

Summary

1. Outline of Project	
Country: The People's Republic of China	Project Title: China Mineral Resources Exploration & Research Center
Sector: Mineral exploration	Cooperation Scheme: Technical Cooperation Project
Division in Charge: First Social Development Cooperation Division	Total Cost: 4.2 hundred millions yen
Period of Cooperation	(R/D): 1999.3.1-1999.8.31 (Extension): 1999.9.1-2001.8.31 (F/U): 2001.9.1-2004.8.31
	Partner Country's Implementing Organization: Institute of Geology and Geophysics, Chinese Academy of Sciences Supporting Organization in Japan: Shinshu University. Tohoku University etc.
Related Cooperation	—
<p>1-1 Background and Summary of the Project</p> <p>Along with its economic development, China has consumed increasingly more mineral resources, while the supply has fallen short of the demand considerably. With approval from both the Chinese and the Japanese governments, a technical cooperation project between the two countries ("the Project") was kicked off in 1994 for exploration of mineral resources, particularly of those of gold, silver, rare metals and rare earth through implementation of geochemical methods. For that purpose, the project implementing organization, the Institute of Geology and Geophysics, Chinese Academy of Sciences (hereinafter referred to as the "IGG"), set up the China Mineral Resources Exploration & Research Center (hereinafter referred to as the "CMRERC") in August 1994.</p> <p>1-2 Project Overview</p> <p>Phase 1: Lab building was the primary task of this phase. 22 labs were set up to create a comprehensive geochemical lab system with state-of-the-art equipment and advanced management.</p> <p>Phase 2: Scientific research was the primary task of this phase. Based on reconnaissance and site selection, the China-Japan joint research mode zone was defined with a focus on certain mineral deposits in Inner Mongolia.</p> <p>Phase 3: The joint efforts continued. A geochemical workshop was held with third-country participants based on results obtained from the earlier efforts.</p> <p>(1) Overall Goal</p> <p>Identification of mineral resources (particularly those of Cu, Au, Ag, rare metals and rare earth) in China.</p> <p>(2) Project Purpose</p> <p>Exploration of mineral resources (particularly those of Cu, Au, Ag, rare metals and rare earth) through implementation of geochemical methods is conducted in CMRERC.</p>	

(3) Outputs

- 1) Mastery of basic research technology for exploration of mineral resources in geology, petrology, mineralogy, geology and geochemistry;
- 2) Development of research capability of characteristics, deposit aging, etc. of ore fluid composition and isotopes;
- 3) Development of research capability of indicated reserves of currently available metals mainly based on geochemical methods;
- 4) Development of capability of identifying development potential applicable to exploration areas;
- 5) Establishment of a necessary organization and system for exploration of mineral resources through implementation of geochemical methods;
- 6) Provision of necessary equipment for exploration of mineral resources through implementation of geochemical methods;

(4) Inputs

Japanese side:

12 long-term experts and 57 short term experts

18 trainees for training in Japan

Equipment (JPY420 million)

Chinese side:

Designation of 29 trainees, 5 clerks, 6 post-postdoctoral researchers, 3 guest researchers

Costs (CNY17 million) (as of the end of 2000)

Provision of land, office and facilities

2. Evaluation Team

Member	Li Wei Chen Qiguang (researchers, Beijing Wanyang Consulting Co., Ltd.)		
Period of evaluation	December 18, 2006 – December 22, 2006	Type of evaluation:	Ex-post evaluation

3. Results of the Evaluation

3-1 Summary of the Evaluation

1) Relevance

In early 2006, the State Council released the Decision on Improvement of Geological Work (numbered GF (2006) 4), requiring enhancement of exploration of important non-energy minerals and implementation of the Mineral Safeguard Program. The Decision emphasized enhancement of exploration of minerals, such as iron, copper, aluminum, lead, zinc, manganese, nickel, tungsten, sylvites and gold. The Decision was to arrange general mineral resources study, introduce and encourage commercial survey, and develop key resource bases in key metallogenic belts, including the three major river areas in Southwest China, the Yaluzangbu River, the Tianshan Mountain Range, the Nanling Mountain Range, and the Daxinganling Mountain Range, to develop a number of key resource bases. The work of CMRERC coincided with this national strategy and responded to the nation's needs. The Project is still highly relevant to date.

2) Impact

- (1) Possibility of achievement of the overall goal
 - Identification of new deposits

Following the Project, researchers identified some deposits with high economic importance in the Daxinganling area based on the newly introduced geochemical methods by the Project together with other various means.

