

**CHAPTER 4 GRASPING RECENT CONDITIONS OF MINING
INDUSTRY AND SUBJECTS OF ITS PROMOTION**

CHAPTER 4. GRASPING RECENT CONDITIONS OF MINING INDUSTRY AND SUBJECTS OF ITS PROMOTION

1. Subject

Armenia has a basement of the mining industry such as exploration, development, production, smelting (Copper and Molybdenum) and manufacturing that covers a comprehensive territory. Also knowledge and technology is accumulated in Armenia. However, in moving to a free market economy, Armenia needs to arrange and restructure its existing basement and system.

The subject embodiment of the policy of promotion of the mining industry covers on the whole such as economy, administration, production, market, etc. based on grasping the actual condition of the mining industry.

- Arrangement of administration of mining industry
- Reconstruction of system of production and competition in a free market
- Construction of State financial basement
- Formation of financial market
- Promotion method of mining industry by using characteristics of resources
- Promotion of the downstream copper business

2. Understanding Actual Condition of Mining Industry

The examination of the promotion of the mining industry has been done through a survey on the recent conditions and case study that covered items on the basement and production fields of its mining industry (Table 4-1).

Table 4-1 Present Condition of the Mining Industry

Item	Present Condition	Subject
Government budget of mining industry	Limited tax revenues just used for maintenance of government and administration organizations. No investment to mining industry. Large debt	Reinforce government loan (especially long term T-bills) Investment to mining industry
Tax system	VAT high rate	Privilege, tax system for mining industry investment
Mining laws	Enforcement of new Concession Law and Subsurface Code	Arranging mining law regulations
Mining Policy	Described in new mining laws	Consistency new mining laws with related laws
Mining organization	Dispersed, functions are insufficient	Unification, make efficient
Investment	Insufficient progress of foreign capital to private mining sector. Negotiation on definition of tax	Information disclosure. Policy for favorable treatment of investment.
Finance	Immature. Only short-term finance (interest rate high). Small stock business. Small scale government loans.	Increase trust of financial organizations Legalize illegal funds
Privatization	A part implemented. In progress	Privatization items. Asset evaluation
Infrastructure	Road repair, open facilities. Repair electrical facilities.	Decrease electricity fee. Arrange road network.
Mining impact on environment	Environmental problems but actual condition unclear. Arrange laws related to environment.	Survey environment, make measures
Mining training	Mining industry decline along with decrease of students. Raise superannuated facilities.	Reconstruct mining industry
Mining operation management	Difficulty supplying capital with partial recovery of production. High costs. Unprofitable selling concentrate.	Supply capital. Improve selling of concentrate. Reduce costs
Exploration, development	Activity stagnated from lack of capital. Foreign investment partially implemented.	Arrange information. Supply capital.
Exploration technique	Old. Start casting off USSR technical evaluation methods	Introduce technology. Spread technical evaluation.
Mine smelter technology	Insufficient systemization and functions	Introduce systemization and automation
Production	Superannuated broken down facilities	Renew facilities. Quality control
Resource information	Access difficulty. Not arranged. Insufficient disclosure.	Disclose information on facility on web site.

3. Examination of Promotion Measures on Mining Industry

3-1 Position of Mining Industry and its Role

Now the mining industry shows a 2.7% share in the GDP because economic activity in a free market is being promoted and the economic basement is weak. It is not expected to increase the State budget by tax revenue and T- bills, etc. in the actual situation. The GDP will increase if the reconstruction of existing mining industry and promotion of exploration and development by using resources in Armenia. The mining industry is a powerful industry having the possibility to contribute to the economic development in every industry. Therefore it is needed to make the mining industry as a target field for priority investment by the State budget especially metal resources in the mining industry is a type of industry for acquiring foreign capital..

3-2 Policy for Making Master Plan

The Master Plan for promotion of mining industry is for 10 years and divided into two stages. The first half of the Master Plan, 5 years, is the stage of reconstruction. The latter half is the stage of development (Table 4-2).

- Reconstruction stage (0-5 years): Arrangement of basement field, arrangement of investment condition, reconstruction of production field. Recovery of productivity should be aimed by the promotion of reconstruction of the mining industry basement corresponding to a free market economy. In this stage, a comprehensive feasibility study on a copper smelter should be done to decide the production scale by means of expanding or constructing a new smelter.
- Development stage (5-10 years): Promotion of exploration and development, increase production. It is needed to raise domestic capital by strengthening the comprehensive system from exploration, mining to smelting by increasing the production amount and structuring the production activity considering the environment.

Table 4-2 Concept of Mining Promotion Measures

Item	Reconstruction Stage	Development Stage
Policy, system	Draft, establishment of system, implementation	Revise, improve, intensive advice from private sector
Investment environment	Establish favorable treatment tax system	Raise private capital
Financial market	Establish long-term finance, large stock market	Establish financial market
Tax system	Reduce VAT, etc, favorable tax treatment to investment	
Mining law	Revise, enforce	Solve problems that occur
Government organization	Construct and practice unified organization	Improve to the most suitable organization through review
Infrastructure	Arrange basic infrastructure, reduce electric power rate	Arrange infrastructure of mining industry
Education	Repair, renew and arrange equipment and facilities	Introduce training from market economy country
Exploration	Establish and put into practice an exploration subsidy system, introduction of technology	Geological map, arrange basic maps of distribution of resources, etc.
Mine	Reconstruct existing mines, renew facilities and machines, introduce technology	Development supporting system, Improve operation management
Smelter	Expansion, ascertains its establishment.	Engineering, construction
Environment	Introduce monitoring equipment, construct management system	
Copper manufacturing industry	Expand present manufacturing production, business examination	Execute F/S
Resource information	Implement disclosure, add information	
Capital	Prepare and establish mining fund	Operation of fund

3-3 Target and Basic Policy for Mining

- The mining industry makes links with the development of the Armenia economy and local society and promotion of employment.
- Promote mining industry with environmental protection.
- Copper, molybdenum and gold as international products are priority kinds of metals - to aim at acquiring foreign currency.
- Strengthening of competitiveness should be attempted by the establishment of the production system in the copper industry in the early stage (30,000 tons per year), and construction of production system of polymetal and gold deposits.
- Arrangement of production system in a free market economy by acquiring new knowledge and technology by the introduction of foreign capital.

3-4 Guideline for Production

- Mining share in the GDP will be more than 10% after 10 years.
- Yearly production of copper will be more than 50,000 tons and gold more than 5 tons after 10 years.

3-5 Basic Policy for Promotion Measures

The promotion measure for realization of the Master Plan is basically to be implemented, to be managed and to be checked the condition of implementation by the Armenia government. The promotion measures in the reconstruction stage are an action program and implementation of mining policy (Fig. 4-1). However, support and cooperation of international organizations and each country are also needed because of the national deficit structure and money shortage for arrangement.

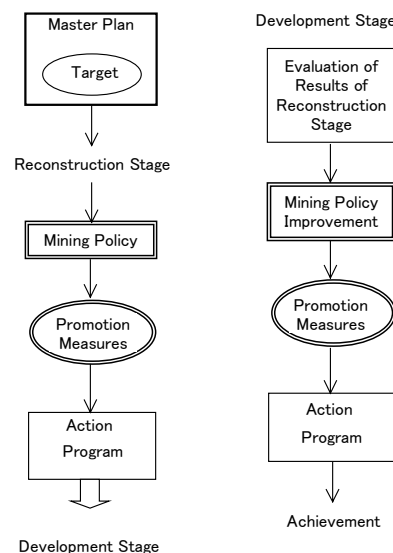


Fig. 4-1 Stages of the Master Plan

- Privatization, recovery of productivity and arrangement of environment on introduction of foreign capital investment and on promotion of exploration and development are important priorities in the reconstruction stage.
- Development by domestic capital, strengthening of competitiveness for production and establish by implementation of environmental management are priorities in the development stage.

- Examination of embodiment and possibility of realization of proposed promotion measures are needed for making the realization of the promotion measures.

3-6 Master Plan (Basic Plan)

Outline of the Master Plan is shown in Table 4-3.

The Master Plan was made by means of reconstructing and developing copper, molybdenum and gold mining as the center of the Armenian mining industry to activate and promote a comprehensive mining industry, taking into account of the guideline (Table 4-4). The content of the promotion plan that consists of the Master Plan will be explained in the chapter of Mining Policy and Promotion Plan.

Table 4-3 Outline of the Master Plan

Stage	Reconstruction	Development
Term	0-5 years	5-10 years
Guideline	Copper 30,000 tons per year, gold 3 tons per year, 5% of GDP	Copper 50,000 tons per year, gold 5 tons per year, 10% of GDP
Copper business	F/S, business plan	Engineering, construction, each component F/S
Privatization	Finished, management improvement	Independent company without support, growth, growth of domestic capital
Introduction of foreign investment	Arrangement of basement for receiving foreign capital (arrangement of investment environment)	Promote exploration and development by foreign capital
Government organization	Arrange uniform system	More functions
Budget for mining industry	Budget for reconstruction	Budget for promotion
Change to IT	Arrangement of basement of web, GIS, database	Expansion and use
Target for increasing employment	Development of new deposit, create business related to IT	Creation by expansion of smelting plant, and exploration and development
Scale for investment (state budget, foreign investment, domestic capital, international organizations, etc. Total)	US\$100 million	US\$200 million

3-7 Action Program

To examine of the promotion of the mining industry, implementation of the Action Program for 5 years sets forth as is a premise (Table 4-5). Action program will be explained in the below further details. Government shall make a budget for implementation of Action Program. Plan, procedure and effectiveness for implementation of each program will be examined at making budget. Promotion plan (Action Program), that is costly and is in need of know-how and technology, will be requested to international organization.

4. Policy for Mining Industry

The establishment of a mining policy and leadership by the administration is indispensable to realize the promotion of the mining industry in the condition of a financial market that is immature and investment environment that is not arranged on its transition to a free economy. The course of the mining industry in Armenia is development by the private sector with foreign capital, arrangement of investment conditions based on international law system, privatization of state-owned enterprises, and receiving fair value for the leasing of mineral resources.

Table 4-4 Master Plan

Year		1	2	3	4	5	6	7	8	9	10
Period		Reconstruction period					Development period				
Cu-Business	Target, smelting	F/S preparation		Implementation of F/S	Rise of Funds	Repair & installation of environment protection facilities for smelting	Establishment of fertilizer & sulfur production plants		Decision on construction of new Smelter		
	Production volume	Cu - 20 thou.t		Cu -30 thou.t		Cu - 40 thou.t		Cu - 50 thou.t			
	Mine	Privatization		Management improvement. Establishment of production expansion system		Implementation of environment protection countermeasures		Stable operation			
Exploration & Development of new deposits (Cu, Mo, Au)	Establishment of Reserves Evaluation system, and exploration system	Development of a new deposit			Development of new deposits (new mines)						
		Promotion of Exploration			Promotion of Exploration						
Arrangement of Legal & Tax system	Amendment			Confirmation of law enforcement status		Review, Amendment and Addition					
Governmental Body for Mining Industry	Establishment of Unified Body	Resolution of Problems and Issues		Establishment of Mining Industry Council		Functioning					
				Plan implementation based on adopted Policy							
Mining Policy & Plan of Development of Mining Industry	Establishment of Study Committee	Policy & Plan Enforcement	Policy & Plan Improvement	Policy reflects private sector's opinion		Evaluation of the results of Mining Industry Policy improved enforcement					
Environmental Countermeasures	Establishment of Environmental Assessment		Implementation of Environmental Assessment Surveys			Establishment & Implementation of Environment Management System					
	Implementation of Environment Pollution Surveys			Creation of Plan of Environment Protection Countermeasures			Implementation of Environmental Countermeasures				
	Establishment of Monitoring System										
Systematization by IT	Expansion of web-site		Expansion of Database & GIS			Establishment of Web-Site - Database - Linked System					
	Data arrangement					Use in implementation of National Development Plan					
Investment	National budget	Each year US\$2-3 million			US\$15 million		Each year US\$3-5 million			US\$20 million	
	Foreign capital				US\$45 million					US\$80 million	
	Domestic capital				US\$20 million					US\$40 million	
	International org.				US\$20 million					US\$60 million	
	Total				Total US\$100 million					Total US\$200 million	
Guideline	GDP 5% after 5 years, copper 30,000 tpy, gold 3 tpy					GDP 10% after 10 years, copper 50,000 tpy, gold 5 tpy					

The mining policy should be possible and reasonable for realizing the reconstruction stage of the first term and the development stage of the latter term in the Master Plan. The Master Plan of the latter stage is needed to be drafted based on the result of the reconstruction stage. The role of government is to promote investment by mining companies through implementation of mining policy and regulation to control the private sector's activity for protection of the public's benefit. The mining policy in the first term, reconstruction stage, which is now proposed, is as follows.

(1) Promotion of Privatization with Step by Step and the Raising of Domestic Capital

Step by step privatization (Fig. 4-2). There are two ideas for privatization of existing national mining enterprises. One idea is to sell them to the foreign investors by tender or negotiation. Another idea is to improve the current managing situation and sell them to domestic or foreign investors. If current situation is improved, sales price of the mine will become high and also will sell more easily. Sales amount must be partially used to reconstruct national mining enterprises for promotion of the whole Armenian mining industry.

- Introduction of foreign capital and raise domestic capital
- Government orders (including support from international organizations) to mining industry companies for the promotion of raising domestic capital, the introduction of system with subsidies and establishment of support measure for finance.

Table 4-5 Five year Action Program

Program	Fund and possible assistance	Responsible for role	1 st year	2 nd Year	3 rd Year	4 th Year	5 th Year
Reform organization (unified)	GB	PMO, MNP, MTED	Fulfillment		Settlement of issues		
Arrangement of mining law (subsurface law & concession law)	GB, EU	MTED, MNP	Study				
Mining policy	GB	PMO, MNP, MTED	Study	Issue			
Council for mining industry	GB	PMO, MNP, MTED,		Study	Establishment		
Policy for tax privilege system	GB	PMO, MFE	Study		Enforcement		
Exploration system	GB, IO	MFE, MNP	Study	Drawing	Enforcement (Introduce of foreign capital)		
Privatization	GB, IO	MFE, MTED, MP	Introduction foreign capital Sale of mining enterprises		Improvement of management		
Introduce of foreign capital	GB	PMO, MFE, MTED	Arrangement		Disclosure of information Investment seminar		
Improvement of management	EBRD, GB	MTED	Request	Introduction of TAM			
F/S for copper business	GB, IO, EC	PMO	Preparation		F/S	Raising funds	
Environmental research	IO, EC	MNP, MTED	Request	Research	Study of measures		
Arrangement of monitoring system	IO, GB	MFE, MNP, MTED	Preparation		Disclosure of information		
Arrangement of mineral information	IO, EC	MNP	Request	Arrangement		Execution	
Training system of human resources	GB, IO	PMO, MNP, MTED	Study	Set up		Execution	
Organization of association of mining industry		MNP, MTED	Study	Set up			
Organization of resources information center	GB, IO	MTED, MNP	Study		Set up		

GB: Government budget, EU: Europe Union, IO: International organization, each country of EU, PMO: Prime Minister office, MFE: Ministry of Finance and Economy, MTED: Ministry of Trade and Economic Development, MNP: Ministry of Nature Protection, MP: Ministry of State Property, EBRD: European Bank for Reconstruction and Development

for risk by the government.

- Disclosure of information and holding investment seminars and exchange technology.

(4) Promotion of Exploration and Development

- Supporting measure for the activity of exploration and development by private company (promotion system for exploration and development by using mining fund, lease of instruments for exploration)
- Support system of promotion of development of small-medium scale deposits
- Arrangement of conditions for introduction of small-scale exploration companies (junior companies) of USA, Canada and Australia through the disclosure of information and seminars.

(5) Countermeasures for Environment and Establishment of Management System

- Environmental administration based on grasping of the investigation of the actual situation of environmental pollution (raising environmental survey company, introduction of technology for survey)
- Support system for environmental countermeasures and management of environment (loan system for fund of monitoring instruments and facilities, system of information disclosure, instruction of technology for management, etc.)

