CHINA EXPLORATION TRENDS • 2015

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In 2015, the economic growth of main countries in the world is diversified dramatically and some developed economies such as America and Europe moderately revive while most emerging market economies face severe downward pressure on economy and even the risk of long-term recession. The uneven development of global economy and slower growth of China’s economy due to structural adjustment make the demand of global energy and key mineral resources grow slowly, and the market of mineral products shifts to a model of supply exceeding demand.

The mining industry in the world encounters serious problems owing to weak momentum and enters the stage of in-depth adjustment. The holistic downward tendency in these four years still continues, but its downward speed is significantly slow, which seems to show signs of bottoming out and assumes new features with new vigor in five concurrent periods. These successive five periods are a period of pattern adjustment, an embryonic period of revival, a development period of technological innovation, an adjustment period of policies and a reforming period of the management structure of the energy source.

Under the influence of momentum shifting, structural optimization of domestic economy as well as the complexity and uncertainty of foreign economic environment, the features of three concurrent periods continue to exist in China’s economy. The overall economic performance assumes a tendency of stability while growing slowly and turns better while maintaining stability, and structural adjustment proactively proceeds.

The investment of China’s geological exploration assumes rational regression, an average annual decrease of around 10% in recent three years, which assumes four significant features as follows. At first, the investment structure of geological exploration is in the process of continuous optimization and adjustment and the investment of mineral product exploration decreases, but it still plays a dominant role. Secondly, the investment of exploration is diversified in mineral types. The investment of exploring coal and iron
ore remarkably decreases while the investment of exploring noble metal and non-ferrous metal is high although influenced at different levels. Thirdly, the regional pattern of exploration investment is further adjusted, and the proportion of investment in West China keeps rising. Fourthly, the workload of drilling tends to decline, and the reduction of workload for coal and iron ores is significant in particular.

In terms of the short-term situation of domestic geological exploration, the investment of social funds as the leading part for the mineral exploration becomes more and more prudent. It is estimated that the overall investment for China’s geological exploration in 2015 totals about 36 billion yuan, a decrease of 10 percentage points over the previous year, which is roughly equivalent to the level in 2009, but it remains a large quantity.

In the long run, China will comprehensively advance the implementation of a series of strategies such as deepening reform and the Silk Road Economic Belt and the 21st-Century Maritime Silk Road (OBOR) in the coming 10-20 years, which will exert a profound influence on geological exploration, so the geological exploration will face new opportunities and challenges. At first, the demand structure of energy sources has dramatic changes and advances the strategic structural adjustment of the geological exploration industry. Secondly, China’s new industrialization, urbanization and green development will advance the expansion of geological exploration and make it shift towards serving people's livelihood. Thirdly, due to the implementation of national strategies of the OBOR and “Made in China 2025”, the geological exploration faces new opportunities and challenges.

In general, along with self-regulation and optimization of China’s economic structure and delivering of benefits in China’s deepening reform, the demand of China’s geological exploration market will become increasingly larger, and the geological exploration will have a wonderful prospect of development in accommodation.

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The geological exploration has entered a new normal with great development prospects / 12
Over more than one decade, the investment of China’s geological exploration reaches its zenith after a period of growth and enters the period of decline like a roller coaster. From the end of 2002, under the influence of many factors such as the international and domestic demands and the market opening, China’s geological exploration grew annually at the speed over 20% and reached the summit in 2012. After the best period of growth in one decade along with complicated and volatile situation of current international economy, the operation of China’s economy tends to be stable while growing slowly, and the structural reform promotes the economic growth to shift its focus of momentum. The demand of geological exploration also changes along with the advancement of key strategies such as ecological improvement and the OBOR.

In 2013, the investment for China’s geological exploration assumed a sign of decline, and it continued to decline at the average annual speed of around 10%, but it remained a high level for the middle and late best period of “golden decade” in general, which was equivalent to the level between 2009 and 2010 (Figure 1).

Figure 1  The comparison of investment for national geological exploration from 2006 to 2015 (the unit is hundred million yuan and the data in 2015 is an estimation)
Overall investment in 2014, the social fund was the dominant one, and all types of funds declined at different levels. The central budget allocated 8.314 billion yuan, with a decrease of 6.7% over the previous year. The local government finance allocated 9.622 billion yuan, a decrease of 22.4% over the previous year. The social fund amounted to 22.338 billion yuan, a decrease of 9.5 percentage points over the previous year.

