

資 料

JOINT EVALUATION REPORT
ON
THE JAPANESE TECHNICAL COOPERATION
FOR
THE PROJECT ON THE RECOVERY OF PRECIOUS METALS
FROM VEIN-TYPE COMPLEX ORES
IN THE REPUBLIC OF COLOMBIA

Prepared by the Japanese Evaluation Team

Jointly with

the Colombian Evaluation Team

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Santafe de Bogota, Colombia

MUTUALLY ATTESTED AND SUBMITTED

TO ALL CONCERNED

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SANTAFE DE BOGOTA, COLOMBIA

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I. INTRODUCTION

1. The Evaluation Team

The Japanese Evaluation Team (hereinafter referred to as "the Japanese Team") organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA") headed by Mr. Yasujirou Suzuki, visited the Republic of Colombia from December 3 to December 13, 1995 for the purpose of evaluating jointly with the Colombian Evaluation Team (hereinafter referred to as "the Colombian Team") the achievements of the Project on the recovery of precious metals from vein-type complex ores in the Republic of Colombia (hereinafter referred to as "the Project") within the framework of the Japanese Technical Cooperation based on the Record of Discussions signed on January 27, 1992 (hereinafter referred to as "the R/D").

After the Joint Evaluation of the Project, the Japanese Team discussed with the authorities concerned of the Government of the Republic of Colombia all the relevant matters pertaining to the Project.

Through careful studies and discussions, both the sides summarized their findings and observations as described in this document.

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2. Schedule of the Joint Evaluation

Table - 1 Schedule of the Joint Evaluation

Year	Month	Day	Operations on the evaluation
1995	November	29	Preliminary discussions on the progress of the Project between the Japanese consultant and the executives of INGEOMINAS and DNP.
1995	November	30	Preliminary discussions on the contribution of the Project to the promotion policy for the Colombian mining industry between the Japanese consultant and the executives of MINMINAS and MINERALCO. Technical discussions on the Project between the Japanese consultant and a professor of the National University of Bogota.
1995	December	1	Preliminary discussions on the progress of the Project between the Japanese consultant and the executives of DNP.
1995	December	4	Overall discussions on the achievements of the Project between the Japanese Team and the executives of DNP & MINMINAS.
1995	December	5	Detailed discussions on the progress and results of the Project between the Japanese Team and the executives of INGEOMINAS.
1995	December	6	Fact-finding tour at the site of the Project by both the Teams. Discussions on the progress and results of the Project between the Japanese Team, the Colombian counterparts and the Japanese experts.
1995	December	7	Discussions on the progress and results of the Project between the Japanese Team, the Colombian counterparts and the Japanese experts.
1995	December	11	Preparation of the joint evaluation report by both the Teams. Discussions on the joint evaluation report at the joint committee for the Project.
1995	December	12	Signing on the joint evaluation report by both the Teams.

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3. Attendance

A. The Evaluation Team

1) The Japanese Evaluation Team

Mr. Yasujiro Suzuki, Leader
Mr. Hiroshi Kawayama, Member (Technical cooperation planning)
Mr. Hisamitsu Ooki, Member (Mineral processing)
Dr. Kenji Tomita, Member (Evaluation analysis)
Mr. Koji Fukushima, Member (Evaluation planning)

2) The Colombian Evaluation Team

Dr. Adolfo Alarcon Guzman, Director General, INGEOMINAS
Dra. Maria Elisa Bernal, Jefa, Division Especial de Cooperacion Tecnica Internacional, DNP
Dr. Albeiro Osorio Cardona, Director General de Minas, MINMINAS (Entrante)
Ing. Orlando Alvarez, Gerente General, MINERALCO

B. Participants in the Meetings

1) The Japanese Experts

Mr. Yukinori Abe, Chief Advisor
Mr. Hisahiro Suzuki, Coordinator
Mr. Masahide Nakao, Expert (Mineral Dressing)
Mr. Toshihisa Shimokura, Expert (Metallurgy)
Mr. Koji Azegami, Expert (Chemical Analysis)

2) JICA Colombia Office

Mr. Yoshihiro Yoshida, Deputy Resident Representative
Mr. Shigeru Takagi, Deputy Resident Representative
Mr. Shunichi Murata, Assistant Resident Representative
Mr. Yasumasa Ito, Interpreter

3) Embassy of Japan in Colombia

Mr. Noriyuki Baba, Second Secretary

4) Departamento Nacional de Planeacion [DNP]

Abg. German Fonseca, Jefe Division Promocion Cooperacion Tecnica
Abg. Guillermo Augusto Correa Castaneda, Jefe de la Division de Proyectos de Cooperacion Tecnica Internacional
Ing. Sandra Fonseca, Consejera, Division de Minas y Energias, Unidad de Infraestructura y Energia

5) Ministerio de Minas y Energia [MINMINAS]

Dr. Victor Manuel Rivera, Director General de Minas (Saliente)
Dr. Albeiro Osorio Cardona, Director General de Minas (Entrante)
Ing. Juan Jose Manrique, Subdirector de Evaluacion
Abg. Javier Ortiz Munoz, Encargado del Area Juridica

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- 6) Instituto de Investigaciones en Geociencias, Minería y Química [INGEOMINAS]
Abg. Alfredo Giovanni Ulloa Pinto, Secretaria General
Qca. Fabio Hernando Perez Gomez, Subdirector del Area de Química
Ing. Luz Marina Aristizabal, Subdirector del Area de Minería
Ing. Alicia Montes Alvarez, Coordinadora de Programa
Ing. Nelson de la Pava Garavito, Jefe de Unidad Operativa de Cali
Ing. Luz Merry Duitama, Jefa de Operativo, Unidad Operativa de Cali
Ing. Jorge Ivan Londono, Coordinador de Proyectos, Unidad Operativa de Cali
Ing. Hector Mario Henao, Jefe de Contraparte, Unidad Operativa de Cali
Qca. Yolanda Canon Romero, Jefe Laboratorio de Química, Unidad Operativa de Cali
Qca. Maria del Carmen Gonzalez, Contraparte, Area Química, Unidad Operativa de Cali
Geo. Jaime Mojica Buitrago, Contraparte, Area Minería, Unidad Operativa de Cali
Geo. Martha Edith Velasquez D., Contraparte, Area Minería, Unidad Operativa de Cali
- 7) Minerales de Colombia S.A. [MINERALCO]
Ing. Samuel Gomez Celis, Subgerente Tecnico
Ing. Felix Antonio Rueda, Subgerente Metales Preciosos
- 8) Universidad Nacional de Colombia
Geologo Luis Eduardo Jaramillo Cortes, Profesor (Exploracion Minera)
Funcionario, Unidad de Planeacion Minero-Energetica [UPME], MINMINAS
Asesor, Area de Minería, INGEOMINAS

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II. METHODOLOGY OF EVALUATION

1. Items for Evaluation

As to the items for evaluation, both the teams agreed as follows.

- ① Input to the Project
- ② Output from the Project
- ③ Purpose of the Project
- ④ Overall goal of the Project
- ⑤ Prospects of sustainability

2. Methodology of Evaluation


The evaluation of the Project was carried out through the following steps with referring the following materials.

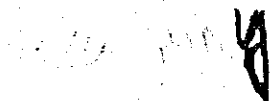
1) Steps for Evaluation

- ① Preparation of the fact sheets on the Project
- ② Analysis and evaluation of the facts sheets
- ③ Interviews and discussions with the persons concerned
- ④ Preparation of the draft of the joint evaluation report
- ⑤ Authorization of the joint evaluation report at the meeting of the Joint Committee for the Project.
- ⑥ Signing to the Joint Evaluation Report by both the sides

2) Materials used for Evaluation

- ① Record of Discussions
- ② Tentative Schedule of Implementation
- ③ Annual Work Plan
- ④ Minutes of Discussions
- ⑤ Logical Framework as shown in Annex - 1
- ⑥ Other documents, materials and data agreed on or accepted in the course of implementation of the Project by both the sides.

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III. BACKGROUND AND SUMMARY OF THE PROJECT

1. Brief Background of the Project

Since the second half of the 1970s, the Government of the Republic of Colombia has been formulated a policy on promotion of mining industry as a part of the most important national economic development plan in order to grow out of the monoculture economy depending upon the coffee industry.

Since 1973, as a part of the above mining policy, the Research Institute for Geology and Mining (INGEOMINAS) has implemented a wide area geological survey under the cooperation of the United Nations aiming at the development of new large scale nonferrous metal mines. Furthermore, from 1980 to 1986, INGEOMINAS has implemented a basic geological survey on mineral resources development at the areas of Piedrancha, Narino States under the cooperation of JICA and MMAJ (Metal Mining Agency of Japan).

As the results of those geological surveys, the El Diamante deposit in Narino has recognized as the high potential complex ore deposit containing valuable metals such as gold and silver.

In 1988, under those backgrounds, the Government of the Republic of Colombia has requested to the Government of Japan a project-type technical cooperation project aiming at the establishment of a Research and Development Center for Mineral Resources in INGEOMINAS, in order to study the mineral processing technology for economical recovery of valuable metals from the above complex ores.

In response to the above request from the Colombian side, the Japanese side has dispatched a preliminary survey team in April 1991, in order to study the present conditions and future prospects pertaining the project such as the details of requests, appropriateness of the project, purpose & scope of technical cooperation, and availability of the site of the project, etc.

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According to the report from the preliminary survey team, the Japanese side has decided the dispatch of a implementation survey team after a dispatch of experts survey team in order to discuss and to formulate the record of discussions necessary for implementation of the Japanese technical cooperation.

Based on the mutual agreement, both the sides signed on the document of R/D on January 27, 1992 and the Japanese technical cooperation on the Project has started on March 31, 1992 at the term of three years.

2. Chronological Review of the Project

The chronological review of the Project is as shown in Annex - 2.

3. Purpose and Overall Goal of the Project

As to the purpose of the Project, both the sides agreed in the document of Master Plan attached to the R/D as follows.

"The objective of the Project is to transfer appropriate technology from the Japanese experts to the Colombian counterpart personnel so as to enable them to carry out research and development on mineral processing technology for the recovery of precious metals and associated metals from vein-type complex ores in the Republic of Colombia."

As to the overall goal of the Project, both the sides agreed at the discussions on the evaluation of the Project as follows.

"Enhancement of dissemination activities in the field of mineral processing technology by INGEOMINAS. Therefore, the verifiable indicators of the overall goal of the Project may be understand as follows.

"Progress of the dissemination activities in the field of mineral processing technology by INGEOMINAS."

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4. Tentative Schedule of Implementation

As to the tentative schedule of implementation for the Project, the original schedule is described in Annex - 3 together with the schedule modified due to extension of the duration of technical cooperation.

5. Technical Cooperation Program

As to the technical cooperation program for the Project, the original program is described in Annex - 4 together with the program modified due to extension of the duration of technical cooperation.

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IV. RESULTS OF EVALUATION

1. Overall Goal of the Project

All the activities described in the Scope of Technical Cooperation of the R/D have been evaluated as mentioned in the following sections. According to its results, the Project is considered to have been favorably conducted.

Through the implementation of the Project, the functions of INGEOMINAS in the field of mineral processing on the vein-type auriferous complex ores have been improved extensively in both human resources and infrastructures by means of the technical cooperation between the Government of Japan and the Government of the Republic of Colombia.

Meanwhile, the Government of the Republic of Colombia has been formulating a policy concerning a national mining development plan, in which the introduction of a new technology available for the purpose of the enhancement of the recovery of precious metals and associated valuable metals and the improvement of environment at the mining districts is recognized as one of the most important measures in line with the national development plan in the sector of mining industry aiming at the acquisition of foreign exchange, the aid for small mining business and the protection of the environment.

Moreover, it is a common understanding in the mining sector that the establishment of a new technology necessary for high metal recovery and pollution free process and, at the same time, feasible for each specific mineralogical characteristics of ores deposited in the areas of the Andes along the Pacific Ocean is requested from all interested parties concerned in the exploitation of those mineral resources.

Under those situation mentioned in the above, the activities of INGEOMINAS in the fields of mineral processing using new technology transferred through the Project are very beneficial to the people of the Republic of Colombia.

