coverage of geothermal flow measurements in secondary tectonic units in the eastern Qinghai-Tibet Plateau, and further deepening the understanding of the crust-mantle thermal structure and heat source mechanism of the Qinghai-Tibet Plateau.

## 4. Investigation, evaluation and monitoring of groundwater

The annual evaluation of national groundwater resources and storage change survey in 2023 was completed. The national groundwater storage decreased by 253 million cubic meters compared with the same period of last year, but that in the North China Plain and Huanghuai Plain increased by 2.35 billion cubic meters and 2.06 billion cubic meters respectively, groundwater quality across the country was generally stable.

10,171 automatic monitoring stations of the national groundwater monitoring network (natural resources departments) were operated and maintained, and systematic groundwater level measurements were completed for 36,256 sites across the country. The forms and annual changes of groundwater flow fields in major plain basins were mastered. The third round of national groundwater resource periodic evaluation was completed in an all-round way, and data such as quantity, quality, storage capacity, exploitable volume and spatial distribution of ground water resources on average over many years were formed.

## 5. Potential evaluation of mineral resources

The resource potentials of 26 minerals including coal, iron ore, manganese and copper were dynamically updated. The potential evaluation of 26 minerals, such as titanium, vanadium, cobalt and niobium, was systematically carried out prediction area delineated, and the resource potential above 2,000 meters estimated.

## III. Marine Geological Survey

### 1. Basic marine geological survey

The regional surveys for marine areas (5 international standard maps; 1 : 250,000) in the South Yellow Sea and Shenhu of South China Sea, covering an area of 81,000 square kilometers were carried out, and a series of 30 standard maps were compiled. 22 geographical entities in key sea areas such as the South China Sea and the East China Sea were newly discovered. 4 favorable zones for geological carbon sequestration in Yantai Depression of South Yellow Sea Basin were delineated, and the characteristics of geological conditions for carbon sequestration were finely depicted.

The regional surveys for marine areas (6 international standard maps; 1 : 50,000) in the East Island of the South China Sea and Caofeidian of the Bohai Sea, covering an area of 2,600 square kilometers, were completed, and a series of 60 standard maps were compiled, supporting the coordinated development of Hainan Free Trade Port and Bohai Rim Economic Belt.

An aerial geophysical survey of 4,230 kilometers in the Pearl River Estuary was completed, a gravity and magnetic anomaly map of continuous sea and land coverage in the Pearl River Estuary was compiled, and new understanding was gained in the geological background of metal mineralization and fault distribution.

The geochemical distribution characteristics and spatial variation regularity of different sedimentary units in the East China Sea, such as coastal zone, continental shelf area and continental slope-trough area, were systematically summarized.

### 2. Marine oil and gas survey

Survey and evaluation of oil and gas resources in waters under China's jurisdiction were carried out. Two favorable Mesozoic-Paleozoic oil and gas zones in key sea areas were selected, and one drilling target was further optimized; Four key structures in key basins in the South China Sea were selected, and one preliminary suggested well location was put forward; The optimization evaluation of oil and gas blocks in the northern South China Sea carried out, and new data packages for the Foshan 28 and Lufeng 27 oil and gas exploration blocks in Pearl River Estuary Basin were submitted.

The deep geological structure and tight reservoir formation mechanism of large sedimentary basins in the eastern sea area were revealed, and the source rock evaluation technology and block optimization method in low-level exploration areas in the South China Sea were preliminarily formed.

## 3. Deep-sea geological survey

A comprehensive geological and geophysical survey of the Pigafetta Basin in the western Pacific Ocean was successfully carried out. Multi-beam survey, shallow stratigraphic profile survey and gravity survey of 1,701 kilometers each, 24 geological sampling sits, and 61 kilometers of seabed camera were completed, and two cobalt-rich polymetallic nodule exploration target areas were delineating in the western Pacific Ocean, covering an area of approximately 100,000 square kilometers.

Resource evaluation of cobalt-rich crust contract areas continued to be carried out, and a second regional abandonment plan for the contract areas was proposed. The "Source-Migration-Accumulation" metallogenic geological model of cobalt and rare earth elements in supergene sedimentary deposits in the western Pacific Ocean was preliminarily established; based on multi-source geoscience data, the application of machine learning technology in polymetallic nodule resource assessment and benthic habitat mapping in deep-sea environment was explored.

## 4. Survey of marine natural gas hydrates

The detailed survey and evaluation of the target reservoir for trial mining in the natural gas hydrate pilot area in the Shenhu sea area of the northern South China Sea was completed, the target reservoir for the third round of trial mining were optimized and the amount of resources was estimated. Besides, the evaluation of hydrate resource selection areas in key areas in the northern South China Sea was completed, eight favorable areas in Qiongdongnan Sea and Shenhu Sea were newly delineated, and three reservoir targets for evaluation were optimized. The environmental baseline survey of Shenhu sea area was carried out, as well as 54 stations including seabed subsurface buoy observation, ocean anchor system observation, deep submersible survey, and marine biological survey were completed, and the latest environmental status of the trial mining target area was mastered.

# Chapter II
# Mineral Resources

Till the end of year 2023, a total of 173 kinds of mineral resources had discovered in China, including 13 kinds of energy minerals, 59 kinds of metallic minerals, 95 kinds of non-metallic minerals and 6 kinds of groundwater and gases.

## I. Energy Minerals

Table 2-1 Reserves of Main Energy Minerals in China

| No. | Minerals | Unit | Reserves in 2022 | Reserves in 2023 |
|---|---|---|---|---|
| 1 | Coal | Billion tons | 207.01 | 218.57 |
| 2 | Oil | Billion tons | 3.81 | 3.85 |
| 3 | Natural gas | Billion $m^3$ | 6569.01 | 6742.45 |

Note: The reserves of oil and gas (oil and natural gas) are remaining proved technically recoverable reserves as per *Classifications for Petroleum Resources and Reserves* (GB/T 19492-2020) and those of other minerals are the total of proved reserves and probable reserves as per *Classifications for Mineral Resources and Mineral Reserves* (GB/T 17766-2020), the same as below.

As of the end of 2023, China's coal reserves increased by 5.6% compared with the end of 2022, while the remaining proven technically recoverable reserves of oil and natural gas increased by 1.2% and 2.6%, respectively.

## II. Metallic Minerals

Table 2-2 Reserves of Main Metallic Minerals in China

| No. | Minerals | Unit | Reserves in 2022 | Reserves in 2023 |
|---|---|---|---|---|
| 1 | Iron | Billion tons of ore | 16.25 | 16.92 |
| 2 | Manganese | Million tons of ore | 275.61 | 261.30 |
| 3 | Vanadium | Million tons of $V_2O_5$ | 7.34 | 10.30 |
| 4 | Copper | Million tons of metal | 40.77 | 40.65 |
| 5 | Lead | Million tons of metal | 21.87 | 24.87 |
| 6 | Zinc | Million tons of metal | 46.08 | 59.93 |
| 7 | Bauxite | Million tons of ore | 675.53 | 707.52 |
| 8 | Tungsten | Million tons of $WO_3$ | 3.00 | 2.85 |
| 9 | Tin | Million tons of metal | 1.00 | 1.17 |
| 10 | Molybdenum | Million tons of metal | 5.90 | 7.81 |
| 11 | Antimony | Million tons of metal | 0.67 | 0.83 |
| 12 | Gold | Tons of metal | 3127.46 | 3203.77 |
| 13 | Silver | Tons of metal | 70344.21 | 66866.44 |

As of the end of 2023, China's iron ore reserves increased by 4.1% compared with the end of 2022, vanadium increased by 40.2%, lead increased by 13.8%, zinc increased by 30.1%, bauxite increased by 4.7%, tin increased by 16.9%, molybdenum increased by 32.3%, antimony increased by 24.1%, and gold increased by 2.4%.

## III. Non-metallic Minerals

Table 2-3 Reserves of Main Non-metallic Minerals in China

| No. | Minerals | Unit | Reserves in 2022 | Reserves in 2023 |
|---|---|---|---|---|
| 1 | Magnesite | Million tons of ore | 680.12 | 695.21 |
| 2 | Fluorspar | Million tons of minerals | 85.92 | 106.90 |
| 3 | Pyrite | Million tons of ore | 1147.86 | 1046.66 |
| 4 | Phosphorite | Billion tons of ore | 3.69 | 3.44 |
| 5 | Potash | Million tons of KCl | 287.89 | 322.01 |
| 6 | Sodium salt | Billion tons of NaCl | 14.29 | 15.54 |
| 7 | Mirabilite | Billion tons of $Na_2SO_4$ | 1.23 | 0.92 |
| 8 | Barite | Million tons of ore | 107.36 | 120.69 |
| 9 | Kaolin | Million tons of ore | 693.45 | 721.47 |
| 10 | Crystalline graphite | Million tons of minerals | 81.01 | 100.40 |
| 11 | Talc | Million tons of ore | 60.46 | 48.44 |

As of the end of 2023, China's magnesite reserves increased by 2.2% compared to the end of 2022, fluorite increased by 24.4%, potash increased by 15.3%, sodium salt increased by 8.7%, barite increased by 12.4%, kaolin increased by 4.0%, and crystalline graphite increased by 23.9%.

# Chapter III Exploration

In 2023, China's investment in oil and gas and non-oil-gas geological exploration increased significantly. Major breakthroughs were made in oil and gas exploration in large oil-bearing basins such as Tarim, Junggar, and Bohai Bay, and strategic major breakthroughs were made in deep coalbed methane exploration in the eastern edge of Ordos Basin. Significant progress was made in non-oil-gas exploration of coal, iron ore, copper, lead-zinc, gold, lithium, fluorite, etc.

## I. Investments in Geological Exploration

In 2023, the investment in geological exploration was RMB 113.82 billion in China, up by 12.7% from the previous year. Among them, the investment in oil and gas geological exploration was RMB 93.75 billion, increasing by 13.8%; the investment in geological exploration of non-oil-gas minerals was RMB 20.07 billion, increasing by 7.7% (Fig. 3-1), and achieving positive growth for three consecutive years.

Of the investments in geological exploration of non-oil-gas minerals, the mineral exploration was RMB 11.76 billion, accounting for 58.5% of the total, increasing by 18.5%; the basic geological survey was RMB 2.22 billion, accounting for 11.1% of the total, increasing by 19.6%; the hydrogeology, environmental geology and geological disaster survey and

evaluation reached RMB 3.83 billion, accounting for 19.1% of the total, decreasing by 15.5%; the geological science, technology and comprehensive study were RMB 2.03 billion, accounting for 10.1% of the total, decreasing by 3.8%; the geological data services and informatization were RMB 232 million, accounting for 1.2% of the total, decreasing by 10.6% (Fig. 3-2).