In terms of the investment structure in different sectors, the investment focuses on the exploration of mineral products. The investment promotes in some sectors while it declines in other sectors. The investment in exploring mineral products is 29.901 billion yuan, a decrease of 17.8 percentage points over the previous year. The investment of basic geological exploration is 4.48 billion yuan, an increase of 8.1 percentage points over the previous year. The investment of assessment for hydrogeological, environmental geological and geological disaster exploration is 3.621 billion yuan, an increase of 15.2 percentage points over the previous year. The investment of geological science and technology and informatization is 2.272 billion yuan, a decrease of 1.2 percentage points over the previous year.

The investment for the geological exploration in the first two quarters of 2015 is 12.668 billion yuan, a decrease of 17.4 percentage points over the first two quarters in 2014 (left in Figure 2). From the perspective of fund source, all types of funds decrease.

From the perspective of current data, the investment of China’s central finance basically maintains a stable level and continuously plays a role of stabilizer. The finance of local governments began to decline from 2012, and the social fund has shown a sign of decline since 2011, which indicates that the social fund has a sensitive response to the market (right in Figure 2).
The structural adjustment is continuously made for the geological exploration on the basis of the national demand, the ecological civilization construction and the social demand. The proportion of funding investments mainly of the financial fund increase year by year in the basic geological exploration, the hydrogeological exploration, the environmental geological and disaster geology and geological science and technology while the proportion of mineral exploration continuously declines due to the influence of demand for bulk mineral products.

The proportion of investment in the basic geological exploration gradually increases. The investment for China’s basic geological exploration in 2014 was 4.48 billion yuan, an increase of 8.1 percentage points over the previous year. As regards fund sources, the central budget allocated 3.349 billion yuan which accounted for 74.7% and increased by 4.6 percentage points over the previous year. The local government finance allocated 1.083 billion yuan which accounted for 24.2% and increased by 22.8% over the previous year. The social fund amounted to 48 million yuan.

Figure 3  The comparison of investment sectors of China’s geological exploration (the unit is hundred million yuan and the data in 2015 is an estimation)
which accounted for 1.1% and decreased by 22.6% over the previous year. The financial fund played a fundamental and leading role, which was mainly used to carry out the regional geological and mineral exploration (Scale: 1:50000), the exploration by geophysics, geochemistry and remote sensing, mineral prospect survey and makes prior fundamental efforts for exploring mineral products.

In the first two quarters of 2015, the investment of China's basic geological exploration continues to increase over the previous year, which is 1.643 billion yuan, accounts for 13.0% and increases by 10.4% over the previous year. The central budget allocates 1.091 billion yuan, which accounts for 66.4% and increases by 7.6% over the previous year. The local government finance allocates 0.531 billion yuan which accounts for 32.3% and increases by 22.6% over the previous year. The social fund amounts to 21 million yuan which accounts for 1.3% and decreases by 48.8% over the previous year.

The proportion of the basic geologic exploration gradually rises in the total investment, rising from 2% in 2006 to 10% in 2014 and to 13% in the first two quarters of 2015 (Figure 3 and Figure 4)

The investment of assessment for hydrogeological, environmental geological and geological disaster exploration gradually increases. The investment of assessment for hydrogeological, environmental geological and geological disaster exploration in 2014 was 3.621 billion yuan, an increase of 15.2% over the previous year. As regards fund sources, the central budget allocated 1.52 billion yuan which accounted for 42% and increased by 51.1% over the previous year. The local government finance allocated 1.637 billion yuan which accounted for 45.2% and decreased by 1.1% over the previous year. The social fund amounted to 0.464 billion yuan which accounted for 12.8% and decreased by 3.5% over the previous year. The central budget intensified more efforts to serve people’s livelihood, continued to promote its investment which were mainly...
used to carry out the activities of geothermal energy, hydrogeological exploration, environmental geological exploration, disaster geological exploration, monitoring and early warning. The local finance enlarged its investment in hydrologic, environmental and geological disasters. The social fund was invested to carry out the activities of the hydrogeology survey on mines, the mine environmental geological survey and assessment.

