

Research on Accelerating the Scientific and Technological Innovation and Development of Geological Prospecting Entities

Lamei Li^{1a}, Yuan Yao^{1b*}, Hao Yan^{1c*}, Fangfang Liu^{1d}, Lei Wang², Junjie Yi^{1e},
Qinghua Yan^{1f}

¹Institute of Mineral Resources Research, China Metallurgical Geology Bureau, Beijing, 101300, China

²Northwest Bureau of China Metallurgical Geology Bureau, Xian, 710119, China

^alilamei-2004@163.com, ^{b*}yaoyuan@cmgb.cn, ^{c*}yanhao@cmgb.cn,

^dliufangfang@cmgb.cn, ^eyijunjie@cmgb.cn, ^fyanqinghua@cmgb.cn, ²wanglei@cmgb.cn

ABSTRACT

Currently, geological prospecting entities are facing varying situations. To seize the chances of development, these entities shall continuously enhance their scientific and technological innovation, so as to take the path of sustainable development. From the perspective of macro geological view, macro resource view and macro ecological view, the paper has explored the development goal, system and mechanism, platform construction, team building, construction of technical equipment system, etc. of geological prospecting entities, providing references for the acceleration of scientific and technological innovation and the formation of core competitiveness of these entities.

Keywords: *geological prospecting entities; scientific and technological innovation; system and mechanism; core competitiveness*

1. INTRODUCTION

The geological field in the new era has different characteristics with that in the past times. The overall layout of the "Five in One" and the national strategy of building a beautiful China require us to guide the scientific and technological innovation in geology with the macro geological view. The implementation of Belt and Road Initiatives, Beijing-Tianjin-Hebei coordinated development and Xiongan New Area Strategy have brought new opportunities to the development of geological works. Therefore, geological prospecting entities need to take into deep consideration of problems such as how to actively adapt to the new situation, improve the scientific and technological innovation system, stimulate the vitality of innovation, promote the development of scientific and technological innovation, make breakthroughs in core technologies, and form a competitiveness in the industry, etc.

2. PRESENT SITUATION OF GEOLOGICAL SCIENCE AND TECHNOLOGY WORK

In recent years, the innovation ability of geological science and technology has been increasingly enhanced, the overall innovation level in geological science and technology has been increasingly improved, and a large number of outstanding scientific and technological talents and major scientific and technological innovative achievements have emerged in geological prospecting industry. However, the theory and technology in geological prospecting still need to be improved, and geological prospecting, like the reform and opening-up, has entered a difficult and complicated period. The existing results of basic geological prospecting and research need to be systematically collated and taken full use, the exploration theory, technical method and prospecting equipment of concealed orebody, deep orebody, shallow overburden area and basin area need to be updated, and the systematization and digitalization of geological exploration need to be improved.

Restricted by equipment and technology, the exploration efficiency and results in discovering mines of geological prospecting entities have been affected to varying degrees (Fu, et al.,2020) .

Based on the law of global prospecting and discovery, the prospecting difficulty in China has become medium. However, the overall degree of mineral prospecting work is relatively low, unidentified mineral resources are still abundant and there is a great prospecting potential, especially in western areas where there are rich mineral resources, and unidentified deep orebody in eastern areas. With the increasing difficulty in geological prospecting, the geological scientific research work is playing an increasingly important role in geological prospecting. The ability of scientific and technological innovation has become the key to realize sustainable development.

As the outcrop mine is currently exhausting, the difficulty in discovering mines is increasing. Mineral prospecting circles at home and abroad have reached a consensus that the research on deep geological resources shall be strengthened, the depth and accuracy of prospecting technology shall be improved and deep minerals of the earth shall be further discovered. In addition, people will enter a new stage of ecological civilization, which takes saving and intensively using resources and protecting the ecological environment as its core(He et al., 2018). People will enter the stage of global cooperation and research, and the driving force of the demand of geological work has changed much; Meanwhile, there are new changes in geological works. Firstly, the basic geology has changed from general information mapping to deep information mining, and the research focus has gradually shifted to geological survey in key zones of the earth; Secondly, the research on mineral resources has changed from traditional mines to emerging mines, from shallow mines to deep mines, from general research to systematic research on the whole life of mineral resources; Thirdly, the integration of information technology and geological prospecting is getting closer and closer, and the era of "big data" is coming.

