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## Research on Mining Development in Yunnan under Ecological Environment Compensation

Jianqun Xiang, Yunzhong Liu\*, Dan Dong, Meng Zhang

School of Economics and Management, China University of Geosciences, Wuhan, 430074, China

\*Corresponding author, e-mail: liu\_yzh8888@sina.com

### Abstract

Yunnan province is rich of mineral resources and the mining industry is the pillar industry in Yunnan. But with the development of mining economy, the problems of the ecological environmental damage have come out. Under the mechanism of ecological environment compensation, the mining economic development in Yunnan needs to deal well with the problems of environmental protection. According to the natural ecological conditions of mining area in Yunnan Province, and combining with the phenomena on economic, social, and environmental development, the paper will analyze the impact on ecological environment in Yunnan in the process of mineral exploitation and utilization. It will also provide the mining development and environmental protection in Yunnan with reasonable proposal and give decision-making references about development plans for government.

**Keywords:** ecological environment compensation, Yunnan Province, development of mining industry

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### 1. Introduction

The step of industrialization in china is speeding up, and with the pressure of population's rapidly growing, economic and social development has increased the demand of mineral resources dramatically. The extensive economy which depends on consuming large amount of mineral resources has also exacerbated the shortage of mineral resources. Based on the organic fusion of ecology and economics — the theory of ecological environment compensation, which is undertaking a research on utilization of mineral resources, is a hot issue concerned by the field of resources, environment and economics in current. The theory of ecological environment compensation is applied on the research of mining economy. The theory depends on the economic means to regulate the development and utilization of mineral resources reasonably, and to protect the exploitation and utilization of resources as well as the sustainable development of ecological environment and economy. The theory will also make mining economic development and ecological environment protection in harmony, and finally realize the common progress among economy, environment and society.

### 2. Mineral Resources Situation in China and the Actual Conditions of Yunnan Province

Mineral resources are not renewable, and they are material basis for our survival and development. And they are not only the source of subsistence, but also the important social material of production. According to the statistics, there are more than 95% of the energies and more than 80% of the industrial raw materials are mineral resources. The Ministry of Land and Resources has released that there are 155 kinds of minerals have been proven reserved in China, including 8 kinds of energy minerals, 144 kinds of metal minerals and non-metallic minerals and 3 kinds of moisture minerals.

Looking from the total amount, China's mineral resources have proven reserved account for about 12% of the world, and have ranked the third place in the world. But the per capita consumption only reaches 58% of the average level of the world, and has ranked the 53th in the world. And looking from the metallogenic geological conditions and grade of mineral resources, the large used and great important minerals, such as iron, copper, aluminum, manganese, zinc, lead, sulfur and phosphorus, are full of the lean and difficult-mining resources which are hard to develop and utilize.

Therefore, the basic situation of China mineral resources is: 1) Gross is very rich, but the amount of per capita consumption is seriously insufficient; 2) The quality of most mines is poor, particularly the bulk minerals, and the minerals do not have international competitiveness; 3) Strategic mineral reserves are short, such as petroleum, gas, bauxite, iron, sylvite, copper, chromite, manganese and other important minerals, and our consumption of mineral resources depends highly on import. But the non-core mineral reserves are abundant; 4) Full of medium and small mines but lack of large or super large-scale and opencast mines; 5) Full of lean and difficult-mining resources but lack of the rich, and the resources are hard to exploit and utilize; 6) By the limit of geographical conditions and the amount of resources, the layout of resources and distribution of productivity don't match.

China is one of the countries rich of mineral resources in the world, and its development of solid minerals has already got the second place in the world. China's total amount of minerals and output is about 5 billion tons per year. What worth carrying out is that the amount of mineral resources which China's state-owned mining enterprises have exploited and utilized reaches 150 and the annual output of minerals is approximately 2 billion tons (excluding oil and gas). About 179 kinds of mineral resources are developed and utilized by small mines, and the annual output is about 3 billion tons. However, the main minerals don't belong to state-owned mining enterprises. Of course, the production of non-ferrous metals, such as crude oil, coal and other 10 kinds of mineral resources, has been in forefront in the world.

Yunnan Province is one of the areas rich of mineral resources, and its main resources and mineral industry are non-ferrous metals and phosphorus chemical industry. Since 1949, through a few rounds of large-scale exploration, 142 kinds of minerals have been found. Among them, there are 61 kinds of resources whose solid mineral resources and reserves keep the top 10 in China, and the first three has 25 kinds of minerals.