The investment of assessment for hydrogeological, environmental geological and geological disaster survey in the first two quarters of 2015 is 1.555 billion yuan which accounts for 12.3% and decreases by 19.1% over the previous year. The central budget allocates 0.549 billion yuan which accounts for 35.3% and decreases by 27.8% over the previous year. The local government finance allocates 0.801 billion yuan which accounts for 51.5% and decreases by 14.1% over the previous year. The social fund amounts to 0.205 billion yuan which accounts for 13.2% and decreases by 10.5% over the previous year.

Although the total investment of assessment for hydrogeological, environmental geological and geological disasters decreases over the same period in 2014, its proportion gradually rises in the total investment, rising from 3% in 2006 to 9% in 2014 and to 12% in the first two quarters of 2015 (Figure 3 and Figure 4).

**The proportion of investment in the basic geological technology gradually increases.** The investment in China’s geological science and technology rose from 0.1 billion yuan in 2006 to 2.272 billion yuan in 2013, and the quantity in 2014 was basically equivalent to that in 2013. As regards fund sources, the central budget allocated 1.034 billion yuan, a decrease of 1.2 percentage points over the previous year. The local government finance allocated 0.525 billion yuan, an increase of 4% over the previous year. The social fund mounted to 0.713 billion yuan, a decrease of 2 percentage points over the previous year. The central finance was mainly used to carry out the activities relating to basic theory researches which support mining exploration, innovation of technical methods to explore mines and information technology, and its investment in 2014 was intensified in technical methods and information technology.

The investment in the first half of 2015 is 0.902 billion yuan, a decrease of 27% over the previous year. The central budget allocates 0.37 billion yuan, a decrease of 42% over the previous year. The local finance allocates 0.27 billion yuan, an increase of 6.7% over the previous year. The social fund amounts to 0.262 billion yuan, a decrease of 24.7% over the previous year.

In general, although the total investment in geological science and technology in the first two quarters of 2015 decreases over the same period in 2014, its proportion gradually rises in the total investment, rising from 1% in 2006 to 6% in 2014 and to 7% in the first two quarters of 2015 (Figure 3 and Figure 4).

**The proportion of investment in the mining exploration gradually increases.** The investment in the mining exploration in 2014 was 29.901 billion...
yuan, a decrease of 17.8% over the previous year. All types of funds decrease, among, the social fund amounted to 21.113 billion yuan, a decrease of 9.6% over the previous year; the central budget allocated 2.411 billion yuan, a decrease of 34.3 percentage points over the previous year; the local government finance allocated 6.377 billion yuan, a decrease of 31.8 percentage points over the previous year.

In the first two quarter of 2015, the investment for coal, iron, copper, lead, zinc, bauxite, tungsten and tin decreases significantly and the investment for molybdenum decreases in a small scale while the investment in gold mines increases over the same period in the previous year. The investment for coal is 1.314 billion yuan, a decrease of 41.3% over the previous year. The investment of iron is 0.589 billion yuan, a decrease of 46.2% over the previous year. The investment of copper is 1.122 billion yuan, a decrease of 29.5% over the previous year. The investment of lead-zinc mine is 0.685 billion yuan, a decrease of 27.2% over the previous year. The investment of bauxite is 0.102 billion yuan, a decrease of 37% over the previous year. The investment of tungsten is 95 million yuan, a decrease of 32.6% over the previous year. The investment of tinstone is 38 million yuan, a decrease of 26.9% over the previous year. The investment of molybdenum is 0.148 billion yuan, a decrease of 4.5% over the previous year. The investment of gold mine is 2.259 billion yuan, an increase of 22.7% over the previous year.

The proportion of the mining exploration gradually declines in the total investment, decreasing from 94% in 2006 to 74% in 2014 and even to 68% in the first two quarters of 2015 (Figure 3 and Figure 4).
The dominant part of the geological exploration is the mineral exploration and the popular minerals include coal, gold, lead-zinc mine and iron, etc. Before 2014, the exploring funds of these key minerals accounted for above 60% in the total investment, and its highest level reached 74% while it was no lower than 57% in 2014. During the zenith of investment in exploring mining products in 2012, the investment of coal exploration was the most remarkable with 12.2 billion yuan which was far more than that of other mining types. The investment of iron, copper, lead-zinc mine and gold was lower than that of coal, and their investment for exploration ranged between 3 billion and 6.4 billion yuan. In 2014, the investment of exploring coal, copper and gold ranged between 5 billion and 6 billion yuan while the investment of iron and lead-zinc mines decreased to the level of 2.5 billion to 3 billion yuan.