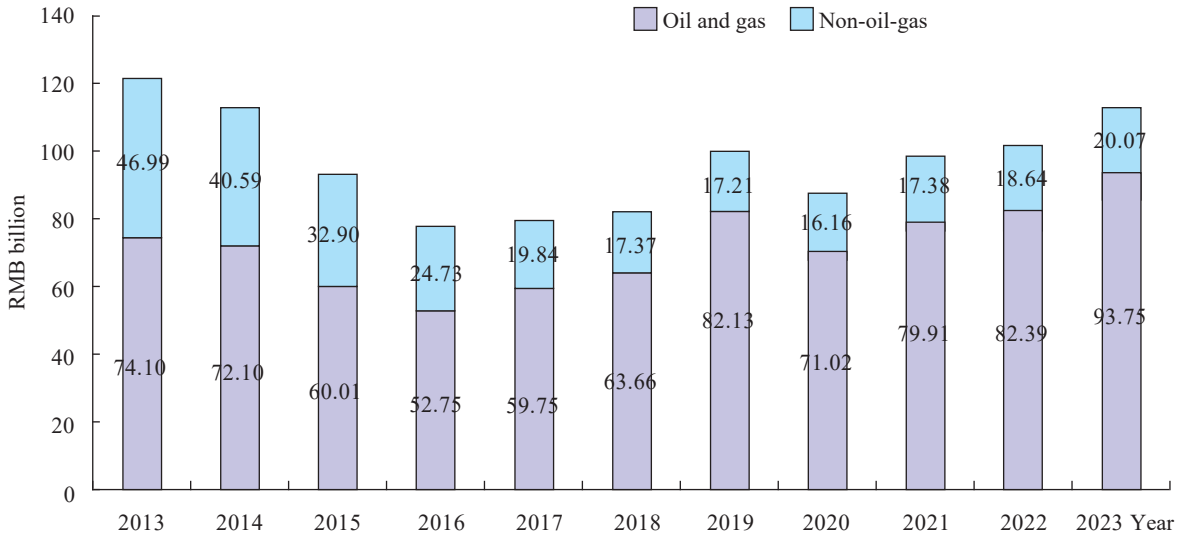



Fig. 3-1 Investment in Geological Exploration in China from 2013 to 2023

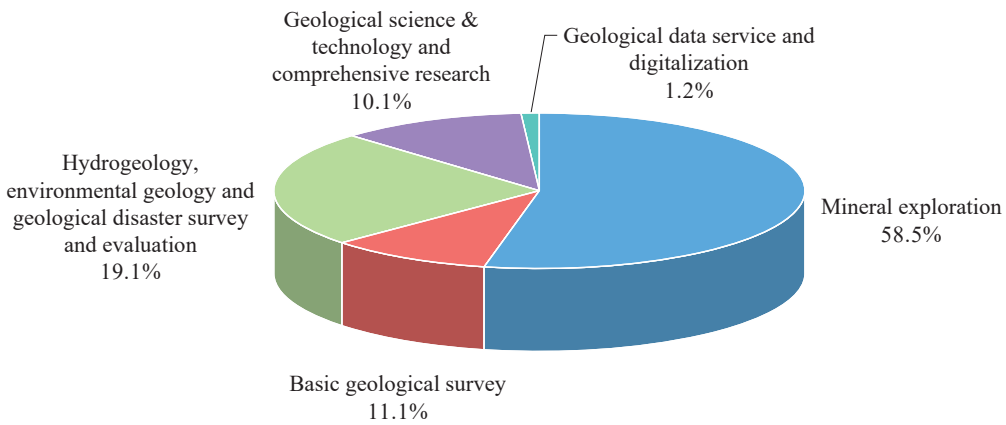



Fig. 3-2 Structure of Investment in Exploration of Non-oil-gas Minerals (by Category)

The exploration of non-oil-gas minerals was dominated by the coal (RMB 1.97 billion), gold (RMB 1.40 billion), copper (RMB 871 million), lead-zinc (RMB 863 million), and iron ore (RMB 552 million). Compared with 2022, the minerals with increased investment mainly include nickel, lead-zinc, copper, molybdenum, gold, iron ore, etc., while the minerals with decreased investment mainly include graphite and phosphorite.

The provincial geological exploration fund invested RMB 3.87 billion, of which RMB 2.60 billion was invested in mineral exploration. 563 mineral exploration projects were implemented, with more investment in gold, copper, coal, iron ore and geotherm.

## II. Progress in Oil and Gas Exploration

### 1. Conventional oil and gas exploration

Breakthroughs were made in conventional oil and gas exploration in many basins. Risk exploration of Xiongtan-1$^{\#}$ Well and Tuotan-1$^{\#}$ Well in the western Tarim Basin obtained high-yield oil and gas flows, which are expected to form a strategic replacement field for 1 billion tons of oil and gas exploration; Ketan No.1 Well in the Kuqa Depression obtained high-yield gas flow in the new Cretaceous strata, opening up a trillion cubic meter natural gas exploration replacement field; Several oil and gas enrichment fault zones were discovered in Shunbei Oilfield and Fuman Oilfield. Several exploration wells in the western depression of the Junggar Basin and deep under the piedmont nappe in the northwest margin obtained high-yield oil and gas flows, making major breakthroughs in new types and new areas. The Sichuan Basin made important discoveries in natural gas exploration in central Sichuan, northeastern Sichuan and other regions. 100-million-ton Hongde oil field was discovered on the western margin of the Ordos Basin. Qinhuangdao 27-3 shallow lithologic oil and gas exploration in the Bohai Sea made an important discovery of a 100-million-ton oil field, and Bozhong 26-6 exploration made an important discovery of the world's largest oil field in Archean metamorphic rock. In Pearl River Mouth Basin of the South China Sea, the first 100-million-ton oil field was discovered in Kaiping 11-4 deep water in depth, and two large-scale oil and gas fields were discovered in Panyu 10-6 and north Huizhou 26-6 under shallow water and in deep strata.

Table 3-1 Completion of Main Mineral Exploration Capital Investment and Drilling Work in 2023

| Mineral | Investment RMB million | Year-on-year increase / % | Meters drilled million meters | Year-on-year increase / % |
|---|---|---|---|---|
| Coal | 1972 | 19.3 | 1.79 | 29.7 |
| Iron ore | 552 | 30.2 | 0.59 | 68.6 |
| Manganese | 71 | -14.5 | 0.03 | -50.0 |
| Copper | 871 | 32.6 | 0.49 | 48.5 |
| Lead-zinc | 863 | 50.9 | 0.69 | 81.6 |
| Bauxite | 270 | 5.9 | 0.27 | 0 |
| Nickel | 104 | 100 | 0.24 | 380.0 |
| Tungsten | 186 | 25.7 | 0.14 | 40.0 |
| Tin | 52 | -5.5 | 0.04 | 0 |
| Molybdenum | 96 | 31.5 | 0.06 | 0 |
| Gold | 1404 | 31.1 | 0.98 | 44.1 |
| Silver | 161 | 32.0 | 0.16 | 166.7 |
| Phosphorite | 199 | -30.9 | 0.15 | -28.6 |
| Graphite | 96 | -32.4 | 0.06 | -40.0 |
| Potash | 83 | -1.2 | 0.02 | -50.0 |

### Feature 3–1 New Oil and Gas Exploration Discoveries of 100 Million Tons in China's Waters

China's sea areas are rich in oil and gas resources and widely distributed. In recent years, new breakthroughs have been made in the fields of deep water, deep layer, buried hill and shallow lithologic oil and gas reservoirs through innovative basin-and-depression-forming mechanisms and new understandings of oil and gas accumulation models, and by continuously increasing exploration and development efforts. In 2023, new oil and gas exploration discoveries of 100 million tons were made in the fields of shallow lithology and deep buried hills in the Bohai Sea, and deep water and deep layers in the eastern South China Sea.

Qinhuangdao 27-3 Oilfield in the central and northern Bohai Sea tested and obtained high-yield industrial oil flow in the shallow lithology field of the lower section, and the newly proven petroleum geological reserves exceeded 100 million tons. The Bozhong 26-6, the world's largest Archean metamorphic rock oilfield, was discovered in the southern Bohai Sea. The negative buried hill drilling in the Bohai Bay achieved a maximum daily oil production of 325 tons and 330,000 cubic meters of gas. Exploration in the eastern South China Sea made the first oil and gas discovery of 100 million tons in deep water and deep areas, and a high-yield oil flow well with a daily output of over 1,000 tons was drilled in Kaiping South Oilfield in the Pearl River Mouth Basin.

## 2. Unconventional oil and gas exploration

Shale gas exploration made new breakthroughs in ancient strata, new Permian strata and ultra-deep layers in Sichuan Basin and its surrounding areas; Unconventional oil exploration achieved new breakthroughs in Jiyang Depression of Bohai Bay Basin, Subei Basin and new areas and new types of exploration in Junggar Basin; Deep coalbed methane exploration achieved strategic breakthroughs in the Daji-Shilou, Nalinhe-Mizhibei, Jiaxian, Shenfu, and Daniudi gas fields in Ordos Basin.

## Feature 3-2 Major Breakthroughs Made in Deep Coalbed Methane Exploration in the Eastern Margin of Ordos Basin

The deep coal seams in Ordos Basin are widely distributed and own great potential for coalbed methane resources. In recent years, through independent research and technological innovation, the theory of deep coalbed methane enrichment and key technologies for development have been formed, a technical system suitable for efficient exploration and development of deep coalbed methane has been established, and major breakthroughs have been promoted in deep coalbed methane exploration and development. In 2023, major breakthroughs were achieved in the exploration and development of deep coalbed methane in the Daji-Shilou, Nalinhe-Mizhibei, Jiaxian, Shenfu and Daniudi Gas Fields on the eastern edge of Ordos Basin.

49 industrial gas flow wells were obtained in the deep No.8 coal seam in the Daji-Shilou North area, with proven geological reserves exceeding 110 billion cubic meters and cumulative proven geological reserves exceeding 220 billion cubic meters. In addition, Jiping-2H well obtained stable and high-yield gas flow in the No.5 deep coal seam. The daily gas test production of four wells in the Nalinhe-Mizhibei area exceeded 100,000 cubic meters, and the proven geological reserves exceeded 120 billion cubic meters. The gas test of Jianan-1H and Jiamei-2H wells in the Jiaxian South Block achieved high yields, with cumulative gas production exceeding 10 million cubic meters. Through complementary exploration and development of tight gas and coalbed methane and large well platform testing, the Shenfu area added more than 110 billion cubic meters of proven geological reserves. Yangmei-1HF Well in Daniudi Gas Field obtained a daily gas production of 104,000 cubic meters in the No.8 deep coal seam.

## III. Progress in Non-oil-gas Exploration

124 mineral deposits were newly discovered in China, including 44 large-scale, 52 medium-scale and 28 small-scale deposits. The top 5 minerals in the newly-discovered deposits include limestone for construction (16 deposits), graphite (10 deposits), cement limestone (9 deposits), granite for construction (7 deposits), and fluorite (6 deposits).

Staged exploration was completed in 428 mineral deposits nationwide, including 134 general surveys, 163 detailed surveys, and 131 exploration sites. The top 5 mineral deposits subjected to the staged exploration include the limestone for construction (50 deposits), coal (22 deposits), cement limestone (20 deposits), fluorite (19 deposits), and gold (18 deposits).

The provincial geological exploration fund had made significant achievements in mineral exploration, with results mainly concentrated in minerals such as gold, copper, coal, geotherm, fluorite, bauxite and lithium. The provincial geological exploration fund disposed of a total of 65 projects, including 56 wholly-owned projects and 9 cooperative investment projects.