(6) Arrangement and systemization of mining law, tax system related to the mining industry

- Partial review of mining law and arrangement of regulation
- Tax incentive measure for survey and exploration company

5. Promotion Measures

5-1 System of Organization

On the present government organization of the mining industry, drawing up of the mining policy, management of mines, management and issue of licenses, management of work on exploration and development, management of environment and work on research and development, etc. are done in the different organization or ministry. Therefore the functions of activities related to the mining industry are dispersed. There are insufficient conditions for the promotion and management of the mining industry because of the dispersed organization. An organization specialized for mining industry promotion is needed for the realization of promotion measures. It is desirable to make a unified organization with transparency and moreover it is needed to make clear the role between government organizations, its administration system and private companies on mining activity (Table 4-6).

(1) Role of Government Organizations and Administration System in the Mining Industry

- Government organizations and administration system have roles to make an environment for activity with sound mining companies and realize mining policy and implement promotion measures for the development of the mining industry. The government has a role to link the development of society and economy by the promotion of the mining industry.
- Private mining companies have independent activity for the mining industry business on survey, exploration, development and production, etc. Mining industry companies have a role for the contribution to the economy and mining industry development.
- Organization of research and development has activity mainly accepting orders from government organizations and mining industry companies.
- NGO like a mining association has a role of indirect support to private mining activities. At same time, it has a role to collect opinions from private companies for the mining policy.
- Promote mining activity with a balance for protection of the environment and life.

Table 4-6 Roles of Government and Private Sector

Item	Government	Private Sector			
		Survey	Exploration	Development	Operations
Role	Promotion measures	Disclose information Mineral resources evaluation Regional Survey Data arrangement	Subsidy Instrument Lease	Loan Supply of interest Tax privilege (accelerated depreciation etc.)	Asset evaluation Privatization Reduction of welfare facilities Decrease electric power rate Improve management (instruction by experts)
	Foreign capital	Economic evaluation of resources of information Cooperation in domestic capital	Technical transfer Raise domestic company (exploration- partial contract)	Technical transfer Raise funds Raise domestic company	Reconstruction of mines (rationalization, renew equipment and facilities)
	Domestic capital	Contract for survey works (government order) Independent survey	Exploration using survey Acquire technology	Acquire technology Raise domestic capital	Acquire quality control Acquire management method

(2) Draft of System of Organization

Reorganization of existing mining organizations of the government that are dispersed and unification should be planned (Fig. 4-3).

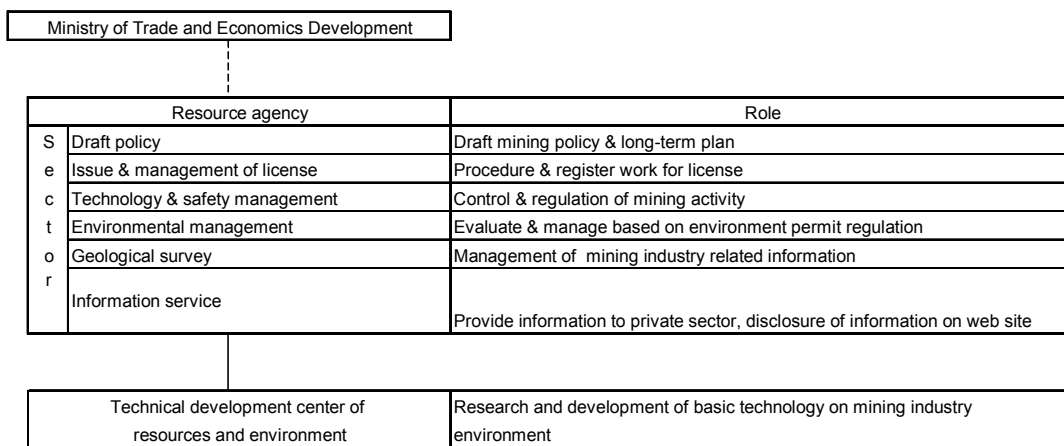


Fig. 4-3 One Example of Unified Organization for the Mining Industry

- Unified organization, agency or department level.
- Government organization is mainly administration work. The practical work related to the mining industry activity is ordered to private companies.
- Each section in the mining organization has common information by the introduction of information technology. Networking in the Ministry and related organizations.
- Organization covers the whole mining industry (policy, planning, management, etc.)
- Government work on research and development is mainly for basic technology. Applied technology needs to be ordered to the private sector.
- Environment control depends on environmental management that gives the authorization of mining, and controls EIA (Environmental Impact Assessment) and environmental monitoring.
- Environmental geology, resources economy, and extensive exploration like area geology and ore deposits, exploration planning and evaluation resources depend on geological survey.

5-2 Mining Law and Tax System

New mining laws (Subsurface Law and Concession Law) proposed now needs more improvement with the point of view of simplification, transparency and promotion of introduction of

foreign investment, etc. for being accepted internationally. On the tax system, method of promotion for development to a strategic and priority industry should be taken.

Generally speaking, resources development demands a long term (five to ten years) and much capital. At the same time, the recovery of investment needs a long time. Much money is necessary to reconstruct existing mines for productivity recovery. Accordingly the financial burden for reconstruction makes mine management difficult as well as heavy taxation. Improvement of law and taxation should be connected with mining promotion. For improvement of taxation, some committees should be formed to concretely discuss the matter.

(1) Improvement of legal control

- Minimum and maximum area should be fixed in the exploration license
- Exploration license by a faster application system and simplification of procedure (application by submission of the desired area, plan, reason and target mineral for exploration)
- Permission for assignment of exploration license
- Ore reserve should be only reported to the related agency of the Government. Related agency compiles only the reported ore reserve, but does not need certification of the ore reserve. The Government's role concerning control of the ore reserve should make clear.
- Improvement of safety and technical regulation (by technical advance). Less national control and items to be advised
- Tax benefits (reduction of tax or tax rate) for strategic industry in Investment Law.
- Shortening of amortization term for machines and equipment
- Simplification of environmental procedure

(2) Tax system

- Tax reduction in the term of reconstruction for copper, molybdenum and gold that are strategic minerals in the Armenian mining industry (applicable for foreign investment more than US\$ 20 million)
- Special benefit for exploration investment of mining and exploration companies.

(3) Establishment of Committee of tax system improvement

- The committee is placed in the Prime Minister's Office collecting related ministries. A member of the committee consists of each ministry.
- National strategic industry will be decided. (with time limit, five years for example)
- Compliance between tax system and related law should be clear.
- Tax exemption or mitigation: corporate tax, royalty, VAT and custom duty
- Strategic industry must contribute to attainment of hard currency, employment and global economy.

5-3 System of Environmental Management

The administration side needs to install monitoring equipment for control and management of environmental protection by mining activity. From a long-term viewpoint, total digitalized IT control system should be aimed (Fig. 4-4). On the mining industry company side, there is insufficient system condition from superannuated and broken down equipment and facilities for environmental management

The system of environmental management is insufficient on arrangement for the administration side and mining industry company side and grasping the condition of environmental pollution. The countermeasures for environmental pollution by the mining activity before independence have not started yet. There is a possibility for becoming a hindering factor for the introduction of foreign capital.

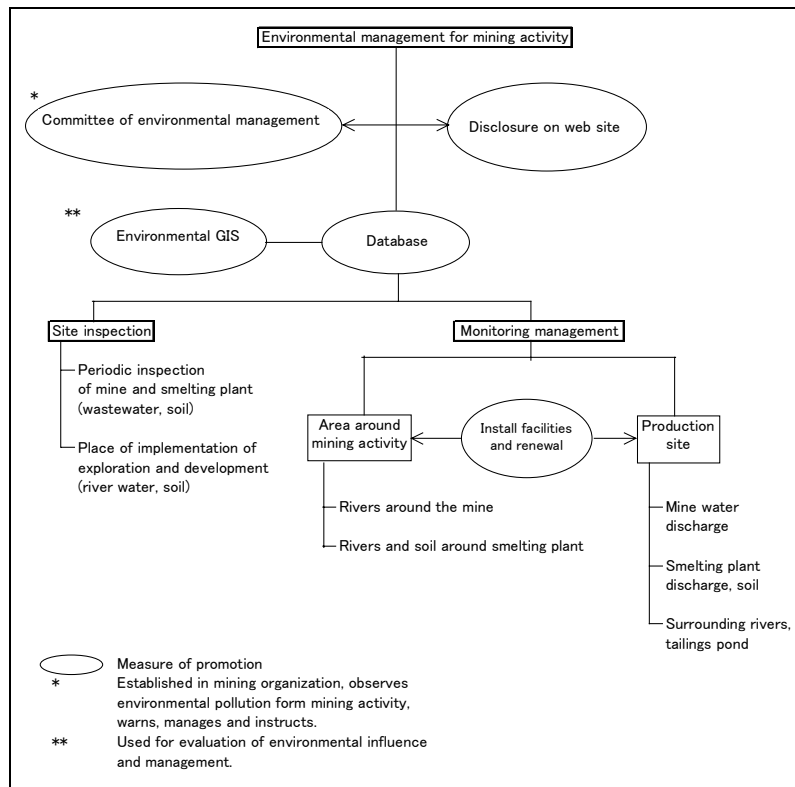


Fig. 4-4 Promotion Measure for Environmental Management

(1) Environmental Monitoring Instrument and Installation of Facility of Countermeasure and Protection for Environmental Pollution

- Installation of monitoring instruments by administration side for regional monitoring points and production facility.
- Improvement and renewal for discharging facility by mining industry company side at each mine. Installation of treatment facility for stack gases on the smelting plant.
- Management of monitoring data by a sector of environmental management and its disclosure on a website. Stable organization should be settled by the introduction of a technical cooperation program of international agency.

(2) Survey of the Present Situation of Environmental Pollution

- Survey of environmental pollution around the Alaverdi smelting plant.
- Survey on the present situation of heavy metal pollution in the southern area (Kajaran, Kapan, etc.).

(3) Establish trust fund of environment

- Establishment of an environmental trust fund. It is necessary to prepare environmental countermeasures after the mine is closed.
- It is needed to improve the present facilities and equipment by the mining fund (mentioned below).

5-4 Privatization

Privatization of mining enterprises has advanced up to stage of corporate stock and a part of them was already sold to the foreign investors. Full-scale privatization is very important matter in near future. It is difficult at present for national investors to purchase the stock because they have not brought up enough to do it. At the same time, investment risk in privatization is large for foreign

investors because there are a lot of problems to rebuild mining operation. Accordingly evaluation price for privatization may fall down considerably. Mining enterprises are desired to be reconstructed by Government funds so Government funds should be distributed reasonably according to priority rank. Improvement of management is needed by experts' assistance from international organization.

If internationally acceptable tender condition would be prepared, foreign mining companies with technology and funds might participate in the tender.

a. Tender Condition

- Reevaluation of property by the western standard (including ore reserve)
- Debt should be cleared off by the tender or drawn from its property.
- Government has responsibility of environmental contamination after the tender before a contract. (Detail responsibility should be clearly specified according to the actual situation based on environmental survey.)
- Fringe benefit is out of the tender so it is desired to be sold by the tender.
- Environmental equipment and facility will be prepared by new owners and their sum should be drawn from the property.
- Temporal tax benefit in VAT, royalty, corporate tax, custom duty and so on.
- Disclosure of financial report by IAS

b. Financial Improvement

- Obligation of IAS and its fixation
- Financial evaluation by supports from international organization
- Tax benefit and carrying over of debt for a long range
- Improvement of management by loans from EBRD in the same manner of ACP's loans from EBRD (A support of Government is necessary.)
- Instruction of foreign experts on strategic management

5-5 Exploration System

Promotion of exploration activity is linked to the efficient use of mineral resources and the promotion of the mining industry. The exploration system (subsidy and loan) should be established so that mining companies can realize independent exploration activity. Examination of establishing a mining fund is needed (Fig. 4-5).

(1) Subsidy for exploration

- | | |
|--|---|
| <ul style="list-style-type: none"> • Regional Survey • General & Detailed Survey • Confirmation Exploration | <p>Survey completely paid by funds of the government budget. The survey work is ordered to the private sector.</p> <p>Half subsidized</p> <p>Confirmation of ore reserves. Loan to the mining fund for exploration around the mine.</p> |
|--|---|

(2) Tax deduction for exploration investment by foreign capital

Tax deduction and reduction of tax rate corresponding to the investment amount for exploration activity by foreign capital is needed to be implemented for activation of exploration by foreign capital with a system having similar measures.

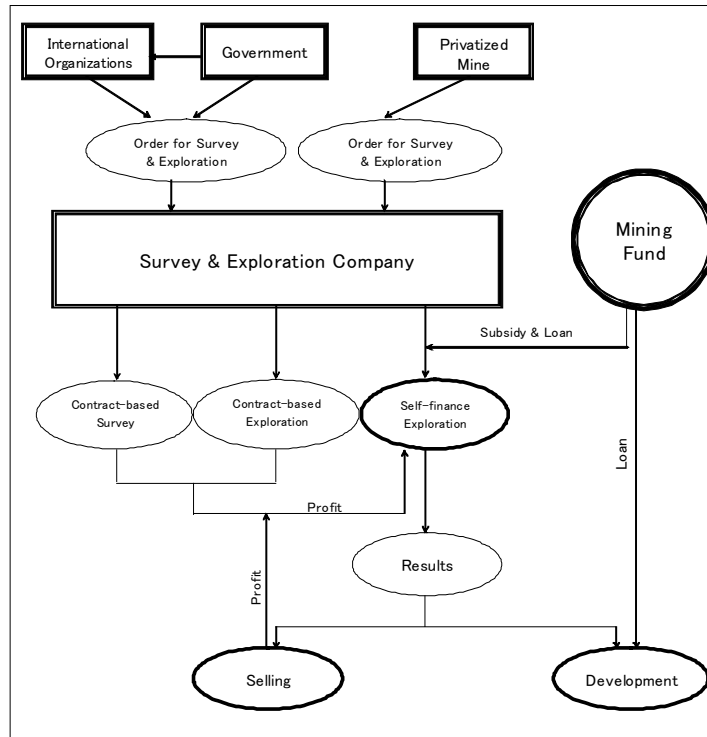


Fig. 4-5 Survey and Geological Exploration Companies Promotion Scheme

(3) Lease of exploration equipment

Superannuated and old exploration equipment is a hindering factor for the promotion of exploration. Exploration companies suffer from a money shortage, so it is needed to lease equipment to them. A lease company treats exploration equipment (drilling machines and geophysical equipment) and drifting machines (leg drills, transporting machines, generator, pumps and etc.) and is owned and managed by mining agent of Government. Lease condition is determined taking into account of economical situation of the mining companies.

(4) Plan for exploration and development

Maintenance, expansion or new construction of smelter is indispensable for reconstruction of continuous production system and promotion of Armenian mining. Accordingly above-mentioned exploration system should be planned and positive exploration development should be realized in the following target areas;

a. Copper Deposits

- Development of the Teghut deposit to support the Alaverdi Smelter

b. Gold Deposit

- Priority is the holding deposits with more than 10 tons of gold
- The Marjian, Tuhmanuk, Lousajour, Verin Vardanadzor deposits

c. Exploration Plan

Necessary is balance of total concept between attained ore reserve by exploration, production of crude ore and feeding crude ore to the smelter. Exploration plan should be prepared on basis of wide consideration from exploring to smelting to give advices to private companies as a role of mining agent of Government (Fig.4-6).