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2. Purpose of the Project

The purpose of the Project has been agreed by both the sides in the Master Plan attached to the R/D as follows; "The object of the Project is to transfer appropriate technology from the Japanese experts to the Colombian counterpart personnel so as to enable them to carry out research and development on mineral processing technology for the recovery of precious metals and associated metals from vein-type complex ores in the Republic of Colombia".

The achievement on the progress of technology transfer from the Japanese experts to the Colombian counterpart personnel was evaluated carefully in consideration of the above description by both the Teams as shown in Table 2.

Referring to the results of Table 2, it is clear that the purpose of the Project would be accomplished up to the end of March 1996, except for some items in the field of mineral dressing and metallurgy.

As to the technology transfer on a resin in column(RIC) process in cyanidation process, the experiments using cationic resin were suspended by mutual consent based on the results of preliminary tests. And the reason why the evaluation on this item is 95% is that the amenability tests of every resin tested was limited to the adsorption process leaving a elution process and electro-winning process due to lack of the time necessary for those tests.

As to the technology transfer on a resin in column(RIC) process in thio-urea process, the experiments using the ore samples treated in autoclave are scheduled. However, the evaluation on this item is 95%, because those amenability tests would be limited in the scope of preliminary tests.

As to the combination process of mineral dressing and metallurgy, it is predicted that the separation of arsenic is necessary depending on the mineralogical characteristics of ore samples tested, because the content of arsenic in the feed solution to a resin process, thio-urea process and electro-winning process is harmful for those processes. Nevertheless, the experiments on the effects of arsenic content to the above processes are not scheduled owing to lack of the time necessary for those tests, so that the

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evaluation on this item is 95%.

As to the technology transfer on pollution control in mineral processing circuits, the Japanese experts have already transferred the basic know-how necessary for treatment of waste water from metallurgical process. However, some practical operation using a waste water treatment apparatus still not carried out, owing to the delay of the arrival of the above apparatus, so that the evaluation on this item is 90%.

Table - 2 Progress on the Technology Transfer aimed at the Project

Subjects on Technology Transfer	Estimated Achievement (%)			
	95/3	95/7	95/10	96/3
1. Mineralogical Study				
a) Identification of ores	40	100	100	100
b) Description of ores	40	100	100	100
2. Mineral Dressing				
a) Sample preparation	100	100	100	100
b) Physical separation of cyanide	60	85	100	100
3. Metallurgy				
a) Chemical separation of cyanide	30	80	90	100
b) Cyanidation process (Solution of gold)				
1) Conventional process (Recovery of gold)	30	30	85	100
2) Carbon in Pulp process (Absorption of gold)	30	70	100	100
3) Carbon in Column process	20			
① Adsorption of gold		85	100	100
② Elution of gold		40	90	100
③ Electro-winning of gold		30	75	100
4) Resin in Column process	20	30	70	95
c) Thio-urea process				
1) Leaching condition		50	80	100
2) Carbon in Column process	30	30	70	100
3) Resin in Column process	20	30	50	95
4) Metal substitution process	30	30	70	100
4. Combination of Mineral Dressing & Metallurgy	20	40	70	95
5. Pollution Control for Mineral Processing	40	40	70	90
6. Analysis of Ore Samples Tested				
a) Chemical analysis	60	80	90	100
b) Instrumental analysis	30	60	85	100

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3. Output from the Project

3-1 Human Resources Development in the Field of Mineral Processing

3-1-1 Mineralogical Study

In the field of mineralogical study, the Colombian side has assigned four geologists for the counterparts to the Japanese experts. In the course of the implementation of the Project, three counterparts have trained in Japan, and one counterpart is now studying at the University in Japan.

The ability on the mineralogical study of those counterparts has been improved, especially in microscopical observation and X-ray diffraction analysis together with the techniques on the preparation of thin section and the polishing of ore samples.

3-1-2 Technology on Mineral Dressing and Metallurgy

In the field of mineral dressing and metallurgy, the Colombian side has assigned three metallurgist for the counterparts to the Japanese experts. In the course of the implementation of the Project, two counterparts have trained in Japan, and one counterpart has retired.

The ability on the metallurgical study of those counterparts has been improved, especially in sample preparation, separation of cyanide by gravity separation and flotation, cyanidation process including conventional process, carbon-in-pulp process, carbon-in-column process and resin-in-column process, and thio-urea process including carbon-in-column process, resin-in-column process and metal substitution process.

According to the progress report of locked cycle tests composed of gravity separation and flotation processes, they have succeeded in getting a gold concentrate of 25.4 g/t Au with gold recovery of 93.3%. And it is reported that the gold recovery in the circuit of cyanidation for the products treated by autoclave has ranged up to 98%, and in the circuit of combination of mineral dressing and metallurgy has also ranged up to 94%.

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3-1-3 Techniques on Chemical and Instrumental Analysis

In the field of chemical and instrumental analyses, the Colombian side has assigned four chemists for the counterparts to the Japanese experts. In the course of the implementation of the Project, two counterparts have trained in Japan, and one counterpart has been transferred to the Pasto Operation Unit of INGEOMINAS. The ability on the chemical analysis and instrumental analysis of the ore samples tested and the products from the experiments in relation to the Project has been improved, especially in X-ray diffraction analysis, fluorescence X-ray analysis, induced coupled plasma spectrometry and atomic absorption spectrophotometry.

The enhanced techniques on chemical and instrumental analysis have greatly contributed in the progress of the Project, for example, 1,370 samples and 6,600 elements have been analyzed at the time of the end of October, 1995 and plenty of manuals on chemical and instrumental analyses have been formulated for effective operation of chemical laboratory under the guidance and cooperation of the Japanese experts.

3-2 Improvement of Laboratories and Facilities in the field of Mineral Processing

The Colombian side has completed the renovation works of laboratories and facilities in the Cali Operation Unit of INGEOMINAS by the expenditure amounted 54.6 million pesos and the provision of machinery and equipment from the Japanese side amounted 224 million yens.

The laboratories and facilities necessary for research and development in the field of mineral processing in the Cali Operation Unit are constructed from a mineral dressing and metallurgical laboratory, a hydrometallurgical laboratory, a chemical and instrumental laboratory, a mineralogical laboratory, etc. Both the Teams recognized that those facilities should be utilized widely for progress of mineral processing technology in Colombia.

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3-3 Publicity on the Results of the Project

The details of papers and reports, technical meetings and technical services presented and/or conducted in relation to the Project are summarized in Table 3.

Both the Teams recognized that the numbers of those papers, meetings and services were not a few in consideration of the period of the Project.

Table - 3 Summary of the Publicity on the Results of the Project

A. Technical Papers and Reports				
No.	Themes	Authors	Location	Date
1	Characteristics of isolation on the ore from el Diamante.	Nelson De La Pava	INGEOMINAS in Cali	Oct. 1995
2	Chemical analysis for the mineralogical and metallurgical process.	Nelson De La Pava	INGEOMINAS in Cali	Oct. 1995
3	Chemical instrumentation and its application in metallurgical process.	Nelson De La Pava	INGEOMINAS in Cali	Oct. 1995
4	Support of instrumentation in the process control of metallurgical process.	Nelson De La Pava	INGEOMINAS in Cali	Oct. 1995
5	Testings on the pressurized oxidation and cyanidation for an auriferous ores.	Nelson De La Pava	INGEOMINAS in Cali	Oct. 1995
6	Mineralogical study in relation to the beneficiation of auriferous ores.	Atonio Romero H.	IXth Mining Congress	Mar. 1994
7	Gold mining industry in the south-west district of Colombia.	Atonio Romero H.	IXth Mining Congress	Mar. 1994
8	Mineralogical characteristics of ores from El Canda and El Diamante.	Atonio Romero H.	IXth Mining Congress	Mar. 1994

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B. Technical Meetings				
No.	Themes	Participants	Location	Date
1	Present situation of mineral processing study in Colombia	Participants: 20 Presentation: 20	INGEOMINAS - Medellin	December 1993
2	Characterization and mineralogy in the process of mineral dressing.	Participants: 50 Presentation: 8	INGEOMINAS - Cali	June, 1994
3	Beneficiation of precious metals.	Participants: 60 Presentation: 21	INGEOMINAS - Cali	October 1995
4	International seminar on the improvement of recovery of precious metals and pollution control.	Participants: 60 Presentation: 12 [Tentative]	INGEOMINAS - Cali	February 1996
C. Technical Services				
No.	Activities	Clients	Participants	Date
1	Preparation of thin sections and identification of gold ores from Casualidad.	Fundacion Universitaria de Popayan	O. J. Vivas, J. E. Amezquita	Mar. 1995
2	Analysis of minerals by X-ray diffractometer.	INGEIMINAS - Medellin	Alvaro Bedoya	Mar. 1995
3	Training on the identification of minerals.	CIMEX, National U. Medellin	Claudia García	Aug. 1995
4	Analysis of clays by X-ray diffractometer.	INGEIMINAS - Medellin	Alvaro Bedoya	Mar. 1995
5	Training on the preparation of thin sections	INGEOMINAS-Bogota	Miguel Vargas	Aug. 1995
6	Training on fluorescence X-ray analyzer and ICP.	INGEOMINAS-Bogota	M. Pachon, J. Quintero H. Cabezas, M. H. Munera	Oct. 1995
7	Training on Fluorescence X-ray analyzer and X-ray diffractometer, ICP & others.	INGEOMINAS-Bogota	M. Pachon, J. Quintero H. Cabezas, M. H. Munera J. Zambrano A. Montes	Nov. 1995
8	Heavy-media and magnetic separation. X-ray diffraction analysis of chromite sample.	INGEOMINAS-Bogota	Marcela Pachon	Nov. 1995
9	Adsorption of gold by active carbon.	Mina "La Victoria"		1995

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4. Input by the Japanese side

4-1 Dispatch of Experts

The Japanese side has dispatched six (6) long-term experts and thirteen (13) short-term experts in relation to the Project as shown in Annex-5.

4-2 Acceptance of Counterpart Personnel for Training in Japan

The Japanese side has accepted sixteen (16) Colombian counterpart personnel in five (5) fields for training in Japan as shown in Annex-6.

4-3 Provision of Machinery and Equipment

The Japanese side has provided the machinery and equipment necessary for implementation of the Project as shown in Annex-7 up to the end of October 1995.

The rest of the Equipment agreed between both the side will be arrived at the site of the Project before the end of March 1996.

4-4 Expenditure of Management Costs

The expenses by the Japanese side for smooth implementation of the Project have amounted to 567 million yens as shown in Annex-8.

5. Input by the Colombian side

5-1 Allocation of Counterparts and Administrative Personnel

The Colombian side has allocated the counterparts and administrative personnel as shown in Annex-12.

5-2 Procurement of Machinery and Equipment

The Colombian side has procured the machinery and equipment necessary for operation of the Project as shown in Annex-11.

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5-3 Renovation of laboratories and Facilities related to the Project

The Colombian side has implemented the renovation works of the laboratories and facilities necessary for the Project up to the end of March 1995.

The expenditure for the renovation works has amounted to 54.6 million pesos.

5-4 Expenditure of Operational Costs

The Colombian side has taken their necessary measures as possible for the expenditure of the operational costs of the Project as shown in Annex-10.

The expenditure for the operational costs has amounted to 544.4 million pesos.

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6. Impact of the Project

The most important impact of the Project is the fact that the functions of research and development at the Cali Operation Unit of INGEOMINAS in the field of mineral processing have been newly established in both human resources and infrastructures.

In line with the National Mining Development Plan, it is expected that those impacts would be beneficial to the development of mineral resources in both economical and social aspects.

7. Prospects of Sustainability

7-1 Organizational Aspects

According to the proposal on the national policy regarding science and technology in the mining sector formulated by the planning council on research activities in the fields of mining and energy, the following policies are recommended: ① Human resources development in advanced and high level. ② Review of mining potentials and geological information including the establishment of five mining technology centers in the whole country and the internationalization in the fields of scientific and technological studies.

Furthermore, according to the explanation by DNP and MINMINAS, the Government of the Republic of Colombia is now formulating a new national mining development plan under the scope of the national development plan, in which the enhancement of the ability necessary for addition of values to mineral products is emphasized.