## Feature 3-3 New Important Progress in Non-oil-gas Exploration in 2023

Coal: 3.2 billion tons of resources were added in Nalinxili, Yijinhuoluo Banner, Inner Mongolia. The new resources of Danan Lake in Hami City, Xinjiang reached 2.5 billion tons. 1.9 billion tons of new resources were added in Yuheng, Yulin City, Shaanxi Province. Coal resource bases such as Ordos in Inner Mongolia, Hami and Santanghu in Xinjiang, Wuzhong in Ningxia, and Jixi in Heilongjiang were further consolidated, playing an important role in ensuring energy supply.

Gold: Xiling Gold Mine in Laizhou City, Shandong Province added 209 tons of gold resources, reaching a total of 592 tons. It is the largest single gold deposit discovered in China, and its position as the world's third largest gold concentration in Jiaodong was further stabilized.

Lithium: Murong lithium in Yajiang County, Sichuan Province added nearly 1 million tons of resources (the largest single pegmatite lithium deposit in Asia), further consolidating resource bases such as western Sichuan and Dahongliutan in western Kunlun.

Phosphorite: Mohong, Leibo County, Sichuan Province, added 770 million tons of resources. The preliminarily evaluated resources in the Yangchang-Mangbu area of Zhenxiong County, Yunnan Province was 1.44 billion tons, which is the largest concealed-single-orebody phosphate-rich deposit discovered so far in Asia.

# Chapter IV
# Development and Utilization

In 2023, fixed-asset investment in China's mining industry achieved positive growth for the third consecutive year. The output and supply of major mineral products increased steadily, energy output hit a record high, the energy consumption structure continued to be optimized, and multiple measures were taken to save, intensify and comprehensively utilize mineral resources.

## I. Fixed-asset Investment in Mining Industry

Fixed-asset investment in the mining industry has been growing for three consecutive years. In 2023, fixed-asset investment in the mining industry continued the growth trend of the previous year, increasing by 2.1% over the previous year, which was 0.9 percentage points lower than the national fixed-asset investment growth rate. Among the fixed-asset investment in the mining industry, except for the decrease in fixed-asset investment in the ferrous metal mining and processing industry, all others have increased significantly. The coal mining and washing industry increased by 12.1% over the previous year, the oil and natural gas extraction industry

increased by 15.2%, the ferrous metal mining and processing industry decreased by 6.8%, the non-ferrous mining and processing industry increased by 42.7%, and the non-metal mining and processing industry increased by 16.2%.

## II. Production and Consumption of Mineral Products

### 1. Energy

Energy security and stable supply capabilities improved. Total primary energy production in 2023 was 4.83 billion tons of standard coal equivalent, representing an increase of 4.2% over the previous year (Fig. 4-1). In the energy production structure, coal accounted for 66.6%, oil made up 6.2%, natural gas occupied 6.0%, and non-fossil energy resources such as hydropower, nuclear power, wind power, and solar power accounted for 21.2%. The total energy consumption was 5.72 billion tons of standard coal equivalent, an increase of 5.7%, and the energy self-sufficiency rate was 84.4%.

China's energy consumption structure continued to improve. In 2023, coal consumption accounted for 55.3% of total primary energy consumption, showing a decrease of 0.7 percentage points from the previous year; oil accounted for 18.3%, an increase of 0.3 percentage points; natural gas accounted for 8.5%, an increase of 0.1 percentage points; non-fossil energy resources such as hydropower, nuclear power, wind power, and solar power accounted for 17.9%, an increase of 0.3 percentage points. Compared with ten years ago, the proportion of coal consumption in energy consumption decreased by 12.1 percentage points, while the proportion of non-fossil energy such as hydropower, nuclear power, wind power, and solar power increased by 7.7 percentage points (Fig. 4-2).

Energy mineral production hit a record high. In 2023, coal production was 4.71 billion tons, an increase of 3.4% over the previous year, and consumption increased by 5.6%. Crude oil production amounted to 209 million tons, an increase of 2.1% (Fig. 4-3), maintaining positive growth for five consecutive years, and consumption increased by 9.1%. Natural gas production was 232.43 billion cubic meters, growing by 5.6%, with an increase of more than 10 billion cubic meters for seven consecutive years, and consumption increased by 7.2%.

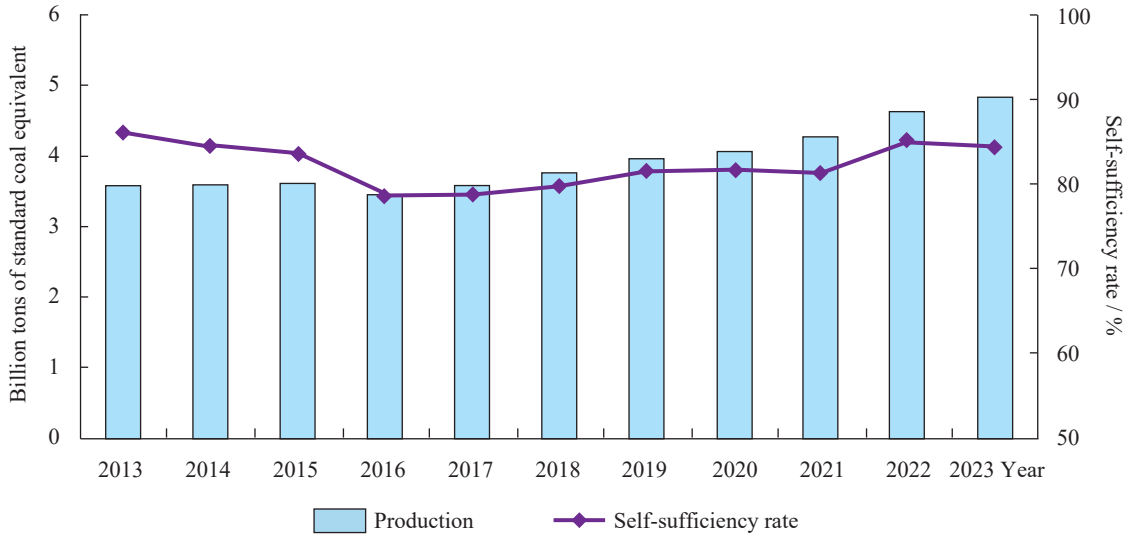



Fig. 4-1 Production of Primary Energy in China

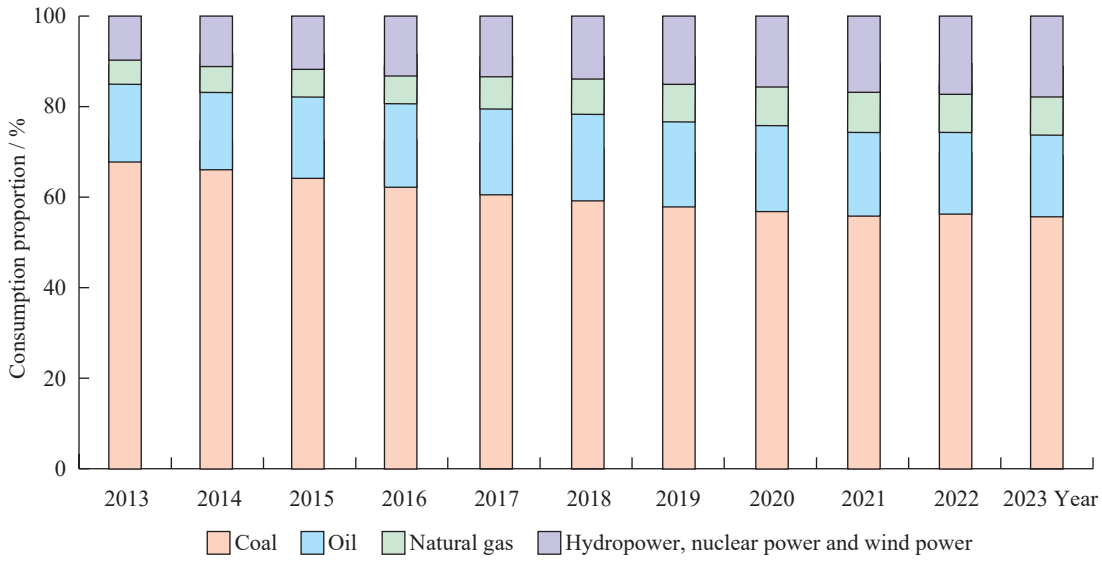



Fig. 4-2 Changes in the Primary Energy Consumption Structure in China

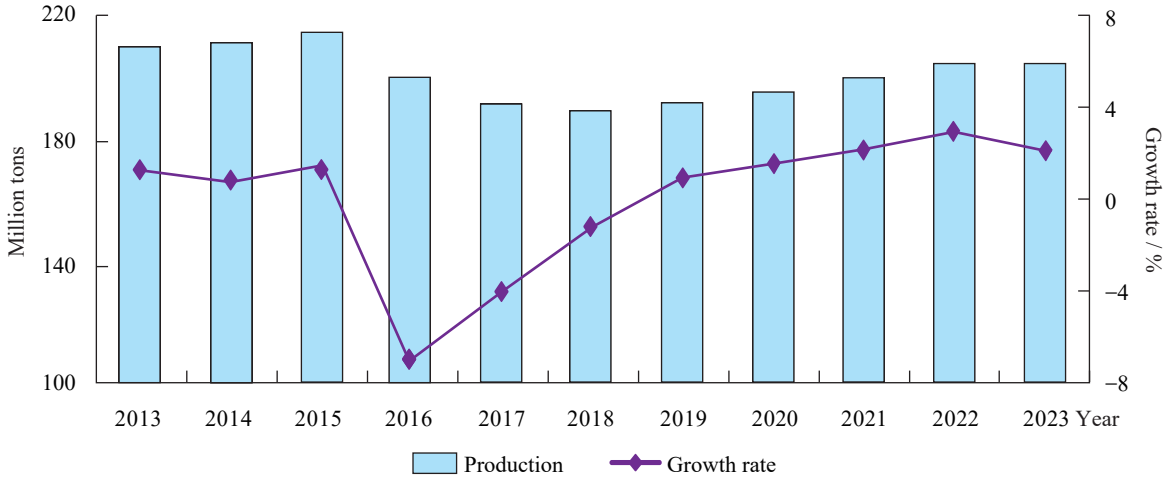



Fig. 4-3 Crude Oil Production and Its Changes in China

## 2. Metals

The production and supply of major metal mineral products increased steadily. In 2023, iron ore production reached 990 million tons, an increase of 7.1% over the previous year; crude steel production was 1.02 billion tons, the same as the previous year (Fig. 4-4). Among the main non-ferrous metal mineral products, the output of copper concentrate (metallic content, same as below) was 1.62 million tons, a decrease of 3.9%; that of lead concentrate was 1.61 million tons, an increase of 7.1%; and that of zinc concentrate was 2.97 million tons, a decrease of 2.4%. The output of ten non-ferrous metals amounted to 74.70 million tons, an increase of 7.1%; of which refined copper was 12.99 million tons, an increase of 13.5%; electrolytic aluminum was 41.59 million tons, an increase of 3.7%.

## 3. Non-metals

In 2023, China produced 105.31 million tons of phosphate rocks (30% of $P_2O_5$), an increase of 7.8% over the previous year, and 2.02 billion tons of cement, a decrease of 0.7% (Fig. 4-5).

