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ARTICLE

CURRENT SITUATION AND TREND OF COMPREHENSIVE DEVELOPMENT AND UTILIZATION OF MINERAL RESOURCES

Abdullahi Arabi*

Department of Applied Chemistry and Chemical Engineering, University of Chittagong, Chittagong, Bangladesh
Corresponding Author's Email: abdullahiarabi@gmail.com

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ABSTRACT

Based on the literature research, by understanding the position and role of mineral resources exploration, the paper recognizes that there are a series of problems and difficulties in mineral resources exploration development at present. Every country pays more and more attention to research on the comprehensive utilization of mineral resources. Therefore, the paper presents development trends on the comprehensive utilization of mineral resources in the future by knowing the current situation of comprehensive exploitation and utilization of mineral resources in various countries. Finally, it put forward the wish to use relevant science to improve the level of comprehensive development and utilization of mineral resources in the future, to make the social, environmental, and ecological benefits embody fully, and to make the resources be effectively used.

KEYWORDS

Mineral Resources, National Economy, Environmental Pollution, Ecological Environment, Comprehensive Development, And Utilization Trend

1. STATUS AND ROLE OF MINERAL RESOURCES DEVELOPMENT

Mineral resources are useful mineral resources produced in nature. It is the basic production object and labor materials, and it is an important material basis for the survival and development of human society. The development scale and utilization degree of mineral resources are important symbols to measure the material wealth, science and technology, and economic development level of a country and a nation. Mineral resources play an important role in the development of the national economy. The industrialization process will inevitably lead to a large increase in the demand for mineral resources, and the utilization of mineral resources is an important means to achieve economic growth and development.

2. PROBLEMS IN MINE RESOURCE DEVELOPMENT

Since the Industrial Revolution, human beings have exchanged extremely high ecological and social costs for high-speed economic growth and a sharp increase in material wealth. This non-sustainable development of the economy has brought modern civilization into a desperate situation, resulting in the comprehensive development and utilization of mineral resources, which is a common issue faced by all countries in the world today. Due to its non-renewable feature, some traditional resource development and utilization methods cause excessive resource consumption and environmental damage, which further accelerate the depletion of mineral resources and environmental degradation, thereby reducing economic benefits, forcing some mining enterprises to suspend business at a loss, and ultimately the growth of the national economy. The problems or dilemmas existing in the development of mine resources are mainly manifested in the following aspects:

2.1 Resources Are Limited and Non-Renewable

With the development of industry, mineral resources are becoming more and more important to human production and life. Human exploration, search, and mining of mineral resources are also expanding, and the demand for industrial raw materials and energy is also increasing sharply. Human beings are madly exploiting mineral resources, and many of the mineral resources on the earth have been exhausted. In the United Kingdom, for example, the output of lead, copper, and iron in the 19th century, accounted for 30% to 50% of the world. Today, these deposits in the United Kingdom have all been mined. While in the United States, the proven manganese, chromium, nickel, and aluminum ores have been almost exhausted. Based on the analysis, according to the reserves of mineral resources on the earth and the annual consumption rate of 2.5%, the existing mineral resources can only be used by human beings for less than 100 years. The "Club of Rome", which is known internationally for its research and development theory, has conducted research on the depletion of mineral resources. They analyzed 19 kinds of mineral deposits and believed that 13 kinds of mineral deposits will be depleted within 100 years according to the constant consumption rate in 1970. If the consumption rate increases exponentially, 14 kinds of mineral deposits will be exhausted within 50 years; if considering the Possibility of discovering large new mines, 15 types of mines will also be depleted within 100 years based on a 4-fold increase in mineral reserves over proven reserves [2].

2.2 Serious Environmental Pollution and Obvious Ecological

Deterioration Trend

For a long time, due to the unreasonable development of mineral resources and neglect of mine environmental protection, the mine environment has been severely damaged and polluted. The land damage and ecological imbalance have become increasingly prominent, the "three wastes" pollution has become serious, and the debris flow ground collapse and other geological disasters are aggravated, which are highlighted in the following aspects:

(1) Mining destroys and occupies a large amount of cultivated land and construction land.