In consideration of the above national policy in scientific and technological aspects and administrative aspects, it is obvious that the sustainability of the Project is hopeful greatly.

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7-2 Social and Economic Aspects

It is the common understanding that the enhancement of gold recovery and the improvement of environmental conditions at the mining districts are the urgent problems to take prompt measures for those situation.

The results of the Project and the enhancement of the functions of INGEOMINAS in relation to those problems are very helpful to find out the countermeasures.

It is also obvious that the prospects of sustainability in relation to the Project are very good at the investigation by social and economic aspects.

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V. CONCLUSIONS

Both the Japanese Team and the Colombian Team have reached the following conclusion, through the careful joint evaluation for the Project at Bogota and Cali.

1) As to the overall goal of the Project, both the Teams recognized that the activities concerning technology transfer in line with the National Mining Development Plan would be carried out through the functions of manpowers and infrastructures of the Cali Operation Unit of INGEOMINAS.

2) As to the purpose of the Project, both the Teams recognized that the most important results obtained through the Project were the activities concerning technology transfer in the field of mineral processing technology aiming at a high gold recovery and environment protection at the gold mining districts.

3) As to the achievements of each items concerning technology transfer, both the Teams recognized that the technology transfer from the Japanese experts to the Colombian counterpart personnel has been implemented satisfactorily, except for some of metallurgical studies.

4) As to the output from the Project, both the Teams recognized that the full assignment of counterpart personnel for the Project has not been realized for some reasons, however, the human resources development for the Project has been implemented at the highest level by mutual cooperation. And the improvement of the laboratories and facilities necessary for research and development in the field of mineral processing has been completed as a result of the renovation works by the Colombian side and the provision of machinery and equipment by the Japanese side. So, it is expected that those facilities

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would be utilized for the development and promotion activities at mining districts. Furthermore, in relation to the evaluation of the publicity on the results of the Project, the number of reports & papers, technical meetings and technical services are not a few in consideration of the period of the Project.

5) As to the input to the Project, both the Teams recognized as follows.

① The Colombian side expressed that the services of the Japanese experts were satisfactory for the Project together with their high ability and hard working attitude.

② The Colombian side expressed that the counterpart training in Japan has been carried out appropriately, except for the term of training at the laboratories.

③ The Colombian side expressed that the provision of the Equipment has been carried out appropriately, except for delay of the arrival of the Equipment at the site of the Project.

④ Complement of the operational costs from the Japanese side was beneficial for smooth implementation of the Project.

⑤ The Japanese side recognized that their high ability and hard working attitude of the Colombian counterpart personnel were the most important factor for successful and smooth implementation of the Project. However, the number of counterparts and the term of assignment were not appropriate for the Project.

⑥ As to the procurement of the equipment, and the expenses of the operational costs, the Colombian side has taken their necessary measures as possible.

⑦ The Colombian side has taken their necessary measures for security of the Japanese experts appropriately. The Japanese Team expressed their thanks to the Colombian side.

6) As to the sustainability of the Project, both the Teams have recognized

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that the implementation of the next stage project (the mining development program mainly composed of pilot plant operation by mobile mineral processing unit) is necessary for the sustainable progress of the Project, because the national mining policy aiming at the improvement of gold recovery and environmental contamination at the mining districts will be realized through a confirmation process based on the results of pilot plant tests on the new technologies which have been transferred at laboratory scale under the Project.

7) As to the overall evaluation of the Project, both the Teams concluded that the Project had been implemented successfully and at the highest level. However, some of the items concerning the technology transfer in the field of metallurgical study (including pollution control techniques) are still necessary for the technical guidance of the Japanese experts.

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Annex-1 Logical Framework for the Project

Technical Cooperation for the Project on the Recovery of Precious Metals
from Vein-Type Complex Ores in the Republic of Colombia

Summary of the Project	Verifiable Indicators	Results of Evaluation	Important Assumptions
<p>Overall Goal of the Project Enhancement of dissemination activities in the field of mineral processing technology by INGEOMINAS.</p>	<p>Progress of the dissemination activities in the field of mineral processing technology by INGEOMINAS.</p>		<p>Implementation of the promotion policy in the field of mining industry by the Colombian Government and mining enterprises.</p>
<p>Purpose of the Project Technology transfer from the Japanese experts to the counterpart personnel of INGEOMINAS so as to enable them to carry out research and development on mineral processing technology for recovery of precious and associated metals from vein-type complex ores in the Republic of Colombia.</p>	<p>The degree of progress on the technology transfer aimed at the Project.</p> <ol style="list-style-type: none"> 1. Mineralogical study. 2. Mineral dressing technology. 3. Metallurgical technology 4. Combination of mineral dressing & metallurgy. 5. Pollution control technology in the field of mineral processing. 6. Analytical techniques for ore samples tested. 	<p>Estimated degree of progress at the final stage of the Project.</p> <ol style="list-style-type: none"> 1. Mineralogy : 100% 2. Mineral dressing : 100% 3. Metallurgy¹⁾ : 100% 4. Combination of mineral dressing and metallurgy²⁾ : 95% 5. Pollution control³⁾ : 90% 6. Analysis of samples: 100% <p>¹⁾ RIC process : 95%</p> <p>²⁾ Arsenic separation is necessary according to characteristics of ores.</p> <p>³⁾ Due to the delay of the equipment provision.</p>	<ol style="list-style-type: none"> 1. Continuation of the services at INGEOMINAS by the counterparts who were transferred technology from the Japanese experts. 2. Guarantee of the operational costs necessary for the implementation of the Project.
<p>Output from the Project</p> <ol style="list-style-type: none"> 1. Human resources development necessary for R & D in the field of mineral processing at INGEOMINAS 2. Improvement of laboratories and facilities in the field of mineral processing at INGEOMINAS 3. Opening to the mining industry the results of the Project. 	<ol style="list-style-type: none"> 1. Number of counterpart personnel acquired the specific technology in each fields. 2. Improved condition of the laboratories and facilities concerned in mineral processing. 3. Results of paper presentation, seminar, and other technical services. 	<ol style="list-style-type: none"> 1. Number of counterparts. Mineralogical study: 4 Metallurgical study: 3 Analytical study : 4 2. The laboratories and facilities in the fields of mineralogy, mineral dressing, metallurgy and chemical & instrumental analysis were improved. 3. Publicity of the results a) Number of papers : 8 b) Number of meetings : 4 c) Number of services : 9 	<ol style="list-style-type: none"> 1. Continuation of the services at INGEOMINAS by the counterparts who were transferred technology from the Japanese experts. 2. Guarantee of the operational costs necessary for the Project. 3. Implementation of the activities for publicity on the results of the Project.
<p>Activities of the Project</p> <ol style="list-style-type: none"> 1. Human resources development <ol style="list-style-type: none"> ① Technology transfer from the Japanese Experts at the laboratory scale. <ol style="list-style-type: none"> a) Experimental procedures. b) Lectures and exercise. c) Practice on experiments. ② Training of counterparts in Japan. 2. Improvement of laboratories and facilities. <ol style="list-style-type: none"> ① Provision & procurement of the Equipment. ② Renovation of facilities and laboratories. ③ Installation & operation of the Equipment. 3. Promotion of publicity on the results of the Project. 	<p>Input by the Japanese Side (March 1992~Nov. 1995)</p> <ol style="list-style-type: none"> 1. Dispatch of the Japanese experts. <ol style="list-style-type: none"> a. Long-term experts : 6 experts, 139 man-month b. Short-term experts: 11 experts, 14.6 man-month 2. Acceptance of the Colombian counterpart personnel for training in Japan. 16 counterparts on the scale of 36.4 man-month. 3. Provision of the Equipment. Total cost of the Equipment is ¥ 224 Million. 4. The total amount of expenses for the Project from the Japanese side : ¥ 567 Million. <p>Input by the Colombian Side (March 1992 ~ Nov. 1995)</p> <ol style="list-style-type: none"> 1. Assignment of the personnel. <ol style="list-style-type: none"> a. Counterpart personnel : 11 b. Administrative personnel: 11 c. Supporting staff : 10 2. Renovation works of building and facilities. The total expenses for renovation: 54,600,000 Pesos 3. Procurement of machinery, equipment and materials. 4. The total amount of expenses for the Project from the Colombian side : 599,000,000 Pesos. (Included the expense for renovation works) 	<ol style="list-style-type: none"> 1. Continuation of the services at INGEOMINAS by the counterparts who were transferred technology from the Japanese experts. 2. Guarantee of the operational costs necessary for the implementation of the Project. 3. Appropriate measures for security of the Japanese experts at the site of the Project. 	

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Annex- 2 Chronological Review of the Project

Year	Month	Items
1988	December	The Government of the Republic of Colombia submitted a request to the Government of Japan for technical cooperation.
1991	April	Dispatch of the Preliminary Survey Team by JICA.
	October	Dispatch of the Expert Survey Team by JICA.
1992	January	Dispatch of the Implementation Survey Team by JICA. Signing of the Record of Discussions for the Project.
	March	Commencement of the Project.
	November	Dispatch of the Security Survey Team by JICA.
1993	March	Training of the Colombian counterpart personnel in Japan. (5 persons in the fields of mineralogy, mining, mineral processing and pyro-metallurgy.)
	June	Dispatch of the Consultation Team by JICA.
	September	Training of the Colombian counterpart personnel in Japan. (4 persons in the fields of project management, mineral processing, hydro-metallurgy and instrumental analysis.)
	November	Dispatch of the Japanese long-term experts. (3 experts in charge of chief advisor, coordinator and mineral processing.)
1994	January	Dispatch of the Japanese long-term experts. (2 experts in charge of metallurgy and chemical analysis.)
	August	Training of the Colombian counterpart personnel in Japan. (4 persons in the fields of project management, mineralogy, hydro-metallurgy and instrumental analysis.)
	October	Dispatch of the Technical Guidance Team by JICA.
	November	Dispatch of the Japanese short-term expert. (1 expert in charge of installation and calibration of X-ray diffraction analyzer.)
1995	January	Dispatch of the Japanese short-term experts. (2 experts in charge of technical guidance on X-ray diffraction analysis, and installation & calibration of atomic absorption spectrophotometer.) Signing of R/D on the extension of the duration of the Project. Ceremony concerning the donation of machinery and equipment from JICA at the site of the Project.
	March	Dispatch of the Japanese short-term experts. (2 experts in charge of calibration and maintenance of X-ray diffraction analyzer and mineralogical study.)
	June	Dispatch of the Japanese short-term expert. (1 expert in charge of mineralogical study)
	July	Dispatch of the Japanese short-term experts. (3 experts in charge of installation and calibration of induction coupled plasma analyzer, particle size analyzer & fluorescence X-ray analyzer and technical guidance on fluorescence X-ray analysis.)
	August	Training of the Colombian counterpart personnel in Japan. (3 persons in the fields of project management, mineralogy and instrumental analysis.)
	September	Dispatch of the Japanese short-term expert. (1 expert in the field of metallurgy.)
	October	Dispatch of the Japanese short-term expert. (1 expert in the field of mineral processing.)
	December	Dispatch of the Evaluation Team by JICA.

