

On Nontraditional Mineral Resources and their Research Method

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1. INTRODUCTION

Mineral resource is nonrenewable. Limited traditional mineral resources have been gradually dried up and exhausted with consumed of economic development; on the other hand, new requirement of burgeoning industries have being put forward to the purposes of mineral resources. All of the questions just focus on how to find and develop adequate resources so as to satisfy the needs of social development over the world. The way of resolved the question, in our opining, is that nontraditional resources substitute or offset traditional resources as far as possible. Nontraditional resources refer to that potential mineral resources are unconsidered and unused under actual condition of techniques and economics, or some mineral resources are too difficult to find because of geological complexity. Therefore, it is necessary of geological research to establish theory system of nontraditional mineral resources.

Therefore, the research of nontraditional mineral resources not only is significant to satisfy the needs of human beings in 21st century, but also important to geology. Based on results of investigation, we got cognition as follow. (1) The new century and new producing area will need the discovery and development of nontraditional deposits. (2) Nontraditional resources will play more and more important role for sustainable development in next century. (3) Industrialized production will ask to correspond the system of nontraditional mining under new standard of environmental requirment.

2. ESSENCE SYSTEM OF NONTRADITIONAL MINERAL RESOURCES

The system of nontraditional mineral resources is included nontraditional resources, research methods, mining, and mineral economics.

Nontraditional resources including new types of ore deposits, new scopes of ore deposits, new depth of ore deposits, new technology of processing and new utilization of minerals. Discovery and exploration new type of ore deposits will ensure to sustainable increasing needs of mineral reserves. Discovery and exploration new scope of ore deposits will partly substitute or offset traditional resources. The new technology of processing and new utilization of mineral resources will be strategic selected to mineral resources in 21st century.

Nontraditional research is the important approach of mineral exploration. In the 21st century the more demand for mineral resources we have, the more scientific methods for reducing exploration risk we need. For resolving this problem, we have to apply a more scientific method of prospecting than have been traditionally used. The nontraditional research is also included other theories, such as nonlinear theory, comparability theory, geological statistics, geo-anomaly forming theory, and so on.

The reformation of mining will influence over the world in 21st century. Face to the changes, every country has to find new thoughtfulness to establish system of nontraditional mining. Under applied new-high techniques and adapted environment protected, the new mining system might be of capabilities of high accession value, synthetic serve and high benefit. So-called high accession value refers to commodity of mineral resources that they are of high benefit. In 21 century, synthetic thought clue has to think about social serve, market needs, and post-mineral economics. On the other hand, synthetic utilization of useful elements of ores and of ore deposits will be also researched in this scope, which synthetically prediction regional resources, such as territorial resource, plantation, mineral and so on.

Mining has vital relationship with economics in every detail, and mining economics is the background of evaluating advancement of mining industry. Based on what ore value is decided by mining economics, what scale of mine and smelt plant are decided to build, which mining development only follows the rules of mineral economics. In fact, mineral economics runs through each specialty of mining and spans geography boundaries. Therefore, the system of strategic resources integrates economics with ore deposits, regional geology and mining in 21st century. We have gotten the conclusion that mineral economics develops under international and inland markets, and also under international and inland resources.

3. RECENT INCISION OF NONTRADITIONAL RESEARCH IN CHINESE

3.1 The distribution of nontraditional deposits and their metallogenic model

The original types of ore deposits have been gradually recognized with geologic researching, but some phenomena of ore-forming are ignored because of the level of geological recognition in different stages. New discovery of nontraditional deposits may bring up great changes in geological research, which not only develops metallogenic theories, but also generates economic benefits. As we know, the discovery of porphyry copper deposits has great reformed, which the porphyry copper was not traditional deposit in that time. Some situations are similar to porphyry copper deposits, such as from chromite of orthomagmatic deposit to that of impregnation deposits, Carlin-type

gold deposits to impregnation Au deposits, diamond found from kimberlite to super-high pressure metamorphic belt and of lamprophyre. In China, therefore, the incision of nontraditional research is looking for new original types of ore deposits, such as gold deposits of strata of precambrian in western Shandong Province, and lower-grade chromite in Hebei Province. At first, the geological background of metallogenic, distribution of the types in space and geohistory, and their metallogenic model, which those types of mineral resources are great demanded in economical development of China.