- Breakthroughs in geological research in the north edge of North China

This subject had been in progress at the time of the terminal evaluation report. New understanding of the background and process of mineralization was gained and new ideas and new target areas were proposed for ore prospecting from several years of subsequent research. Guided by the theories, researchers of the subject worked with local exploration organizations in research and metallogenic prediction. Ores were discovered by engineering verification in areas including Honghuagou, Chaihulanzi and Ao'ergai.

- Progress in mineralization research of copper and gold deposits in Xinjiang

The advanced test technology offered by the labs provided reliable test data for completing researches of the Project, playing a significant role in understanding of the orogeny and mineralization characteristics in Central Asia-type orogenic belts. Analysis and tests conducted by the labs also helped remarkably understanding the mineralization patterns of copper and gold deposits in Xinjiang.

(2) A causal relationship between impact and the Project

The geochemical experimentation and research system introduced under the Project was at the level in late 1990s and the most equipped one in China then. This system improved the basic research technology required by researchers for understanding exploration of mineral resources in fields of mineralogy, petrology, geology and geochemistry, and empowered them to conduct further research on ore fluids and predication of target areas.

The Project provided a high-level technical platform and the reliable analytical data by the lab equipment for CMRERC, which laid the solid foundation for scientific research projects. The lab equipment, which has played a key role in scientific research by CMRERC and by IGG, include those for major elements, trace elements, solid isotope mass spectra, stable isotopes, fluid inclusion temperature measurement and electron microscopy. The chemical approaches for stable isotopes (H, C, O and S) have been key ones of CMRERC and IGG for research of mineral resources. The microscope hot and cold stage for fluid inclusion testing has been indispensable in research of physical and chemical conditions during deposit mineralization.

As indicated above, the equipment and technology introduced under the Project indispensably supported in identification and exploration of abovementioned new deposits.

(3) Positive impact on CMRERC

- Improved research capability

Since the completion of the Project, researchers have made considerable achievements with equipment introduced under the Project. Some papers were published on domestic and international journals including the Science Citation Index (SCI), and some results were directly applied to deposit discovery.

The terminal evaluation report of the Project suggested that researcher should be familiar with measurement processes and equipment operations. The ex-post evaluation found that the researchers were deeply impressed with the need for change of ideas and for participation in experiments, they claimed that change of ideas of one of the key benefits from the project

implementation.

- Enhanced role of CMRERC

After completion of the initial project, CMRERC's ranking as a key lab for research of mineral resources of CAS endorsed extension of the Project in 2001, based on human resources, equipment and achievements of scientific research, and CMRERC became a leading force for exploration and research of mineral resources in China.

The establishment of CMRERC and the forward-looking work in the north edge of North China and the Daxinganling area gathered attention from peers in China and other countries.

CMRERC has been awarded a number of key projects of the National 973 Program, the Pan-Deng Program, and the Strategic Innovation Action Plan of CAS and become a leading force in geoscience in China. From 2001 to 2006, researchers of CMRERC published 339 papers, including 212 SCI papers. Among the papers, 169 papers were published on domestic and international journals with researchers of CMRERC as the primary authors, including 36 SCI papers.

(4) Ripple Effects

- Impact in China

After the project implementation, introduction of technology under the Project had a wide and demonstrative impact in China. Research institutes affiliated to the Ministry of Land and Resources and the Ministry of Education followed the Project in establishing similar labs. CMRERC has established and maintained close ties with those organizations.

The Project implementation is of great importance to the development of solid geoscience in China. Researchers of CMRERC have published a set of practical exploration techniques which have been widely validated and recognized in over 20 mining areas with noteworthy results. Geological and mineral experts and authorities of the Ministry of Land and Resources highly recognized them and many enterprises and local governments discussed with CMRERC on possible cooperation.

In August 2003, CMRERC and the government of Chifeng City jointly established the "Joint Center for Research of Non-Ferrous Metal Resources in Daxinganling"; in October of the same year, CMRERC and the Bureau of Ecology and Mineralogy of Inner Mongolia jointly established the "Inner Mongolia Joint Center for Research of Ecology and Mineralogy" and signed a comprehensive cooperation agreement with the Department of Land and Resources of Inner Mongolia.

- Impact in the world

From 2001 to 2004, CMRERC held four training sessions for countries near China, with 86 foreign trainees.