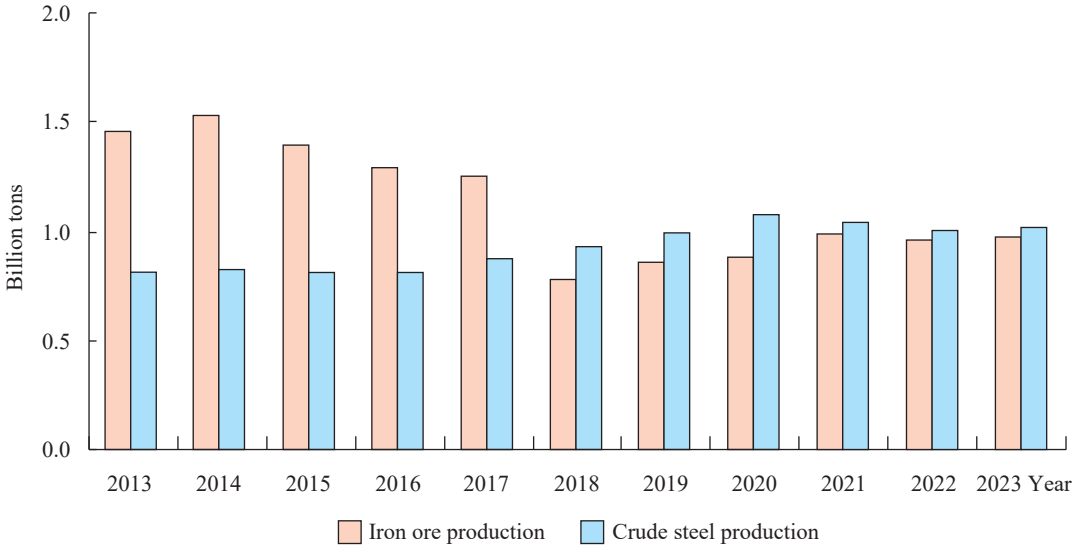



Fig. 4-4 Changes in the Production of Iron Ore and Crude Steel in China

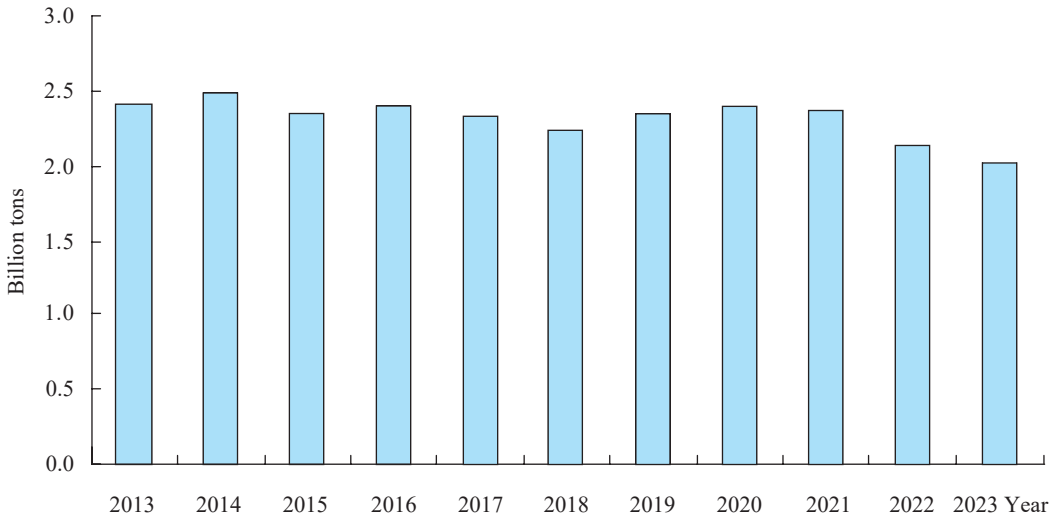



Fig. 4-5 Changes in Cement Production in China

## III. Conservation and Comprehensive Utilization of Mineral Resources

### 1. A survey and evaluation system for the exploitation and utilization level of mineral resources established

In March 2023, the *Notice of the General Office of the Ministry of Natural Resources on Issuing the Pilot Work Plan for the Expansion of the Survey and Evaluation of the Exploitation and Utilization Level of Mineral Resources* was issued, and the entire process covering the assessment system was carried out. In February, 2024, the *Notice of the Ministry of Natural Resources on Issuing the Measures for the Survey and Evaluation of the Exploitation and Utilization Level of Mineral Resources (Trial)* was issued. The measures clearly stipulate strengthening data quality control and management, actively exploring the application of evaluation results, establishing accountability mechanism and doing a good job guarantee. At the same time, specific requirements are put forward for the work connotation, division of responsibilities, survey objects, survey contents, evaluation indicators, evaluation methods, results reporting, time schedule of the survey and evaluation. The measures aim to establish a normalized survey and evaluation system for the exploitation and utilization level of mineral resources, and promote the comprehensive conservation and efficient utilization of resources. The Ministry of Natural Resources officially launched the survey and evaluation of the exploitation and utilization level of mineral resources.

### 2. Industry standards on "three rates"[1] released

In December 2023, 10 industry standards including the *"Three Rates" Standard Requirements for Mineral Resources Part 1: Coal* were released, clarifying the standard requirements for mineral resources exploitation, mineral dressing and processing and comprehensive utilization of symbiotic and associated minerals, and stipulating "three rates" standard requirements for 85 minerals such as coal, petroleum, gold and graphite. At the same time, according to the current level of development and utilization of mineral resources in China from high to low, the "three rates" indicators are divided into the leading indicator,

[1] The "three rates" indicators of mineral resources refers to the mining recovery rate, dressing recovery rate and comprehensive utilization rate of mines.

general indicator and minimum indicator in turn. The release and implementation of this series of standards will effectively promote the comprehensive conservation and efficient utilization of China's mineral resources and improve the comprehensive utilization efficiency of mineral resources.

### 3. A advanced and applicable technology evaluation specifications released

In order to further standardize the comprehensive evaluation of advanced and applicable technologies for the conservation and comprehensive utilization of mineral resources, in June 2024, the *Evaluation Specifications for Advanced and Applicable Technologies for the Conservation and Comprehensive Utilization of Mineral Resources* (DZ/T 0468-2024) was released, clarifying the basic principles, evaluation procedures, evaluation indicators, evaluation methods, and calculation processes for the evaluation of advanced and applicable technologies. Through a standardized technical evaluation process, technologies in the field of mineral resource utilization that have the effects of resource conservation, efficient utilization, and environmental protection, have great potential, and have certain room for promotion and application were evaluated, to drive the promotion and application of advanced and applicable technologies, and provide technical support for promoting the high-quality development of the mining industry.

### 4. Establishment of demonstration counties (cities) in the field of minerals evaluated

In May 2024, according to the *Notice of the Ministry of Natural Resources on Carrying out the Establishment of Natural Resources Conservation and Intensive Demonstration Counties (Cities)* and the *Notice of the Ministry of Natural Resources on Identifying Natural Resources Conservation and Intensive Demonstration Counties (Cities)*, the evaluation of the establishment of demonstration counties (cities) in the field of minerals was organized and carried out, objectively evaluating the implementation of the overall plan, objectives, tasks and policies and measures for resource conservation and intensive utilization during the demonstration cycle of natural resource conservation and intensive demonstration counties (cities), and timely grasping the achievements, existing problems and creating experience.

# Chapter V
# Ecological Restoration of Mines and Green Development

The supervision and management of ecological restoration in active mines got strengthened and the implementation mechanism of ecological restoration projects was improved. Guided by demonstration projects, the ecological restoration of abandoned mines left over from history during the "14th Five-Year Plan" was promoted and the implementation of key projects was coordinated. The construction of investigation, monitoring and evaluation business system was strengthened, and the construction of technical standard system intensified. The application demonstration of green exploration equipment was enhanced and the green exploration standard system got improved. The supervision and management of green mine construction was strengthened, the dynamic management of green mine directory was enhanced, the dynamic management mechanism of "entry and exit" was improved, and the standards of green mine construction were perfected.

# I. Ecological Restoration of Mines

## 1. Improve the supervision and management mechanism of ecological restoration of mines

The supervision and management of ecological restoration of production mines was strengthened. The *Notice of the General Office of the Ministry of Natural Resources on Carrying out the "Random Selection and Public Release" Supervision and Inspection of Geological Environment Protection and Land Reclamation of Mines in 2023* was issued, and supervision and inspection across the country were uniformly deployed to urge mining enterprises to strictly fulfill their land reclamation and ecological restoration obligations. The linkage mechanism between the reclamation and restoration of existing mining land and new mining land was implemented, and the *Notice of the General Office of the Ministry of Natural Resources on Regulating the Acceptance of Reclamation and Restoration of Existing Mining Land* was issued to clarify the two types of existing mining land and their specific requirements and operation paths such as project implementation and acceptance procedures. The review of the "two-in-one" plan (referring to the geological environment protection and land reclamation plan of mines) continued to be optimized, and the review of the plan of potash and other guaranteed supply mining projects was promptly handled. A total of 24 batches of 173 "two-in-one" plans were reviewed and announced throughout the year.

## 2. Promote the ecological restoration of abandoned mines left over from history during the "14th Five-Year Plan" under the guidance of demonstration projects

The management of deployed and implemented projects was strengthened, the annual performance self-evaluation of the first batch of 11 demonstration projects during the "14th Five-Year Plan" was organized and carried out, and the completion of the construction of the information management system for the ecological restoration demonstration project of historical abandoned mines was promoted. The competitive selection of the second batch of

demonstration projects was completed, and 18 projects located in critical river basin areas such as the Yangtze River, the Yellow River, the northern sand control belt, and the "Three North" project area were included into the scope of support. A demand analysis of the central government's transfer payments to local governments for the ecological restoration of abandoned mines left over from history from 2024 to 2026 was conducted, and central financial support continued to increase. In 2023, the central government allocated a total of RMB 3 billion in key ecological protection, restoration and management funds to support local governments in carrying out demonstration projects for ecological restoration of abandoned mines left over from history. A mid-term assessment of the implementation of ecological restoration action plan for abandoned mines left over from history during the "14th Five-Year Plan" was carried out, and all localities were urged to take effective measures to fully achieve the expected goals.

Key projects were implemented in a coordinated way. Project implementation mechanism was improved and the *Notice of the General Office of the Ministry of Natural Resources on Strengthening the Standardized Implementation, Supervision and Management of Land and Space Ecological Restoration Projects* was issued to put forward normative requirements for key links such as preliminary work, implementation management, compliance with laws and regulations, and implementation guarantee of projects.

### 3. Strengthen the construction of investigation, monitoring and evaluation system for ecological restoration of mines

The annual image patches change verification mechanism of historical mines was established and improved, the annual image patches change of historical abandoned mines across the country was organized and completed, and dynamic management of inventory ledgers was realized. Nine provinces and regions along the Yellow River were guided to promote the investigation and evaluation of ecological damage and pollution status of historical mines, a geographic information database of ecological damage image patches of mines in the Yellow River Basin was established to provide a basis for scientifically organizing and implementing

ecological restoration of historical mines and mine environmental pollution control in the Yellow River Basin. Monitoring and evaluation of ecological restoration effectiveness in typical historical mine ecological restoration areas (sites) in the Yellow River Basin was implemented, and evaluation indicators for ecological restoration effectiveness of mines were initially established. A nationwide survey of land damaged by mining was planned to carry out to provide basic support for scientifically selecting natural restoration and artificial restoration measures, effectively revitalizing abandoned mining land, and promoting the comprehensive utilization of resources such as coal gangue and tailings.