(unit : tonns of Cu metal)

Dist.	mine	actual	year										remarks	
			1	2	3	4	5	6	7	8	9	10		
Northern Area	Tekhut		drilling(oxidized zone)		leaching test		F/S		preparation,construction			16,000	20,000	crude ore: 5.0mill t/y with 0.47%Cu (rec.=85%)
	Alaverdi	1,000	1,500	1,500	1,800	1,800	2,500	2,500	2,500	2,500	2,500	2,500	2,500	crude ore: 70,000t/y→100,000t/y, 2.5-3.0%Cu (rec.=90%)
	Others		1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	Shamloukh,etc
	Sub-total	1,000	2,500	2,500	2,800	2,800	3,500	3,500	3,500	3,500	19,500	23,500		
Southern Area	Kajaran	12,000	12,000	12,000	13,000	13,000	14,000	14,000	15,000	15,000	16,000	16,000	Capacity crude ore: 9.2 mill t/y 0.27% Cu/y 18,000t metal Cu/y	
	Agarak	4,000	drilling 985m-895mL		6,000	6,000	7,000	7,000	8,000	8,000	9,000	9,000	Capacity crude ore : 3.2 mill t/y 0.34% Cu 12,000t metal Cu/y	
	Lichk		re-evaluation		preparation,construction			4,000	6,000	6,000	6,000	6,000	crude ore: 1.2mill t/y with 0.63%Cu (rec.=85%)	
	Dastakerd		IP,TDEM		drilling		drifting		F/S		preparation,construction		10,000	crude ore: 2.0mill t/y with 0.95%Cu (rec.=85%)
	Marjan		regional survey		detailed survey			drifting		F/S		construction etc		
	Kapan	1,000	800	1,600	3,300	5,900	8,400	8,400	8,400	8,400	8,400	8,400	8,400	crude ore: Kazor :50,000t/y 1.44%Cu→500,000t/y 1.80%Cu Shaumyan:90,000t/y 0.30%→300,000t/y 0.34%
Sub-total	17,000	17,800	18,600	22,300	24,900	29,400	33,400	37,400	37,400	39,400	49,400			
total	18,000	20,300	21,100	25,100	27,700	32,900	36,900	40,900	40,900	58,900	72,900			
Others	silica (Alaverdi)		regional survey		drilling		estimation		preparation		5,000	10,000	13,000	1 mill t of potential resource partly 1 g/t-2g/t Au

Fig. 4-6 One Example of Copper Prospecting Program

5-6 Supporting Development

Privilege measures to the tax system and raising mining funds or supporting techniques are needed for the promotion of development of new deposits. It needs also to promote small- to intermediate-scale development with a small amount of investment by their own power by raising domestic capital although development depends on the introduction of foreign investment. (Fig.4-7)

- Loan of development (examination of mining fund, guarantee for loan of funds of development, supply of interest)
- Support of development technology (technical cooperation of international organizations and each country)
- Introduction of economic evaluation technique
- Deferred payment of tax related to the investment for development. A decrease for the tax corresponds to the investment amount for development (VAT, excise tax and income tax)
- Model business of existing mines especially underground mines (introduction of technology for strengthening competitiveness, etc.).

5-7 Rationalization and Reconstruction of Mines and Smelter

The measures for mines and smelting plants was concreted through examination and survey of Alaverdi smelting plant and mine (Kapan), which are the targets for this case study.

- Making a plan of rationalization for reconstruction.

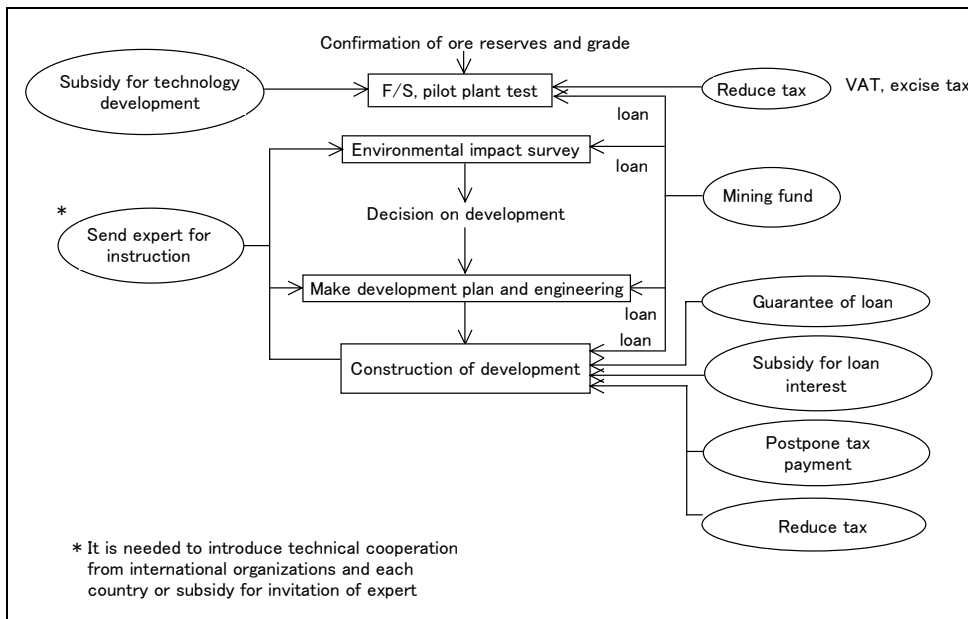


Fig 4-7 Promotion Measure for Development

- Technical introduction for production, technique (grade) and management at the Kapan mine (underground mine) of polymetal deposit. Introduction of management technology for production process. Simplification of organization.
- Loan of funds for the renewal of facilities and machines. A long-term loan from the mining fund, etc.
- Consulting for management, international accounting standards, quality control and energy conservation technology (technical cooperation using dispatch of experts from international organizations or advanced country of mining industry). Method of concrete cost reduction and knowledge and technology for grasping its efficiency.
- Separation or disposal of welfare facilities
- Sell or treat fixed asset excess.
- Reduce the electric power rate (privilege measure for a mining and smelting company in reconstruction stage giving one-third of recent electricity rate, reduction measure in the development stage is one-half of recent rate).
- Loan of funds for renewal of facilities and machines (examination of loan from mining fund, loan from international organizations, sell stock, etc.)
- Review of selling condition of products of the mining industry such as concentrate and blister, etc.
- Installation of environmental facilities and equipment.
- Privilege measure of tax system (no tax in a limited period for the renewal of facilities and machines in the reconstruction stage).
- Reduce manpower.
- Expand the scale of the Alaverdi smelting plant and install a production facility for electrolysis.

5-8 Environmental Management of Mines and Smelter

Management of wastewater discharge, waste and tailings are insufficient. It is estimated that pollution of river water and soil by acid water and heavy metals are expanding around the mines. It

is needed to make supporting measures for environmental management to mines and smelting plants for strict protection by environmental standards for discharge and environmental standards.

- Installation of machines and facilities of environmental management
- Implementation and management system for inspection, maintenance and repair of facility for treatment of wastewater
- Disclosure of monitoring data. Disclosure of data by mining environment website.

5-9 Drafting the Settlement of the Strategy for the Business of Copper Smelting and Manufacturing

The present copper smelting business has managed by using the scrap of the Alaverdi smelting plant, which was broken in the USSR period, as the raw materials for a part of the concentrate in the domestic and copper scraps. The feasibility study for expanding production, electrolysis copper production and installation of environmental protection facility are needed. The copper business strategy should be settled by the examination of the advantages or disadvantages of the manufacturing business in the feasibility study. In the term of reconstruction, concentrate of the south area is exported to Iran in the same situation, and concentrate of the north area is better to be treated at the Alaverdi smelting plant by expanding the treatment capacity. Also, it is desirable to buy concentrate from Georgia and expand the amount of concentrate production by the promotion of exploration and development. In the term of development, it is thought to expand Alaverdi's capacity (40,000 to 50,000 ton per year) of electrolytic copper based on the feasibility study in the term of reconstruction (Fig 4-8, Table 4-7 and Fig.4-9). And the same time, it is necessary to study the oxide ore reserve by exploration and a possible introduction of SX-EW by field test.

- Implementation of the feasibility study for the smelting business (Study on ability to supply, sulfide acid market, market of concentrate and metal using existing facilities, condition of location, etc. is important).
- Implementation of pre-feasibility study for copper manufacturing (market of manufacturing products, technology, etc).

It is better to study the establishment of an industrial park (tax-free zone) for the copper manufacturing business based on the cooperation with Iran. Intensive production for copper manufactured products is efficient for strengthening its competitiveness (Fig. 4-10).

- Study on introduction of SX-EW method

Feasibility study or pre-feasibility is indispensable in strategic action for copper smelting and manufacturing industry, but its business scale depends on treatment and domestic/neighborhood market of sulfide acid for the reason of environmental protection. Usage of sulfide acid in Armenia is supposed in fertilizer, additives to asphalt for road paving and solution of SX-EW. Not only feasibility study within copper smelting and manufacturing industry but also feasibility study on total copper industry taking into account of environmental countermeasures, environment protection, promotion of agriculture, road pavement and development of SX-EW, would give a clear orientation and scale of copper business. Accordingly it is possible to attain fatal conclusions for following problems; 1) Repair or expansion of the Alaverdi Smelter, 2) Construction of copper smelter in the southern area, 3) Study on necessity of two smelters, 4) Current situation and sale of concentrate to foreign countries like Iran. In case of selections related to environmental protection and countermeasures, maintenance of infrastructure or fertilizer, it is easy to attain international supports. As mentioned above, total feasibility study is necessary to determine the maximum effect of copper industry (Fig. 4-11 and Table 4-8).

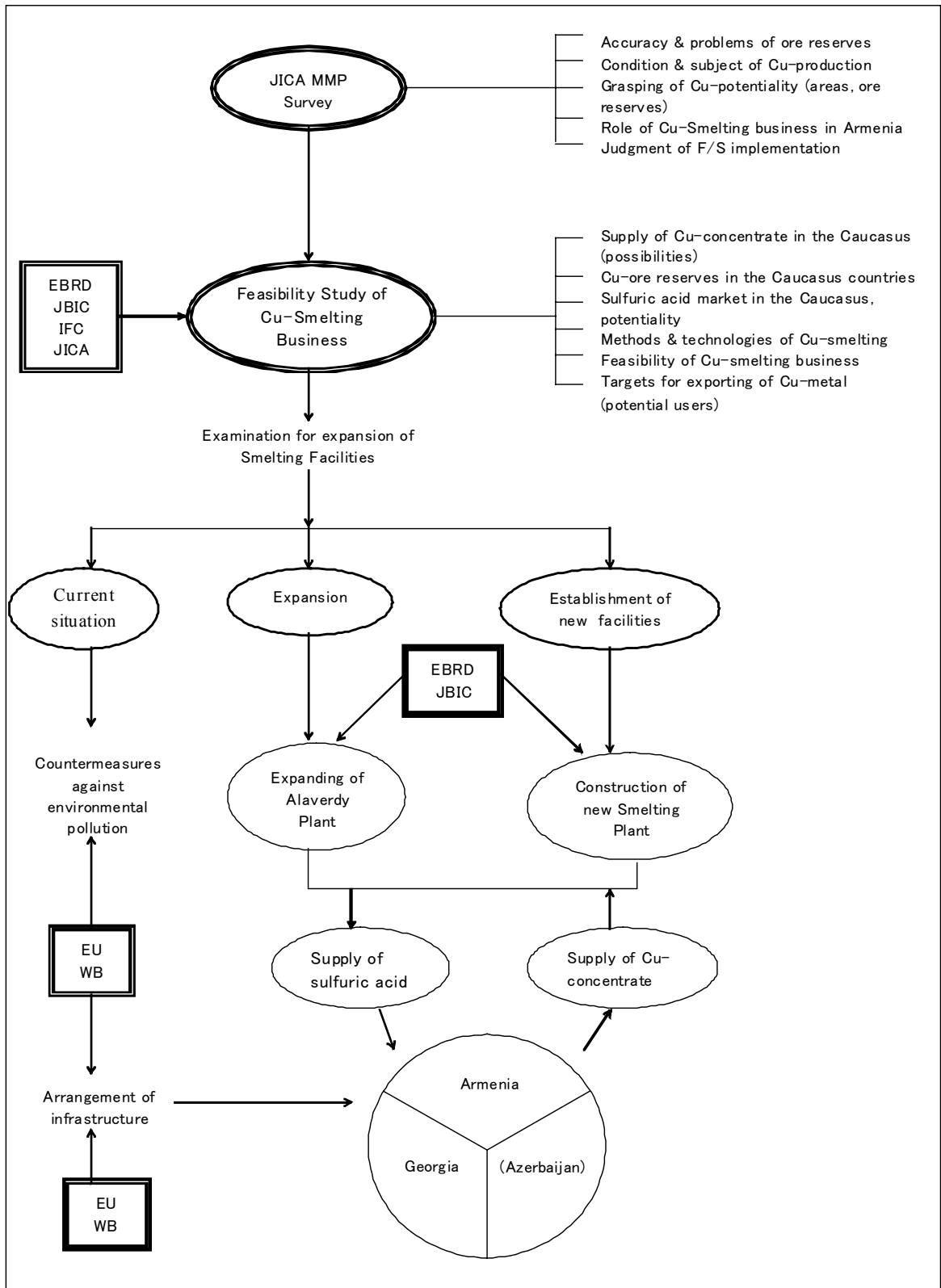


Fig. 4-8 Improvement Scheme of Copper Smelting Business

Table 4-7 Draft Plan of Copper Business Concept

Area	Reconstruction term	Development term
North area	<ul style="list-style-type: none"> Reconstruction of Alaverdi (Cu metal basis 30,000 tons) F/S for Alaverdi expansion of electrolytic refining Promotion of exploration and development Buy concentrate from Georgia (10,000 ton Cu) 	<ul style="list-style-type: none"> Alaverdi expansion and construction of electrolytic copper refinery (40-50 tons Cu) Copper production increased by new mine (20,000 tons Cu) Promotion of exploration and development
South area	<ul style="list-style-type: none"> Promotion of privatization and reconstruction of mine Continue exporting to Iran Concentrate production increased from existing mines Promotion of exploration and development 	<ul style="list-style-type: none"> Increase concentrate amount (30,000 to 40,000 tons Cu) New mine development Promotion of exploration and development
Whole country	<ul style="list-style-type: none"> F/S of copper business Study of industrial park of copper manufacturing with Iran Evaluation of establishing a new smelting plant Confirmation of sulfuric acid market Confirmation of copper oxide ore reserves, test for SX-EW Raise domestic trading company 	<ul style="list-style-type: none"> F/S and determination on industrial park establishment Selling sulfuric acid to Caucasus area Decision on new smelting plant Trading business started by domestic trading company F/S for SX-EW