In China, for example, the total amount of waste slag discharged from mining and related industries is about 5.8 billion tons, accounting for 89% of the national waste slag storage. The damaged land area by the national mining industry is 1.4hm2−2.0hm2 and increases at a rate of 0.02hm2 per year.

(2) Mining induces geological disasters, causing casualties and safety hazards

suffer.

According to a survey of 1,173 state-owned large and medium-sized mines, underground mining accounts for 68.89%, and the subsidence area covers an area of 84 201hm2, accounting for 39.57% of the land area destroyed by mine development [3]. From the above data, it can be seen that the mining of mine resources has played a great role in inducing geological disasters to a large extent, and will inevitably cause potential safety hazards.

(3) Mining causes soil erosion and land desertification, destroying the ecological environment.

Mining activities, especially open-pit mining, have caused extensive damage to vegetation and soil on the hillside. The loose material such as waste rock and waste slag produced by the quilt and the hillside soil can easily lead to soil erosion in the mining area. Before the development and construction of the mining area, the environment of the surrounding area is in harmony. Once the development and construction are formed on a large scale, due to the stripping, disturbance, transportation, and accumulation of surface materials, the mining area has coarse soil texture, poor structure, poor erosion resistance and extreme It is vulnerable to wind erosion, water erosion, and gravity erosion, etc. The vegetation in the mining area is destroyed and the environment undergoes great changes, which leads to soil erosion and serious ecological problems.

(4) The water balance in the mining area is destroyed, resulting in various water environment problems.

Drainage of mines has resulted in a large regional drop in groundwater levels, tens of meters or even hundreds of meters in some places, resulting in large-scale drainage funnels, damage to the water balance system in the mining area, and water shortages. According to incomplete statistics, there are more than 30 non-ferrous metal mines in the country with serious water pollution caused by waste residue and tailings. On the one hand, there is a shortage of water resources, and some regions and most cities have entered a period of the water crisis. On the other hand, the water environment is polluted, and the remaining clean water resources are being lost.

(5) Mine mining produces a lot of "three wastes", which cause pollution to the surrounding environment.

The exhaust gas, dust, and waste residue from mining cause air pollution and acid rain, especially in the sulfur chemical industry and coal mining industry. The industrial waste gas emission in the carbon mining industry is 395.4 billion m3/a, among which the harmful substances are 731,300 t/a, mostly soot, sulfur dioxide, nitrogen oxide, and carbon monoxide. The atmospheric environment around the mine is polluted to different degrees. The discharge of wastewater and liquid waste from mining accounts for more than 10% of the total industrial wastewater discharge in the country, and the treatment rate is only 4.23%. The wastewater produced by a large number of mines is directly discharged into rivers, lakes, and seas without treatment, resulting in serious pollution of water sources.

2.3 Quality of Mineral Resources Decreases Year by Year with The Development of Mineral Resources, And the Mining Cost Increases Year by Year

With the increasing demand for mineral resources in various regions of the world,

high-grade and large-scale ore deposits are constantly being mined, but due to limited mineral resources, human beings have to turn the mining objects to some ores with low grades, small scales, many common metals and associated ores, few single ore, difficult beneficiation and smelting, and minerals. Mines embedded with fine particle size and high impurity content will increase overall investment, increase non-productive expenses, and increase unit costs, which will affect economic benefits. In addition, some mines have a large mining depth, increase the height of ore and rock, increase the transportation distance, increase the height of the dump, reduce the utilization rate of the equipment, and increase the production cost. Most non-ferrous mines are underground mining. As the mining depth increases, the production conditions deteriorate, the mining difficulty increases, and the production cost increases.