China is making overall deployment for geological work with "macro geological view, macro resource view and macro ecological view"(Shi et al.,2014). Meanwhile, the top-level design of geological industry has been placed more emphasis on, so as to meet the needs of economic and social development. With the constant promotion of national geological prospecting works, to explore the potential resources of known mines, to prospect three-dimensional blind mines in the eastern regions, and to investigate regional comprehensive prospecting in the dangerous areas in the western regions have become the main objectives of geological prospecting industry. Accelerating the

innovation of prospecting theory and the integration of rapid evaluation technology to achieve a rapid breakthrough in prospecting has become an urgent need in China. The recent transformation and restructuring layout of geological prospecting teams in China have put forward requirements to us to have a clear understanding of the situation we are facing, the responsibilities we shoulder, the situation and orientation of the teams, and the strategic objectives. Meanwhile, it is necessary to strengthen planning, carefully deploy, refine the implementation plan, strengthen the implementation effect, and steadily advance the works.

3. ADJUST THE DEVELOPMENT OBJECTIVES

The deepening of the reform of geological prospecting industry system in China is facing an important period, which is also the key period of major adjustment of the structure of geological works. The integration of macro geological view, macro resource view and macro ecological view, will adjust the geological prospecting industry in 6 aspects, namely, the adjustment from mineral prospecting to natural resources prospecting, from resource prospecting to comprehensive prospecting, from land-based prospecting to land-sea integrated prospecting, from single discipline to multi-disciplinary intersection, from solid minerals to new energy and strategic energy, and from plan submission mode to market demand mode.

Geological prospecting entities shall comprehensively analyze the domestic and international situation, adjust and deepen the layout in the objectives and fields of development based on their advantages. In addition, they should also constantly follow the national strategies such as "the belt and road initiative", coordinated development of Beijing-Tianjin-Hebei, Xiongan New Area, western development, Yangtze River Economic Belt, and construction of Greater Bay Area. The prediction and study on the medium and long-term development trend of mining industry shall be carried out, so as to provide scientific decision-making basis for the deployment and adjustment of geology and mineral resources strategy.

Based on the consolidation of traditional geology, the entities shall proactively adjust the research objectives, expand the study on environmental geology, urban geology and construction of big data platform, etc. Traditional geological prospecting entities should focus on the analysis and study on metallogenic regularity and potential, application and demonstration of prospecting techniques and methods, study on comprehensive development and utilization of minerals, construction of data platform and strategic research, integration and promotion of scientific and

technological innovation achievements, etc. Meanwhile, they should also gradually improve their capabilities in scientific and technological research and development in hydrogeology, engineering geology, environmental geology, disaster geology, marine geology, energy geology, remote sensing technology, etc. By focusing on product categories, they will become large geological science and technology innovation bases and form their core competitiveness.

4. IMPROVE THE SYSTEM AND MECHANISM

We should accelerate the reform and innovation of institutional mechanisms, establish and perfect the stimulation mechanism from multiple levels, constantly innovative the development goal, promote the innovation and developmental vitality. In terms of the adjustment and improvement of systems and mechanisms, we should establish management system with clear responsibilities, rights and benefits and operation mechanism to encourage scientific and technological innovation, forming a dynamic operational mechanism with both incentives and constraints (Wan, 2021). Meanwhile, through the enhancement of the cooperation with relevant state ministries, local governments, industry associations and international institutions, a pattern of overall utilization of resources inside and outside the system will be formed, as well as a win-win cooperation in scientific and technological innovation.