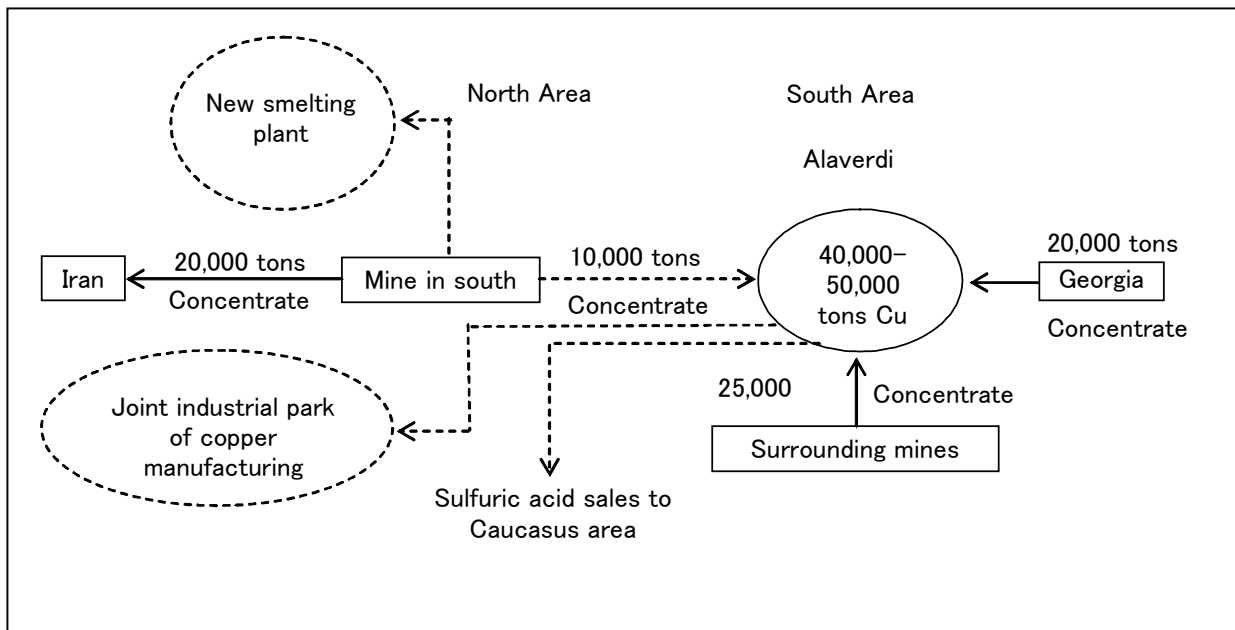


Fig. 4-9 Draft Plan of Copper Business Concept after 10 years

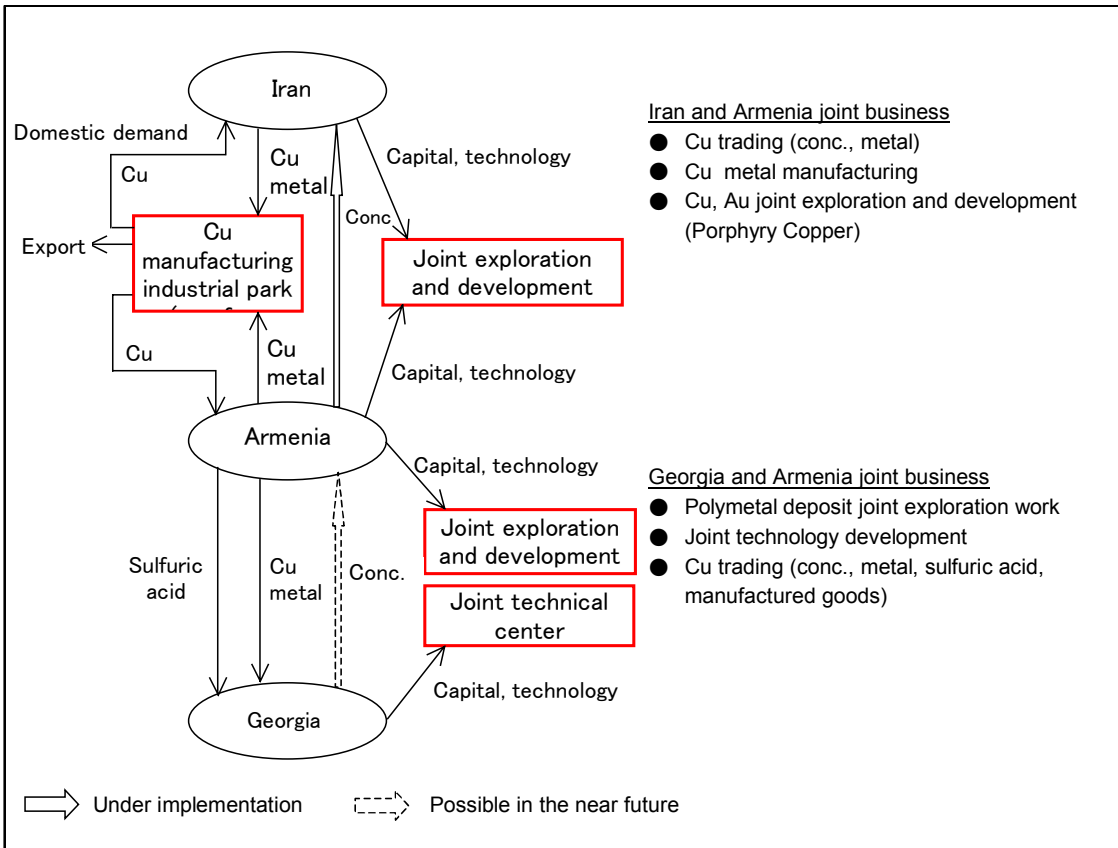
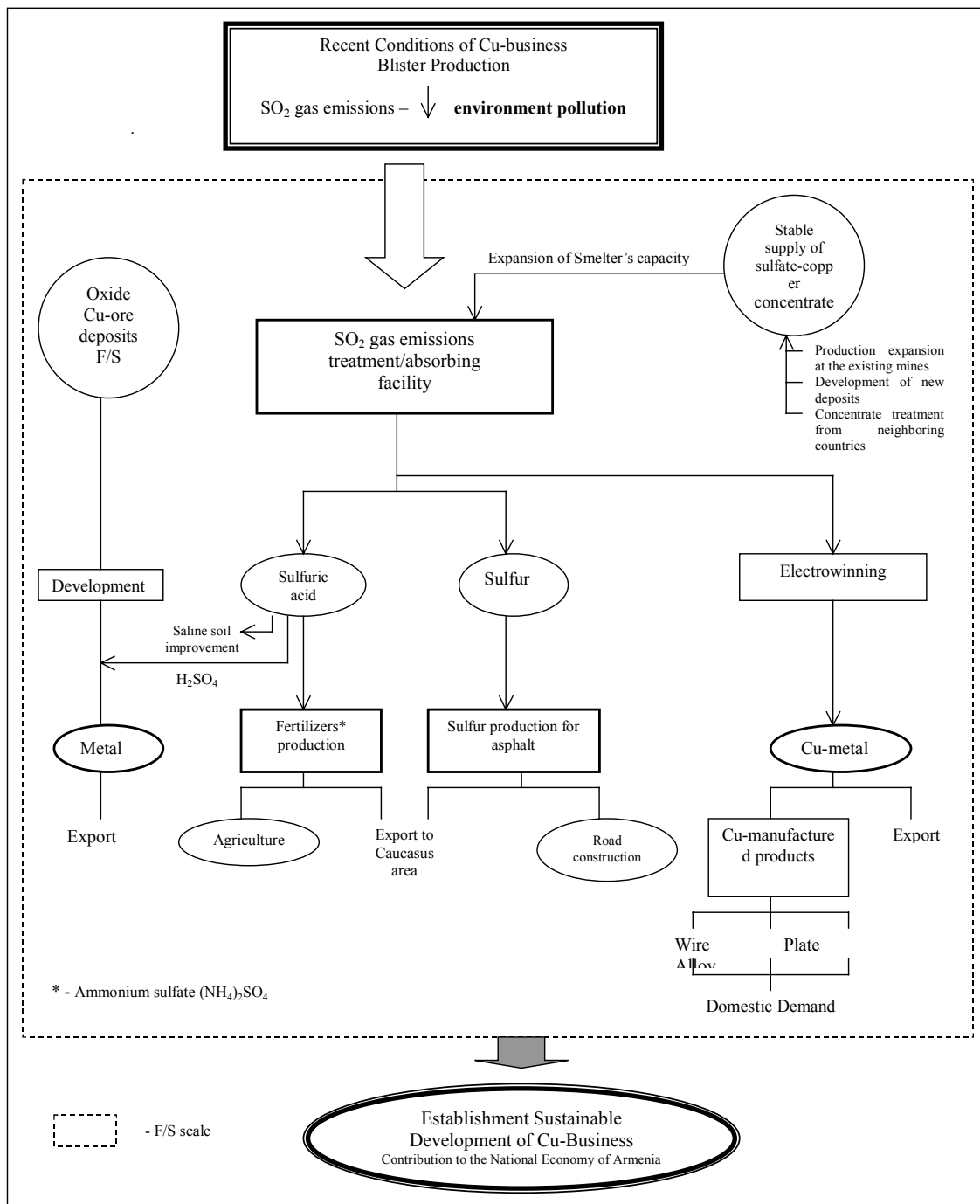


Fig. 4-10 Promotion Measures of Joint Business with Neighboring Countries



Concept of Cu-Business – Basement of Armenian Economy

Fig. 4-11 Copper Business Concept

Table 4-8 Necessity of Comprehensive Feasibility Study on the Copper Business

<p>1. Results of Mining Master Plan (MMP) investigations</p> <ul style="list-style-type: none"> • Cu-business has an important role in promotion of mining industry of Armenia • Armenia has a potential for Cu-concentrate supply to the Smelters (over 40 thousand t/y) • Yet there is no demand and market for sulfuric acid inside Armenia, therefore it is needed to create one. • There are possibilities for introduction and use of SX-EW technology. However surveys of oxide ore are insufficient. • Copper Smelter doesn't have necessary facilities for environment protection and it pollutes surrounding area. It is needed to install environment protection facilities. <p>2. Necessity and purpose of feasibility study:</p> <ul style="list-style-type: none"> • To study necessity of investment and feasibility for environment friendly Cu-business based on MMP survey results • To judge suitable business system and feasibility • To concrete the governmental policy and the course of copper business development <p>3. Study items:</p> <ul style="list-style-type: none"> • Production of Cu-concentrate (potential of Cu-concentrate supply domestically and Caucasus Area) • Evaluation of oxide ore reserves in order to organize copper production based on SX-EW technology, feasibility study of target for development deposits (Teghout etc.) • Market for sulfuric acid and sulfur in the Caucasus area • Potential market for fertilizers produced from sulfuric acid domestically and in Caucasus area • Improvement of soil polluted with salt • Potential market for sulfur from Smelter domestically and in Caucasus area in the field of asphalt production necessary for road constructions • Consumer markets and potential market for Cu-metal manufactured in Caucasus area. • Potential clients and users of Cu-metal for export. <p>4. Term of study and supporting organizations</p> <ul style="list-style-type: none"> • Two-years • As nominee organizations for feasibility study implementation the following organizations (EU, EBRD, IFC, UNDP, JICA) are thought to be appropriate <p>5. Output</p> <ul style="list-style-type: none"> • Policy of Cu-business and business design • Mitigation of environment pollution from Smelting Plant • Judgment of copper production by SW-EX and feasibility of target project for development (Teghout etc.) • Suitable size, amount of investments, technology, facility and feasibility of Cu-smelting business in Armenia • Judgment of possibility for establishment of fertilizers production plant in Armenia • Suitable size of the Alaverdy Cu-Smelter in the Northern area of Armenia • Judgment of consideration of construction of new smelter in the Southern part of Armenia • Judgment of Cu-metal manufacturing business from the point of view of an appropriate size, site, kinds of products and technology • Comprehensive feasibility study of Cu-business for sustainable development • Method of raising the funds necessary for investments
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5-10 Disclosure of Information

- Establish retrieval system on the website.
- Construction of reference system by digitizing the resource information.
- Construction of maintenance and management, and addition of data.

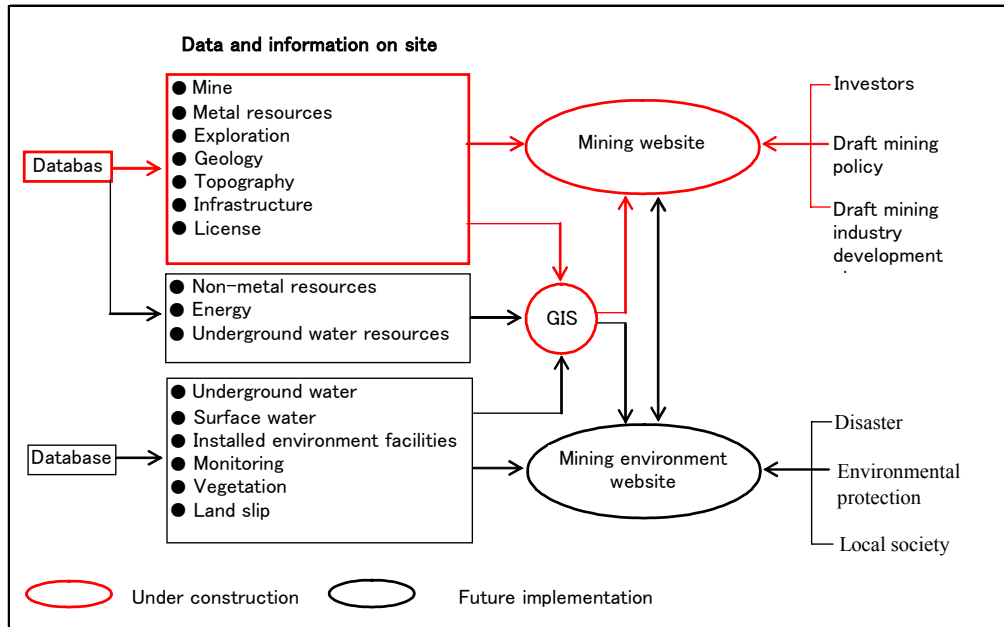


Fig. 4-12 Promotion Measures for Website and GIS

5-11 Mining Fund

Raising funds is the largest subject for realizing the promotion measure of the mining industry. Insufficient State budget, large debt and chronic financial deficit make it difficult for expenditure for the promotion measure. It is expected to realize a part of the support measure by establishing a mining fund, which is funded as a part of the original capital by the funds of royalty, etc. Also it is needed to realize a loan for the fund by an international organization. However, expenditure from the fund and method of management is an important subject. (Fig. 4-13)

- Fund raising method
 - Royalty
 - State budget
 - National bonds of intermediate term
 - Two-step loan from international organization
 - Repayment after loan
- Target of subsidy and loan of the fund
 - Subsidy system for exploration
 - Loans to promotion system for development (feasibility study, engineering and construction works for development)
 - Loans system for reconstruction or rationalization
 - Subsidy for technical development
 - Subsidy and loans for pollution protection

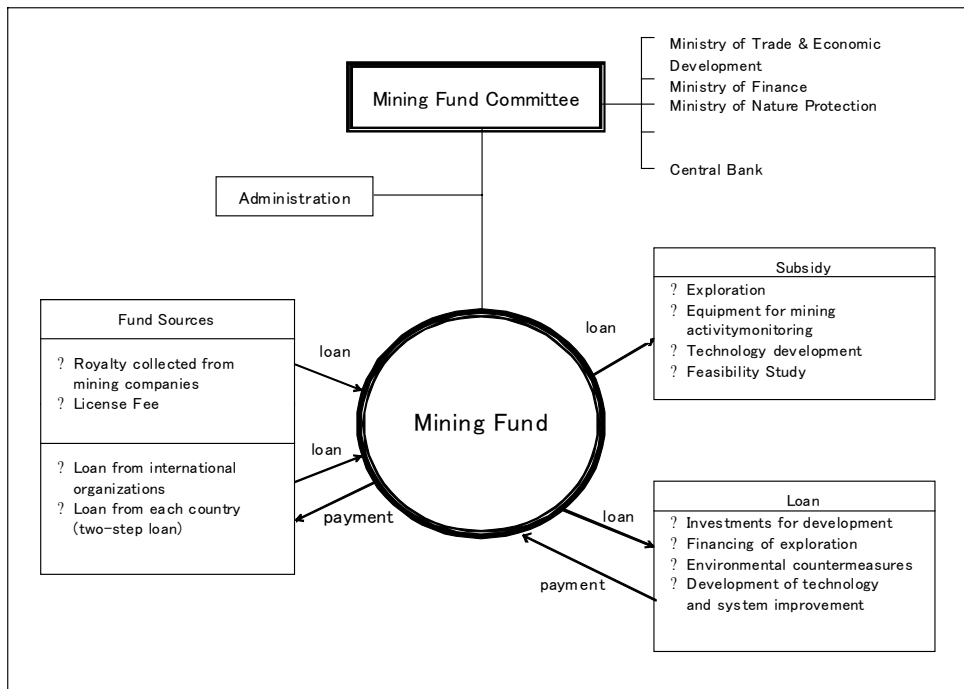


Fig. 4-13 Mining Fund (basic idea)

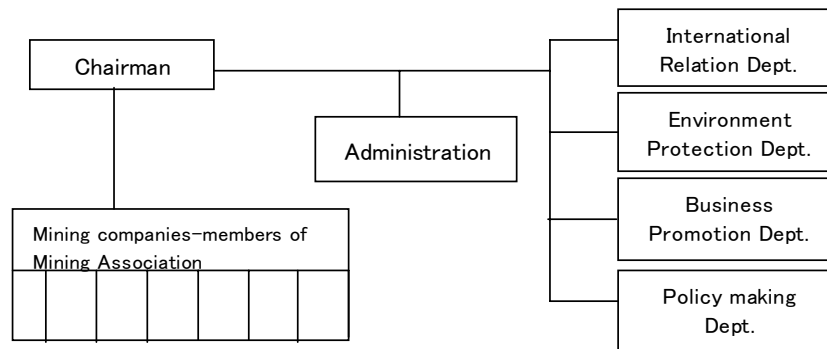
- Operations and management
 - Legalization of system (loan and discount, conditions for subsidy, sum)
 - Funds operation committee
 - Methods for funds administration and callback and shift conversion

5-12 Association of the Mining Industry

The sound development of the mining industry is the harmony between the administration and the private sector. Establishment of a mining industry association is needed for a role as a mediator between the administration, mine and local residents, as a group for receiving requests from the private sector and bringing them to the administration, and as a communication organization for requests from the administration to the private sector. The association is composed of mining, smelting, and survey companies, consultants, and foreign capital companies. The association also has a role for gathering information on the mining industries in the world (Fig. 4-15).