The mineral advantage in Yunnan is non-ferrous metal, whose species is relatively complete, but the problem of replacing resources stands out. Ferrous metals are iron, manganese, chromium, nickel, titanium and so on. Iron is in large reserve, but in which the lean is more and the rich is less, and one third of the reserves are oolitic hematite and siderite which are difficult to choose. What's more, the chromium and vanadium are short. Precious metals, such as gold, silver, platinum and palladium, are in tremendous potential. Coal, geothermal, hydropower and uranium are abundant, but lack of oil and gas. And the mineral advantage in Yunnan Province is chemical raw materials.

### **3. Development of Mining Industry and Ecological Environmental Protection in Yunnan Province**

Yunnan Province is rich of mineral resources and developed mining industry. It has mainly been a base of non-ferrous metal and chemical industry of phosphorus. In recent years, the mining economy has become the core industry in Yunnan industrial system, which has an average annual rate of 20% and has pulled the industrial economic growth of 5.37%. According to several important economic index, such as the investment in fixed assets of mining industry, the total capital of the mining industry, the employees of mining industry, the export of mineral products and the gross industrial output value of mining industry, the mining industry has been the biggest industry in Yunnan Province.

In 2010, the gross mining output value in Yunnan Province (including exploiting, choosing, smelting and outstretched processing) was 300 billion yuan, accounting for 41.5% of Yunnan's GDP (722.418 billion yuan). And the mining added value was 180 billion yuan; the tax and profit was 36 billion yuan. According to the data in 2007, in Yunnan Province, the amount of ore was 240.0088 million tons and the mining industry output value (including mineral raw materials and primary products) was 31.596 billion yuan, and also the profit was 6.57 billion yuan. The data indicates that Yunnan mining economy has been developing rapidly.

In Yunnan, the mines are mainly in small scale and low production capacity. There are full of small mines (about 96.8%) and the large-scale mines are just a little (only about 1.4%). Looking from the concrete data about the development and utilization of mineral resources and amount of mines, in Yunnan, the amount of mines is 1,214, and there is 633 key-mining area. According to the number of mining enterprises, in Yunnan, the number of mining enterprises has reached 8,866, but these enterprises are mainly in small scale, and the number of employees in mining enterprises is about 438,500. Government hopes improving the quality of

exploiting mineral resources through the principle of "one mine one lord; orderly and unitively; mining in scale", and controlling the total amount of mines less than 6,000. According to the existing 8,675 valid mining permits, the approved area is about 4,628.94 square kilometers, accounting for 1.17% of the land area in Yunnan Province.

According to the development of mining economy in Yunnan, there exist serious problems:

### **3.1. Exploiting Mineral Resources cannot reach Scale-effect**

Looking from the scale of mining enterprises' production, the production of the large and medium-sized mining enterprises in Yunnan has accounted for only 25.13%, but the small mining enterprises' production is 74.87%. And looking from the scale and production links, the mineral development in Yunnan is difficult to walk the street of large-scale mining and intensive and highly efficient management.

### **3.2. Exploiting Mineral Resources cannot reach Scale-effect**

The development and utilization of mineral resources in Yunnan Province is still in extensive operation. Mineral resources waste seriously in Yunnan, especially the small mining enterprises, which till have used the backward technology in widespread. In the process of exploitation, the recovery rate is very low and the same to recovery rate of choosing minerals as well as comprehensive utilization index. Part of the mining enterprises, which are restricted by technology or other reasons, have appeared the phenomenon that they accept the rich but abandon the lean and pollute the environment. The result of these kinds of situations is, on the one hand, they have damaged the utilization of mineral resources; on the other hand, they have exacerbated the contradiction between the supply and the demand of mining and also the contradiction between mineral exploitation and ecological protection.

### **3.3. Mining is Short of Ecological Environment Compensation**

Mineral resource in Yunnan is overexploited and people are lack of environmental protection consciousness. Around the mines, the geological environment has been damaged seriously, and there need much money to restore and manage it, and also it is full of difficulties. In accordance with the data provided by relevant department, in Yunnan, the mining industry has occupied or damaged the soil about 279,400 hectares, accounting for 4.6% of cultivated land (a total area of 6.0487 million hectares) in 2010, and the direct economic loss is about 30 7.3074 million yuan. In recent years, due to mining, the soil occupied or damaged is still increasing year by year, and the recovery has been lagged seriously. For example, in 2007, only 24.1% (about 1,859.99 hectares) of the mineral soil occupied or damaged (about 7 717.40 hectares) was restored. The mining economic development brings damage to the ecological environment and has affected the sustainable development of society and economy. The contradiction between mining industry development and ecological environmental protection has formed a threat and uncoordinated factor to the demand of development and utilization of mineral resources as well as the environmental, economic, and social development. It is a heavy task to protect and restore the geological environment.