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Annex 2-1 Survey Teams Dispatched By JICA

Type of Survey Team	Term of Survey	Member of Survey Team
Preliminary Survey Team	April 6 ~ April 19, 1991	Dr. Kenji Tomita, Special Technical Advisor, JICA Mr. Ken Maki, Staff, Mining Division, MITI Dr. Hiroshi Sakamoto, Chief, Mineral Processing Laboratory, National Research Institute for Resources and Environment, AIST, MITI Mr. Hisamitsu Ooki, Assistant Manager, Technical Department, Japan Mining Industry Association Mr. Yasushi Yamada, Staff, Technical Cooperation Division, Mining and Industrial Development Cooperation Department, JICA
Experts Survey Team	October 5 ~ October 27, 1991	Mr. Masahide Nakao, Metallurgist, MINDECO Mr. Toshihisa Shinokura, Metallurgist, MINDECO
Implementation Survey Team	January 18 ~ January 30, 1992	Mr. Kozo Esaki, Special Technical Advisor, JICA Mr. Junichi Nakayama, Staff, Mining Division, MITI Mr. Kyoichi Koyama, Director, International Cooperation Department, JMEC Mr. Hisamitsu Ooki, Advisor, International Cooperation Department, JMEC Mr. Mitsunari Takahashi, Staff, Technical Cooperation Division, Mining and Industrial Development Cooperation Department, JICA
Consultation Team	June 12 ~ June 25, 1993	Dr. Kenji Tomita, Special Technical Advisor, JMEC Mr. Masatoshi Murata, Chief Engineer, Technical Section, Development Department, MINDECO Mr. Koji Azegami, Engineer, Technical Section, Development Department, MINDECO Mr. Mitsunari Takahashi, Staff, Technical Cooperation Division, Mining and Industrial Development Cooperation Department, JICA
Technical Guidance Team	October 29 ~ November 13, 1994	Dr. Kenji Tomita, Special Technical Advisor, JMEC Mr. Kohei Munakata, Staff, Mining Division, MITI Mr. Hisamitsu Ooki, Deputy General Manager, Development Department, MINDECO Mr. Kanji Miura, Manager, Technical Division, Development Department, MINDECO Mr. Tomoo Niida, Staff, Technical Cooperation Division, Mining and Industrial Development Cooperation Department, JICA
Evaluation Team	November 27 ~ December 15, 1995	Mr. Yasujiro Suzuki, Deputy Director, Technical Cooperation Division, Mining and Industrial Development Cooperation Department, JICA Mr. Hiroshi Kawayama, Chief of International Cooperation Section, Mining Division, MITI Mr. Hisamitsu Ooki, Deputy General Manager, Development Department, MINDECO Mr. Koji Fukushima, Staff, Technical Cooperation Division, Mining and Industrial Development Cooperation Department, JICA Dr. Kenji Tomita, Special Technical Advisor, JMEC

[Notes] JICA : Japan International Cooperation Agency
 MITI : Ministry of International Trade and Industry
 AIST : Agency of Industrial Science and Technology, MITI
 JMEC : Japan Mining Engineering Center for International Cooperation
 MINDECO : Mitsui Mineral Development Engineering Co., Ltd.

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Annex-3 Tentative Schedule of Implementation

Calendar Year	1992				1993				1994				1995				1996	
Quarter	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II
I. Duration of the Project	-----																	
II. The Japanese Side	-----																	
2.1 Dispatch of Survey Teams	-----																	
(4) Consultation					=													
(5) Technical Guidance						=			-									
(6) Evaluation												=						
2.2 Dispatch of Experts	-----																	
(1) Long-term Experts	-----																	
1) Chief Advisor																		
2) Coordinator																		
3) Metallurgist (Mineral processing)																		
4) Metallurgist (Metallurgy)																		
5) Chemist (Chemical analysis)																		
(2) Short-term Experts	(Mineralogist and other Short-term Expert(s) on specific fields may be dispatched, if necessary)																	
2.3 Counterpart Training in Japan					=			=				=					=	
2.4 Provision of Equipment																		
2.5 Progress Report																		
III. The Colombian Side	-----																	
3.1 Renovation and Arrangement of Building and Facilities																		
3.2 Allocation of Counterparts & Administrative Personnel																		
3.3 Provision of Equipment																		
3.4 Expense of Operational Costs																		
3.5 Progress Report																		

----- Original Schedule; = Modified Schedule after the duration of cooperation was extended by mutual agreement.

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Annex-4 Technical Cooperation Program

Calendar Year	1993				1994				1995				1996	
Quarter	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II
1. Mineralogical Study														
1.1 Identification of ore minerals					—————									
1.2 Mineralogical description for ore samples tested					—————									
2. Mineral Processing Technology														
2.1 Sample preparation					—————									
2.2 Separation of cyanide by physical process					—————									
3. Metallurgical Processing Technology														
3.1 Separation of cyanide by chemical process					—————									
3.2 Cyanidation process					—————									
(1) Conventional process					—————									
(2) Carbon-in-pulp process					—————									
(3) Carbon-in-column process					—————									
(4) Resin-in-column process					—————									
3.3 Thio-urea process					—————									
(1) Carbon-in-column process					—————									
(2) Resin-in-column process					—————									
(3) Metal substitution process					—————									
4. Combination of Mineral Processing and Metallurgy					—————									
5. Pollution Control Technology for Mineral Processing					—————									
6. Analysis of Ore Samples Tested														
6.1 Chemical analysis					—————									
6.2 Instrumental analysis					—————									
7. Preparation of Reports					—————									

——— Original Schedule; ==== Modified Schedule after the duration of cooperation was extended by mutual agreement.

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Annex- 5 The Japanese Experts Dispatched by JICA

(As of December 12, 1995)

Type of Expert	Name of Experts	Assigned Duty	Assigned Term
Long-Term	1. Mr. Seiichi Tozawa	Chief Advisor	November 1, 1993 ~ March 30, 1995
	2. Mr. Yukinori Abe	Chief Advisor	March 25, 1995 ~ March 30, 1996
	3. Mr. Hisahiro Suzuki	Coordinator	November 1, 1993 ~ March 30, 1996
	4. Mr. Masahide Nakao	Mineral Dressing	November 8, 1993 ~ March 30, 1996
	5. Mr. Toshihisa Shimokura	Metallurgy	January 17, 1994 ~ March 30, 1996
	6. Mr. Koji Azegami	Chemical Analysis	January 17, 1994 ~ March 30, 1996
Short-Term	1. Mr. Taro Ikeda	Installation & calibration of X-ray diffraction analyzer.	November 3, 1994 ~ Nov. 24, 1994
	2. Mr. Yutaka Anzai	Technical guidance on X-ray diffraction analysis.	January 10, 1995 ~ March 25, 1995
	3. Mr. Katsushi Tabata	Installation & calibration of atomic absorption spectrophotometer.	January 30, 1995 ~ Feb. 19, 1995
	4. Mr. Taro Ikeda	Maintenance & calibration of X-ray diffraction analyzer.	March 4, 1995 ~ March 14, 1995
	5. Mr. Mitsuo Yamaguchi	Mineralogical study.	March 6, 1995 ~ May 5, 1995
	6. Mr. Mitsuo Yamaguchi	Mineralogical study.	June 26, 1995 ~ Sept. 25, 1995
	7. Mr. Shinsaku Yoshida	Installation & calibration of induction coupled plasma (ICP) analyzer and particle size analyzer.	July 5, 1995 ~ August 1, 1995
	8. Mr. Tomoaki Yorozu	Installation & calibration of Fluorescence X-ray analyzer.	July 24, 1995 ~ Aug. 14, 1995
	9. Ms. Miho Kurihara	Technical guidance on fluorescence X-ray analysis.	July 27, 1995 ~ Oct. 26, 1995
	10. Mr. Masatoshi Murata	Metallurgical technology.	Sept. 10, 1995 ~ Oct. 8, 1995
	11. Mr. Kanji Miura	Mineral processing technology.	October 10, 1995 ~ Nov. 7, 1995
	12. (Undecided)	Lecture at the seminar.	(Scheduled for February 1996)
	13. (Undecided)	Lecture at the seminar.	(Scheduled for February 1996)

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Annex-6 Acceptance of the Colombian Counterparts for Training in Japan

Name of Counterparts	Scope of Training	Term of Training
1. Mr. Gustavo Garzon Valencia	Pyro-metallurgy	Mar. 16, 1993 ~ June 14, 1993
2. Mr. Jaime Mojica Buitrago	Mineralogy	Mar. 16, 1993 ~ June 14, 1993
3. Mr. Jorge Martin Molina Escobar	Mineral processing	Mar. 16, 1993 ~ June 14, 1993
4. Mr. Juan Carlos Molano Mendoza	Mineralogy	Mar. 16, 1993 ~ June 14, 1993
5. Dr. Adolfo Alarcon Guzman	Mining industry	Mar. 30, 1993 ~ Apr. 16, 1993
6. Ms. Maria Cristina Nino de Villaveces	Project management	Sept. 15, 1993 ~ Oct. 17, 1993
7. Ms. Luz Stella Ramirez Duque	Mineral processing	Sept. 15, 1993 ~ Nov. 28, 1993
8. Mr. Jorge Ivan Londono Escobar	Hydro-metallurgy	Sept. 15, 1993 ~ Nov. 28, 1993
9. Ms. Yolanda Canon Romero	Instrumental analysis	Sept. 15, 1993 ~ Nov. 28, 1993
10. Mr. Nelson De La Pava Garavito	Project management	Aug. 15, 1994 ~ Sept. 14, 1994
11. Mr. Hector Mario Henao Zapata	Hydro-metallurgy	Aug. 15, 1994 ~ Oct. 26, 1994
12. Ms. Alicia Montes Alvarez	Instrumental analysis	Aug. 15, 1994 ~ Oct. 26, 1994
13. Ms. Gloria Ines Rodriguez Sierra	Mineralogy	Aug. 15, 1994 ~ Oct. 26, 1994
14. Mr. Carlos Mario Cardenas Agudelo	Project management	Aug. 28, 1995 ~ Nov. 3, 1995
15. Ms. Tereza Jesus de Duque Duque	Mineralogy	Aug. 28, 1995 ~ Nov. 3, 1995
16. Mr. Alvaro Pinilla Torres	Instrumental analysis	Aug. 28, 1995 ~ Nov. 3, 1995

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Annex-7 Machinery and Equipment provided by JICA

No.	Name of the Equipment	Specifications	Quantity	Arriv. Time	Price (Purchase)	Condition	User
I. Machinery and Equipment procured in Japan							
A. Mineralogical Study [G: Good, NG: No Good, Re: Repair, Mi: Mineralogy]							
A-1	Heavy Liquid Sepa. System	Heavy Liuids, Separator, etc.	1 Set	94/7	¥ 1,027,300	G	Mi
A-2	Automatic Point Counter	with Accesories	1 Set	95/5	¥ 800,000	G	Mi
A-3	Stereo Microscope	Olympus SZH-10-151 with Acces.	1 Set	94/7	¥ 769,000	G	Mi
A-4	Polarizing Microscope	Olympus BHS-75LP with Acces.	1 Set	94/7	¥ 1,120,000	G	Mi
A-5	Photo-system for A-4	Olympus IM-10AX-12 with Acces.	1 Set	94/7	¥ 423,800	G	Mi
A-6	X-ray Diffractometer	Rigaku D/MAX-2000 with Acces.	1 Set	94/8	¥ 18,906,000	NG→Re	Mi
A-7	Automatic Dryer Set	Dryer, Vacuum Pump, Compresser	1 Set	94/7	¥ 1,015,500	⇒G G	Mi
A-8	Rock Cutting Machine	Rock Cutter MC-100 with Acces.	1 Set	94/7	¥ 715,300	G	Mi
A-9	Polishing Machine	ML-180 with Accessories	1 Set	94/7	¥ 1,267,200	G	Mi
Subtotal for Item A					¥ 26,044,100		
B. Studies on Mineral Dressing and Metallurgy [G: Good, EX: Exchange, MD: Mineral Dressing, Me: Metallurgy]							
B-1	Jaw Crusher	0.3 t/hour	1 Set	94/8	¥ 3,395,000	G	MD
B-2	Sample Grinder	50 kg/hour	1 Set	94/8	¥ 3,194,000	G	MD
B-3	Sampling Apparatus	Spritter, Dryer & Filter	1 Set	94/7	¥ 1,488,400	G	MD/ Me
B-4	Balances	30 kg, 3 kg, 180 g, 200 g	1 Set	94/7	¥ 1,143,900	G	MD/ Me
B-5	Hard Grobe Tester	with Picnometer	1 Set	94/7	¥ 1,045,000	G	MD
B-6	Sizing Apparatus	Lo-Top Shaker with Screen Set	1 Set	95/5 94/7	¥ 1,284,210	G	MD
B-7	Particle Size Analyzer	Laser Diffraction Type	1 Set	95/5	¥ 8,950,000	NG→EX ⇒G	MD
B-8	Shaking Table & Jig	Type: Wilfley & Hartz	1 Set	94/7	¥ 8,788,000	G	MD
B-9	Magnetic Separators	Type: Isodynamic & Davis Tube	1 Set	95/5 94/8	¥ 6,665,600	G	Mi
B-10	Ball Mill	Laboratory Type	1 Set	95/5 94/7	¥ 2,307,000	G	MD
B-11	Flotation Testing Machine	MS Type, 500 g & 250 g	1 Set	94/7	¥ 2,572,900	G	MD
B-12	Electric Furnaces	MIK-6, MIRH-400, with Acces.	1 Set	94/8	¥ 3,457,600	NG→G	Me
B-13	Autoclave	with Stirring Device	1 Set	94/8	¥ 3,153,400	G	Me
B-14	Draft Chamber	Fume Hood Model: FHS-A	1 Set	94/8	¥ 2,648,800	G	Me
B-15	Cyanidation Testing Appa.	Pump, Stirrer, etc.	1 Set	94/7	¥ 1,715,400	G	Me
B-16	Compressor & Vacuum Pump	Air Pump (120 l/min)	1 Set	94/7	¥ 334,200	G	Me
B-17	CIP, CIC Testing Apparatus	Pump, Stirrer, etc.	1 Set	94/7	¥ 1,543,400	G	Me
B-18	EW/Refining Testing Appa.	Electrolytic Tank etc.	1 Set	94/7	¥ 2,207,600	G	Me
B-19	pH Meter	with Printer	1 Set	94/7	¥ 220,700	G	Me