- Establishment of a mining industry association has a role of communication and adjusting requests of private companies.
- Establishment by funds of NGOs from the USA and other countries.
- Website is needed to be established. The website is linked to the mining website.
- Instruction by experts from advanced countries in mining. Distribution of human resources with English ability and mining knowledge.
- Compile information on private sector in mining activity.

1. Purpose
 - Organization of group of mining companies for promotion of mining industry
 - Realization of promotion of sound mining sector activity
2. Satisfaction
 - NGO Registration in Ministry of Justice
3. Member
 - Armenian Mining, Exploration, Survey, Consulting & Engineering Companies
 - Foreign Mining, Exploration, Survey, Consulting & Engineering Companies (working in Armenia)
4. Organization



5. Role
 - Mining policy proposals to governmental organizations
 - Information exchange with government
 - Gathering of information concerning trends and status of mining industry in the world
 - Compiling of activity for mining companies
 - Adjustment with local society – environment protection etc.
 - Holding of seminars
 - Information disclosure through web-site
6. Activity funding sources
 - Membership fee from mining companies, acquire of financing from international foundations

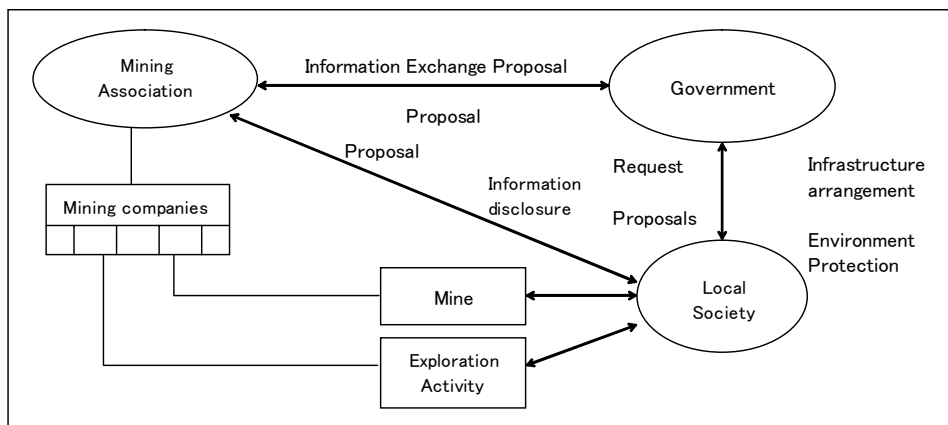


Fig. 4-14 Concept of Mining Association

5-13 Education of Human Resources

a. Establishment of a technical development center

Geological condition is same as Georgia so type of ore deposits is also same. A technical development to enable system and technical development is needed jointly with Georgia. The center is desired to have a common theme target of Georgia (Fig. 4-16).

- Improvement of mineral processing technology for complicated ore.
- Development of a new system for underground mining
- Introduction and improvement of SX-EW method

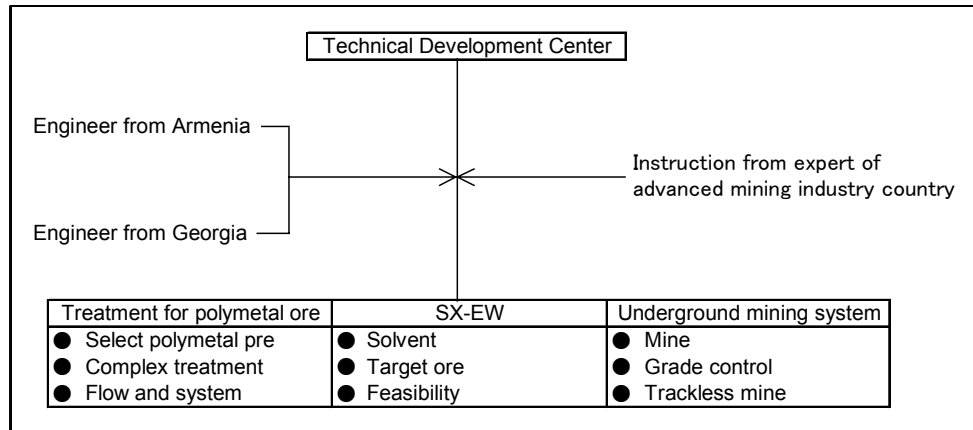


Fig. 4-15 Technical Development Center

b. Training system in advanced countries in mining

- Establishment of training system by Armenian Government (national budget)
- Usage of training programs of international organization or advanced countries

c. Invitation of experts

- Information in specific fields (mineral economy, environment economy, mineral evaluation, feasibility study)
- Mining situation (the newest technology, M&A of mining companies, environment problem/ countermeasures, mining policy)
- Mining finance, mining accounting (funds raising, international accounting)
- Management of mining company (management system, investment condition & its evaluation, raising of capital)

d. Domestic training system

- Basic education for English, accounting, legal system and so on
- Mining specific education like mining policy, mining promotion plan, environment protection and so on
- Practical mining education like management, environment control, business accounting

5-14 Promotion Measures with Neighboring Countries

Armenia is a landlocked country. Therefore, it is needed to construct cooperation with neighboring countries on the mining business especially the activity of exploration, research, technology development, education, smelting business, manufacturing business, etc. for bringing efficiency in the mining industry. This is an important subject for examination.

- Exploration with cooperation of Georgia for polymetallic deposits in the north area. Joint exploration with Iran for porphyry copper deposits in the south area.
- Cooperation facility with Georgia for education, research and technology development

center.

- New division system for the Caucasus area in a free economy.
 - Copper smelting in Iran for copper concentrate in the south area
 - Establishment of joint cooperation industrial park for copper manufacturing (tax-free zone by Iran and Armenia). Incentive is given for production and downstream production.
 - Copper smelting at Alaverdi for concentrate from Georgia.

5-15 Resources Information Center

Ten years has passed since Armenia was independent. However it is not capable to attain the global mining tendency but only the partial information. It is necessary to grasp the exact global tendency for promotion of the Armenian mining industry. If there is a function to transmit information of the Armenian mining industry to the world by means of internet system, it will be of assistance to promote mining investment by foreign investors. Establishment of this kind organization would be able to carry out the appropriate mining policy and promotion plan (Fig. 4-16).

- Collection of information like metal price, exploration, technical development, companies activities (mainly from internet)
- Collection and compilation of mining laws, mining policies and tax information in other countries
- Transmission of the world mining information to domestic demanders through website.
- Distribution or sale of the Armenian mining information (resources map, geological map and etc.)

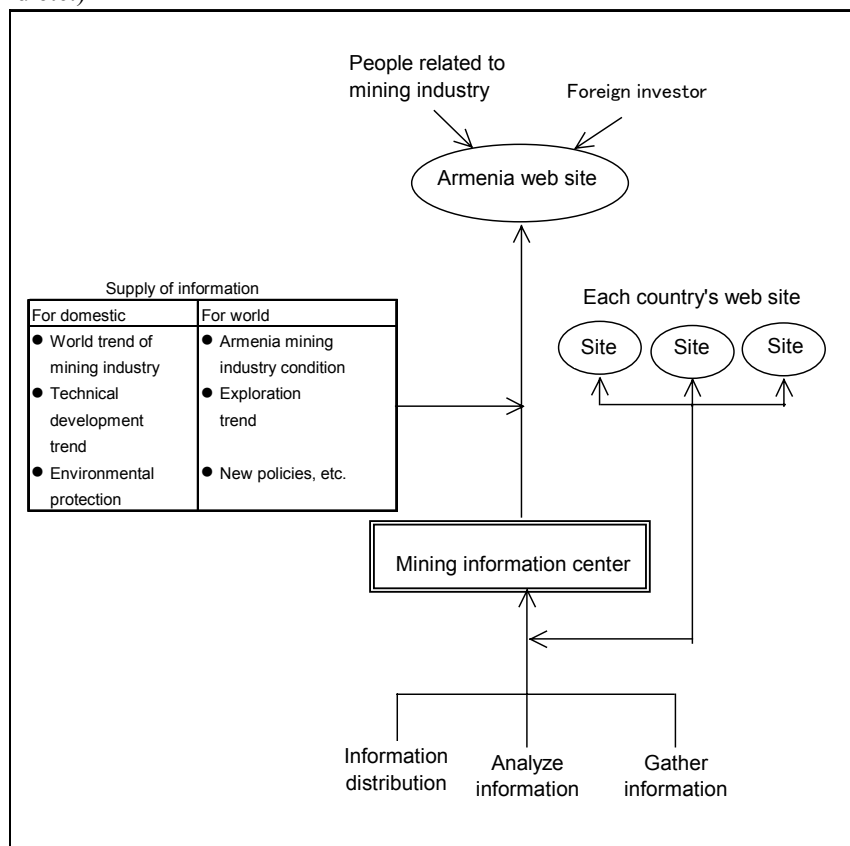


Fig. 4-16 Resources Information Center

6. Subject to Realize Settlement of the Promotion Measures

6-1 Mining Promotion Plan

- Improvement and arrangement of mining law quickly, review tax system
- Raising funds to construct a mine and smelting plant.
- Examination of possibility for the promotion of exploration and development and mining fund.
- Recognition of the mining industry as a priority industry.
- Support from international organizations or each country (creation of project based on promotion measure)
- Forming financial market

6-2 Investment Scale to Promotion Measures

A huge finance is needed for the promotion of the mining industry by realizing promotion measures. Investment scale in the implementation term of the Master Plan is US\$100 million for the reconstruction term, US\$200 million for the development term for a total of US\$300 million, on a very rough estimation (Table 4-9). These money should be financed by loans and technical assistance from international organizations and each country, foreign capital, Armenia government (tax revenues, national bonds) and domestic capital. Concrete effective investment of the investment amount and term of repayment of the loan are needed to study the target of investment. Also, the method of finance after drafting a plan of investment should be concremented.

Table 4-9 Goals of Investment for Promotion Measures

(1) Reconstruction Term

	Amount (US\$ million)	Promotion Measures
National Budget	15	Management improvement of state enterprises based on copper business F/S, arrangement of tax and law, information arrangement, evaluation of resources, support for exploration and development
Foreign Capital	45	Mine management improvement of Kapan and Kajaran mines, environmental countermeasures, exploration, development of new deposits
Domestic Capital	20	Exploration, development, copper smelting plant expansion, equipment of environmental management, reconstruction of mines
International Organizations	20	Environmental survey, improvement of management, countermeasures for environment, monitoring system of mining industry company, arrangement of IT, change to IT
Total	100	

(2) Development Term

	Amount (US\$ million)	Promotion Measures
National Budget	20	Support for exploration and development component F/S, engineering of business project based on copper F/S construction of environmental countermeasures,
Foreign Capital	80	Exploration and development (copper, gold)
Domestic Capital	40	Exploration and development
International Organizations	60	Construct environmental countermeasures, expand IT, environmental facilities of copper smelting plant
Total	200	

6-3 Assistance Program and Promotion Measure

International organizations (WB, EBRD) and each country like Japan (JICA, JBIC), etc. have assistance and supporting programs for various fields. It is better to study the introduction to the project (promotion measure) to be possible that applies to a program in these programs on the promotion measures. The realization of the introduction should be attempted by the concretion of promotion measures on the study of these measures. Mining organizations should make an effort for the introduction by survey of the assistance program of each country, international organizations, and by studying the possibility for realizing the promotion measure of the assistance program. EU-PHARE is a fund for the reconstruction of East Europe. The Armenia government is now requesting as a target country for using this fund. If Armenia is recognized as a target country for this fund, EU-PHARE will become a powerful assistance fund for the mining industry promotion. EU and World Bank have implemented already support for an environment project with the target of three countries of the Caucasus. The creation of an assistance project for the three countries of the Caucasus in the mining field and realization of these supporting projects from international organizations are the subject for studying now on.

CHAPTER 5 RECOMMENDATIONS

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1. Importance of the Mining Industry

1-1 Mining Industry's Effectiveness to Other Industries

Japan was once a mining industry country. Profits from the mining industry created and expanded the machine and metal manufacturing industries. The mining industry has constructed the basement of industries. Recently, Japan has become a mining industry country having the smelting business as its main constituent with dependence of importing almost all the concentrates such as copper and zinc because of the reduction of mines. Japan is a custom smelter with a 10% share of copper smelting and 8% share of zinc smelting in the world. However, the metal industry, machine parts industry and electronics industry have been expanding with the mining industry as the basement of them.

The mining industry has effectiveness for developing and extending to the downstream businesses and application business by using metal like smelting → metal manufacturing → parts, electronics industries, if the mining industry is competitive by the effective practical use of its underground resources. Also the development of mines linked to the arrangement of the local infrastructure and promotion to the distribution business (Fig. 5-1).

Armenia has comprehensive technology from exploration, development to smelting for copper, molybdenum and gold. Armenia has potential underground resources linked to the production of 50,000 tons per year copper, 20,000 tons per year zinc and 5 tons per year gold as a metal basis. Therefore the establishment of a mining industry basement with competitiveness is needed to be done by the arrangement and reconstruction of existing mines and smelting plants, promotion of exploration and development such as copper, zinc and gold, at first, under a free market economy. Armenia should recognize the role of the mining industry for economic growth and position the mining industry as a strategic industry for the above reasons. Therefore Armenia should concentrate their power and tackle to realize the Master Plan.

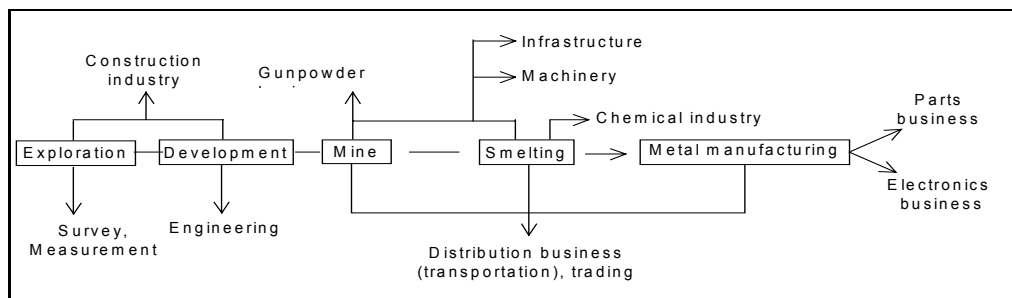


Fig. 5-1 Extending Business from Mining Industry

1-2 Trend of Metal Production Amount

Metal production amount in the world has been growing at 1-5% for many metals. Main metals show a positive growth in 1990-2000 (Fig. 5-2). Recently recycling has been promoted. However the rate of recycling is low (copper 13%, zinc 4%). The condition of dependence to metals from underground resources has not changed in the world.