CMRERC conducted comprehensive joint research with scholars from Germany, the US, the UK, Japan, etc., which has improved the international influence of CMRERC. Since its listing as a key lab, CMRERC has been recognized by international peers as one of the three major labs of mineral resources in China.

In August 2008, CMRERC participated in the oxygen and hydrogen isotope test and calibration event held by International Atomic Energy Agency (IAEA) labs, and CMRERC's results met requirements of IAEA. In 2005, CMRERC and IAEA jointly established the Hydrodynamic and Hydrochemistry Lab.

To improve the level of equipment and human resources for geological research in Mongolia, and

enhance the friendship between people and cooperation between geological research institutes of the two countries, CMRERC launched the Mongolia Geological Science Lab project in 2004. The total investment of the project was CNY33.5 million.

3) Sustainability

- Support by government policies

The recent role of CMRERC is in concert with the China's master plan for exploration of strategic resources and is alone with the needs in the current economic development. It is safe to expect that CMRERC would be supported by government policies in the long run.

- Organization

In the later stage of the Project, CMRERC became a key lab of CAS and gained organizational stability. All dedicated members of CMRERC held a doctoral degree, and most of them held titles of associate researcher or higher. The team is competitive in research of mineral resources.

All counterparts in the Project still work in related research, except one who was retired and one who was transferred.

- Technical level

Since completion of the Project, CMRERC has acquired many more advanced lab equipment to supplement the existing equipment. At present, the introduced equipment is not only used in research of mineral resources, but also in wider areas, such as water resources, geologic environment, disaster control and biomedicine.

Every year, CMRERC offered 10-20 joint open research activities by utilizing lab equipment. CMRERC has been undertaking increasingly more scientific and technological projects and delivering results of better quality. In addition to the projects in the 973 Program, the 863 Program, and National Scientific and Technological Projects, CMRERC has been proactively working with organizations and enterprises from home and abroad.

Since completion of the Project, CMRERC has been open and provided training on geochemical skills for graduate students with the lab's introduced equipment. The number of graduate students, particularly doctoral students, studying at CMRERC has been increasing. Geochemical training provided by CMRERC to foreign trainees has been highly recognized.

- Financial status

As a key lab of CAS, CNY500,000 has been by CAS to CMRERC as operating costs every year, covering routine expenditures and open subjects. CNY1 million – CNY1.5 million has been provided by IGG to CMRERC for lab development every year.

In addition, the key lab was granted over CNY10 million as inputs for research projects every year, providing on-going financial support for research activities. Main fund sources include CAS, the Ministry of Science and Technology, IGG and various foundations for scientific development.

3-2 Factors that Promoted the Realization of Effects

CAS developed capacity of CMRERC by setting the club in CMRERC. The Decision on Improvement of Geological Work released by the State Council promotes the development of CMRERC.

3-3 Factors that Impeded the Realization of Effects

No notable adverse impact was identified.

3-4 Conclusion

Since completion of the Project, CMRERC has used the advanced equipment introduced under the Project in further research of mineral resources. The progress and findings of research work in the north edge of North China and the Daxinganling area gathered attention from peers, governments and enterprises in China and other countries. New deposits have been identified through wide cooperation with enterprises and organizations, and there is a possibility of achieving the overall goal. At the same time, the demonstration activities of the Project raised China's research level.

Since its listing as a key lab of CAS, CMRERC has gained support by government policies and governmental departments, maintained a stable organizational structure and an empowered team of researchers, secured sources of routine expenditures and research funds and kept lab equipment working properly. The equipment has been upgraded, supplemented and improved in a timely manner along with the furtherance of research. CMRERC is considered to have the ability of sustainable development, and the impact of the Project will last for quite a long time.

3-5 Lessons and Recommendations

Geochemical method is one of the important means of exploration and research of mineral resources. The Project played a significant role in improving China's capability of exploration of mineral resources. CMRERC met the project purpose upon completion of the Project. However, the realization of the overall goal to identify mineral resources (particularly those of Cu, Au, Ag, rare metals and rare earth) in China more relies on the availability of other means and so should be tested for a long period of time. It also requires effective cooperation between organizations involved in exploration of mineral resources. Therefore, the causal relationship has to be validated with more scientific and careful methods.

As a key lab, CMRERC is expected to increase inputs for lab equipment to keep its leadership in China and continuously improve its capability and level of research. Moreover, it is recommended that China and Japan expand cooperation scientific research of a deeper level of exploration of mineral resources.