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No.	Name of the Equipment	Specifications	Quantity	Arriv. Time	Price (Purchase)	Condition	User
B-20	CN Meter	Model:N-23F	1 Set	94/7	¥ 441,400	G	Me
B-21	ORP Meter	with ORP Electrode	1 Set	94/7	¥ 354,400	G	Me
B-22	Auxiliary Equipment	Flowmeter Kit, Cleaner, etc.	1 Set	94/7	¥ 7,930,800	G	Me
B-23	Reagents	Various Chemicals		94/7	¥ 1,166,210	G	Me
B-24	Wastes Treatment Apparatus	for Waste Water & Solids	1 Set	94/7	¥ 328,600	G	Me
Subtotal for Item B					¥ 66,337,420		
C. Analytical Laboratory					[AL: Analytical Laboratory]		
C- 1	Vibrating Mill	Type:T-100	1 Set	94/7	¥ 1,311,700	G	AL
C- 2	Desicator & Dryer	Drying Oven: DK-63	1 Set	94/7	¥ 397,600	G	AL
C- 3	Balance	Electronic Precision IM-20	1 Set	94/8	¥ 1,828,300	G	AL
C- 4	Water Purification Appara.	10 l/hour	1 Set	94/7	¥ 423,800	G	AL
C- 5	Heater	Hot Plate	1 Set	94/7	¥ 118,000	G	AL
C- 6	Draft Chamber	Fume Hood Model CCW-S	1 Set	94/8	¥ 2,031,500	G	AL
C- 7	Gas & Dust Scrubber	Exhaust Gas Washing Type RS-A	1 Set	94/8	¥ 2,522,600	G	AL
C- 8	Electric Furnace	High Temperature Muffle Type	1 Set	94/8	¥ 4,466,420	G	AL
C- 9	Atomic Absorption Spectro- photometer	SIMADZU AA- 660 with Accesso.	1 Set	94/8	¥ 8,173,160	G	AL
C-10	Spectro-photometer	SIMADZU UV-1201 with Accesso.	1 Set	94/8	¥ 1,011,000	G	AL
C-11	Inductivity Coupled Plasma Spectrometer	SIMADZU ICPS-1000 with Access.	1 Set	95/5	¥ 30,406,000	G	AL
C-12	X-ray Fluorescence Analy.	RIGAKU RIX-1000	1 Set	95/5	¥ 25,540,000	G	AL
Subtotal for Item C					¥ 78,279,980		
Total for Item A, B & C [Purchase Price]					¥170,661,500		
Laboratories	1st Cargo	2nd Cargo	3rd Cargo	Total Price (Purchase)	FOB Price	CIF Price	
	1994.7	1994.8	1995.5				
Mineralogy	¥ 6,338,100	¥ 18,906,000	¥ 800,000	¥ 26,044,100	¥ 27,166,009	¥ 28,399,423	
Dressing & Metallurgy	¥ 29,353,020	¥ 19,254,400	¥ 17,730,000	¥ 66,337,420	¥ 68,988,159	¥ 73,075,093	
Analysis	¥ 2,251,100	¥ 20,082,880	¥ 55,945,000	¥ 78,279,980	¥ 81,035,855	¥ 87,591,763	
Total	¥ 37,942,220	¥ 58,243,280	¥ 74,476,000	¥170,661,500	¥177,191,023	¥189,066,279	
II. Machinery and Equipment procured in Colombia							
D. Procurement by the JICA Office in Colombia				[G: Good, NG: No Good, Re: Repair, COMM: Common Use]			
D- 1	Television, Video FAX Projector, ORP, Photocopier Computer Vehicle Security Measures	SONY KV2127/SONY VHS PANASONIC Panafax UF-150 EIKI 840A1E, 3100P, TOSHIBA 7910 NEC IFDD 42MB 486 DX4-100 NISSAN PATROL Vehicle, Communication, etc.	1 Set 1 Set 1 Set 2 Set 1 Set 1	92/3 92/3 92/3 92/3 95/8 92/3 94/3	¥ 96,000 ¥ 89,000 ¥ 949,000 ¥ 1,518,000 ¥ 240,000 ¥ 4,000,000 ¥ 7,669,000	G G G G G G G COMM COMM COMM COMM COMM COMM	
Total for Item D [Procured in Colombia by JICA]					¥ 14,561,000		
Total Expenses for the Equipment by JICA:					¥203,627,279		

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Annex-8 Expenses by the Japanese Side for the Project

[Unit : Thousand Japanese Yen]

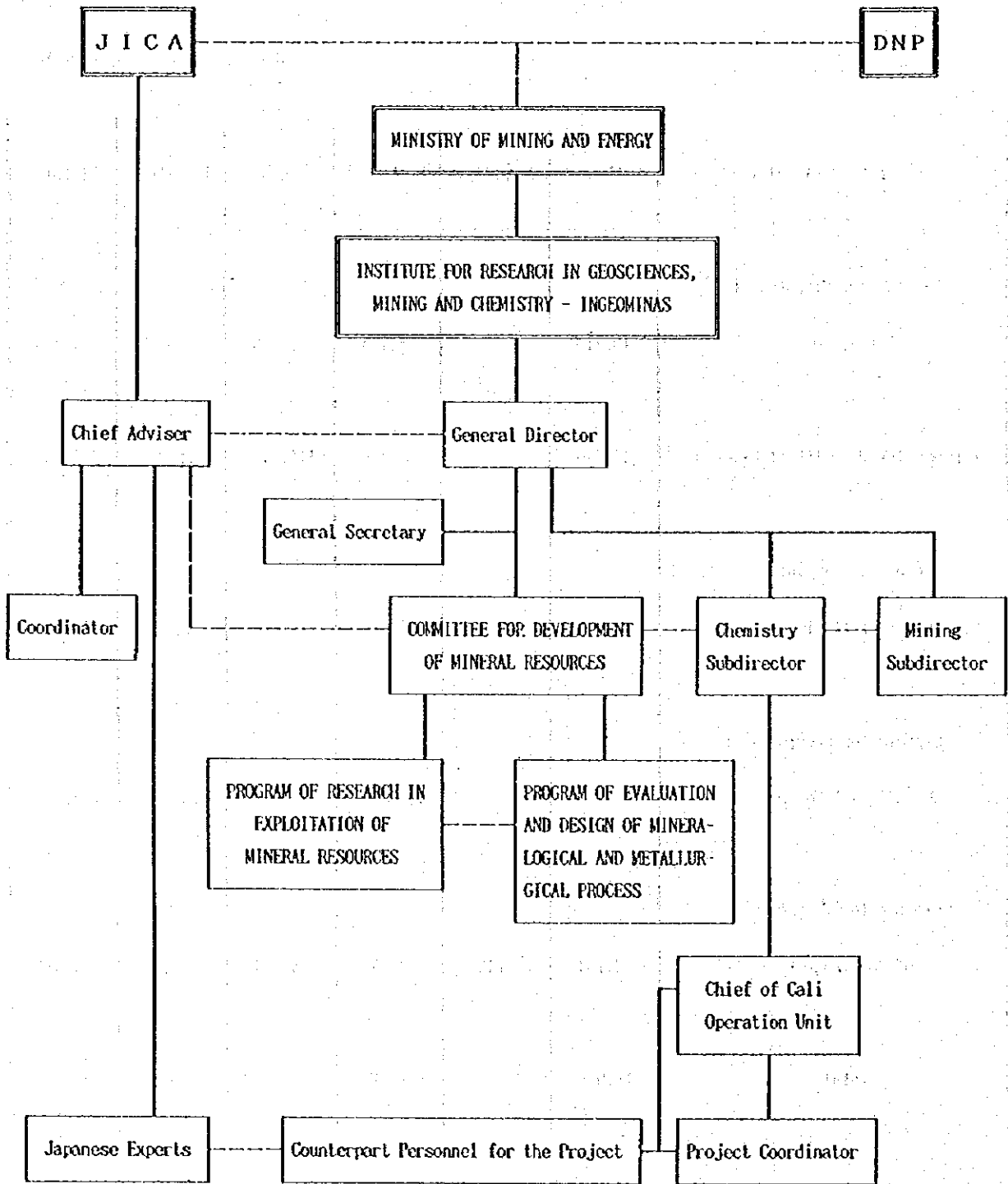
The Japanese Fiscal Year	1 9 9 1	1 9 9 2	1 9 9 3	1 9 9 4	1 9 9 5	Total
Expense for Dispatch of Survey Teams	19,213	-	5,798	7,556	8,896	41,463
Expense for Dispatch of Experts	10,540	-	56,745	116,046	84,108	267,439
Expense for Training of Counterparts in Japan	-	3,910	3,128	3,128	2,346	12,512
Expense for Provision of Machinery & Equipment	-	-	107,885	91,624	24,556	224,064
Expense for Management of the Project	9,164	142	4,289	4,484	3,499	21,574
Total	38,918	4,052	177,845	222,837	123,405	567,057

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Annex-9 Management System for the Project at INGEOMINAS



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Annex-10 Expenses by the Colombian Side for the Project

[Unit: Million Peso]

Items	Calendar Year				
	1992	1993	1994	1995	1996*
Expenditures for Salary and Wages	13.0	57.8	117.2	196.4	49.1
Expenditures for Equipment and Materials	0.4	20.4	18.6	28.9	11.0
Expenditures for Utilities	--	--	3.4	13.8	2.0
Other Expenditures (Transportation)	--	1.0	5.2	4.2	2.0
Total Expenditures for Operation	13.4	79.2	144.4	243.3	64.1
Expenditures for Renovation Works of Facilities and Buildings	19.0	26.6	5.9	1.6	1.5
Grand Total of Expenditures	32.4	105.8	150.3	244.9	65.6

* January 1996 ~ March 1996

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Annex-11 Machinery and Equipment procured by the Colombian Side

No.	Name of the Equipment	Specifications	Quantity	Arrival	Price (Colom. Pesos)	Cond	User
1	Atomic Absorption Spectrophotometer	Phillips Model SP9	1	1985	\$ 6,000,000	Good	Ch.
2	Atomic Absorption Lamps		26		\$ 3,240,000	Good	Ch.
3	Centrifuge	MSE Cod 4-79, SK-995	1		\$ 150,000	Good	Me.
4	Electronic Balance	Dertling TP 41 1609	1		\$ 350,000	Good	Me.
5	Balance	Dertling R40 1609	1		\$ 400,000	Good	Ch.
6	Draft Chamber	Siemens	1		\$ 350,000	Good	Ch.
7	Distillation Unit	Mark II	1		\$ 50,000	Good	Ch.
8	Water Washer	Philips Harris 385	1		\$ 300,000	Good	Ch.
9	Ultrasonic Scrubber	Decon FS 200	1		\$ 260,000	Good	Ch.
10	Electric Stirrer	VWR Vortorex	1		\$ 150,000	Good	Ch.
11	Drying Oven	TYT	1		\$ 250,000	Good	Me.
12	Electric Magnifier	Luxo	1		\$ 150,000	Good	Mi.
13	Mineralogical Lamp	Shott Ref 1500T	1		\$ 750,000	Good	Mi.
14	Assay Balance	Southern	1		\$ 90,000	Good	Me.
15	Balance	Southern Model 23	1		\$ 20,000	Good	Me.
16	Hardness Scale	Seven Pencils	1		\$ 200,000	Good	Me.
17	Hydrocyclone	with Accessories	1		\$ 300,000	Good	Me.
18	Hammer	for Field Survey	1		\$ 20,000	Good	Mi.
19	Scintillation Counter	for Radioactivity	1		\$ 200,000	Good	Ch.
20	Stabilizer	for Voltage	1		\$ 100,000	Good	Ch.
21	Pulverizer		1		\$ 500,000	Good	Me.
22	Jaw Crusher		1		\$ 1,000,000	Good	Me.
23	Disc Grinder		1		\$ 1,000,000	Good	Me.
24	Ball Mill	Denver Fire Clay	1		\$ 600,000	Good	Me.
25	Petrographic Microscope		1		\$ 2,000,000	Good	Mi.
26	Rock Cutter		1		\$ 300,000	Good	Mi.
27	Polishing Machine	Buchler	1		\$ 1,000,000	Good	Mi.
28	Bench for Chemical Laboratory	with Sink	2		\$ 400,000	Good	Ch. & Me.
29	Bench for Chemical Laboratory		16		\$ 6,000,000	Good	Ch. & Me.
30	Glass Instruments		1		\$ 1,000,000	Good	Ch. & Me.