Armenia's reserves (metal amount) are copper 7.7 million tons, zinc 890,000 tons, gold 390 tons and molybdenum 860,000 tons, etc. Armenia's reserves can contribute at the above rates to the world's metals production growth. Armenia's reserves are needed to promote their usage based on the metals' growth rate in the world and rate of recycling. The mining industry is based on supply and demand. The metal mining industry is an industry for acquiring foreign currency by production of international products. Armenia has a chance for obtaining a market of its mining

industry products in the expanding markets. Expanding of production by recovering at the early stage is needed based on the Master Plan and recognition of the importance of the mining industry.

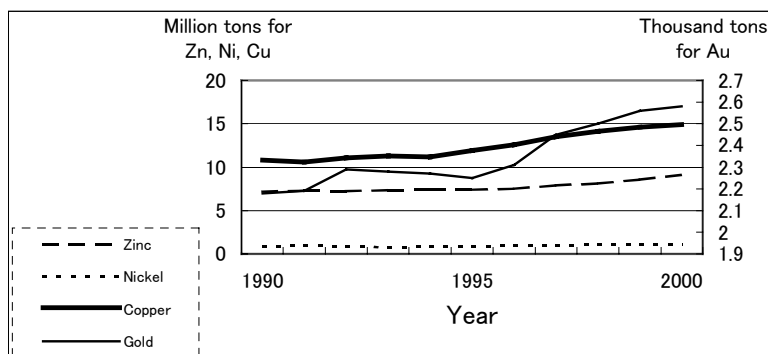


Fig. 5-2 Trend of Metal Production in the World

Source: USGS Mineral Yearbook 2001

1-3 Reconstruction of the Mining Industry Basement

The mining industry basement is composed of technology, training of human resources, infrastructure and facilities, laws and regulations, management and operations, protection of the environment, and changing to IT, etc. In the FSU (former Soviet Union), these basements have been maintained in the Soviet distribution system. After independence, reconstruction has been done for adapting to a free economy system for making the transition to a free economy. Laws and regulations have been arranged. However, the renewal of technology, acquiring knowledge and know-how on management and operations, and change to IT has now started. Training, which gives importance on the mining field because of the recession of the mining industry, is a future important subject. Mining industry facilities need investment for superannuated equipment and renewal of equipment and facilities for environmental protection is indispensable now and in the stage of practical implementation.

Table 5-1 Reconstruction of the Mining Industry Basement

Main Arrangement of Basement Items	Method of Reconstruction	Content
Technology	<ul style="list-style-type: none"> • Introduction of foreign capital • Improve existing technology 	<ul style="list-style-type: none"> • Technical transfer of foreign company • Instruction of expert from advanced country of mining industry
Infrastructure	<ul style="list-style-type: none"> • Support from international organizations 	<ul style="list-style-type: none"> • Repair roads, arrangement of railroads
Facilities of mining industry	<ul style="list-style-type: none"> • Privatization (introduction of foreign capital) 	<ul style="list-style-type: none"> • Renewal by investment of foreign company
Human resources	<ul style="list-style-type: none"> • Introduction of foreign capital • System of training • International organization support 	<ul style="list-style-type: none"> • Acquire knowledge, technology from foreign company • General training and specific field training • Spread of international accounting standards
Information technology (IT)	<ul style="list-style-type: none"> • Expand web site • Introduction of foreign capital 	<ul style="list-style-type: none"> • Introduction of equipment from foreign company • Digitize information and data
Protection of environment	<ul style="list-style-type: none"> • Privatization • International organization support 	<ul style="list-style-type: none"> • Facility and equipment renewal • System of monitoring in mining industry district

Arrangement of basic infrastructure has been started by the support of the World Bank and each country, etc. The reconstruction of the basement needs a huge amount of investment, is not easy and takes a long time. However, if the reconstruction is done by the participation of foreign investment on the privatization, introduction of foreign investment for exploration and

development, support from international organizations and sending experts from advanced mining industry countries, etc., the mining industry basement will be arranged. For this matter, people who have a view of the whole mining industry are needed and should promote the reconstruction of the mining industry basement by checking on the condition of its arrangement with the establishment of a unified organization of the mining industry (Table 5-1).

2. Expanding Future Potential of Copper Mining Industry

The characteristic of the Armenia mining industry is copper deposits. Gold, molybdenum and zinc exist in many kinds of copper deposits and composed of copper- molybdenum deposits, copper-gold deposits and copper-gold-zinc deposits. Now these types of deposits were developed and operated as mines. Also Armenia has a copper smelting plant and part of the molybdenum concentrate is treated in the smelting business. Copper is positioned as a basic business in the mining industry.

If the production system was constructed for the production of electronic copper like before independence in the copper smelting business, the production of rolled copper products like pipes, plates, sticks and wire from copper metal becomes a possibility. Also, copper metal and these products are linked to the expansion of the alloy business or parts manufacturing business by using copper. The market is the Caucasus area and neighboring countries. The copper smelting business brings the manufacturing business related to many kinds of copper products and the creation of the parts business. There is potential for expanding employment.

Almost all the copper mineral in Armenia is chalcopyrite. Sulfide acid, which is produced for environmental protection in the smelting business, contributes to the promotion of agriculture as fertilizer. Sulfide acid also has a possibility for restoring land as a neutralizing material for salt-damaged land. Moreover, it is possible to adapt to treat copper oxide ore by SX-EW method and it is not impossible to develop a new mining industry balanced with the environment like in-place leaching. Sulfur has a potential possibility for use as a material for solid and heat resistance for asphalt roads. If it is possible, sulfur can become the material for asphalt and effective reduction of the use of heavy oil. This will bring about cost reduction. The market for sulfur will expand over the whole Caucasus area.

Therefore the copper mining industry has a big effect of expanding to develop agriculture, new mining industry and industry. The government should recognize sufficiently the importance of the copper mining industry and position it as a national strategic industry. Therefore, a feasibility study that grasps the economics of the whole copper mining industry should be implemented.

- The copper mining industry has the highest priority strategic business of the nation.
- The copper mining industry has a possibility for the development of downstream business such as manufacturing industry and copper parts business.
- Protection of the environment for the copper smelting business has the potential to create a new leaching mining industry and promotion of agriculture and industry.
- A feasibility study is needed to grasp the comprehensive business feasibility of the whole copper mining industry.

3. Training of Human Resources

3-1 Government Organizations

System of training human resources is recommended in this Master Plan. It is not desirable to reconstruct and promote the mining industry for improvement of the mining industry in its recent condition, if the government organizations do not recognize the importance of the Master

Plan and does not tackle its realization by the concentration of their power. It is indispensable that the private and government sectors become like one body. However, now the private sector activity is insufficient in its recent condition. Therefore if the government does not promote aggressively, the activity of the private sector will not be activated. For the above matter, the generation change in human resources related to the mining industry should be a priority issue.

To acquire the abilities to make a plan, establish a vision, and administrate are indispensable for the training of the new generation having a role in the mining industry sector in government organizations. Personnel who can grasp the comprehensive mining industry are needed to train and to be raised. Now English has become the common language around the world. The mining industry is a business that is developed internationally. Bureaucrats and technocrats in charge of the mining sector in government organizations are required to acquire the above abilities and language ability through training education, training system, human resources and overseas training from now.

A 5-year action program for the term of reconstruction in the Master Plan is proposed. For implementation of measures in the action program are needed to make an intermediate-term plan (5 years), short-term plan of 1-2 years based on the intermediate-term plan, make a budget for the implementation of measures and implement the budget. Moreover, it is needed to request support from international organizations for the above abilities. Therefore the necessity of the promotion measures and effectiveness of the implementation of them should be examined sufficiently.

- Training of human resources is indispensable for the realization of the Master Plan.
- Acquiring the ability to make plans, establish a vision, and administrate
- Making a training system of human resources and implementation

3-2 Private Companies

Training of human resources in private companies is carried out in each company. In case of the introduction of foreign investment by privatization, acquiring knowledge of the free economy and transferring of new technology is possible by joint venture with foreign investment. If a company like Armenian Copper Program (ACP) can receive a loan, US\$ 3 million, for company management improvement from the EBRD, it is also useful for training of human resources related to company management under a free economy. If a private company contact with a foreign mining company, financing company, etc. through their business activity, it will be linked to acquire knowledge and know-how. Training like the above through actual practice is important. Human resource is a resource of the company. Training human resources gives an impact to the company's development. Therefore it is needed to recognize the importance of the training of human resources and implementation of systematic training. It is desirable to carry out the support of training for the promotion of the private sector's activity by implementation of the training of human resources of private companies by the government (Fig. 5-3).

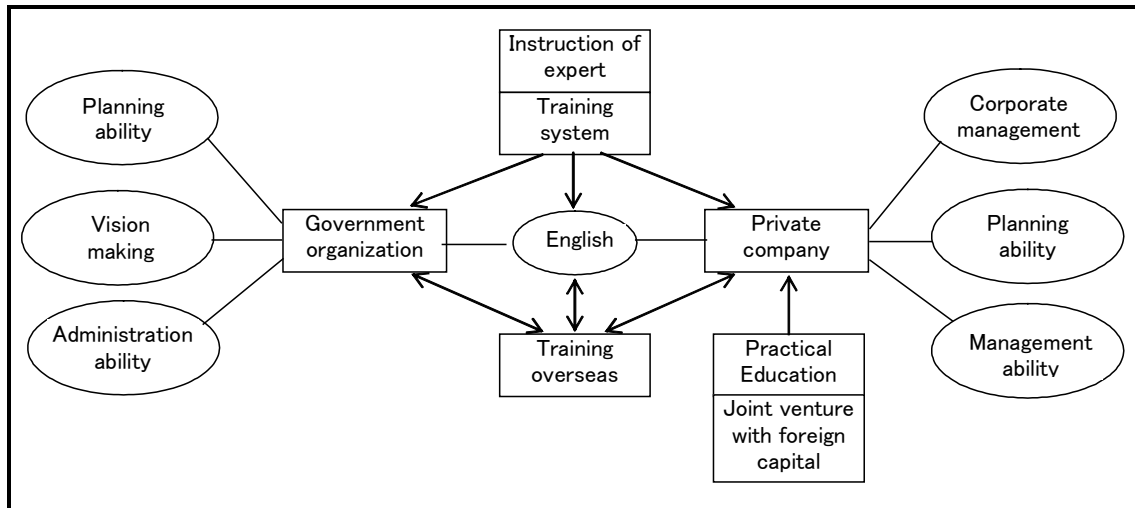


Fig. 5-3 Training System

4. Mining Industry Policy and Administration

4-1 Mining Industry Policy

Mining industry policy is proposed in this Master Plan. Mining industry policy should be enforced linked to a state development plan. The proposed mining industry policy is a policy for the reconstruction and promotion based on the characteristics of the mining industry of Armenia. Government organizations enforce the policy by evaluation of the policy in the planning stage and examination for realization. A deep understanding of the policy is needed for the people related to the mining industry. Adjustment of the policy should be implemented by the evaluation of the effectiveness through the implementation conditions of the mining industry policy. Moreover, a suitable policy should be realized and carried out. The method of acquiring the view or comment for a private company is indispensable for drafting a suitable policy. The evaluation of policy implementation and changing of the policy should be carried out through a third party organization like the council of mining industry composed of a mining association of private companies, representatives of the private sector and people with much experience and knowledge of the mining industry.

- Mining industry policy linked to the state development plan.
- Understanding of mining industry policy to people related to the mining industry
- Reflection of private companies' view for a suitable mining industry policy

4-2 Administration Abilities

Administration ability for the implementation and management of policy is needed to carry out the mining industry policy. Government organizations of Armenia have high ability in administration. However, the administration ability as a whole organization has been forced into a worsening condition because of the reform of administration, reform of organization, and reduction of manpower of the organizations. Although work such as many kinds of reforms by changing the system and enforcement of the law, etc. in moving to a free economy is increasing; there is a possibility that the administration may not always have a suitable manpower and arrangement of human resources.

Now the administration is under a period of moving to a free economy on the management of license, procedures for investment, procedures of applying for a license, application

for permission for development, etc. Simplification of procedures that require much time is needed for procedures of permission and approval. For improvement of the administration ability simplification and reduction of management work, upgrading the ability of the bureaucrat are needed to be carried out by Ministry and government (Table 5-2).

Table 5-2 Upgrading of the Administration Ability

Items	Improvement Measures for Upgrade
Treatment of administration	Promote IT, networking, uniform documents
Approval and procedure	Simplify (need to give overseas training and inspection, send high ranking government officials)
Draft policy	Hold seminar, train overseas
Make plan	Train overseas, acquire through implementation of Master Plan
Management	Reduction of items of management, uniformity, systemization
Information	Sharing information, disclosing information
Human resources education	Education system, implementation of training seminar

4-3 State Strategy

Promotion and expansion of the copper business has a high possibility to increase state profits for Armenia. For this matter, a study of the below issues are needed.

- Caucasus area and domestic market of sulfide acid
- Effectiveness of using sulfur for heavy oil for the construction of asphalt roads. Way of acquiring technology for the production method of sulfur.
- Domestic demand of ammonium sulfate and market of the Caucasus area
- Usage of land after neutralization and neutralization by sulfate acid to salt-damaged land
- Confirmation of the amount and grade for the target resources to use for the SX-EW method

Full-scale feasibility study is carried out based on the above study. To position the copper business as a state strategy by making a course for business promotion, cooperation for finance, request to international organization, cooperation to foreign investment, support to domestic company growth, clarification on the state's role to the copper business, etc. should be concreted based on the results of the feasibility study. For Armenia in the reconstruction term of the state, it is sufficiently thought that there is a possibility that only depending on the free market principles is not linked to a business with state profit. The government should realize the copper business over the Ministry level by taking the leadership. Recognition and examination of the advantages and disadvantages for the introduction of foreign investment is needed (Fig. 5-4).

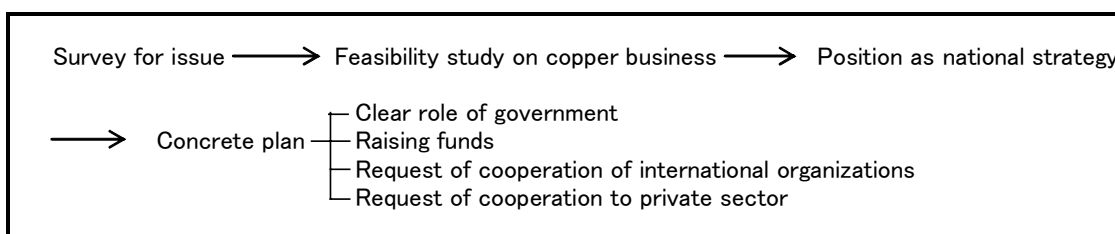


Fig. 5-4 Copper Business and National Strategy

5. Issues of Economic Development

5-1 National Finance

Macroeconomy and improvement of national finance are indispensable for the promotion of the mining industry. The Armenia government has actively carried out the reconstruction of the economy after its independence. However, improvement of the macroeconomy indexes and

increasing the annual revenue in the national finance must be promoted still now. Conspicuousness of tax payment still has not risen. Tax payment from companies and individuals on their annual income has not increased because of the increase of the tax burden, insufficient management system for collection, and private company's low activity, etc. Moreover, insufficient establishment of a financial market brings difficult conditions on the growth of industry. The increase of debt from international organizations, etc. for the reconstruction of the nation has become a burden to its national finance. Simplification of the tax payment procedure, reduction of the tax rate, establishment of a financial market and raising of industry are needed to advance steadily and strategically (Table 5-3).

Table 5-3 Comments on Improvement of Finances

Items	Measures for Improvement
Issue of External Bond	Improve parameters of macro-economy.
Issue of National Bonds (Intermediate Term)	Political stability, strength of government trust, reduction of interest rate.
Amount of Stock Trading	Spreading of international accounting standards, transparency of corporate accounting
Establish Intermediate-term Loan by Bank	Strength of bank's trust, improve savings system, reduction of interest rate.
Reduction in Tax Rate	Improvement of tax collection system management, reduction of tax rate of VAT and other taxes
Procedures on Tax Payment	Thorough tax collection at the salary source, simplify application system

5-2 Establishment of International Accounting Standards

The most important matter for companies is "trust". How to obtain trust is directly linked to a company's activity. Accounting is a system to correctly show a third party about the condition of a company. It is a system to secure a company's transparency. It also is a method to measure the company's strength. The company carries out implementation based on strategy as a base of the corporation's "accounting standards", which is used as measurement. Accounting standards are so called a rule of business society.