## 4. Increase the construction of ecological restoration technical standard system of mines

The formulation of four national standards for ecological restoration of active mines was organized, including the *Technical Specifications for Coal Mine Land Reclamation and Ecological Restoration* to guide mining enterprises to practice the concept of "protection first and green development" and implement the requirements of "restoration while mining"; the formulation of two industry standards for mine ecological restoration projects was organized, including the *Guidelines for the Preparation of Implementation Plans for Mine Ecological Restoration Projects* to standardize the implementation and acceptance of mine ecological restoration projects.

## 5. Publish typical cases of ecological restoration of mines

The collection and selection of mine ecological restoration cases was organized, and 11 typical cases were included in the *Collection of Typical Cases of Land and Space Ecological Restoration* and released to the public at the First Forum on Natural Resources and Ecological Civilization. The typical case summarized the typical technical models and scientific measures explored and formed in the field of mine ecological restoration, as well as the experiences and practices of various regions in overall management, institutional mechanisms, and fund raising.

## Feature 5-1 Fragrance of Wine in Abandoned Sand Mining Pit

Helan Mountain is an important physical geographical boundary in China and an important ecological security barrier in northwest China. Zhenbeibao mining area is located in the alluvial fan margin area at the eastern foot of Helan Mountain. The earth and rock in the mining area are exposed in a large area, and the ecological problems are prominent. In June 2020, General Secretary Xi Jinping pointed out during his inspection of Helan Mountain: "We must resolutely protect the ecology of Helan Mountain."

Learning from nature and solutions tailored to local conditions. Ningxia banned and integrated the "small scattered" mining sites in Zhenbeibao mining area, made full use of the old quarries and remaining mining pits in the area to carry out ecological restoration, designed on the basis of the original topography, implemented a series of comprehensive improvement projects, developed the grape cultural tourism industry, and achieved the effect of integrating nature and artificiality.

Governance path of perseverance and continuous relay. Ningxia continues to carry out management and ecological restoration of abandoned mining areas, strengthen infrastructure construction such as roads, water supply and drainage, and land reclamation, integrate the spatial pattern of industrial, ecological and tourism development, improve the ecological environment, deepen industrial integration, and guide enterprises to "dig gold" in abandoned mines.

Organic integration of traditional culture and regional characteristics. On the basis of the strategies of ecological restoration and cultural remodeling in the mining area, a number of garden wineries, ecological wineries and cultural wineries with typical oriental style have been built by using the original natural environment and historical and cultural resources.

The ecological restoration of the abandoned mine in Zhenbeibao of Helan Mountain not only protects the huge ecological value contained in Helan Mountain, but also realizes the green transformation of industry and high-quality economic development, which truly unifies environmental protection and economic development with meeting the people's growing needs for a better life, and is a vivid practice of the concept of "two mountains".

## II. Green Exploration

### 1. Strengthen the application demonstration of green exploration equipment

In the implementation of a new round of prospecting breakthrough strategic actions, the application demonstration of green exploration equipment was strengthened. Focusing on the green exploration needs of desert Gobi, grassland wetlands, forest coverage areas, and intertidal tidal flats, work areas were selected in the East Tianshan Mountains-Beishan Mountains, the western foot of the Greater Khingan Mountains, the northwest section of the Changbai Mountains, and the eastern part of Hainan Island, and mature self-developed technology and equipment were promoted, realizing in-depth application of domestic exploration equipment, and building demonstration projects of green exploration technology and equipment in typical scenarios.

### 2. Improve the green exploration standard system

All localities were encouraged to issue local standards for green exploration according to local conditions. According to different scenarios such as grasslands, forests, wetlands, and Gobi deserts, relevant requirements have been refined and the green exploration standard system is continuously improved.

## III. Construction of Green Mines

In April 2024, the Ministry of Natural Resources and relevant departments issued the *Notice on Further Strengthening the Construction of Green Mines*. The document shall be implemented from the date of issuance and shall be valid for five years. The document positions the construction of green mines as a comprehensive promotion; strictly manages third-party assessment, clarifies that the third-party assessment funds of green mines are guaranteed by the government finance, and it is strictly prohibited to charge mining companies; implements dynamic management of green mine list, and those that meet the standard conditions will be

included in the provincial or national green mine list, and there will no longer be a municipal or county-level green mine list; revises and improves the evaluation indicators, from 100 items with 1,000 points to 49 items with 100 points, highlighting key indicators; further strengthens supervision and assessment, and selects no less than 10% of existing green mines to carry out on-site inspection every year in accordance with the requirements of "Random Selection and Public Release"; encourages mining enterprises to adopt advanced and applicable technologies and strengthen the upgrading and transformation of green and low-carbon technologies and equipment.

## 1. Comprehensively promote the construction of green mines

The construction of green mines changed from demonstration leadership to comprehensive promotion. The construction of green mines was promoted in all new, renovated and expanded mines, and active mines in a classified and orderly manner, the application of green and low-carbon advanced applicable technologies was accelerated, and policy support was increased. By the end of 2028, 90% of large-scale mines and 80% of medium-scale mines with licenses in production will meet the requirements of green mine standards.

As of the end of 2023, a total of 1,074 national-level green mines had been built.

## 2. Strengthen the supervision and management of construction of green mines

The dynamic management of green mine list was strengthened, the dynamic management mechanism of "entry and exit" was improved, mining enterprises meeting the standard requirements were included into the green mine list, and those that did not meet the standard requirements were removed in a timely manner according to procedures. The management of third-party evaluation was standardized, clear requirements were put forward for the nature and composition of third-party evaluation institutions, supervision and management measures were refined, and a "blacklist" and accountability mechanism was established to ensure the fairness and justice of evaluation results. The supervision and assessment was

strengthened, and site inspection of existing green mines was carried out according to a certain proportion every year in accordance with the requirements of "Random Selection and Public Release". The construction of green mines was incorporated into the government performance appraisal system and the off-office auditing evaluation index system of natural resources assets of leading cadres. The communication and coordination mechanism between departments was improved, the daily supervision of green mines was strengthened, and cooperation was conducted closely according to the division of responsibilities to jointly promote the construction of green mines.

### 3. Improve construction standards of green mines

Industry standards were studied for open-pit mining mines and geothermal mineral water green mine construction, the revision of nine industry standards for green mine construction such as non-ferrous metals and coal was initiated, and the approval of the national standard *General Principles for Green Mine Evaluation* was actively promoted. All localities were encouraged to formulate and revise local standards, such as *Shanxi Province's Specifications for the Construction of Green Mines-Metallic Ores* (DB14/T 2977-2024) and *Jiangxi Province's Standards for the Construction of Green Mines-Part 3: Gold Industry* (DB36/T 1275.3-2020) by comprehensively considering factors such as region, mineral type, scale, and mining method. Qualified mining groups and enterprises can actively develop enterprise standards and apply them in practice.

### 4. Improve national evaluation indicators for the construction of green mines

The national evaluation indicators for the construction of green mines were improved, resource utilization, ecological restoration, green and low-carbon, scientific and technological innovation, and mine land harmony were highlighted, and the applicability and operability of the indicators were improved. The evaluation indicators were set into two categories: obligatory indicators and promotion indicators, including 20 obligatory indicators, which are the bottom line requirements, and 29 promotion indicators, which reflect differences and play an encouraging and guiding role.

# Chapter VI
# Policies and Regulations on Mineral Resources

The revision of the *Mineral Resources Law of the People's Republic of China* (hereinafter referred to as the *Mineral Resources Law*) continued to be promoted. The 10th Session of 14th National People's Congress(NPC) Standing Committee conducted the second review of the *Mineral Resources Law (Revised Draft)*. The mining activities of marine mineral resources were further standardized, rare earth management was enhanced, the construction of green mines was strengthened, and a survey and evaluation system for the exploitation and utilization level of mineral resources was initially established.

## I. Laws and Regulations

Since 2023, the Ministry of Natural Resources has cooperated with the Ministry of Justice and the Legislative Affairs Commission of the National People's Congress to carry out work

such as soliciting opinions, field research, and expert discussions to further revise and improve the *Mineral Resources Law (Revised Draft)*. In December 2023, the 7th Session of 14th NPC Standing Committee conducted the first review of the revised draft. In June 2024, the 10th Session of 14th NPC Standing Committee conducted the second review of the revised draft. The second review draft of the revised draft added provisions to promote the green development of mining industry, improved the planning and preparation of mineral resources, improved the relevant provisions of mining rights, standardized exploration and mining activities, and strengthened the ecological restoration of mining areas. At present, the Ministry of Natural Resources is promoting the formulation of supporting regulations for the *Mineral Resources Law* to ensure the integrity and coordination of the legal system.

In October 2023, the Standing Committee of the NPC revised and promulgated the *Marine Environmental Protection Law*, which will take effect on January 1, 2024. This law will guide marine exploitation activities to adapt to the carrying capacity of resources and environment, further standardize the exploitation activities of marine mineral resources, and explicitly prohibit the exploitation of sea sand within the strictly protected shoreline; when drilling wells from the shore to exploit seabed mineral resources, effective measures should be taken to prevent polluting the marine environment; when exploring and developing marine oil and gas resources, an emergency plan for oil and gas pollution should be prepared in accordance with relevant regulations and reported to the sea area agency of the competent ecological environment department of the State Council for filing.

In April 2024, the State Council promulgated the *Regulation on Rare Earth Administration*, which will come into effect on October 1, 2024. The regulations stipulate that rare earth resources belong to the state, and no organization or individual may encroach on or destroy rare earth resources; the state implements unified planning for the exploitation of rare earth

industry; no organization or individual may purchase, process, sell or export illegally mined or illegally smelted and separated rare earth products; the R&D and application of new technologies, new processes, new products, new materials and new equipment in the rare earth industry are encouraged and supported.

## II. Rules

In May 2024, the *Measures for the Management of Exploration and Mining Information of Mining Right Holders* was issued by the MNR, which will come into effect on July 1, 2024. The measures streamline and standardize the scope of filling and publicizing the exploration and mining information of mining right holders, implement the relevant requirements that the identification of dishonesty must be based on legally binding documents, strictly standardize the identification standards and procedures of seriously untrustworthy subjects, adjust and improve the abnormal list system, establish a rectification mechanism, and strictly manage measures. While streamlining the information filling content of mining right holders, the measures further standardize the post-event supervision of mining right holders' exploration and mining activities, promote the integrity and self-discipline of mining right holders, and create a market environment for fair competition.

## III. Taxes

The *Announcement on Relevant Tax and Fee Policies to Further Support the Development of Small and Micro Enterprises and Individual Industrial and Commercial Households* by the

Ministry of Finance and the State Taxation Administration clarifies that from January 1, 2023 to December 31, 2027 resource tax (excluding water resource tax) will be halved for small-scale VAT taxpayers, small low-profit enterprises and individual industrial and commercial households.

The *Announcement on Continuing the Preferential Policy of Resource Tax Reduction for Coal Replaced by Backfill Mining by the Ministry of Finance and the State Taxation Administration* clarifies that in order to encourage intensive mining and utilization of coal resources, from September 1, 2023 to December 31, 2027, the tax on coal resources replaced by backfill mining will be reduced by 50%.