[Notes] Ch.: Analytical Laboratory, Me: Metallurgical Laboratory, Mi: Mineralogical Laboratory

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Annex-12 List of the Colombian Counterpart Personnel (I)

Name	Position	Assignment Terms	Fields	Expert	Remarks
Dr. Adolfo Alarcon Guzman	General Director	Mar. 1992~	Official Representative		©
Qca. Maria Cristina Nino de Villaveces	Chemistry Subdirector	Mar. 1992~Jul. 1995	Chemistry		Transferred to [A]. ©
Qca. Fabio Hernando Perez Gomez	Chemistry Subdirector	Jul. 1995~	Chemistry		
Ing. Luz Stella Ramirez Duque	Project Coordinator	Jan. 1992~Nov. 1994	Chemistry		Retired [B]. ©
Ing. Alicia Montes Alvarez	Project Coordinator	Dec. 1994~	Chemistry		©
Ing. Silvia Alvarez	Project Coordinator	Oct. 1994~Dec. 1994	Mining		Transferred to [C].
Ing. Jorge Martin Molina Escobar	Project Coordinator	Mar. 1992~Oct. 1994			Under study in Japan. ©
Ing. Carlos Mario Cardenas Agudelo	Project Coordinator	Mar. 1995~	Mining		©
Ing. Antonio Romero Hernandez	Mining Subdirector	Mar. 1992~Oct. 1995	Mining		Retired [G]
Ing. Nelson De La Pava Caravito	Chief of Cali Operation Unit	Nov. 1993~	Mining		©
Sr. Kennedy Velz Padilla	Head of Operation	~Jul. 1995			Transferred to [E].
Ing. Luz Merry Duitama	Head of Operation	Aug. 1995~	Metallurgy	Nakao	<T>
Geo. Juan Carlos Molano Mendoza	Counterpart	Mar. 1992~Oct. 1995	Mineralogy	Yamaguchi	Under study in Japan. ©
Geo. Jaime Mojica Buitrago	Counterpart	Mar. 1992~	Mineralogy	Yamaguchi & Anzai	©
Geo. Martha Edith Velasquez David	Counterpart	Jun. 1995~	Mineralogy	Yamaguchi	<T>
Geo. Gloria Ines Rodriguez Sierra	Counterpart	Mar. 1992~	Mineralogy	Yamaguchi	©
Ing. Jorge Ivan Londono Escobar	Coordinator	Jan. 1993~	Metallurgy	Nakao, Murata, Shimokura	©
Ing. Hector Mario Henao Zapata	Chief of the Counterparts	Jan. 1993~	Metallurgy	Nakao, Miura, Shimokura	©
Ing. Luis Fernando Ordonez Castillo	Counterpart	Jan. 1994~Jul. 1995	Metallurgy		Retired. [D]
Qca. Yolanda Canon Romero	Counterpart	Mar. 1992~	Chemistry	Azegami, Kurihara, Anzai	©
Qca. Gustavo Garzon Valencia	Counterpart	May 1992~Apr. 1995	Chemistry	Azegami	Transferred to [F]. ©
Qca. Maria del Carmen Gonzalez Martinez	Counterpart	May 1995~	Chemistry	Azegami, Kurihara	<T>

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List of the Colombian Counterpart Personnel (2)

Name	Position	Assignment Terms	Fields	Expert	Remarks
Oca. Lina Maria Aguirre	Counterpart	Apr. 1995~Nov. 1995	Chemistry	Azegami	<T>
Ing. Tereza Jesus de Duque Duque	Counterpart	Aug. 1995~	Mineralogy	Shimokura	©
Sr. Alvaro Pinilla Torres	Laboratory Assistant	Mar. 1992~	Chemistry	Azegami	©
Sr. Hector Fabio Bacca Luna	Laboratory Assistant	Dec. 1993~	Metallurgy	Nakao, Shimokura	
Sr. Noel Antonio Lopez Herrera	Laboratory Assistant	Dec. 1993~	Mineralogy	Yamaguchi	

[A] Office of the General Director of INGEOMINAS, [B] ECOCARBON, [C] Medellin Operation Unit,
 [D] Triturados Saratoga, [E] Private Mining Company, [F] Pasto Operation Unit, [G] Universidad Nacional Medellin

© : Trained in Japan.
 <T> : Temporary employee

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Annex-13 Records of the Meetings for the Project

Date	Site	Subject for Meeting
November 11, 1993	Cali	Measures concerning the security for the Japanese experts.
April 7, 1994	Cali	< the same as the above >
October 28, 1994	Cali	< the same as the above >
November 14, 1995	Cali	< the same as the above >
February 2, 1994	Bogota	Measures concerning the security for the Japanese experts.
December 19, 1994	Bogota	< the same as the above >
March 13, 1995	Bogota	< the same as the above >
September 28, 1995	Bogota	< the same as the above >
October 12, 1994	Cali	Discussions on the renovation works of laboratories.
October 24, 1994	Cali	< the same as the above >
November 10, 1994	Cali	< the same as the above >
November 22, 1994	Cali	< the same as the above >
November 28, 1994	Cali	< the same as the above >
November 30, 1994	Cali	< the same as the above >
December 12, 1994	Cali	< the same as the above >
January 2, 1995	Cali	< the same as the above >
January 16, 1995	Cali	< the same as the above >
February 13, 1995	Cali	< the same as the above >
February 23, 1995	Cali	< the same as the above >
February 24, 1994	Cali	Discussions on the progress of the Project.
March 2, 1994	Cali	Discussions between counterparts and experts.
December 12, 1994	Cali	< the same as the above >
January 10, 1995	Cali	< the same as the above >
February 1, 1995	Cali	< the same as the above >
February 8, 1995	Cali	< the same as the above >
March 1, 1995	Cali	< the same as the above >
April 5, 1995	Cali	Coordination and discussions between counterparts and experts.
May 9, 1995	Cali	< the same as the above >
June 9, 1995	Cali	< the same as the above >
July 7, 1995	Cali	< the same as the above >
September 13, 1995	Cali	< the same as the above >
October 10, 1995	Cali	< the same as the above >
May 5, 1994	Cali	Extension of the terms of the Japanese technical cooperation.
August 2, 1994	Cali	< the same as the above >
August 29, 1994	Bogota	< the same as the above >
September 28, 1994	Bogota	< the same as the above >
May 24, 1995	Bogota	Preliminary discussions on the next step of the Project.
June 27, 1995	Bogota	< the same as the above >
March 27, 1994	Bogota	Greetings on arrival of the successor to the chief advisor.
June 28, 1994	Cali	Visit from the auditor of JICA.
January 24, 1995	Cali	Ceremony concerning donation of machinery and equipment from the Japanese side.

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Annex-14 Evaluation Check List

Technical Cooperation for the Project on the Recovery of Precious Metals
from Vein-Type Complex Ores in the Republic of Colombia

Evaluation Grade : <input type="radio"/> Good, <input type="checkbox"/> Fair, <input type="checkbox"/> Unsatisfactory Evaluation Point of View : <input type="checkbox"/> (I) Technology transfer by the Japanese Experts. <input type="checkbox"/> (A) Technology acquirement by the Colombian Counterpart Personnel

Evaluation Items	Acquired Results	Results of Evaluation						Remarks
		Japanese		Colombian		General		
		T	A	T	A	T	A	
1. Overall Goal of the Project Enhancement of dissemination activities in the field of mineral processing technology by INGEOMINAS.		-	-	-	-	-	-	Refer to Comment- (1)
2. Purpose of the Project Technology transfer from the Japanese experts to the counterpart personnel of INGEOMINAS so as to enable them to carry out research and development on mineral processing technology for recovery of precious and associated metals from vein-type complex ores in the Republic of Colombia.	A. Overall Results The function of INGEOMINAS was strengthened in the field of mineral processing technology through a cultivation of human resources and an improvement of laboratories and facilities. B. Individual Results Estimated achievements at the final stage of the project. (March 30, 1996)							Refer to Comment- (2.1) Refer to Comment- (2.2)
<div style="border: 1px dashed black; padding: 5px; margin-top: 10px;"> <p>*¹⁾ The experiment using cationic resin was suspended by mutual consent. *²⁾ The experiment using the ore samples treated in autoclave is scheduled. *³⁾ The arsenic separation is necessary according to the characteristics of ore samples tested. *⁴⁾ Due to the delay of arrival of the equipment for waste water treatment *⁵⁾ Self-reliant study by the Colombian side is possible, but the guidance by the Japanese experts is desirable.</p> </div>	1. Mineralogical study a) Identification of ores : 100% b) Description of ores. : 100% 2. Mineral dressing a) Sample preparation : 100% b) Physical separation of cyanide. : 100% 3. Metallurgy a) Chemical separation of cyanide. : 100% b) Cyanidation process (Leaching of gold) 1) Conventional process : 100% (Recovery of gold) 2) CIP process : 100% (Adsorption of gold) 3) CIC process ① Adsorption of gold : 100% ② Elution of gold : 100% ③ Electro-winning of Au : 100% 4) RIC process ¹⁾ : 95% c) Thio-urea process 1) Leaching condition : 100% 2) CIC process : 100% 3) RIC process ²⁾ : 95% 4) Metal substitution process : 100% 4. Combination of mineral dressing & metallurgy³⁾ : 95% 5. Pollution control for mineral processing⁴⁾ : 90% 6. Analysis of ore samples a) Chemical analysis : 100% b) Instrumental analysis : 100%	○	○	○	○	○	○	
		○	○	○	○	○	○	
		○	□ ⁵⁾	□	□	□	□	
		○	□ ⁵⁾	○	□	○	□	
		□	□	□	□	□	□	
		○	□ ⁵⁾	○	□	○	□	
		○	○	○	○	○	○	
		○	□ ⁵⁾	○	□	○	□	

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Evaluation Check List (2)