As we all know, Yunnan Province is a water source for China and Southeast Asia. There are six rivers, such as Dulong River (Irrawaddy), Nu River (Salween), Lancang River (Mekong River), Jinsha River (Yangtze River), Yuan River (Red River) and Nanpan River (Pearl River), go through or originate from here. There will be a serious problem for damaging the ecological environment in here.

The development of the mining industry in Yunnan must insist on the scientific concept of development, and regard the exploitation of mineral resources and environmental protection as guidance. Researching the comprehensive deployment of mineral resources protection and utilization in Yunnan must be in accordance with the medium and long-term development strategy of regional economy and society, and combine with the demand of regional economic construction and social development. Strengthening the comprehensive evaluation of mineral resources protection and exploitation of the key metallogenic zone and important economic zone, promoting the connection of all kinds of funds effectively, and improving the using efficiency and level of local economy and mineral resources must co-ordinate the economic benefits between the central government and local governments and take various forms about investing and developing mineral resources into consideration.

However, shortage of the knowledge about ecological environment compensation while exploiting mineral resources and the ineffective measures of ecological environment compensation has formed the bottleneck for development of mineral resources in Yunnan Province.

#### **4. China's Practice References on the Experience of Foreign Ecological Environment Compensation**

We believe that the exploitation of mineral resources is a necessity of the development of economy and society, and the exploitation, development and utilization of mineral resources involve the method of how to raise mining economic input and output. Because of the damage for ecological environment while exploiting and developing the mineral resources, the understanding about mineral resources exploitation and the value in use should include the ecological environment compensation. Economics put that the ecological environment has the value and the value in use, and economic means should be used for controlling the damage of ecological environment, and also the economic compensation should be used for the victims in order to realize the purpose of protecting ecological environment. The common method is to charge (or compensate) the behavior of damaging (or protecting) resources and environment, and increase the cost (or profits) of these behaviors. Therefore, we can accord the economic externality theory of ecological environment to realize the purpose of protecting resources, and reduce (or increase) the external diseconomy (or external economy) through encouraging the behavior of damaging (or protecting) the environment.

##### **4.1. Foreign Experience of Ecological Environment Compensation**

The exploitation, development and utilization of mineral resources are a necessary process for our humanity in the period of economic development. Exploiting and processing mineral resources will lead to ecological environmental damage. In the past, exploiting and processing mineral resources only paid attention to the efficiency while utilizing mineral resources, and ignored protecting the ecological environment. However, in order to solve the contradiction between the supply and demand of mineral resources, the developed countries attach great importance to the ecological basis and environmental carrying capacity. In the process of exploiting, developing and utilizing the mineral resources, the mechanism of ecological environment compensation can deal well with the problems. And we can consult the experience of ecological environment compensation in Germany and the United States.

###### **4.1.1. Practice and Experience in Germany**

Germany is rich of coal resources and its exploitation and utilization of coal resources are highly developed. Germany mining industry has done strong harm to the ecological environment and has affected people's life and social sustainable development. In face of the contradiction between the development of mining industry and environmental protection, the German government has formulated the "Federal Minerals Law ", which has provided clear rules about the ecological environment compensation and recovery in mining area.

"Federal Minerals Law" has distinguished the problem about the ecological environment compensation and recovery between the new and old mining area, and has taken different measures to compensate the new and old mining area. Legislation is mainly to help develop German mining industry and to solve the problems left by history. The law regulates that the government will bear the compensation cost of solving the problems left by history about ecological environmental damage in old mining area. At the same time, establishing mineral reclamation companies to handle the ecological environment compensation and recovery in mining area, and the government financial will bear the funds. The federal government will bear 75% of the funds and the state government will bear 25%.

"Federal Minerals Law" has regulated that the newly established mine would bear all the costs to compensate and recover the ecological environment if it caused ecological environmental problems. In order to solve the problems effectively, the specific measures are taken out that the mining area developers must prevent the ecological environment from being damaged before examined and approved, and must compensate and recover the damaged ecological environment. The ecological environment compensation and recovery need a lot of money. "Federal Minerals Law" has regulated that mining enterprises should reserve about 3%

of their profit per year as the special fund for compensating and recovering ecological environment, because the ecological environmental damage won't stop due to enterprises' financial problems. In the process of law's enforcement, the government will appoint special investigation team to check the ecological environmental protection and recovery in mining area.