International accounting standards (IAS) have become a unified standard of the world by progressing of internationalization. The mining industry activity must have activity across boundaries of nations. If this is not so, it is difficult to maintain and develop the mining industry. Trust of the international market for the introduction of foreign investment should be obtained. Government organizations and mining industry companies need to tackle with the same recognition that the establishment and use of IAS have become important for economic development.

5-3 Relations with Neighboring Countries

(1) Copper business with Iran

Now almost all copper concentrate, which is produced in the south area of Armenia, is exported to Iran. The production capacity of Iran's copper smelting plants is 200,000 tons. The domestic supply of copper concentrate in Iran is insufficient. In several years, the copper concentrate of Armenia has an important position for Iran's smelting plants. However, if Iran with its big resources potential becomes active in its exploration and development through promotion by the introduction of foreign investment, it is thought there is a possibility the Armenia copper concentrate exports could become unstable. Therefore in several years, the export of copper concentrate in the south area to Iran is linked to the expansion of the production amount of Armenia's domestic copper concentrate, but in the future the construction of a comprehensive

system from the mine to smelter is desirable for the acquisition of maximum profit to Armenia with importance of state profit based on the copper business feasibility study.

Already Iran's companies have participated in Armenia in businesses such as food manufacturing and finance, etc. and expanded their business. A good relation between Armenia and Iran has been established through joint ventures. The relationship in the copper business should be examined sufficiently for its advantages and disadvantages. It is desirable that the business relation can supply each other's weak point or give strength for each weak point. It is thought to give big effectiveness that exploration and development especially cooperation relation of joint exploration and development for the same resources (porphyry type copper deposit, massive polymetal sulfide deposit) in the adjoining area, metal manufacturing from copper metal and parts business linked to the reduction of the burden to investment and expansion of the market. If the copper manufacturing business operates in an industrial park with special tax incentives by the industrial park method with consideration of the environment, competitiveness is brought by the concentration of production and it becomes the core for the development in the local society. Moreover, it means that Armenia can obtain an export route to the Persian Gulf.

- Joint exploration and development with Iran
- Establishment of industrial park with Iran for copper manufacturing business
- Establishment of export route of the Iran side for Armenia

(2) Relation with Georgia

Before the Alaverdi Smelting Plant was damaged, the Madneuli Mine of Georgia supplied copper concentrate to the Alaverdi Smelting Plant. Now the Madneuli Mine has production of 10,000 tons (metal basis) of copper concentrate. The concentrate has been exported to Europe through a European trader. The transportation cost competitiveness for export has decreased and has given an impact to the sales price of the concentrate. The distance from the Madneuli Mine to Alaverdi is about 70 km. With the progress of the reconstruction of the Alaverdi Smelting Plant, the Madneuli Mine concentrate supply to Alaverdi is for mutual prosperity linked to each countries' profit.

Around the border of Armenia and Georgia is an area of potentiality of a massive polymetal sulfide deposit (copper, zinc, gold). Both countries have accumulated knowledge for exploration and development for this type of deposit. To explore and develop jointly linked to the strength of the relationship of both countries' mining industry and upgrade of the technical level. Moreover, almost all of this type deposit is small-medium scale, target of underground mine and complex ore with a low recovery rate for processing. Therefore if both countries establish a technical development center jointly and carry out technical development jointly, risk dispersion and strengthening of development ability occurs.

- Joint exploration and development for massive sulfide polymetal deposit
- Supply of copper concentrate from the Madneuli Mine of Georgia to the Alaverdi Smelting Plant of Armenia
- Joint technology development with Georgia for the mining and processing areas for polymetal massive sulfide deposits, etc.

(3) Neighboring Countries Relations and Issues

The three Caucasus nations consisting of Armenia, Georgia and Azerbaijan comprise totally a population of 16 million, which enables in size to build up the regional economic bloc. Armenia should take into account the cooperation with those neighboring countries through the economic and business activity. To aim at formation of the Caucasus regional economic bloc with independent from the subordinate Caucasus for the USSR in the era of the FSU, Armenia should

build up its economic role to be performed based on its framework and the reciprocal arrangement for making the best use of the resources and industries in each country. A trade fair of Caucasus by JETRO held on 2001 in Japan could be positioned as the first step toward formation of such economic bloc. For realizing the joint economic activity, the joint industrial complex of copper manufacturing business for two countries (Armenia and Iran for example) may be developed to locate in the area adjacent to the border between two countries, and be used as a supply base for materials and commodities to the regional economic bloc. In addition to such scheme, the joint development of mining and technology by the countries will serve as one of the ways for building up the economic bloc (Table 5-4). It will also be needed the mechanism, which the Caucasus regional economic bloc can be linked to the great-sphere economic bloc expanding in the vicinity (Fig. 5-5, Fig. 5-6). By EU, the scheme of a system for transportation with the support is currently under way to be built up and the preparation and improvement of related infrastructure have already started to be made for these economic blocs.

Table 5-4 Field of Mining Industry and Cooperation with the Neighboring Countries

Items	Measures for Improvement
Technology R&D Center	Education and training for human resources, and technology development by using the devices and facilities of the State University of Armenia.
Joint Exploration	Exploration of copper and gold ores in the area adjacent to the border (Georgia and Armenia).
Joint R&D	Joint development of the mine by the companies of two countries.
Smelting & Manufacturing	Allotment of the roles in charge in smelting (Armenia takes charge of copper) and allotment of the roles in the metal processing.
Caucasus Mining Industry Association	The Association plays the role as the traction force in promoting the mining industry in the three countries concerned through collection of the information and its analysis.

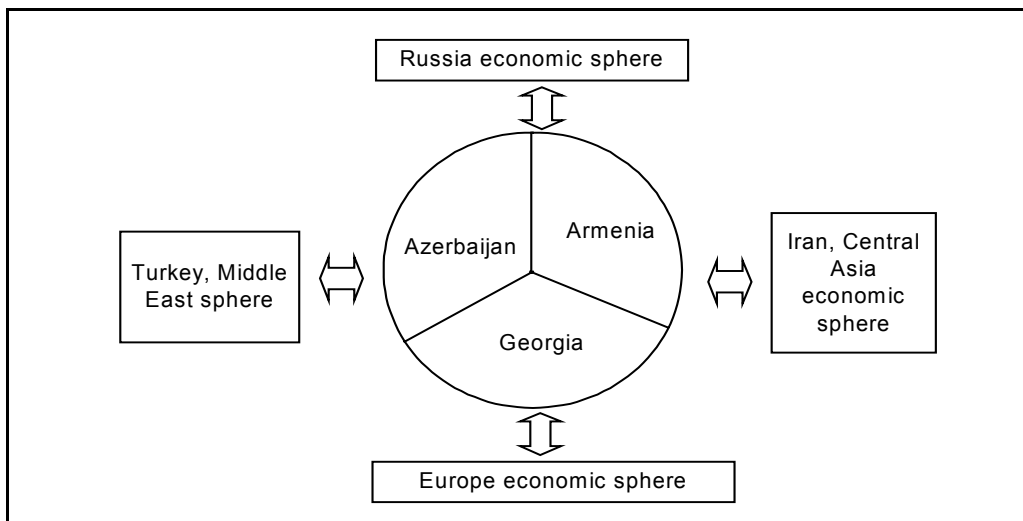


Fig. 5-5 Relationship of Caucasus Economic Area with Surrounding Area

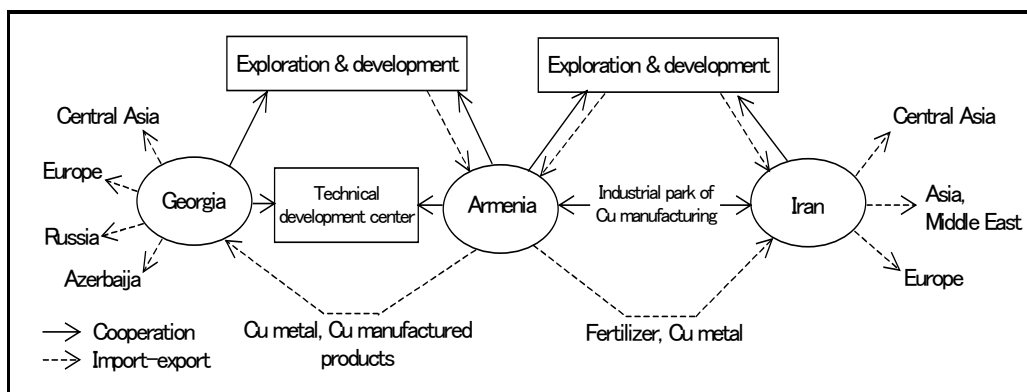


Fig. 5-6 Relations with Neighboring Countries and Export Route for Copper Products

6. Recent Situation of Mining Industry

6-1 Globalization

The mining industry in the world has increased the production amount as a whole and has progressed to large-scale production and large-scale equipment and facilities for mines and smelting plants. The oligopoly structure of giant multinational mining industry companies (majors, example, BHP-Billiton, Anglo-American, Rio Tinto) has been established. The top ten producers of copper in the world have a 60% share and gold have a 40% share. Each country's resources have been disclosed. Realistic average price for metal in the previous 35 years has been decreasing (Fig. 5-7). Investment country and production basement place of majors have been expanding. Majors have made a competitive strength by the system of large-scale production (Fig. 5-8). On the other hand, many mines and smelting plants in a mineral resource country, which lost its competitiveness, are faced with management difficulty. Some of them become targets for merger and acquisition by majors. Most of these countries are small-medium scale mining industry companies. In the world, environmental protection has become important. These companies have been driven to close or withdraw or become difficult to exist by the addition of the environmental costs.

This tendency is especially strong in Central Asia, Caucasus and East Europe. Most countries in these areas received big damage of a decreased production amount with the transition to a free economy. There are many mines and smelting plants, which are facing difficult management and closed mines. Each country has promoted privatization and the introduction of foreign investment. However, important decision factors for foreign investors are policy, law, tax system and political stability of each country in addition to attractive mineral resources for participation of foreign investors. These areas' countries, which have not completely escaped out of the former COMECON era's constitution, are in a condition with a big handicap.

Armenia also is faced with the same conditions. Armenia has many disadvantages for the reconstruction and improvement such as 1) improvement with a viewpoint of "competitiveness" for policy, law and tax system compared to other mining industry countries, 2) Simplify the procedure for acquiring a license, 3) Clarify the responsibility of past environmental pollution for the former USSR era, 4) Superannuated mining facilities and equipment, 5) Immature financial markets, 6) Transparency of company and 7) landlocked country. Mining industry policy and promotion measure in the Master Plan are the means for the promotion of the mining industry by overcoming these negative factors. Armenia must recognize these factors in its mining industry by themselves. If there is no strong will and action by the people and organizations related to the mining industry for overcoming these factors to the mining industry trend in the world, the mining industry is not promoted.

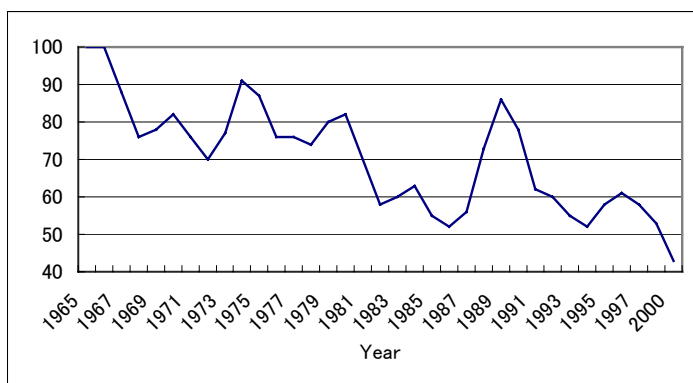


Fig. 5-7 Real Trend of Metal Price

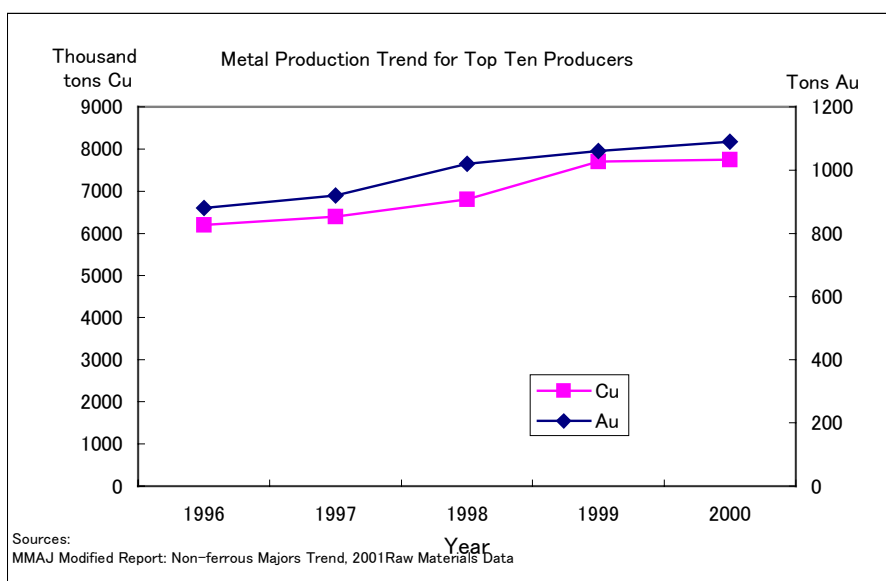


Fig. 5-8 Metal Production Trend of Top Ten Producers

6-2 Tax Rate of Mining Countries and Competitiveness to Investment

Factors such as abundant resources, location of mines and deposits, infrastructure (electricity, water, roads, railroads, etc.), procurement, securing manpower, environmental regulations, technical basement, political stability, and simple procedure for acquiring license are important for mining industry companies to invest in the mining sector in a foreign country. In addition to these factors, the tax system and rate are influential decision factors to an investor because it gives an impact directly to the profits. The tax system and rate must be competitive for countries wishing to attract investment. These factors are a big incentive for the investor. The Caucasus and Central Asia area has a disadvantage of high mineral resource tax and social tax rates compared to advanced mining industry countries, South America and Asia, and high main tax rates compared with many countries in the world (Table 5-5). The Caucasus and Central Asia area tax burden has high mineral resources tax in addition to social taxes. Each country in Caucasus and Central Asia has a mineral resource tax on revenue. Therefore mineral resource tax is an actual deduction on revenue. This may be one possible cause for making it difficult to make a profit. Now foreign investment to Caucasus and Central Asia area has not progressed according to the expectation of each country. The cause of this is thought to be the economic condition, political

stability and financial market, etc. However, it is thought the above tax disadvantage is a big factor. From the viewpoint of tax, Central Asia and Caucasus are not competitive for the introduction of investment.

Armenia is thought that it has relatively competitiveness for investment though it does not have attractive features for investors because of the tax factor from the viewpoints of Europe and USA. Moreover it is needed to have a tax system and rate that is competitive for investment.