Evaluation Items	Acquired Results	Results of Evaluation						Remarks
		Japanese		Colombian		General		
		T	A	T	A	T	A	
3. Output from the Project 1) Human resources development necessary for R & D in the field of mineral processing at INGEMINAS. 2) Improvement of laboratories and facilities in the field of mineral processing at INGEMINAS. 3) Opening to the mining industry the results of the Project.	1. Number of counterpart personnel acquired the specific technology in each fields. a) Mineralogical study : 4 b) Metallurgical study : 3 c) Analytical study : 4 2. Improvement of laboratories & facilities. a) Mineralogical Lab. : 100% b) Mineral Dressing Lab. : 100% c) Metallurgical Lab. : 100% d) Instrumental Analy. Lab. : 100% e) Chemical Analysis Lab. : 100% 3. Publicity on the results of the Project. a) Number of papers, etc. : 8 b) Number of seminars, etc. : 4 c) Number of services : 9	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		Refer to Comment-[3.1]
		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		Refer to Comment-[3.2]
		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		Refer to Comment-[3.3]
4. Input to the Project [Input by the Japanese Side] A. Dispatch of the Japanese Experts B. Acceptance of the Colombian Counterpart Personnel for Training in Japan C. Provision of Machinery and Equipment D. Complement of Operational Costs at the Site of the Project	[The Japanese Side] A. Dispatch of experts 1. Long-term experts a) Specialized field: 5 Fields b) Number of expert : 6 Expt. c) Term of dispatch : 3 years 2. Short-term experts a) Specialized field : 10 b) Number of expert : 13 c) Term of dispatch: 10-90 days B. Acceptance of counterparts a) Training field : 5 b) Number of trainee: 16 c) Term of training: 17 days - 3 months d) Effects on the Project C. Provision of the equipment (Total value: ¥ 224 Million) a) Time of provision b) Installation & calibration c) Operation & utilization d) Maintenance D. Expenses for local costs (Total expenditure: ¥ 25 Million) a) Items of complement b) Amount of complement. c) Time of complement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Refer to Comment-[4.A]
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Refer to Comment-[4.B]
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Refer to Comment-[4.C]
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Refer to Comment-[4.D]

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Evaluation Check List (3)

Evaluation Items	Acquired Results	Results of Evaluation						Remarks	
		Japanese		Colombian		General			
		T	A	T	A	T	A		
[Input by the Colombian Side] E. Assignment of the Personnel	[The Colombian Side] E. Assignment of the personnel 1. Counterpart personnel Mineralogy: 4 persons Metallurgy: 3 persons Analysis : 4 persons a) Specialized field b) Number of counterparts c) Qualification d) Term of assignment 2. Administrative personnel (11 persons) 3. Supporting staff (10 persons)							Refer to Comment- (4.E)	
F. Renovation Works of Building and Facilities	F. Renovation works of laboratories and facilities (Total expenditure: 54.6 Million Pesos)								Refer to Comment- (4.F)
G. Procurement of Machinery, Equipment and Materials	G. Procurement and allocation of machinery, equipment and materials								Refer to Comment- (4.G)
H. Expenses of the Operational Costs for the Project	H. Operational costs for the Project (Total expenditure: 544.4 Million Pesos)							Refer to Comment- (4.H)	
I. Security for the Japanese Experts	I. Security for the Japanese Experts							Refer to Comment- (4.I)	
5. Prospects for Sustainability of the Project.	1. Organizational aspects a) Enhancement of the mission of INGEOMINAS in the field of mineral processing and metallurgy. b) Enhancement of the function of INGEOMINAS in the field of mineral processing and metallurgy in both human resources and facilities. 2. Social and economic aspects a) Necessity of improvement on the present operational conditions at the Colombian mining industry. b) Requests from the private mining enterprises on the technical consultancy services to meet a cost saving and pollution free operation.							Refer to Comment- (5)	
Overall Evaluation of the Project								Refer/6	


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Evaluation Check List (4)

Evaluation Items	Comments from the both Evaluation Teams
1. <u>Overall Goal of the Project.</u>	The Colombian side expressed their expectations on the INGEOMINAS's activities concerning technology transfer in line with the National Mining Development Plan.
2. <u>Purpose of the Project.</u> 2.1 Overall Results.	The most important results obtained through the Project are the activities concerning technology transfer in the field of mineral processing technology aiming at a high gold recovery and environment protection at the gold mining districts.
2.2 Individual Results	The technology transfer from the Japanese experts to the Colombian counterpart personnel has been implemented satisfactorily, except for some of metallurgical studies.
3. <u>Output from the Project.</u> 3.1 Number of Counterparts.	The full assignment of counterpart personnel for the Project has not been realized for some reasons, however, the human resources development for the Project has been implemented at the highest level by the mutual cooperation.
3.2 Improvement of Laboratories, etc.	The improvement of the laboratories and facilities necessary for research and development in the field of mineral processing has been completed as a result of the renovation works by the Colombian side and the provision of machinery and equipment by the Japanese side. It is expected that those facilities would be utilized for the development and promotion activities at mining districts.
3.3 Publicity on the results of the Project.	The numbers of reports & papers, technical meetings and technical services are not a few in consideration of the period of the Project.
4. <u>Input to the Project.</u> (The Japanese Side) 4.A Dispatch of the Japanese Experts.	The Colombian side recognized that the services of the Japanese experts were satisfactory for the Project together with their high ability and hard working attitude.
4.B Acceptance of Counterparts in Japan.	The Colombian side explained that the counterpart training in Japan has been carried out appropriately, except for the term of training in laboratories.

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Evaluation Check List (5)

Evaluation Items	Comments from the both Evaluation Teams
4.C Provision of the Equipment.	The Colombian side explained that the provision of the Equipment has been carried out appropriately, except for delay of the arrival of the Equipment at the site of the Project.
4.D Complement of the Operational Costs.	The complement of the operational costs from the Japanese side was beneficial for smooth implementation of the Project.
[The Colombian Side] 4.E Assignment of the Personnel.	The Japanese side recognized that their high ability and hard working attitude of the Colombian counterpart personnel were the most important factor for successful implementation of the Project. However, the number of counterparts and the term of assignment were not appropriate for the Project.
4.F Renovation Works of Laboratories.	The renovation works of laboratories and facilities have been implemented satisfactorily.
4.G Procurement of the Equipment.	As to the procurement of the equipment, the Colombian side has taken their necessary measures as possible.
4.H Expenses of the Operational Costs.	As to the expenses of the operational costs, the Colombian side has taken their necessary measures as possible.
4.I Security for the Japanese Experts.	The Colombian side has taken their necessary measures for security of the Japanese experts appropriately.
5. <u>Sustainability of the Project.</u>	For the sustainable progress of the Project, the implementation of the next stage project (the mining development program mainly composed of pilot plant operation by mobile mineral processing unit) is necessary, because the national mining policy aiming at the improvement of gold recovery and environmental contamination at the mining district will be realized through a confirmation process based on the results of pilot plant tests on the new technologies which have been transferred at laboratory scale under the Project.
6. <u>Overall Evaluation of the Project.</u>	Both the sides concluded that the Project has been implemented successfully and at the highest level.

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MINUTES OF THE DISCUSSION
BETWEEN
THE JAPANESE EVALUATION TEAM
AND
THE AUTHORITIES CONCERNED
OF
THE GOVERNMENT OF COLOMBIA
ON
THE JAPANESE PROJECT-TYPE COOPERATION
FOR
THE RECOVERY PRECIOUS METALS
FROM VEIN-TYPE COMPLEX ORES
IN THE REPUBLIC OF COLOMBIA

December 1995

Santafe de Bogota, Colombia

MINUTES OF THE DISCUSSIONS
BETWEEN THE JAPANESE EVALUATION TEAM
AND THE AUTHORITIES CONCERNED OF
THE GOVERNMENT OF COLOMBIA
ON THE JAPANESE PROJECT-TYPE TECHNICAL COOPERATION
FOR THE RECOVERY PRECIOUS METALS FROM VEIN-TYPE COMPLEX ORES
IN THE REPUBLIC OF COLOMBIA

The Japanese Evaluation Team (hereinafter referred to as "the Japanese Team") organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA") headed by Mr. Yasujiro Suzuki, Deputy Director, Technical Cooperation Division, Mining and Industrial Development Cooperation Department, JICA visited the Republic of Colombia from December 3 to December 13, 1995, for the purpose of evaluating jointly with the Colombian Evaluation Team (hereinafter referred to as "the Colombian Team") the achievement of the Japanese Technical Cooperation for the Recovery Precious Metals from Vein-Type Complex Ores (hereinafter referred to as "the Project") on the basis of the Record of the Discussions signed on January 27, 1992 (hereinafter referred to as "the R/D").

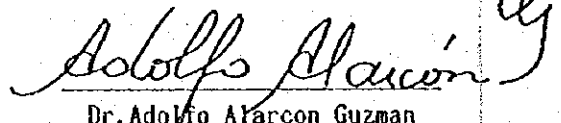
After the Joint Evaluation of the Project, the Japanese Team Discussed with the authorities concerned of the Government of the Republic of Colombia over the matters for the successful implementation on the Project.

As a result of the discussions, both sides mutually agreed upon the matters referred to in the document attached hereto.

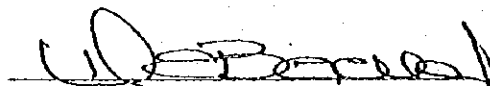
Santafe de Bogota, December 12, 1995



Mr. Yasujiro Suzuki
Japanese Evaluation Team,
Leader,
Japan International
Cooperation Agency,
Japan.



Dr. Adolfo Alarcon Guzman
General Director,
Institute for the Research in
Geosciences, Mining and
Chemistry (INGEOMINAS),
The Republic of Colombia.



Dr. Maria Elsa Bernal
Chief,
Special Division of
International Technical Cooperation,
National Planning Department,
The Republic of Colombia.

ATTACHED DOCUMENT


1. The Joint Committee of the Project confirmed the Joint Evaluation Report on the Japanese Technical Cooperation for the Project on the Recovery of Precious Metals from Vein-Type Complex Ores in the Republic of Colombia which was submitted by both the Evaluation Teams.

2. International seminar on the improvement of recovery of precious metals and pollution control will be held at Cali in February 1996 by the INGEOMINAS. For this seminar, two (2) short-term experts in the field of mineral dressing and metallurgy will be dispatched as the seminar lecturers.

3. The Japanese Team requested that the Colombian side shall take necessary measures to ensure prompt customs clearance, internal transportation and installation of the machinery and equipment (waste water treatment apparatus for chemical laboratory works, etc.) which will be provided by JICA in the middle of January 1996. In case of the delay of the arrival of the waste water treatment apparatus for chemical laboratory works over the end of February 1996, both sides agreed that the implementation of the Japanese technical cooperation as the Follow-up for the project in the field of the pollution control for mineral processing will be necessary at least for a few months.

4. The Colombian side requested that the Japanese Individual Experts in the field of "Metallurgical Study" are necessary to supplement and enhance the outputs of the Project. The Japanese Team expressed that some of the items concerning the technology transfer in the field of metallurgical study (including pollution control techniques) are still necessary for the technical guidance of the Japanese experts.

5. The Colombian side explained the contents of the Phase II of the Project (the mining development program mainly composed of pilot plant operation by mobile mineral processing unit), and strongly requested the implementation of the Phase II of the Project by the Japanese technical cooperation. The Japanese Team replied to convey the request for the Phase II of the Project to the authorities concerned of the Japanese Government.