4.1. Establish an efficient management system

From the perspective of reshaping the management system, the important role of expert committee in scientific research layout, resource allocation, scientific and technological evaluation, etc. shall be given full play. The establishment of an advisory committee system composed of high-level experts inside and outside the system shall be explored to improve the strategic and scientific nature of innovation and development, and form an integrated management mode.

4.2. Explore an efficient resource allocation system

As the undertaking party of resource allocation, these entities shall proactively explore a new mode of overall allocation of resources, link resource allocation to innovation performance, and gradually improve classified evaluation systems and mechanisms based on innovation, safeguarded by quality, in accordance with contribution and evaluated by achievement.

4.3. Improve the system of scientific and technological innovation

To stimulate the vitality of scientific and technological innovation system, we should regularly adjust and standardize rules and regulations, constantly improve the procedure of the formulation, modification and abolishment of rules and regulations, so as to improve the binding force and implementation of the system. We should implement the relevant requirements of the central government on the reform of "more freedom, better management and service" in scientific research, and establish a system with clear responsibility, ordered standard and efficient coordination. We should fully enhance the enthusiasm and creativity of scientific research personnel, so that scientific research teams will have greater decision-making power on technical plans, greater control over funds and greater right to mobilize resources.

Through the establishment of medium and long-term incentive mechanism, the motivation of scientific personnel will be stimulated. Through the implementation and improvement of policies such as fund management of science and technology projects, the budget management, process management, performance management and results management will be enhanced and regulated. By implementing and improving the management system of indirect funds for scientific research projects, the proportion of performance pay for personnel incentive will be increased; By establishing and improving relevant systems for utilizing external human resources, it is conducive to jointly construct key laboratories and postdoctoral research workstations with universities. By hiring senior experts, visiting professors, etc., we will give full play to the role of external scientific and technical personnel, and make up for the shortage of existing personnel.

4.4. Create a good environment

Through the construction of corporate culture, a healthy and upward cultural atmosphere for scientific research will be formed, so as to create a good employment environment. During the optimization of the environment for talent development, we should fully respect labor, knowledge, talent and creativity. Only with a good atmosphere for scientific research will the cohesion of the team be strengthened, and the soft power of scientific and technological development be improved (Lan, 2015).

5. ACCELERATE THE ESTABLISHMENT OF THE PLATFORM

More specified and professional-oriented research institutes shall be established based on the strategic positioning of geological prospecting entities. Meanwhile, we should proactively promote the development model of win-win cooperation. We should strengthen the cooperation with relevant scientific research institutions, universities and enterprises at home and abroad, build platforms for research, and improve collaborative innovation capability.

Through the establishment of common technology platforms, including the regional mineral research and development platform, ferrous metal research and development platform, geological big data application research and development platform, polar basic geology research platform, exploration technology research and development platform, environmental and disaster geology research platform, remote sensing and geophysics research and development platform, urban geology research and development platform, geological and mineral information research and development platform, etc., the role of colleges and research institutes can be fully exerted, so that applied research and common technology research in the industry can be carried out to promote the technological progress.

To ensure the stable operation of the research platform, operation management systems and mechanisms of the platform should be established, a system covering the establishment of scientific research platform, platform construction and implementation, operation and management, and acceptance and assessment should be formulated. We should also stress on regular evaluation and adjustment, implement an open, flexible operation mechanism, carry out dynamic management to make the platform become a high-level scientific and technological innovation platform with continuous vitality and suitable for talents development.

Based on the enhancement of the establishment of science and technology research and development platforms, we should explore the establishment of industrial platforms, such as establishing incubator technology companies, so that the scientific and technological achievements can be practically applied to promote the development of the industry.