3. STATUS QUO OF COMPREHENSIVE DEVELOPMENT AND UTILIZATION OF MINING RESOURCES

3.1 Status Quo of Comprehensive Development and Utilization of Domestic Resources

Since the early 1980s, China has formulated relevant policies and regulations on the comprehensive utilization of mineral resources, which has effectively promoted the development and improvement of the comprehensive utilization of mineral resources. The comprehensive utilization level of non-ferrous metal mineral resources has been improved year by year. Among the 45 kinds of symbiotic and associated useful components, 33 kinds can be comprehensively recovered. For example, Jinchuan Nonferrous Metals Co., Ltd. has not only recovered nickel but also comprehensively recovered copper, platinum, copper, gold, and germanium. A variety of elements such as iridium, starvation, and nails have become typical examples of the comprehensive utilization of non-ferrous metal minerals in my country.

Jiangxi Copper Company started a comprehensive recovery of mineral resources in 1985. In addition to recovering copper, lead, zinc, and sulfur, associated gold and silver are basically concentrated in copper concentrate, lead concentrate, and zinc concentrate for recovery. The recovery rates of gold and silver in various mines have been greatly improved under the close cooperation of geological work. In particular, the gold and silver recovery rates of Dexing Copper Mine increased from 59.98% and 21.34% in 1986 to 64.05% and 53.91%, respectively, and the company-wide sulfur recovery rate also increased from 51.06% in 1986 to 57.1%. The sulfur recovery rate of the Pingtong Mine increased from 71.28% to 81.86% [4]. After the Guixi smelter is completed and put into operation, the beneficial elements such as gold, silver, sulfur and selenium-enriched in the copper concentrate are further recovered to produce finished gold, finished silver, refined selenium, and sulfuric acid; the harmful element arsenic is also oxidized Arsenic products are recycled, turning waste into treasure. At the same time, Dexing Copper Mine and other mines are actively carrying out research and implementation of non-ferrous metals. By then, the comprehensive utilization level will be further improved. The comprehensive utilization level of ferrous metal minerals in my country has also been greatly improved, and the comprehensive utilization rate can generally reach 30% to 40%, of which iron ore is 36.7%. The main components of iron, vanadium, and titanium have been comprehensively recovered from Panzhihua New Steel Vanadium Magnetite. Baotou iron ore comprehensively utilizes various components such as iron, rare earth, and silver. These two major mines have obtained good technical and economic indicators, demonstrating a major breakthrough in the comprehensive utilization of ferrous metal mineral resources.

The comprehensive utilization of solid waste in China's non-ferrous industry and metallurgical industry is mainly to use tailings and waste rock as mining filling materials, building materials, etc. In China's non-ferrous industry, the highest utilization rate of waste rock and tailings is 69%, while in the iron and steel industry, the utilization rate of blast

furnace slag is 85%, the utilization rate of the converter and open-hearth furnace dust is 90%, and the utilization rate of beneficiation tailings is only 2%.

On the whole, the comprehensive utilization of my country's mineral resources is still not enough. According to the census statistics of 419 mines with comprehensive development and utilization value, there are 82 kinds of minerals that can be comprehensively recycled, 54 kinds of minerals have been recovered, and the recycling rate is 60%, of which the mines with better comprehensive utilization account for 36%. The total recovery rate of large and medium-sized iron ore mining and dressing in my country is about 68%, and the recovery rate of mining, dressing, and smelting of major non-ferrous metals is about 55%. According to the survey and statistics of 1,845 important mines, only 2% of mines comprehensively utilize more than 70% of useful components; less than 15% of mines comprehensively utilize more than 50% of useful components; and mines that comprehensively utilize less than 25% of useful components 75%. Among the 246 symbiotic and associated large and medium-sized mines, 32.1% of them did not comprehensively utilize useful components.

Through the above comparison, although my country's resource development and comprehensive utilization have made great progress and development, there are still serious losses and waste of mineral resources, and its comprehensive utilization potential is huge.