The *Announcement on Continuing to Implement Preferential Policies for Reducing Resource Tax on Shale Gas by the Ministry of Finance and the State Taxation Administration* clarifies that in order to promote the exploitation and utilization of shale gas and effectively increase the supply of natural gas, the resource tax on shale gas (at the prescribed tax rate of 6%) will continue to be reduced by 30% before December 31, 2027.

In 2023, the total national resource tax revenue reached RMB 307 billion, a decrease of 9.4% from the previous year, accounting for 1.69% of the national tax revenue.

In 2023, the income from the transfer of mining rights was RMB 222.26 billion, and the income from exploration rights and mining rights reached RMB 1.24 billion.

# Chapter VII
# Mineral Resources Management

The mid-term evaluation of the implementation of national mineral resources planning during the "14th Five-Year Plan" period was completed; the supervision and management of geological exploration operation of geological exploration were strengthened; statistics, review and filing of mineral reserves were promoted; the reform of mining rights management was enhanced, the disclosure of exploration and mining information of mining rights holders, "Random Selection and Public Release" spot check and credit management continued to be promoted, the establishment of a joint force for the supervision of paleontological fossils was actively explored, and the assessment of concentrated producing areas of national key protected paleontological fossils was completed.

## I. Mineral Resources Planning and Management

The mid-term evaluation of the implementation of the national mineral resources planning during the "14th Five-Year Plan" period was completed. The evaluation showed that

the implementation of the planning was progressed smoothly, with nearly 80% of the indicators meeting or exceeding expectations, basically achieving "half of the tasks by half of the time". By innovating the evaluation method, the mid-term evaluation of the implementation of the provincial mineral resources master planning was promoted by project, deploying simultaneously and fully completing the mid-term evaluation of the provincial planning.

The *Notice of the Ministry of Natural Resources on Improving Matters Related to the Implementation and Management of Mineral Resources Planning* was issued to further implement planning implementation responsibilities, require annual planning implementation monitoring and analysis, strengthen planning implementation evaluation, improve planning dynamic adjustment mechanism, streamline and optimize planning review matters, vigorously support strategic mineral exploration and mining in energy resource bases and nationally planned mining areas, give full play to the spatial guidance role of exploration and mining planning blocks, encourage the orderly release of sand, gravel and clay mining rights in centralized mining areas, strengthen planning database construction and management system application, and improve informatization service level.

The industry standard of *Technical Regulations for the Preparation of Provincial Mineral Resources Master Planning* was issued and implemented to strengthen the guidance on the preparation of provincial mineral resources master planning, and improve the scientificity, rationality and operability of the planning.

## II. Geological Exploration Management

### 1. Basic situation of geological exploration sector

As of the end of 2023, there have been 415,300 employees in non-oil-gas geological exploration units across the country, a decrease of 3.7% from the previous year, including 168,700 geological exploration personnel, 83,700 engineering investigation and construction personnel, 12,200 mineral development personnel, and 150,700 other personnel.

The total revenue was RMB 394.94 billion, an increase of 0.1% over the previous year, of

which the centrally managed geological exploration units achieved a total revenue of RMB 35.08 billion, a year-on-year decrease of 12.0%; localized management geological exploration units achieved a total revenue of RMB 159.80 billion, a year-on-year increase of 1.8%; other geological exploration units achieved a total revenue of RMB 200.06 billion, a year-on-year increase of 1.3%.

## 2. Supervision and management of geological exploration activities

The *Notice of the General Office of the Ministry of Natural Resources on Carrying out the "Random Selection and Public Release" Supervision and Inspection of Geological Exploration and Geological Disaster Prevention and Control Activities in 2023* was issued, clarifying the overall requirements, inspection content, working methods and work requirements, increasing the proportion of spot inspections in some provinces, strengthening problem rectification, as well as carrying out rectification and "looking back" on the problems discovered in inspections since 2020 to ensure that inspections focus on key points and achieve practical results.

The *Notice of the General Office of the Ministry of Natural Resources on Building and Making Good Use of the National Geological Exploration Sector Supervision Service Platform* was issued, smoothing the channels for owner evaluation and social evaluation of geological exploration projects, accurately and comprehensively recording the credit behavior of subjects, timely collecting and applying shared credit information, and taking the integrity record of geological exploration units as an important factor in financial investment project arrangement and honorary award recommendation and selection, and creating an honest and trustworthy market atmosphere in the sector by continuously improving the credit evaluation indicator system.

## 3. Safety operation of geological exploration

The *Emergency Notice of the General Office of the Ministry of Natural Resources on Further Improving Safety Production in the Geological Exploration and Surveying & Mapping Industries in 2023* was issued, requiring strengthening policy guidance and supervision in combination with the work characteristics of the geological exploration and surveying &

mapping industries, focusing on key links such as field safety risk prevention, arranging them item by item, and establishing and improving the list of hidden problems and corrective measures.

The *Notice on Doing a Good Job in Safety Operation Management in the Geological Exploration and Surveying & Mapping Industries at the End of the Year and the Beginning of the Year* was issued, requiring all localities to continuously strengthen system construction, focus on key links, do practical and detailed territorial supervision, and urge the implementation of main responsibilities to do a solid job in rectifying problems.

The *Guidelines for Key Inspection Matters for Safety Operation in the Geological Exploration and Surveying & Mapping Industries (Trial)* was issued to conduct detailed investigation of potential safety risks in the industry from the operational level and promote the rectification of problems.

## III. Mineral Reserves Management

### 1. Statistics of mineral reserves

Through a number of measures such as careful deployment of annual work, continuous strengthening of quality control, and highlighting key points of data review, the 2023 statistical data summary of national mineral reserves was completed.

The normalized quality monitoring of reserve statistics continued to advance according to the frequency of "once every three years". The first round of national mineral reserve statistics and statistical quality monitoring of all minerals were completed in an all-round way. Provinces (autonomous regions and municipalities) were notified on issues related to the implementation of reserve statistics system and quality control requirement, and were supervised to implement rectifications.

The new resources of fiscally funded exploration projects were summarized and counted to serve another round of strategic actions to seek breakthroughs in prospecting.

## 2. Approval of important minerals overlaid by construction projects

The *Notice of Seven Departments including the Ministry of Natural Resources on Strengthening the Preliminary Work of Land Use Approval and Actively Promoting the Construction of Infrastructure Projects* was implemented to participate in the site selection and route selection of construction projects, and guide feasibility compilation units not or less to overlay important mineral resources when formulating alternative plans.

Survey and evaluation research were carried out on overlaid mineral resources in construction projects, and provinces (autonomous regions and municipalities) were urged to implement the *Notice of the General Office of the Ministry of Natural Resources on Providing Examination and Approval Services for Overlaid Important Mineral Resources in Construction Projects* related to the survey and evaluation requirements of overlaid important minerals in specific areas.

## 3. Review of mineral reserves

The *Letter of the General Office of the Ministry of Natural Resources on Clarifying the Minimum Industrial Index of China's High-grade Iron Ore* was issued, clarifying that the minimum industrial index of China's high-grade iron ore is 45% of total iron grade (TFe).

The *Notice of the General Office of the Ministry of Natural Resources on Issuing the Measures for the Management of Mineral Reserve Review Expert Database* was issued, selecting and establishing the Mineral Reserve Review Expert Database of the Ministry of Natural Resources, announcing that 635 review experts in more than 20 professional fields of oil and gas minerals, solid minerals, and geothermal mineral water geology, mining, dressing and smelting, and economics were put into the database.

The supervision and guidance of review was strengthened. In 2023, the MNR completed the supervision and guidance of review in five provinces (autonomous regions and municipalities), completed the supervision and guidance of 23 provinces (autonomous regions and municipalities) in total, and carried out evaluations. All provinces (autonomous regions and municipalities) completed 203 times of supervision and guidance.

About 30 national mineral reserve review business exchanges and expert trainings, and national oil and gas mineral reserve review and filing business trainings were carried out, covering about 30,000 people nationwide.

### 4. Re-evaluation of symbiotic or associated minerals and low-grade resources

The *Notice of the General Office of the Ministry of Natural Resources on Issuing the Work Plan for the Re-evaluation of Symbiotic or Associated Minerals and Low-grade Resources of Some Strategic Minerals in Another Round of Strategic Actions to Seek Breakthroughs in Prospecting and Re-evaluation Indicators* and *Use Requirements for Symbiotic or Associated and Low-grade Resources in Large and Medium-sized Mining Areas of Some Strategic Minerals* were issued, deploying the re-evaluation of mines in production and large and medium-sized mining areas across the country. The country needs to prepare re-evaluation reports for 704 mines in production and 1,144 large and medium-sized mining areas. As of the end of June 2024, the preparation of re-evaluation reports for 283 mines in production had been completed.

## IV. Mining Rights Management

### 1. Setting of mining rights

As of the end of 2023, there have been 12,173 registered exploration rights nationwide, representing an increase of 10.6% over the previous year, and the registered area had been 2.63 million square kilometers, showing an increase of 10.6%. There were 30,514 registered mining rights nationwide, a decrease of 1.3%, and the registered area was 332,000 square kilometers, an increase of 14.8%.

### 2. Transfer of mining rights

As of the end of 2023, 459 exploration rights have been transferred nationwide, an increase of 26.8% over the previous year. The total transfer area reached approximately 30,000 square kilometers, an increase of 111.5%.

### 3. Management policy of mining rights

In order to further lower the threshold for obtaining mining rights and activate the transfer market of mining rights, together with the Ministry of Finance, the MNR issued the *Guiding Opinions on Formulating the Starting Price Standard for Income from the Transfer of Mining Rights*. The starting price standard of the income from the transfer of mining rights of non-oil-gas minerals is mainly determined based on the area of mining rights while comprehensively considering factors such as metallogenic conditions and exploration degree; the starting price standard for the income from the transfer of mining rights of oil and gas minerals is mainly based on the average monthly settlement price of crude oil futures, which is determined by land and sea areas respectively.

In order to implement the relevant requirements for the reform of mining rights management, the *Notice of the General Office of the Ministry of Natural Resources on Issuing Guidelines for the Preparation of Mineral Resources (Non-Oil-Gas) Development and Utilization Plans* was issued to further optimize the preparation content of mineral resources development and utilization plans and improve the efficiency of plan preparation and review, speed up the registration procedures of mining rights, and promote the rational utilization and green development of mineral resources.

## V. Credit Management for Mining Right Holders

The credit supervision role of mining right holders was given full play to continue to promote the disclosure of exploration and mining information of mining right holders. In 2023, 47,313 cases of mining rights should be publicized nationwide, and 47,270 cases were actually publicized, with a publicity rate of 99.91%, an increase of 0.51 percentage point over the previous year. Among them, 11,958 exploration rights should be publicized, and 11,954 cases were actually publicized, with a publicity rate of 99.97%; 35,355 mining rights should be publicized, and 35,316 cases were actually publicized, with a publicity rate of 99.89%.

"Random Selection and Public Release" spot check and inspection were earnestly organized and carried out. A total of 6,745 mining rights were spot checked and verified throughout the year, with a verification rate of 14.26%, of which 1,087 exploration rights were verified; 5,658 mining rights were verified. The credit management of mining right holders was strictly implemented. In 2023, a total of 455 mining right holders were included in the abnormal list, involving 463 mining rights. Relevant information was disclosed to the public and was subject to social supervision.