The investment in exploring coal was less than one half of the quantity in the zenith period, which was an important factor for the decrease in the total investment of the geological exploration. Due to the low investment risk and fast-yielding results, the coal was one of the most popular types in mineral exploration for investors and a type with the most investment which accounted for above 30% in the investment of mineral exploration every year. From 2006 to 2012, the investment on coal grew rapidly. In particular, from 2010 to 2012, its average annual investment exceeded 10 billion yuan. After its zenith of 12.2 billion yuan in 2012, it decreased dramatically due to excessive productivity, and fell to 5.9 billion yuan in 2014, which was less than one half of the quantity in 2012 (Figure 5). It merely accounts for 10% in the total investment in the first two quarters of 2015.

The investment on surveying iron decreases dramatically, which is another important factor on the decrease of the total investment for the geological exploration. The investment on surveying iron ores accounts for around 8% of the investment on the geological exploration every year. From 2006 to 2012, the investment of surveying iron increased dramatically, and it reached 5 billion yuan in 2012. Later, it decreased by more than 1 billion yuan every year (Figure 5). It accounts for 4% in the total investment in the first two quarters of 2015.

The investment on surveying copper, aluminum, lead-zinc mine and gold basically maintains a high level. After a rapidly rising period before 2012, the investment of copper exceeded 5.5 billion
yuan in 2012, and then maintained the level of 5.5 billion yuan. The investment on surveying bauxite accounted for a small proportion, and it increased in 2014 over the year 2013. The investment on surveying lead-zinc mines still maintained a relatively high level. The investment on surveying gold reached its zenith of 7.2 billion yuan in 2013. Later, due to the influence of gold price, it decreased dramatically to 5.6 billion yuan in 2014, but it still maintained a dominant level (Figure 5).

Figure 5  The comparison of the investment on the main minerals in China’s (unit: hundred million yuan)
Along with the strategies of the Western Development and the OBOR, the proportion of geological exploration on the West China gradually rises, the proportion on the middle of China gradually declines and the east of China maintains a low level of investment. Due to the Western Development, the western region has become the main area for the geological exploration in China (Figure 6 and Figure 7). In 2014, the investment accounted for 51%, 16%, 29% and 4% respectively in the west, east, middle and other (transregional) areas of China (Figure 6).

The investment on West China had reached 20.64 billion yuan, with a decrease of 7% over the previous year. In some provinces of Western China, such as Xinjiang, Gansu, Qinghai, Yunnan, Sichuan and Guizhou, the investment funds exceeded one billion yuan. In addition, the funds in Xizang and Chongqing were 0.904 billion and 0.672 billion yuan respectively. The expenditure in Ningxia was the smallest, which was merely 0.312 billion yuan.

The investment on Middle China reached 11.779 billion yuan in 2014, a decrease of 19% over the previous year. And more than one billion yuan came into service in Inner Mongolia, Anhui, Shanxi, Jiangxi, also, the investment in other provinces ranged from 0.5 billion to one billion yuan.
The investment on East China reached 6.173 billion yuan in 2014, a decrease of 16% over the previous year. For East China, the investment in Shandong, Hebei exceeded one billion yuan, and that in Guangxi, Guangdong and Liaoning ranged from 0.5 billion to one billion yuan.

The investment in the other (transregional) regions reached 1.682 billion yuan.
The complete workload of drilling in China gradually increased from 2006 to 2012, and it reached the zenith of 26.38 million meters in 2012. Later, it gradually decreased. Among, the complete workload of drilling on coal and iron decreased significantly. The current data shows that it continues to decrease in 2015 and is predicted to fall to the level in 2009 (Figure 8).

The complete workload of drilling in 2014 is 18.54 million meters, a decrease of 16.9% over the previous year. The top five provinces (autonomous region) which complete the workload of drilling include Inner Mongolia (2.8603 million meters), Xinjiang (2.7199 million meters), Shandong (1.2123 million meters), Guizhou (1.1423 million meters), Yunnan (0.9883 million meters).