Government guarantees the quality of ecological environmental recovery, and comes on standard about developing mines and recovering environment, and also regulates the concrete operating link. For example, the soil digged out from open mining must be piled up classifiably so that it can be restored to initial and restore productivity; the mine water extracted can't be poured into rivers or lakes straightly, and it must be cleansed through reed wetland biological treatment; the owners of mines are responsible for underground water around the mines, and the owner must restore the mining pits into artificial lakes and be responsible for managing them about 100 years; if the reclamation area was cultivated land, it must have grown crops for seven years and made it restore productivity before accepted.

Strict measures can ensure that the mining enterprises will not do harm to the ecological environment while developing mineral resources. At the same time, the government is according to the three principles, that are avoid, reduce and compensation, to undertake strict management on ecological environment compensation.

#### **4.1.2. Practice and Experience in USA**

The United States Congress has taken legal measures to solve the problem of ecological environment compensation in mining. In 1977, the "The Surface Mining Control and Reclamation Act", whose abbreviation is SMCRA, request that open-pit mining enterprises must pay a certain amount of security deposit in advance, and must undertake financial arrangement of ecological reconstruction well for ecological environment compensation before obtaining the production license. SMCRA regulates that if the mining enterprises completed the reclamation, the whole security deposit levied would return to the mining enterprises; If there was no performance of reclamation, the security deposit would be used to subsidize some other association undertaking the reclamation. In 2006, the United States Federal Bureau of Land Management had formulated ten principles which were concerned about the management of energy resources and non-energy resources in the new period. The article 3 reiterated the importance of ecological security deposit. And the principles had also regulated that the United States Federal Bureau of Land Management must ensure security deposit should be used for reclamation.

The United States' policies and laws request that it is necessary to guarantee the ecological environment can be recovered before mining enterprises start to work. And the US has provided some specific financial support to compensate the damaged ecological environment and some feasible security measures of protecting the ecological environment.

We can consult the experience of ecological environment compensation in Germany and the United States to help us develop our mining industry.

#### **4.2. Foreign Experience of Ecological Environment Compensation**

China's ecological environment compensation is not strong enough. In China, in the process of exploiting mineral resources, the practice that compensates the damaged ecological environment began in 1983. The first trial of ecological environment compensation in Yunnan Province is in the process of exploiting phosphorus attempting to impose and charge the covering vegetation and other activities lead to ecological environmental damage. But the trial is not to further promotion. Until the 1990s, the state has imposed the exploitation of mineral resources and the initial purpose is to adjust the differential income in resource development, but it has no special funds on ecological environment compensation. We should pay attention to the protection of ecological environment and hope to reduce environmental pollution and ecological damage in exploiting mineral resources.

The problem of protecting and managing mineral resources stands out. In 1994, China has issued the "Mineral Resources Compensation Fees Levy Regulations" to collect mineral resources compensation fees. But the mineral resources compensation fees have stayed in making up for countries' shortage of resources exploration and administrative investment. And the fees are mainly used for complementing insufficiency of mineral resources exploration, whose 70% is used for complementing the shortage of funds for mineral exploration and 20% is

used for mineral resources management and protection and the remaining 10% is used for subsidizing the management departments. However, the stipulation neither takes ecological environment compensation into consideration, nor do take the ecological environment compensation fees. Mineral resources compensation fees only safeguard and promote the mineral resources management and mineral resources exploration, protection and reasonable development.

In 1997, the Article 32 of the "Mineral Resources Law of People's Republic of China" clearly specified the protection of ecological environment. The article reads: "Exploiting mineral resources must save land. If cultivated land, grassland or forest land was damaged due to mining, the mining enterprises must have taken measures, such as reclamation, planting trees and grass or some other useful measures to recover according to local conditions. If exploiting mineral resources did harm to people's work and life, the mining enterprises must have compensated people, and taken necessary redressal actions." The article is general about protecting the ecological environment, and doesn't mention the specific measures of compensating the damaged ecological environment.

The "Water and Soil Conservation Law of the People's Republic of China" and "Land Reclamation Ordinance" later promulgated have established a basic protective principle that "who damage, who recover" and put forward another principle that "who recover, who benefit" which is about beneficiaries.