6. ACCELERATE TEAM BUILDING

We should further optimize the structure of scientific research team, strengthen the cultivation of leading researchers through introduction, cultivation and cooperation. In this way, a geological research team led by academic leaders with reasonable age structure, professional distribution, unity and cooperation, and

complementary advantages will be built. We should further improve the overall level of the scientific research and innovation team, cultivate a group of geological talents with multiple levels, so as to build a high-level geological science and technology innovation team with complete specialties, distinctive features and moderate scale.

6.1. Strengthen the introduction and training of personnel

We should vigorously strengthen the cultivation and introduction of high-level and outstanding young talents, strengthen the classification and evaluation of talents, and introduce talents in line with the strategic development of geological prospecting entities. In addition, we should also strengthen the cultivation of scientific research talents and management talents, so as to further improve the core competitiveness of the team(Wang, 2020).

6.2. Strengthen the advantages of the talent team

We should further strengthen the advantages of existing group of talents based on the construction of platforms and capabilities, establish a high-level innovative team which is cooperative and excel at researching on prospecting technology and strategy, and further improve the team cohesion and collaborative innovation.

6.3. Strengthen intelligence sharing

We should stick to the mutual benefit and win-win principle, strengthen the intelligence sharing with institutions of higher learning, scientific research institutes and enterprises, and improve the level of scientific and technological cooperation through various forms of technical activities and exchanges.

6.4. Accelerate the construction of technical equipment system

To improve the ability and level of scientific research development of geological prospecting entities, we should accelerate the development of the implementation in innovation, enhance the construction of the equipment system of aerial remote sensing technology, field geological exploration technology, rock and mineral experimental test technology, as well as the comprehensive processing platform of earth resources and ecological environment data. Through the construction, development and application of the comprehensive processing platform of earth resources and ecological environment data, the transformation of the processing of geoscience data will be promoted, so

as to provide strong support for the deep development of geoscience research and application data of resources and environment. In this way, the prediction in geological prospecting will be achieved, the development and utilization of mineral resources will be more scientific, and data processing will be more convenient and real-time, and public service will be more citizen-friendly. Eventually, an integrated big data sharing processing platform which can investigate, collect and integrate various geological data will be established.

7. CONCLUSION

In this paper, we analysis the environment of geological work and objectives of geological development, discuss how to enhance the core competitiveness of geological prospecting entities. The main conclusions can be summarized as below:

(1) The entities shall proactively adjust the research objectives based on the consolidation of traditional geology, then form their core competitiveness.

(2) The geological prospecting entities needs to constantly improve the systems and mechanisms, the research and development platforms, technical teams and equipment.

(3) We explored the new scientific and technological innovation and development path of geological prospecting entities, thus provided new ideas for the coordinated layout, transformation and upgrading, and high-quality development of these entities.

ACKNOWLEDGMENTS

This work was financially supported by Research on Industrial Development and Technological Collaboration of Geological Prospecting enterprise.

REFERENCES

- [1] Fu G L, Zhu T H, Zheng H.(2020)Discussion on the connotation and path of high-quality development of geological prospecting economy - taking Guizhou Bureau of Geology and Mineral Prospecting and Development as an example [J]. China Land and Resources Economy, (1): 11-15.
- [2] He X Y, Liu H P, Wang X J, et al. (2018)Thoughts on geological exploration under the new situation[J]. China Land & Resources Economics, 31(8):6.
- [3] Shi J F, Tang J R, Zhou P, Zheng J W.(2014)The development trend of global geological survey and

its enlightenment to China. Geological Bulletin, 33(010), 1465-1472.

- [4] Wan Jinbo.(2021) Key tasks of improving the national science and technology innovation governance system [J]. National Governance Weekly, (Z4): 42-47.
- [5] Lan Hai. (2015) Research on the Construction of Scientific Research and Innovation Team of China Geological Survey [D]. Sichuan. Southwestern University of Finance and Economics, 3-5.
- [6] Wang L L. (2020)Current situation and countermeasures of incentive mechanism for scientific and technical personnel in geological prospecting units[J]. China Land Resource Economics, 33(1):5.