The complete workload of drilling in the first two quarters of 2015 in China is 4.71 million meters, a decrease of 26.2% over the previous year (6.38 million meters in the first two quarters of 2014). The top five provinces (autonomous region) which complete the workload of drilling include Shandong (0.8865 million meters), Guizhou (0.3811 million meters), Anhui (0.3399 million meters), Yunnan (0.3154 million meters), Xinjiang (0.2661 million meters).
Currently, the rapidly rising period for a decade has ended in China’s mining industry together with global mining industry and China has entered a new stage which features deep adjustment. This adjustment does not only result from internal periodical rules, but also results from the external transformation of market demand and supply and pattern. Both endogenous and exogenous impetus shape the current situation of mining industry which has an influence on geological exploration.

6.1. Mining industry development and market demand

The development of mining industry has similar periodical rules with economic development, and it is closely related with the process of industrialization. The development of global mining industry can be divided into three periodical cycles in the main (Figure 9). The first periodic time took the American industrialization as its momentum and lasted for 30-40 years; the second periodic time took European reconstruction and Japanese industrialization after World War Two as its momentum and lasted for about 30 years; the third periodic time began in 2003 and took the industrialization and urbanization in emerging nations such as China as its momentum. Compared with the first and second periodic time, the intensity, scale and speed of mining industry in the third periodic time were better than the first and second ones, but its duration time was equivalent to one third of the first and second periodic time.
Along with the transformation and upgrading of China’s economy, the industrial structure is experiencing a new round of adjustment, optimization and upgrading. The demands on many minerals grow slowly, and even the overall demands on some minerals decline. Meanwhile, the performance of other emerging economies is not satisfactory as expected. Due to the influence of relative sufficiency of suppliers and relative weakness of demanders, the development of global mining industry continuously declines, which is profoundly manifested in the fact that the investment in global non-oil/gas solid mineral resources continuously decreases, the financing in primary exploration companies is difficult and the index of global mining industry declines successively for four years from 2011. However, from the perspective of current trend of mining industry, it tends to decline slowly and shows a sign of bottoming out (Figure 10).

**6.2. New signs of global mining industry in five concurrent periods**

In general, the global mining industry has entered the stage of deep adjustment due to weak momentum. In spite of grim situation of current global mining industry, it has shown new features in five concurrent periods and had great vigor. The first period is the period of pattern adjustment. The focus of demand on global resource products is shifting. The excessive production of resources which are represented by coal, steel and cement results in declining demand. The demand on bulk mineral products such as aluminum, copper and lead-zinc mines continues to maintain a high level. The demand on energy resources which are represented by lithium, cobalt, rare earth, rare metal and rare-scattered elements mineral resources, gas and oil, etc. will grow.
rapidly. The adjustment of demand pattern will promote mergers, acquisitions and reorganization. **The second period is an embryonic period of revival.** Although the complete revival of mining industry is difficult in the short term, some industry insiders hold a positive opinion for the demand of energy resources in the long term, and actively look for opportunities to prepare for the next round of prosperity. **The third period is a development period of technological innovation.** In the face of grim market situation and fierce market competition, the enterprises in the mining industry intensify their research and development of exploration technology in deep/overlaying areas and the activities of intelligent mines, high-efficient mining technology and management innovation in order to make innovation a new impetus of enterprise development. **The fifth period is an adjustment period of policies.** In order to promote the development of mining industry, many resource-based countries amend many policies and measures, lower access threshold to attract investment while strengthening supervision on operation and expecting to obtain more benefits from resource development or protect local environment and employment. **The fifth period is a reforming period on the management structure of energy source.** The pattern of global energy resources has dramatic changes over dozens of years. The emerging economies which are represented by China have become the main actors in energy resource trading. The consuming focus shifts from west to east. The supplying centers have become multi-polarized. However, the management framework of energy resources was formed 40 years ago and its reform has become an international consensus.