China has begun to pay much attention to, in the process of exploiting mineral resources, the problem of protecting ecological environment in legal and management. And the government has been exploring how to make up or compensate the damaged ecological environment. Ecological environment compensation needs constantly being enriched and perfected in theory and practice.

## **5. Policies and Suggestions on Developing Mining Industry in Yunnan Province**

Yunnan province is full of mineral resources, and the development of mining economy is very important. On the one hand, it can satisfy the demand of mineral resources for national economic and social development; on the other hand, we must exploit and utilize mineral resources reasonably. To develop the mining economy, we must operate the ecological environment compensation well.

### **5.1. Suggestions on Developing Mining Industry in Yunnan Province**

#### **5.1.1. Increasing Funds and Technical Input in Mineral Resources Exploration and Development**

The place where metallogenic condition is well, resource potential is huge, and the work is of low degree in Yunnan Province, we should increase researches on public geological exploration and mineral resources evaluation. We should increase technical investment to the mines which have been discovered or have been working and raise their exploiting skill.

#### **5.1.2 Integrating Mining Enterprises' Advantages and Potential, and Strengthening Mining Economy**

We can integrate the existing mining rights, and introduce mining groups which have advantages and abilities, and also shut down or merger or transfer the possession of mine whose technology, mining ability and capital strength are poor.

#### **5.1.3. Giving Full Play to the Government, Enterprise and Society in the Role of Ecological Environment Protection**

We should insist on developing the mining economy and protecting the ecological environment. In the process of ecological environment compensation, we should give full play to government departments whose function are guiding and supervising, strengthen environmental protective investment, improve the environmental management system and encourage various forms of restoring and reconstructing the mining environment.

## **5.2. Principle of Implementing Environmental Protection**

Special attention is that in the process of mineral resources exploitation we must follow the rule of ecological environment compensation, and adhere to the following principles:

### 5.2.1 Principle of Sustainable Utilization

In combination with regional mineral resources distribution, we can deploy the activities of mineral resources exploitation reasonably, and regulate or optimize the allocation of mineral resources in macroeconomic. Through regulating the mining development, it can realize the coordination of resources exploitation and ecological environmental protection, and fairly utilize the mineral resources in generation and inter-generation.

### 5.2.2 Principle of Interest Balance and Environmental Justice

In the process of exploiting mineral resources, the ecological environment compensation insists on a duty that "who pollute who pay; who use who compensate; who damage who restore".

### 5.2.3 Principle of Complementing Government and Market

Using the system of government fiscal payment transferring and the system of environmental tax can improve the mechanism of ecological environmental property rights, the trading mechanism and the price mechanism, and can express the impact of the market mechanism which can guide the supply and demand of ecological environment resources, and also can build a mechanism of ecological benefit and responsibility sharing in fair and openness.

### 5.2.4 Principle of Compensation

Mineral resources compensation can use diversified economic means, such as compensation to mineral resources, value of ecological environment and the produced value by labor input.

### 5.2.5 Principle of Ecological Protection

We can implement payments in advance on the ecological environment compensation. From the decision-making stage of mineral resources development, we can take measures to solve the damage of ecological environment, invest the effective measures that compensate the ecological environment in the process of development and utilization and slow down or avoid reducing the losses of the quality and quantity of ecological system to minimum.

## 6. Conclusion

In China's mineral resources exploitation process, we has paid much attention to the ecological environmental protection in legal and management, and the problem has been solved theoretically and practically to a certain extent, but The damage of ecological environment needs to take various measures to make up or compensate, and the ecological environment compensation needs constant enrichment and improvement in theory and practice. Through learning the actual experience of the ecological environment compensation in Germany and the United States, we can draw lessons from their experience to strengthen the management of mining development and environmental protection so that can keep mineral development and protection in balance.

## References

- [1] JY Li, SJ Wang. "Research on Legal Mechanism of Ecological Environment Compensation," Heibe Law. 2007; 6. (in Chinese)
- [2] MD Gao. "Research on Legal System of Ecological Environment Compensation of Mineral Resources in Our Country". Studies in Law and Business. 2007; 2. (in Chinese)
- [3] T Gao. "The Exploration on Mechanism of Ecological Environment Compensation of Exploiting Mineral Resources—Take the Oil Development in Qingyang as the Example," Environmental Conservation. 2007; 4. (in Chinese)
- [4] The State Council. "The State Council on Strengthening Geological Work Decision". Geological Publishing Print, Beijing. 2006; 7.
- [5] CM Yang, JH Cheng, CP Hao. "Resources and Environment Economics". Hubei People's Publishing Print, Wuhan. 2007.