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ATTENDANCE

A. The Evaluation Team

1) The Japanese Evaluation Team

Mr. Yasujiro SUZUKI,	Leader
Mr. Hiroshi KUWAYAMA,	Member (Technical cooperation planning)
Mr. Hisamitsu OOKI,	Member (Mineral processing)
Mr. Kenji TOMITA,	Member (Evaluation analysis)
Mr. Koji FURUSHIMA,	Member (Evaluation planning)

2) The Colombian Evaluation Team

Dr. Adolfo Alarcon Guzman,	Director General, INGEOMINAS
Dra. Maria Eliza Bernal,	Jefa, Division Especial de Cooperacion Tecnica Internacional, DNP
Dr. Albeiro Osorio Cardona,	Director General de Minas, MINMINAS
Ing. Orlando Alvarez,	Gerente General, MINERALCO

B. Participant in the Meetings

1) The Japanese Experts

Mr. Yukinori ABE,	Chief Advisor
Mr. Hisahiro SUZUKI,	Coordinator
Mr. Masahide NAKAO,	Expert (Mineral Dressing)
Mr. Toshihisa SHIMOKURA,	Expert (Metallurgy)
Mr. Koji AZEGAMI,	Expert (Chemical Analysis)

2) JICA Colombia Office

Mr. Yoshihisa YOSHIDA,	Deputy Resident Representative
Mr. Shigeru TAKAGI,	Deputy Resident Representative
Mr. Shunichi MURATA,	Assistant Resident Representative
Mr. Yasumasa ITO,	Interpreter

3) Embassy of Japan in Colombia

Mr. Noriyuki BABA,	Second Secretary
--------------------	------------------

4) Departamento Nacional de Planeacion [DNP]

Abg. German Fonseca,	Jefe Division Promocion Cooperacion Tecnica
Abg. Guillermo Augusto Correa Castaneda,	Jefe de la Division de Proyectos de Cooperacion Tecnica Internacional
Ing. Sandra Fonseca,	Consejera, Division de Minas y Energias Unidad de Infraestructura y Energia

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5) Ministerio de Minas y Energía (MINMINAS)

Dr. Victor Manuel Rivera,	Director General de Minas(saliente)
Dr. Albeiro Osorio Cardona,	Director General de Minas(entrante)
Ing. Juan Jose Manrique,	Subdirector de Evaluacion
Lic. Javier Ortiz Munoz,	Ecargado del Area Juridica

6) Institute de Investigaciones en Geociencias, Minería y Química (INGEOMINAS)

Abg. Alfredo Giovanni Ulloa Pinto,	Secretario General
Qco. Fabio Hernando Perez Gomez,	Subdirector del Area de Química
Ing. Luz Marina Aristizabal,	Subdirector del Area de Minería
Ing. Alicia Montes Alvarez,	Coodinadora de Programa
Ing. Nelson de la Pava Garavito,	Jefe de Unidad Operativa de Cali
Ing. Jorge Ivan Londono,	Coodinador del Proyecto, Unidad Operativa de Cali
Ing. Hector Mario Hanao,	Jefe de Couterparte, Unidad Operativa de Cali
Qca. Yolanda Canon Romero,	Countraparte, Area Química, Unidad Operativa de Cali
Qca. Maria del Carmen Gonzalez,	Countraparte, Area Minería, Unidad Operativa de Cali
Geo. Jaime Mojica Buitrago,	Countraparte, Area Minería, Unidad Operativa de Cali
Geo. Martha Edith Velasquez,	Countraparte, Area Minería, Unidad Operativa de Cali

7) Minaral es de Colombia S.A. (MINERALCO)

Ing. Samuel Gomez Celis,	Subdirector Tecnico
--------------------------	---------------------

8) Universidad Nacional de Bogota

Geologo Luis Eduardo Jamillo Cortes,	Profesor (Exploracion Minería)
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3 プロジェクト関係機関のプロジェクト担当官・関連職員に対する評価調査総括表

(終了時評価調査団：1995年11～12月)

面談調査日	11月29日	12月 1日	11月29日	11月30日	11月30日	11月30日
面談調査機関	国家企画庁 [DNP]	国家企画庁 [DNP]	地球化学・鉱山 ・化学研究所 [INGEOMINAS]	鉱山・エネルギー省 [MINMINAS]	コロンビア鉱山公社 [MINERALCO]	コロンビア国立大学 (在米ブタ)
面談者	MTCの技術協力課長、技術協力課副課長	MTCの技術協力課長、技術協力課副課長	MTCの長官、MTCの化学部長、MTCの調整官	鉱山局長、技術部長、技術課長、MTCの技術部長、MTCの技術課長、MTCの技術課長	MTCの技術部長、MTCの技術課長	MTCの技術部長、MTCの技術課長
1. プロジェクト上位目標との整合性		INGEOMINASの技術普及活動が、自国の国家開発計画 (鉱業分野) のなかで推進されることを期待したい。	今後、第二フェーズ (移動選鉱設備を活用したパイロットプラント試験) を鉱山公社と協力して実施することによって、技術の普及を図る。	アンデス山系の太平洋岸の鉱床の開発は、それぞれの特長に基き、採率向上に必要となる技術の普及が望まれていた。そのため、成果普及活動を行っている。		
2. プロジェクトの目標達成度 2.1 総合的成果	合金選鉱分野における技術の移転に加え、環境保全と金回収率向上の処理技術が導入されたので、当初の計画を十分に達成している。	実験室規模での技術移転がすべて達成された。毎年、プロジェクトの評価が実施されている。	金回収率向上のためのプロセス停止する手法が実施されたことにより、最大の成果であると高く評価されている。	選鉱別選鉱特加の選鉱技術の移転が可能なことにより、多量の選鉱の普及に寄与することになる。		
2.2 技術分野別の実績						
3. 技術協力計画の目標達成度 3.1 人材の養成	専門家派遣と研修員受入れによって、技術移転は適切に実施されている。	技術移転が順調に実施されていると了解している。	諸般の事情により、十分な人員を配置出来なかったこと、臨時職員での対応したことで、最善の対応が実施された。			
3.2 試験研究施設の整備	機材供与と改修工事によって、選鉱製錬に必要の施設が整備されている。		選鉱製錬の試験研究に必要な施設が十分に整備された。今後、これらの施設を	鉱山局の試験研究施設は老朽化している。本プロジ		

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	は適切に整備された。		活用して、鉱業界への技術支援	エクトによる試験研究施設		
3.3 試験研究成果の公開	96年2月のセミナー開催に加え、第三回国研修の実施を要請している。		カリでは、鉱業関係者を招聘し、95年10月に開催された96年2月に開催されたセミナーが閉じられ、以降、さらには技術普及界との間での特別な会議を開催している。	鉱山地帯の各種レベルの技術者に対する研修能力を、さらにパイロットによる試験的運用が期待されている。	クリーンで、目撃経済性のある鉱物処理プロセスの開発が、金鉱山を含むコロンビアの鉱業界で要望されていたので、本プロジェクトの成果普及活動は有益である。	金鉱業に関するセミナーが1995年12月にINGEOMINASで開催される。
4. 暫定実施計画の目標 達成度 【日本側負担】 4.A 専門家の派遣	日本人専門家は技術能力が高く、かつ勤勉で、十分に技術移転を達成したと評価されている。		日本人専門家については、長期・短期の両者について全面的に満足している。技術移転についても満足している。			
4.B 研修員の受入れ	帰国研修員は受受後状況良好で、日本での研修実施状況に満足している。		研修員受入れについては、適切に実施された。満足している。研修期間が長期的に互に望ましく、研究期間が最低2ヶ月必要であった。また、帰国研修員の一部は復職していない事実は反省している。国内見学旅行は技術的にも文化的にも興味深く、有効であった。			
4.C 機材の供与	必要な機材が専門家派遣と合わせた適切な供与技術移転に効果的であった。		機材供与については、サイトに到着したことを遅延し、延びたことを補うために全面的に（未到着の機材がある）機材の届け			

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			調整・操作指導については完璧であった。今後の機材保全については、予備措置の申請とプロジェクトの対応とを口頭で対応している。			
4.D 運営経費の補完			日本側は適切な時期に、適切に対応してくれたと評価している。			
[コロンビア側負担] 4.E 人員の配置		C/Pの勤務状況に対する評価について、心がを表明された。	諸般の事情により、技術移転を受けるに必要となる人員を確保することが出来なかった。また臨時職員でも対応し、人事異動もあつたが、最善の措置で対処したいと理解して欲しい。			
4.F 実験室の改修工事			改修工事は十分に達成したと評価している。			
4.G 資機材の調達			必要に応じて、可能な限り、対応した。			
4.H 運営経費の支出			必要に応じて、可能な限り、対応した。			
4.I 専門家の安全保障	専門家の安全保障については、今後も適切に対処していく。		コロンビア側は限定条件の下で、今後も適切に対処していく。			
5. プロジェクトの効果	クリーンな金抽出技術の移転は、金回収率の向上のみならず、汚染地帯の環境保全の改善に貢献する。	目下策定中の国家開発計画（鉱業分野）では、技術導入と、環境保全の両方を同時に達成するよう努力が加わっている。本プロジェクトの成果は、小規模な金産出分野で活用される。	カリの地域には、これまで、選鉱・製錬の施設がなかったが、今後この地域に各種の産業が誘致される。今後またこの地域の発展に貢献する。また、選鉱・製錬の施設がなかったが、今後この地域に各種の産業が誘致される。今後またこの地域の発展に貢献する。	この地域では、最大の規模の金産出を望んでいる。この地域で最大の規模の金産出を望んでいる。この地域で最大の規模の金産出を望んでいる。	MINERALCO は対して、資金を業として、貧乏層を支援している。本プロジェクトの成果は、小規模な金産出分野で活用される。	金の抽出回収率は、環境汚染、客観的に改善された。このプロジェクトの成果は、小規模な金産出分野で活用される。

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6. プロジェクトの自立発展の見通し 6.1 政府組織としての自立発展の見通し	本件プロジェクトは重要かつ有効なものであると認められている。第二フェーズの側面は第二フェーズ開始までの長期専門家要請している。	目下決定中の国家開発計画のなかで、鉱業関係の検討がなされている。	金回収率の向上と環境保全との両立を図るべく、プロセスの改善に努めている。また、パイロットプラントの建設が重要である。	鉱業法の改正を含む関係機関との協議が進展している。環境保全を含む関係機関との協議が進展している。	本件プロジェクトの第二フェーズでは、INGEOMINASと共同で対応している。	現在の企業実況を踏まえ、今後の開発戦略について検討している。
6.2 社会・経済的観点での自立発展の見通し	汚染された産金地帯の環境改善が期待されている。		太平洋沿岸地帯は資源豊かであるが、汚染された産金地帯は、この地域の社会的・経済的発展に寄与することになる。	アンデス山系の太平洋沿岸地帯には、アフリカ・インドネシアなどを含め、この地域の環境改善と産業発展は重要な貢献となる。	各地の金鉱山が保有する価値（ポテンシャル）が十分に生かされていないのが現状である。今後の社会的・経済的発展が十分に期待出来る。	採鉱権、鉱業権等の取得に必要な先折国の分析結果に依拠するが、現在はINGEOMINASの化学機器分析所に対応可能である。
7. 総合評価	専門家派遣、研修機材提供、技術協力などのプロジェクト方式は、本プロジェクトについて満足している。		本件プロジェクトは、最高レベルで実施されており、満足している。	本件プロジェクトを通じて、アンデス山系の太平洋沿岸地帯の環境改善と産業発展に寄与する機会を提供している。	本件プロジェクトは、成功裡に実施されていると理解している。	本件プロジェクトは、成功裡に実施されていると理解している。

4 プロジェクト関係会議開催状況

開催期日	場所	主要議題
November 11, 1993 April 7, 1994 October 28, 1994 November 14, 1995	カリ カリ カリ カリ	日本人専門家の安全対策 同 上 同 上 同 上
February 2, 1994 December 19, 1994 March 13, 1995 September 28, 1995	ボゴタ ボゴタ ボゴタ ボゴタ	日本人専門家の安全対策 同 上 同 上 同 上
October 12, 1994 October 24, 1994 November 10, 1994 November 22, 1994 November 28, 1994 November 30, 1994 December 12, 1994 January 2, 1995 January 16, 1995 February 13, 1995 February 23, 1995	カリ カリ カリ カリ カリ カリ カリ カリ カリ カリ カリ	建物・施設改修工事打ち合わせ 同 上 同 上 同 上 同 上 同 上 同 上 同 上 同 上 同 上 同 上
February 24, 1994 March 2, 1994 December 12, 1994 January 10, 1995 February 1, 1995 February 8, 1995 March 1, 1995	カリ カリ カリ カリ カリ カリ カリ	プロジェクトの進捗状況 専門家とカウンターパート間の打ち合わせ 同 上 同 上 同 上 同 上 同 上
April 5, 1995 May 9, 1995 June 9, 1995 July 7, 1995 September 13, 1995 October 10, 1995	カリ カリ カリ カリ カリ カリ	専門家・カウンターパート業務調整会議 同 上 同 上 同 上 同 上 同 上
May 5, 1994 August 2, 1994 August 29, 1994 September 28, 1994	カリ カリ ボゴタ ボゴタ	技術協力期間の延長に関する打ち合わせ 同 上 同 上 同 上
May 24, 1995 June 27, 1995	ボゴタ ボゴタ	次期プロジェクトに関する事前協議 同 上
March 27, 1994	ボゴタ	後継チーフアドバイザー着任挨拶
June 28, 1994	カリ	J I V A 監事のプロジェクトサイト視察
January 24, 1995	カリ	日本側からの機材供与式典

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