3.2 Status Quo of Comprehensive Development and Utilization of International Resources

The comprehensive utilization rate of copper, lead, zinc, nickel, and other metal mines in the United States and Japan is 76% to 90%. Western countries have recovered more than 70 kinds of valuable elements from the process of dressing and smelting of non-ferrous metals, the value of by-products accounts for 30% of the total output value, and the recovery rate of dressing and smelting has reached more than 80%. More than 95% of arsenic, antimony, diamond, bismuth, nickel, germanium, cadmium, lead, zinc, radium, strontium, milling, selenium, and sulfur in the United States are recycled through comprehensive utilization. Japan continuously produces seven kinds of concentrates and 20 kinds of elements such as copper, lead, zinc, barite, pyrite, sericite, silica sand, and 20 kinds of elements from its "black ore", recovery of copper, lead, zinc, gold, and silver. The rate of utilization reached 94%, 92.8%, 95.2%, 74%, and 85.5% respectively, and the comprehensive utilization rate of resources was over 90%.

Seven copper concentrators including Dural in the United States have comprehensively recovered some elements in copper, gold, silver, aluminum, and molybdenum respectively, with a comprehensive utilization rate of 88% to 91%. The Grace Iron Mine in Pennsylvania, USA comprehensively recovers iron, gold, silver, copper, cobalt, and other metals. Canada has comprehensively recovered tantalum, cesium, beryllium, and gallium from Manitoba pegmatite ore. The utilization rates of fly ash in Germany, France, and the UK are 80%, 60%, and 55% respectively, while in Japan and Denmark it is close to 100%. The utilization rate of coal gangue in Japan, Germany, Australia, Canada, and Poland is over 85%. The blast furnace slag utilization rate is 100% in the United Kingdom, the United States, France, Germany, Sweden, Canada, and Belgium. The steel slag utilization rates in the United States, Germany, and the United Kingdom are 100%, 90%, and 80%, respectively [5].

It can be seen from the above that the comprehensive utilization of these countries has reached a very high level. The utilization level of industrial solid waste in the United States, France, Germany, Japan, and the United Kingdom ranks among the top in the world.

4. RECYCLING AND UTILIZATION OF MINE RESOURCES AND FUTURE DEVELOPMENT TRENDS

In the development and utilization of mineral resources in the future, we should not only pay attention to the utilization rate of resources to achieve the optimal allocation of resources but also pay attention to the economic, social, and ecological benefits in the process of resource utilization, so as to minimize the environmental impact of pollution generated in the process of resource mining. We should control the actual environment of mining area development, and try to achieve no-waste mining when technically and economically feasible. In addition, the sustainable development of the mining industry, as a brand-new development concept of mineral resources development, cannot realize single mineral resource development at the expense of the destruction of other resources but must take the road of coordinated development and sustainable utilization of resources and the environment. Therefore, the development trend can be summarized as:

The mining scale is developing to a large scale.

The vast majority of countries and the industry are converging on large-scale mining. They regard mining as a temporary occupation of land resources. From the guiding ideology, they tend to make quick decisions and restore the original ecological environment as soon as possible after mining. Some mines with small reserves are also designed to be larger in scale, and the service life is shortened, which can effectively abandon the limited use of resources by some small and medium-sized mines in my country at the current stage, and can also avoid small and medium-sized mines. The excessive mining cycle expands the ecological impact range and some other negative effects, such as: occupying land, reducing the effective utilization of land, dust pollution, etc. In the case of the overall downward trend of mining resource grade, large-scale mining is also conducive to improving resource recovery rate and reducing resource waste.

The construction of intelligent mines.

Computers have been widely used in the establishment of ore deposit models, tunnel geometry models, geostatistical models, mining method selection models, production scales, mining sequences, rock mechanics evaluation models, and technical and economic evaluation models. Or the automation of the operation line, so that the computer plays a huge role in improving the performance and efficiency of rock drilling equipment, charging equipment, loading and transportation equipment, etc. In addition, the development of radio communication systems and network technology has made the mining system, support system, and management system networked and timely, which has laid the foundation for the establishment of intelligent mines. Canada has set a vision to achieve by 2050 of mechanically crushing or cutting mines in the far north. Mineral processing will be directly located underground, through satellite manipulation of all the underground equipment automatic operation, become an unmanned mine, which will greatly reduce the traditional mining and separation process caused by serious damage and impact on the ecology and environment.