## VI. Conservation and Management of Paleontological Fossils

A joint force for the supervision of paleontological fossils was actively explored to promote the coordination between ministries and provinces and inter-provincial joint supervision. The six provinces of Gansu, Shaanxi, Ningxia, Inner Mongolia, Shanxi and Qinghai took the lead in piloting, established an inter-provincial joint working mechanism, and signed the *Memorandum of Cooperation on Strengthening the Protection and Management of Paleontological Fossils*. The composition of relevant personnel of ministerial-level paleontological fossil expert committees was adjusted, and the establishment and improvement of provincial-level paleontological fossil expert committees was promoted. The assessment of concentrated originating areas of national key protected paleontological fossils was completed. The relevant work of the national inter-ministerial joint meeting on comprehensive management of combating smuggling and the inter-ministerial joint meeting on cultural relics safety was carried out. Administrative approvals were strictly standardized. In 2023, a total of six approvals for the excavation of key protected paleontological fossils and two entry and exit approvals were completed. 71 times of fossil identification were completed. Suspected Chinese paleontological fossils intercepted overseas were identified, provided legal evidence and recoursed to promote the early return of Chinese fossils lost overseas.

# Chapter VIII
# Geological Data Management and Services

In 2023, focusing closely on new round of strategic actions to seek breakthroughs in prospecting and the needs of economic and social development, natural resources authorities at all levels and geological data collection institutions actively promoted the management of geological data, further enriched the collection resources, solidly advanced the informatization construction, and continuously improved the level of geological data integration research and sharing services.

## I. Geological Data Management

The geological data management system got continuously improved. The *Working Rules for the Entrusted Custody of Original and Physical Geological Data such as Oil and Gas* was

issued to further standardize the entrusted custody of original and physical geological data such as oil, natural gas, coalbed methane, shale gas, and marine geology.

In 2023, a total of 10,165 geological data remittance vouchers and 1,175 geological data remittance notices within a time limit were issued nationwide. The remittance rate of geological work projects (mining rights) nationwide reached 94.93%, with an increase of 1 percentage point from 2022.

## II. Geological Data Collection

### 1. Achievements and original geological data

As of the end of 2023, the total amount of geological data collected by geological data collection institutions at the ministerial and provincial levels had reached 989.30 thousand files and 19.86 million pieces, and the total amount of original geological data had amounted to 62.20 thousand files and 3.51 million pieces. Meanwhile, the entrusted units kept a total of 3.53 million files and 10.71 million pieces of original geological data.

### 2. Physical geological data

As of the end of 2023, geological data collection institutions at the ministerial and provincial levels had preserved a total of 3.52 million meters of cores, 371.40 thousand bags of cuttings, 133.80 thousand specimens, 378.50 thousand light slices, and 10.81 million bags/bottles of samples. The entrusted units had preserved a total of 1.65 million meters of cores and 42.51 million bags of cuttings.

## III. Geological Data Services

The integrated research, sharing and utilization of geological data were deepened to

continuously improve the level of social services. Various collection institutions have actively provided massive and diversified information for new round of strategic actions to seek breakthroughs in prospecting , major engineering construction projects, emergency disaster relief and urban construction.

The online order services of geological data were comprehensively promoted. A geological data network order service platform was established, and 460 thousand geological data catalogues (14.63 million pieces) were published online, providing the public with online search, "one-stop" ordering, and cross-regional geological data network order services that can be seen throughout the process. "One-stop online government services", full-process supervision, and "one-time handling" services of national geological data utilization were realized.

The collection institutions at the ministerial and provincial levels received 111.70 thousand visits with a year-on-year decrease of 9.25%, providing 132 thousand achievement data utilization services (7.72 million pieces) and 18.90 thousand (728.70 thousand pieces) original geological data utilization services.

The national digital core platform continued to be upgraded, providing 133.70 thousand meters of physical geological data core utilization services. The entrusted units received 41.20 thousand visits with a year-on-year increase of 70.74%, providing 71.70 thousand original geological data utilization services, and 333.80 thousand meters of physical geological data core utilization services.

As of the end of 2023, the number of registered users of "Geological Cloud" had exceeded 141 thousand, with annual visits of approximately 4.23 million, annual data product views of 726.95 thousand, annual data product downloads of 138.86 thousand, and annual interface data service visits of 6.32 million.

# Chapter IX
# Scientific and Technological Innovations in Mineral Resources

In 2023, the scientific and technological achievements in the field of mineral resources were remarkable, and a number of important results were produced; 10 national standards and 59 industry standards in the field of mineral resources were issued and implemented.

## I. Technological Milestones in Field of Mineral Resources

The implementation of national key research and development plans and other national science and technology plan projects was actively promoted, and new breakthroughs were made in the basic geological theory, regional metallogenic and prospecting theory and the research and development of key technical equipment.

### 1. Major improvements

New minerals in nature, such as yuchuanite-(Y), wenlanzhangite-(Y), niobobaofite-(N), bayanoboite-(Y) and nipeiite-(Ce) were discovered and named.

A new model of uplift growth of Qinghai-Tibet Plateau and deformation of basin-range around Qinghai-Tibet was put forward, and a new mechanism of continental lithosphere evolution driven by mantle plume and craton Phanerozoic reconstruction was revealed.

Continental-scale zircon Hf isotope mapping of magmatic rocks in South China was carried out for the first time, which redefined the boundary of metallogenic belts and the spatial attribution of mineral deposits, and revealed the crustal spatial structure of the juxtaposition of new, ancient and reconstructed crusts in South China.

Carbonate rocks with high carbon isotope anomalies were discovered for the first time, and the rare earth occurrence facies and Ce anomalies in clay particles of deep-sea rich rare earth sediments were re-understood.

A new model of multi-source restriction nodule crust mineralization was proposed, which revealed that low deposition rate and bottom water oxidation create conditions for metal mineralization, while Asian wind dust deposition and diatom explosion restrict metal enrichment.

The “inherited” potassium formation theory of brine potassium salt in Qaidam Basin and the new continental “glutenite” potassium formation model were innovatively improved.

The theory of natural gas hydrate system reservoir formation and “three-phase control” exploitation was improved, and seven key technologies for trial production were tackled and test verification achieved expected results.

The important contribution of metal-driven anaerobic oxidation of methane in deep-sea cold spring sediments to methane carbon sink was quantitatively evaluated, revealing the coupling mechanism of microbial-mediated anaerobic oxidation of methane and metal reduction.

A prospecting target area prediction model of “quantitative data + machine learning + expert experience” was proposed, which realized rapid prediction and full coverage of potential mineral deposits and prospecting potential areas in the Duolong ore concentration area of the Bangong Lake-Nujiang River metallogenic belt.

A fast and reliable separation method was developed to separate barium (Ba) and rare earth elements (REEs), which achieved the accurate analysis of rare earth element content in barite reference materials for the first time.

A series of horizontal directional drilling rig equipment at different depths were successfully developed.

## 2. Major achievements

A "multi-source and multi-stage" metallogenic model and a "multi-factor superposition" prospecting model were constructed, and a "six-in-one multi-factor coupling" plate-shaped uranium metallogenic theory was formed; new technical methods such as quantitative core hyperspectral information interpretation and shallow three-dimensional seismic with controllable source were developed, and the effective identification of deep ore-controlling elements and weak mineralization information was realized; a comprehensive prediction and evaluation technology system for sandstone-type uranium deposits in large rift basins was integrated and constructed, realizing the quantitative prediction of uranium potential in the whole Songliao Basin.

The metallogenic theory of "multi-cycle, deep-cycle and endogenous-exogenous integration" was improved, and the metallogenic rules of pegmatite-type lithium deposits was further revealed. Five key ore-concentrated areas were identified in Shaligou and Tamuqie in Xinjiang, Shinaihai in Qinghai, Jiada in Sichuan, and Luozha in Tibet, and a number of new ore bodies were discovered through drilling verification.

The "cascade mechanical impurity removal-directional flotation enrichment" technology of clay-type lithium resources was innovatively developed to achieve tailless utilization of aluminous rock-type lithium resources. "Low energy consumption precise activation-targeted high separation" and "pre-adjustment-sustained release-endpoint micro-area control" technologies were pioneered, with the lithium leaching rate greater than 90%.

A full-chain research on the efficient Ni-Co-Se extraction, short-range utilization, tailings resource utilization, and co-extraction of associated scandium from laterite nickel ore has been

carried out. The influence law of phase evolution during the pressure leaching process has been ascertained. A mathematical model of two-phase flow and transfer in an ultra-large high-pressure acid leaching autoclave has been established. The design of key components has been completed. A complete set of ultra-large laterite nickel ore multi-compartment continuous reaction autoclaves with high temperature resistance, high pressure resistance and abrasion resistance has been developed.

A new technology of "magnetic gravity synergistic enrichment-flotation enhanced separation" of niobium and rare earth elements adapted to the characteristics of resource endowment was proposed, breaking through the efficient enrichment and precise separation technology of fine-grained niobium and rare earth below 20 microns.

The occurrence state of gallium in coal, the source and time limit of ore-forming materials, the mineralization factors and time limit of gallium were found out, providing important isotope geochemical evidence for the mineralization of gallium deposits in coal.

The first magmatic rock database and research platform was created in China, global magmatic rock map, Asian magmatic rock map, deep-time magmatic rock map were compiled and published, the trinity research paradigm of "data + mapping + research" was innovated, the spatiotemporal evolution framework of Asian granite was constructed, as well as the three-way and five-stage aggregation model of Asian continent and the new concept of orogenic belt classification and material orogenic belt were put forward, enriching the theory of crustal growth.

A multi-magnetic sensor UAV aeromagnetic exploration system and a UAV ground-air transient electromagnetic system with completely independent intellectual property rights were innovatively developed, providing new technology and method for large-scale rapid and fine exploration of key survey areas, exploration areas and deep mines.

## II. Technical Standards in the Field of Mineral Resources

In 2023, 10 national standards and 59 industry standards in the field of geology and mineral resources were released and implemented.

In order to strengthen the quality management of geological exploration and strengthen the protection and utilization of mineral resources, 6 industry standards, including the *Code for Quality Management of Geological Exploration Organization*, *Technical Regulations for the Preparation of Master Planning of Provincial Mineral Resources*, and *Specification for Geological Survey of Mineral Resources (1 : 50000)* were issued and implemented.

In order to better adapt to the needs of ecological civilization construction, tap the karst cave landscape and karst carbon sink potential, accurately understand karst speleology and karst carbon sink technical knowledge, and effectively guide the development of artificial intervention in karst sink enhancement technology, two national standards, including the *Essential Terminology of Karst Speleology*, and *Technical Requirements for Karst Critical Zone Monitoring*, were issued and implemented.

In order to improve the quality of geological environment survey, monitoring and evaluation, geological disaster prevention and control survey, monitoring, and early warning, a national standard Specification for *Hazard Assessment of Groundwater Aquifer Damage in Mine Areas* and 14 industry standards, such as *Specification for Environmental Geological Survey (1 : 50000)*, *Technical Requirements for Land Quality Assessment in Mining Area*, *Code for Fine Investigation of Landslide, Collapse and Debris Flow Disasters* were issued and implemented.