3.2 Discovery and exploration new type of ore deposits in crisis mines

According to statistics, 70% of total amount of ore deposits were recently found near or skirts of known large mines in eastern China. On the other hand, it is necessarily to have new discoveries around such large mines, so called crisis mines, which they have served more than tens years. Based on investigation, the incision of the nontraditional research includes two aspects as bellow.

3.2.1 Discovery and research new useful associated components in crisis mines

The ore deposits are mainly a metallogenic series of metals or nonmetals, which some have utilized one or some components of them in China. When large crisis mines serve a long time, it is strictly phenomena to run short of reserves and organize befittingly production. Therefore, based on geological analysis and synthetic utilization, associated components may have new values under recent economic and technique condition. A large Cu-Au ore deposit, for example, has mined its Cu for a long time, but the component of Au has not utilized as gangue. After exploring its gangue and goaf piles, it is very convenient to circle Au reserves, which the economic benefit may compare to explore and establish an Au mine. If outspreaded the investigation over a province or whole country, some crisis mines will be extended their serve cycle, and the demand of such mineral resources will be partly satisfied in the future.

3.2.2 Discovery new types of ore deposits in crisis mines

In crisis mines, discoveries new types of ore deposits are also very important because most ore deposits are mainly a metallogenic series of metals or nonmetals in China. In our country, production of mines were merely focused on a main type, which, the others were not paid enough attention. As we know, some Skarn ore have paragenetic relationship with porphyry ore and hydrothermal ore in general. Some of ore types have been found, but some may be not because of research degree and recognition level. Based on modern metallogenic theories and further research data, it is

possible to find new type of large-scale ore bodies in crisis mines. Gejiu cassiterite deposits in Yunnan province, for example, were found oxidized ores of vein and layer at first. Then, oxidized ores of banded, veinlet and stockwork zones were found, and at last, primary ores in contact zones found, which the production has changed from mere distilling Sn to distilling Sn, Cu and polymetallic ores.

3.3 Developing nontraditional prediction theory

The prediction of mineral resources is a complex question, which nontraditional methods are asked by the century and the scientific branch. As mentioned on above, we develop the geo-anomaly theory to find essential rules of mineralization, which the theory is not only suitable for nontraditional mineral resources, but also for conventional. The relationship between the geo-anomaly and ore-forming/ore-finding is a very complicated problem, which deals with at some influential factors. Such as: (1) the development and evolution process of ore forming; (2) the burial condition and erosive extent of mineral deposits (bodies); (3) the mineral prospecting work and research extent; (4) the development level of the study of mineral deposits and mineral prospecting; (5) the development level of technology used in the area being prospected; (6) the characters of the geophysical field and the geochemical field of mineral deposits or bodies; (7) the time of the ore-forming and the extent of being remolded after the formation, etc. Because these factors have different situations, the nature, connection and obviousness of the relationship between the geo-anomaly and ore forming are different.

The relationship between the geo-anomaly and ore-forming is of the obvious type and the hidden one. The geo-anomaly that has the obvious relationship with ore forming is often in coupling or telescopic relationship with geophysical and geochemical anomaly, which provide the relatively reliable prognosis for mineral resources or mineral bodies. In general, the obvious types are shallowly buried underground mineral deposits, mineral bodies or mineral resources. The mineral-bearing formation has a considerable contrast with the geophysical field and (or) geochemical field of the surrounding geological formation, which has a late ore forming and has not undergone strong reform. As for the geo-anomaly hidden relationship with ore forming, its relationship with the geophysical and geochemical anomaly shows the following two cases. Firstly, at the anomaly, the geophysical and geochemical coupled with it does not appear. The cause for the formation of the previous hidden is that the ore body is deeply buried, which the ore body has minor difference of physical property with the surrounding rock. Secondly, in the geological background field, there is the geophysical and geochemical anomaly telescoping, which can not be explained at present. The cause is due to the lack of height in working level and cognitive level.