6.3. Rational recession of China's geological exploration and development in a good manner in the long term

From the perspective of the recent situation, China’s geological exploration will maintain rational recession in general. As the dominant part of investment, the social fund will become more rational and prudent in investing mineral product exploration. We estimate that the overall investment of China’s geological exploration in 2015 continues to decrease as it was in 2014, and it totals about 36 billion yuan, a decrease of 10% over the previous year, which is roughly equivalent to the level in 2009, but it remains a large quantity.

In the long term, the coming 10-20 years will be a crucial period when China extensively carries out the synchronous development of industrialization, urbanization, informatization, agricultural modernization and ecological development. In order to achieve the Two Centenary Goals and realize the Chinese Dream of the great rejuvenation, the powerful supports by energy resources, ecological environment and geological information services will be required, so China’s geological exploration has a great prospect.

**At first, the demand structure of energy sources and mineral resources has dramatic changes and**
advances the strategic structural adjustment of geological exploration. China’s economy and society have entered the middle and late stage of industrialization and the zenith of resource demand is coming, so the structure of demands on China’s energy and mineral resources is dramatically being changed. China will strive for optimizing energy structure, take clean and low-carbon development as the main orientation to adjust energy structure, promote the exploration of clean energy resources such as oil, gas, shale gas, natural gas hydrate, uranium and geothermal energy. The fourth industrial revolution which is dominated by the intelligent manufacturing has come, and the strategically mineral resources (lithium, cobalt, rare earth, rare metal and rare-scattered elements mineral resources) which are required in emerging industries will become an emphasis of demand, which will advance the exploration of minerals such as rare earth, rare metal, rare-scattered elements, etc. On the other hand, the demand of steel and related industries on lead and zinc has entered a stable stage, and the attraction on mineral exploration will be restricted.

Secondly, China’s new industrialization, urbanization, informatization, agricultural modernization and green development will advance the expansion of geological exploration to serve people’s livelihood. The ecological progress requires that the geological exploration shall play a role in optimizing development pattern of national land space, comprehensively promoting resource conservation, strengthening protection of natural ecological system and environment, and requires that hydrologic geology, engineering geology and environmental geology provide more powerful fundamental support.

Thirdly, due to the national strategies of the OBOR and “Made in China 2025”, the geological exploration faces new opportunities and challenges. The realization of the Chinese Dream requires powerful support from energy and mineral resources. The implementation of the OBOR, coordinated development for the Beijing-Tianjin-Hebei region, the Yangtze River Economic Zone, “Made in China 2025” and National Exploration & Development Plan will promote China’s economy to lead the development of regional economy and even the global economy while promote the demand on resource exploration, environmental protection and ecological rehabilitation. It is a new opportunity and also a new challenge for geological exploration.

In general, along with the implementation of a series of national strategies and delivering of benefits in China’s deepening reform, the demands of China’s geological exploration market will become increasingly larger, and the geological exploration will have a wonderful prospect.
In 2007, in order to further strengthen the management of geological exploration, guide and regulate the investment direction and pattern of geological exploration, the Ministry of Land and Resources of the People's Republic of China decided to establish a reporting system of geological exploration achievement at the ministry and provincial level. Relying on the project of national geological exploration progress analysis of Development and Research Center of China Geological Survey, the ministry gradually established a four-class system for tracking the progress of national geological exploration, which included geological survey unit, geological survey bureau and industrial bureau, provincial land resource department (bureau) and industrial chief bureau and Ministry of Land and Resources, established a platform on tracking national geological exploration progress and a submission network system on geological exploration progress and achievements and realized a full coverage and organic connectivity of about 2600 enterprises and institutions with the geological exploration competence in China. Through collection and analysis, achievement data with wide representativeness and authority were concluded, which was widely recognized and adopted in the industry.

Currently, a mechanism of regular data statistics and situation analysis for half a year or one year has formed, and some achievements have been listed into national statistics and timely issued through the bulletin of land and resources and the report of China’s mineral resources, etc. For the purpose of statistics and application, the geological exploration is divided into four types including basic geology, mineral exploration, hydrologic geological environment and disaster geology, geological science and technology and informatization. The data in this paper is cited from the system of tracking national geological exploration progress unless indicated.

The data in this paper does not include Hong Kong Special Administrative Region, Macao Special Administrative Region and Taiwan Province and all the investment data of geological exploration don’t refer to petroleum, natural gas, shale gas and coal seam gas.