In order to further meet the needs of geological survey work and realize the standardization of terminology in the fields of geological drilling, geochemical exploration, and hydrogeological work, three national standards including *Terms of Geochemical Exploration*, and *Terms of Drilling Engineering* and *Terms of Hydrogeology* were issued and implemented.

In order to meet the analysis and testing needs of a new round of prospecting breakthrough strategic actions and various resource evaluations, based on the development of modern large-scale analytical instrument testing technology, three national standards, such as *Soil and Stream Sediment- Determination of Iodine Content-Pressurized Ammonia Extraction Inductively Coupled Plasma Mass Spectrometry*, *Methods for Chemical Phase Analysis of Antimony Ore-Determination of Antimony Content in Valentitnite , Stibnite and Antimonate* and *Methods for Chemical Phase Analysis of Copper Nickel Sulfide Ore-Determination of Nickel and*

*Cobalt Contents in Six Mineral Phases*, as well as 15 industry standards, such as *Methods for Chemical Analysis of Rare Earth Ores* and *Methods for Chemical Analysis of Ilmenite* were issued and implemented.

In order to meet the needs of mineral resource exploration, technical requirements for dynamic management of reserves, dressing and smelting tests, economical and intensive utilization, and paleontological fossil protection, a national standard of *Specification for Comprehensive Exploration and Evaluation of Mineral Resources* and 24 industry standards including *Specifications for Periodical on-state Investigation of Mineral Resources*, *"Three Rates" Standard Requirements of Mineral Resources*, and *Code of Practice for Excavation, Preparation, Reconstruction and Mounting of Vertebrate Fossils* were issued and implemented.

## III. Scientific and Technological Innovation Platforms in the Field of Mineral Resources

In terms of national scientific and technological innovation platforms, the construction and operation of science and technology innovation platforms in the field of mineral resources were actively promoted, and cooperation was provided to the Ministry of Science and Technology to formulate guidelines for the layout direction of national key laboratories in the field of geoscience, and condensed eight directions: key mineral metallogenic theory, deep exploration and imaging, deep mineral resources exploration, underground clean resource exploration, deep mineral resources exploitation, mine safety and disaster prevention, mineral processing science and technology, green extraction and high-value utilization of key minerals. The National Key Laboratory of Multi-resource Collaborative Continental Shale Oil Green Exploitation, which was constructed by the Oil and Gas Resources Survey Center of China Geological Survey, was approved by the Ministry of Science and Technology in March 2023.

In terms of ministerial-level science and technology platforms, 10 field scientific observation and research stations were newly approved, including Tianjin medium and low temperature

geothermal energy, Qinghai Muli natural gas hydrate and permafrost environment, and South Yellow Sea earth multi-sphere layers, covering the research of geological mineral and energy exploration and development, geological disaster prevention and control, marine mineral resources, etc.

## Feature 9–1 Important Achievements of Scientific and Technological Innovation Platforms in the Field of Mineral Resources

The Deep Gold Mine Exploration and Mining Technology Innovation Center of the MNR completed the project of "Metallogenic Model and Prospecting Breakthrough of Liaoshang Pyrite-Carbonate Vein-type Gold Deposit in Jiaodong", and established a metallogenic model to guide the exploration work of the Xilaokou gold mine in response to the major demand for gold mine mineral resources shortage. In March 2023, it submitted nearly 50 tons of gold metal, becoming another major prospecting breakthrough in the northeastern margin of the Jiaolai Basin.

The "Tungsten-Gold-Copper-Iron Polymetallic Metallogenic System Deposit Model and Prospecting Breakthrough in the Middle and Lower Reaches of the Yangtze River and Adjacent Areas" project implemented by the Key Laboratory of Mineralization and Resource Evaluation of the MNR in 2023 delineated a total of 26 prospecting target areas. Five large and five medium-sized ore deposits have been verified by the prospecting project, achieving a major breakthrough in the prospecting of buried ores in the middle and lower reaches of the Yangtze River and adjacent areas and deep edges.

The Key Laboratory of Aerial Geophysics and Remote Sensing Geology of the MNR developed measurement technology and equipment such as UAV aeromagnetism, ground-to-air electromagnetism, and UAV fixed-wing aeromagnetism, and developed data processing software systems such as UAV aerial magnetism and aerial gravity, and basically built an aerial gravity and magnetism exploration technology system for light and small UAV aerial magnetism, long-range fixed-wing UAV and medium-sized unmanned helicopters, which has become "aerial equipment" supporting another round of prospecting breakthroughs.

# Chapter X International Cooperation

In 2023, international cooperation in the field of mineral resources continued to improve quality and efficiency. Contact was actively maintained with major energy resource countries and international organizations and pragmatic cooperation was promoted in the field of geology and minerals through international exchange platforms such as the China Mining and the China-ASEAN Mining Cooperation Forum to further consolidate multilateral and bilateral friendly cooperative relations.

## I. Bilateral and Multilateral Cooperation Mechanisms

### 1. Bilateral cooperation

Pragmatic cooperation with Saudi Arabia, Pakistan, Kazakhstan, Belarus, Serbia, Turkey, Australia, Honduras, Cuba, Suriname, Uruguay, Chile and Brazil was actively promoted in the field of geology and mineral resources, further enhancing cooperative relations in geoscientific research, geological survey, mineral resources development and management, mineral

exploration technology and methods, and mining investment, as well as further expanding the bilateral cooperation network.

China-Pakistan cooperation in the field of geology and mineral resources was included in the China-Pakistan joint statement, and China-Serbia cooperation in the field of geology and mineral resources was included in the China-Serbia joint statement. Memorandums of understanding or bilateral cooperation agreements on geoscience cooperation were signed with Russia, Argentina, Pakistan, Belarus, Poland, Uzbekistan, Vietnam, Peru, Nigeria, Venezuela, Democratic Republic of the Congo, Belgium, Japan, Iran, Suriname, Uruguay, Serbia and other countries. Visits were paid to the geology and mineral departments of Chile and Brazil, laying a foundation of mutual trust for bilateral technical cooperation in new energy and key minerals.

The 11th meeting of the Geology and Mineral Subcommittee of the China-Kazakhstan Cooperation Committee was successfully held, and in-depth exchanges were conducted with the Ministry of Industry and Construction of Kazakhstan on implementing the consensus reached by the two heads of state to "further deepen practical cooperation in the field of geoscience, continue to carry out investigation and research on geological and mineral cooperation, tap the potential of mining investment cooperation between the two countries, and serve the economic and social development of both sides".

## 2. Multilateral cooperation

The "Chemical Earth" big science project added Peru and Cuba, and the global-scale geochemical benchmark network sampling covered an area of about 400,000 square kilometers, effectively implementing the chairman's statement of the high-level dialogue on global development. The *Initiative of Digital "Chemical Earth" for Global Green Development* was jointly released by the UNESCO East Asia Multisectoral Regional Representative Office.

The "Global Karst" big science project signed a memorandum of understanding with universities in Croatia and Slovakia, successfully holding the 16th international training,

and releasing the global karst science and technology innovation cooperation initiative. The international standard proposal *Technical Regulations for the Development and Utilization Management of Karst Water Resources* was submitted to the National Standardization Administration for review.

Participation was made in promoting the DDE international big science project, and part was taken in the 80th, 81st and 82nd steering committee meetings and the 59th annual meeting of CCOP. CCOP Research Center on In-situ Stress (CCOP-RCIS) was established. CCOP-RCIS will devote itself to promoting the cooperation between CCOP member countries and cooperative countries in the field of crustal stress, building an international cooperation platform for crustal stress, establishing an international expert think tank for crustal stress research, implementing international crustal stress investigation and research projects, creating an crustal stress information sharing platform for active tectonic belts in the Pacific Rim, holding international academic seminars on crustal stress, and promoting the development of crustal stress disciplines.

A delegation was sent to attend the 15th annual meeting of the United Nations Resource Management Expert Group. The development and application progress of United Nations Framework Classification (UNFC) and the United Nations Resource Management System (UNRMS) continued to be tracked. The Ministry of Natural Resources and the United Nations Economic Commission for Europe jointly developed docking documents between the upgraded China's mineral resource & reserves classification standards and the United Nations resource classification framework.

Experts from the MNR served as members of the United Nations Energy Transition Critical Minerals Group and actively performed their duties, promoting just and equitable management of the global value chain of critical minerals. The Global Environment Facility's "Energy Saving and Green and Low-carbon Improvement of China's Phosphorus Chemical Industry Chain" project was organized and implemented, the third meeting of the project steering committee was held, focus was put on promoting research on green and low-carbon policies

and standards for phosphate ore development and tailings management, the construction of demonstration projects was promoted, and green and low-carbon capacity building for employees was carried out.

## II. International Mining Cooperation Platforms

### 1. China Mining 2023

The (25th) China Mining 2023 was successfully held in Tianjin in a combination of "offline + online" form, themed with "Innovation-driven High-quality Development of Mining Industry". Focusing on topics such as the progress of geological surveys at home and abroad, innovative applications of technical equipment, mineral supply and demand situation, mining capital market, mineral products trading market, green mining and sustainable development, the conference held a number of thematic forums, special forums and online exhibitions, and released the *Initiative of Digital "Chemical Earth" for Global Green Development*. A total of more than 5,000 representatives from 28 countries and regions attended the conference, and the total number of exhibitors exceeded 10,000.

### 2. 2023 China-ASEAN Mining Cooperation Forum

The 2023 (12th) China-ASEAN Mining Cooperation Forum was successfully held in Nanning. With the theme of "Joining Hands to Integrate into the Construction of the 'Belt and Road' and Seek Sustainable Development of Green Mining", this forum focused on topics such as geoscience cooperation mechanism, mining transformation and green development, new technology development and application services. A total of more than 1,500 representatives from 24 countries participated in the forum.

### 3. China-Africa Geoscience Cooperation Center

In 2023, China-Africa Geoscience Cooperation Center, jointly built by geological survey

agencies, scientific research institutions and universities of China and African countries, was formally established. Diplomatic envoys from more than 10 African countries in China, including Sudan, Morocco, the Democratic Republic of Congo, and the Republic of Congo, attended the meeting on site, and deeply connected China-Africa development plans in the fields of sustainable utilization of energy resources and geoscience innovation, so as to improve African countries' geoscience research and resource governance capabilities and levels.

## 4. Forum on Geoscience Cooperation and Mining Investment for SCO Countries

In 2023, China-SCO Geoscience Cooperation Research Center hosted Forum on Geoscience Cooperation and Mining Investment for SCO Countries, with more than 300 representatives from more than 10 national geological and mineral management departments, scientific research institutes and mining enterprises attending. Three new bilateral cooperation agreements were signed with geological and mineral management agencies and geoscience research institutions of Belarus, Kazakhstan, and Armenia, and *SCO National Mining Development Report* was released.

## 5. China-Arab States Geoscientific Cooperation Seminar

The 4th China-Arab States Geoscientific Cooperation Seminar in 2023 was successfully held. At the seminar, new progress in the field of China-Arab States geoscientific cooperation, such as fine geological mapping of the Saudi Shield and the construction of a global mineral resources information system was introduced.

## 6. Other

The construction of the "Belt and Road" International Geoscience Education and Training Center was included in the list of pragmatic cooperation projects of the Third "Belt and Road" Forum for International Cooperation.