The construction of environmentally friendly mines will be the future trend.

At present, on a global scale, from the government to the public, the emphasis on environmental protection has reached an unprecedented level. Human beings, resources, and the environment have become the major themes of the development of human society. The construction of ecological mines and the improvement of the mine environment has become the key to the development of the mining industry. The inevitable trend. Due to the growing emphasis on environmental protection, approval times for mining licenses are getting longer. Now, many mines start from the discovery of ore bodies. After feasibility analysis, environmental assessment, preliminary design, infrastructure construction, and commissioning, it generally takes more than 10 years. Large mines even decades, such as the Geyuan tantalum and niobium mine, began in 1957. It has been nearly half a century between the discovery and the preparation of the feasibility study in 2007. As environmental issues will become an important factor in the development of the mining industry, this process will only take longer in the future. Faced with this situation, the mining sector is forced to take corresponding countermeasures, especially environmental protection policies, and try to keep the ecological balance from being destroyed while working on the development of the mine resources. For example, the Mining Law of Ontario, Canada stipulates that the mine must Provide land reclamation plans and pit closure plans in terms of design, capital assurance, etc. In addition, in the process of mining resources development, corresponding comprehensive resource utilization measures and environmental protection measures should be formulated, such as solution-leaching mining, waste-free technology, etc.

Seek international cooperation and enhance the optimal allocation of resources.

Due to the different economic development levels of countries in the world, the effective utilization of mineral resources depends to a certain extent on the country's production technology level and production costs, and other factors. Therefore, in the process of resource development and utilization, it is necessary to actively seek cooperation with other countries. Cooperation to maximize resource extraction and utilization. In recent years, investment in foreign mining companies in Africa and South America has increased year by year, and the internationalization of mining is showing a clear trend. In China, obvious steps have been taken in the internationalization of mining development. In today's world where the pace of economic globalization is accelerating, higher requirements are placed on the sustainable utilization of mineral resources. Mining investment, technological innovation, etc. are all affected by the comprehensive utilization of mineral resources. Therefore, the mining resource mining industry has greatly improved in terms of technological development and cost reduction, which is the only way for mining enterprises to take scientific and technological progress to improve economic benefits.

Recycling of alternative resources.

For a long time, the price of mineral raw materials has continued to rise. For example, the price of copper has risen exponentially in the past two years, resulting in the development of some mine resources with lower grades, resulting in a continuous increase in production costs, environmental pollution, and ecological damage. keep getting worse. Therefore, while using the existing resources scientifically and rationally, we must also actively seek new alternative resources, such as the recycling of scrap metals. The recycling of waste resources will have an impact on the production of mineral primary metals. On the one hand, it can reduce the production of mineral primary metals and improve resource utilization. On the other hand, it can reduce environmental and ecological damage and achieve sustainable social and economic development. important measures.

5. SUMMARIES

The research on the comprehensive development and utilization of mineral resources is of great significance to the sustainable development of the national economy and to ensure the full utilization of mineral resources. In the process of mineral resource development and reuse, we must not only emphasize the development of the economy itself, but also comprehensively evaluate its social benefits and good environmental and ecological benefits, and pay attention to the rational allocation of resources and the effective and sustainable utilization of resources. Therefore, in the process of comprehensive development and utilization of mineral resources in the future, theories and technologies of systems theory, economics, social science, ecological environment, mineral processing, metallurgy, computer science, and environmental science should be comprehensively applied to continuously improve our country. The technical level and comprehensive utilization level of mining development, in order to fully, effectively, and continuously utilize the limited mineral resources. Only on the basis of a benign environment and ecological balance can the development of the mining industry achieve healthy and sustainable development.

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