Table 5-5 Taxes and Company Cost related to Mining Industry

(1) Caucasus and Central Asia

Item	Armenia	Georgia	Kyrgyz	Kazakhstan
Profit tax (on profit)	20%	20%	30%	30%
VAT	20%	20%	20%	20%
Social tax (on salary)	Social security 3% up	27+4%	33+1.5%	Pension 25.5% social security 1.5% medical insurance 3% employment fund 2%
Mineral resource tax	royalty 1%	≒ sales 3~6%	prod. cost 5~15%	Negotiable
Environment tax	None	None		None
Enterprise activity tax	None	sales-supply cost)*1	None	None
Fund for mineral development	None	None	sales 2~15%	None

(2) South America and Asia

Item	Peru	Chile	Indonesia	Philippines
Profit tax (on profit)	30%	15% plus 35% on distribution	30%	35%
VAT	18%	18%, credits	10%, credits	0~10%
Social tax (on salary)	Housing fund 9% health & accident insurance 3.6% 18 monthly salaries- bonus 1 yr salary- severance profit sharing 8% net profits	Labor accident and occupation fund- 0.9%, 1.7%, 2.6% or 3.4% 1% of payroll for training 2.4% unemployment insurance profit sharing 30%	Old age, disability, death 4% sickness & maternity 6% married, 3% single workman's compensation 0.24-1.74% all based on payroll	Social security 5% up to 12,000 p health insurance 3% workman's compensation 1%
Mineral resource tax	None	Unknown	Au \$225/kg <2t \$235/kg >2t Cu \$45/t <80,000t \$55/t >80,000t	sales Cu 2%, Au 4% on gross output value
Environment tax	None	None	None	mine waste: 0.05 p/Mt mine tailings fee: 0.1 p/Mt
Enterprise activity tax	None	None	None	None
Fund for mineral development	None	None	None	None

(3) Western countries

Item	USA (Arizona)	Western Australia	Canada	Sweden
Profit tax (on profit)	15-34% <\$10M, 35%>\$10M	36%	31.97%	28%
VAT	None	None	7%	25% on equipment
Social tax (on salary)	Workman's compensation+ unemployment insurance (UI) is 6.2% on first \$7,000 but UI credit up to 5.4% social security+medicare- 7.65%	Payroll tax 3.95-6% wages < A\$600,000 below based on payroll health insurance 3% accident insurance 1.4% old age & disability 2.55% unemployment 3% other social contributions 1.2% with a cap at A\$8,000	Federal pension 2.8% of payroll, unemployment insurance 2.95%, State: health, workman's compensation 0.98% to 1.95% of payroll	Social security 33.06% plus 5-10% more in a negotiated agreement
Mineral resource tax	None	Au none Cu ore 7.5% concentrate 5% anode 2.5% realized value	None	None
Environment tax	If alternative minimum taxable income (AMTI) >\$2M, tax=0.12%*AMTI	None	None	None
Enterprise activity tax	None	None	None	None
Fund for mineral development	None	None	None	None

6-3 Exploration and Development Target

Securing sources of reserve for the future is indispensable for the promotion of the mining industry and economic growth by the mining industry. It should be developed in the early stage for production by the promotion of exploration to potential areas and deposits in the viewpoint of possible future development of copper deposits.

In the north area, the Tekhut deposit needs to be developed quickly. However, the recovery rate of the drilling core is low (70-75%) in the FSU era. Therefore shallow boring should be carried out to study leaching by using the drilling core. Implementation of a feasibility study is desirable after this work. The Alaverdi plant needs to use silica as flux. To find silica rock with gold around the plant is needed. There is a possibility for feasibility even though the gold grade is low. Therefore exploration with a geochemical survey for silicate rocks with gold around the plant is desirable and needs to be actively promoted.

In the south area, the Dastakerd deposit is in a mine that has been closed since 1974. However the deposit has an average grade (0.95% copper, 0.043% Mo). Therefore it is needed to study the re-development of this deposit, which is a high priority. According to the Ministry of Nature Protection, the structural geology surrounding the Dastakerd deposit is complex. At first, it is important to select an exploration area by the analysis of existing data and do geophysical exploration (IP, electromagnetic exploration by the TDEM method). After this work, it is needed to carry out drilling exploration and drift exploration.

Concerning gold deposits, it is difficult to find a large-scale deposit. Therefore it is desirable to have a target for exploration and development of existing small-medium scale deposits. In the case of a gold deposit (silver), a low sulfide ore, over 10 tons of gold amounts is needed as a general principle. In Armenia, there is no deposit with the possibility of a mine with 10 tons of gold amount with over C₁ reserve, except the Zod and Megradzor deposits, which are under operation. Judgment on development should be done by clarifying the reserve amount and grade by exploration for P and C₂ reserves on other deposits. Therefore exploration should be done with priority for 10 ton gold reserve. Tuhmanuk and Lusajour deposits are listed as target deposits because of having a possible medium-high grade gold (Table 5-6).

In the case of polymetal deposits that metals except gold have value, there is the possibility of development even though the gold grade is slightly low. It is thought that the Marjian and Verin Vardanadzor deposits are priority targets of exploration because of the expectation of increasing the reserves, especially Marjian accompanied with Mazmazak mineralization, 3 km northwest of the Marjian deposit. A huge increase of reserves is expected. Also it is recognized the intrusive of quartz monzonite at two places. Mineralization of copper and molybdenum is known. Therefore porphyry copper deposit is expected. Therefore exploration should start at first, regional geological survey, regional geochemical survey; then geophysical survey (IP, TDEM), detailed geological survey, drilling exploration are needed to be implemented.

6-4 Small-medium Scale Deposits

Characteristic of resources in Armenia is small-medium scale deposits. The above globalization is selective based on the principle of competitiveness. This gives a big damage to small-medium mining industry companies. The small-medium mining industry companies have kept their role of development as the core of the local economy. However, this matter has given a serious impact to the local society by the company's reduction and closing.

Table 5-6 Recommendation for Exploration

Deposits	District	Mine	Actual condition	Exploration
Copper Deposits	Southern District	Dastakerd	Reserves: 9.6 mill t, 0.95% Cu, 0.043% Mo (Rather high copper grade) Complicated geologic structure Production (underground and open pit): 0.4 mill t, Tailings: 0.09% to 0.16% Cu, 0.008 to 0.0043% Mo	Geophysical survey and drilling
	Northern District	Tekhut	Reserves (B+C1+C2): 450 mill t, 0.35% Cu, 0.022% Mo Drill core recovery in shallow areas: <70% Leached zone: 50 m to 70 m, 0.1% Cu Enriched zone: 20 m±	Drilling for oxidized zone
Gold Deposits	Southern District	Marjian	Reserves (C2): 3.5 mill t, 3.39g/t Au, 1.60% Pb, 1.28% Zn Mazmazak Ore Showing exists in ca 3 km NW More Cu-Mo indices around the mine. It is possible to develop both PC and polymetallic deposits.	Analysis for existing data Geophysical survey and drilling
	Northern District	Alaverdi to Shamloukh	Existence of silicified zones: max 1 g/t Au content in part It is convenient for Cu refinery for flux.	Geochemical survey and drilling

A small-medium scale deposit is not a target of the majors. It is thought that foreign companies participate in the development of medium-scale deposits in Armenia. However, their target is a deposit with the possibility of being mined by open-pit method. Therefore the target deposits are limited. Moreover, it is needed to recognize that foreign companies will withdraw if the feasibility becomes low and there is difficulty making a profit. Although there are some reasons Armenia depends on foreign investors, it is because of the lack of money. It is needed to have a target and realize it to establish a mining industry basement by domestic capital.

The mining industry with a target to participate in the global unified market is forecasted to have difficulty due to sustainable development because of the competitive power of the majors. A comprehensive system from exploration to smelting and manufacturing should be joined in a Caucasus area economic bloc by using Armenia's comprehensive basement. To progress on the development of the small-medium scale deposits linked to the contribution of the economy by underground resources based on a reciprocal relation of the Caucasus three countries and two countries' cooperation in Iran. Development of high-grade ore deposits, management of grade control and systemization are needed for strengthening of competitiveness. For this matter, it should be considered to do technical transfer and technical instruction by experts from mining industry advanced countries and Japan, etc. It is thought to have a two-step loan by the government with a government guarantee and management of a mining fund, etc. for raising funds for exploration and development for small-medium scale deposits. However, establishing a basement by the government with the possibility of finance from the financial market is a priority matter. It is thought that Armenia's mining industry should have a target, "mining industry activity in the Caucasus economic bloc". The Armenia mining industry activity's target is not a mining industry with globalization.

- Dependence on foreign capital is linked to risk. Raising of the mining industry by domestic capital is important

- Establishment of the financial market and financing from the financial market for developing small-medium deposits
- “Mining activity in the area” in the Caucasus economic bloc

6-5 Importance of Economic Evaluation

Economic evaluation by a pre-feasibility study for resources is indispensable in the stage of exploration and stage of finishing exploration. Moreover, the pre-feasibility study and case study for an operating mine are useful for management improvement. A case study is carried out for the copper mine in this survey. Technical improvement points for mining and processing are proposed. Also concreting problems on management and having a course on improvement became clear. It is needed to promote the mining industry, which can compete in the market economy, by spreading of knowledge on economic evaluation and recognition of its importance. People related to the mining industry especially executives and managers should have skills of economic evaluation.

6-6 Environmental Protection

Mining industry activity causes environmental pollution by the discharge of large amounts of waste in each process such as mining, processing and smelting because it has harmful heavy metals in the deposit. The waste becomes the cause of harmful heavy metal pollution. Waste is linked with health damage to man by the pollution of the soil, underground water and surface water. Also, there is a possibility to bring devastation to the land and destruction to nature by mining. The smoke from smelting plants becomes the cause of acidification of the rivers and acid rain.

Environmental regulations related to the mining industry have become strict in every country. Protection of the environment and local society should be considered from the beginning stage of development. Continuous protection of the environment is required after the completion of the mining activities. Watching the impact to the environment has become strict by monitoring of the mining industry companies by the government, local society and non-governmental organizations (NGOs). Strict management considering the environment has become thorough from the planning stage of the project for the protection against the huge cost in the case of an environmental problem occurs.

The future mining industry activity is difficult without placing a great importance on environmental protection. Environmental pollution has already accumulated in Armenia. The implementation of an environmental survey and countermeasures for the previous pollution must be done. However, countermeasures to environmental problems of the operating mines and smelting plants should be tried immediately to keep the pollution from expanding.

- Sulfur extracting facility of the Alaverdi Smelting Plant
- Clean up of tailings, which exists at the bottom of the river near the Kapan Mine
- Renewal of environmental facilities of operating mines and smelting plants.

Government organizations of the environmental administration must have facilities, equipment and manpower with a realistic practical function for environmental protection.

6-7 New Mining Industry

Solvent extraction-electrowinning (SX-EW), which produces copper metal directly from copper oxide ore, has increased its production amount for the past 20 years. Now the production share of copper metal by SX-EW is 20% in the world. The production cost is 20% lower than general concentrate production, although the rate is different for each deposit and weather condition.

The target is restricted to copper oxide ore. Now technology development is progressing to sulfide ore. Therefore, if the application area expands to sulfide ore such as copper, zinc, etc., there is a possibility that SX-EW will become the mainstream method of the mining industry in the future because of the method's advantages on cost and environmental protection. Tekhut deposit (copper, molybdenum, porphyry deposit), which is possessed by ACP in Armenia, has copper oxide on the top of the deposit. It is desirable to accumulate technology by the introduction of SX-EW method to the Tekhut deposit, even though the SX-EW method has still not been used in Armenia.

In-place leaching method applying the SX-EW method has been thought as a method of direct recovery for only target elements without mining ore in underground. Not only oxide ore, but also sulfide ore becomes a target like the above matter and low-grade ore becomes a possibility of the application. Therefore, the application has no waste rock, tailings and smelting slag, which is discharged in each process of the mining industry. This links the mining industry that is balanced with the environment. If this method is applied to the remaining reserves of closed mines, low-grade ore reserves will be linked to maintaining its resources and useful usage of resources. Moreover, the in-place leaching method is applied to tailings by using the mined-out areas in the mine. This is linked to resolve the environmental problems.

The Santa Cruz deposit of the USA has carried out proving tests of in-place leaching. Also in Japan, Tsuchihata mine is trying this method to process tailings by filling the mined-out areas on a small scale. However, there are many issues for technology development, such as making an environment for the leaching solution to leach useful elements by freely moving in an underground deposit, making many cracks to increase the contact area of the mineral containing the metal to the leaching solution, and making a closed environment to prevent the underground water outside of the deposit from mixing with the leaching solution. This 21st century new mining industry has a possibility for realization. Armenia also needs to watch the trend of technical development of the new mining industry like the above new mining industry (Fig. 5-9, Fig 5-10).

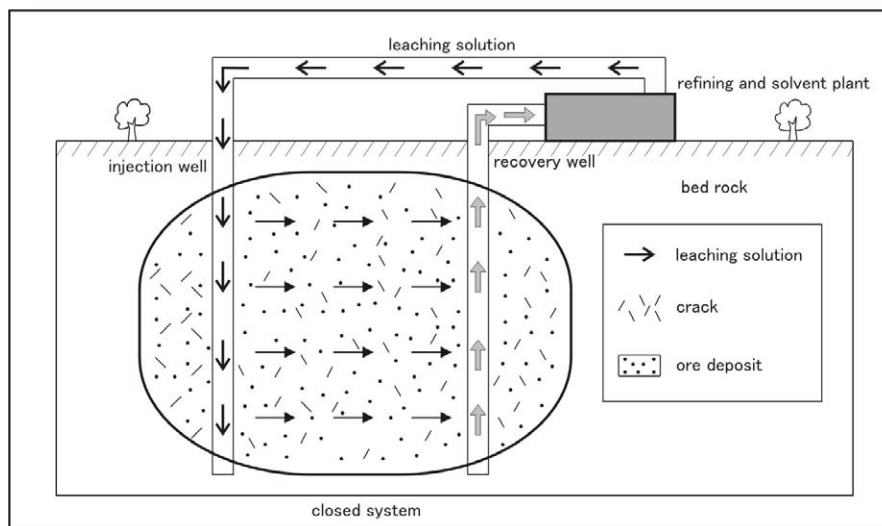


Fig. 5-9 Schematic Diagram of In-place Leaching

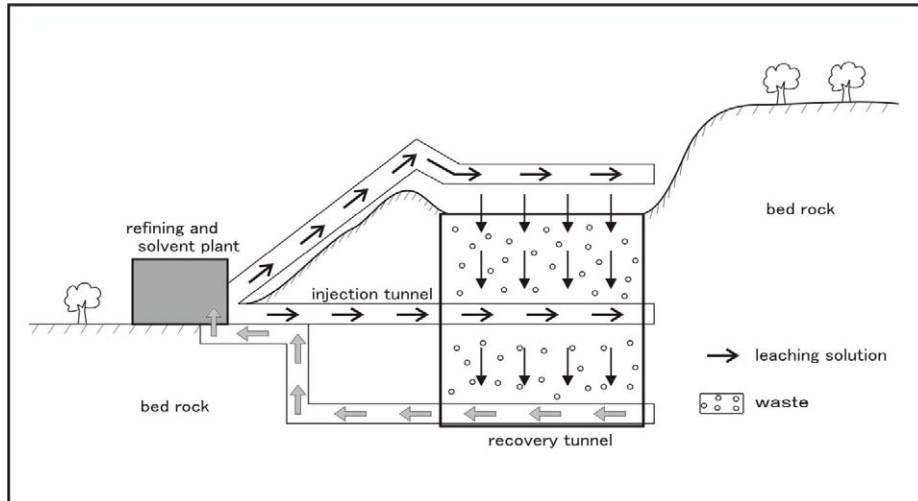


Fig. 5-10 Schematic Diagram of In-place Leaching used for a Mined-out Space

7. From Promotion of Mining Industry to Sustainable Development

7-1 Sustainable Development

“Sustainable Development” is the consensus of the international society. In the mining field, the Mining, Mineral and Sustainable Development (MMSD) project through the World Business Council for Sustainable Development (WBCSD) and International Institute for Environment and Development (IIED) has surveyed and studied for two years and their report was issued in May 2002. The MMSD report covered mineral, metal, exploration, production, usage, re-usage, re-cycling and final destruction. This report provides an efficient framework to the mining industry field for sustainable development including these broad fields.

- Comprehensive economic activity accompanied with efficient government system, social problems, and environmental protection \Rightarrow “sustainable development”
- Make cost reduction, make fair distribution of profit and, make stable condition for present generation, and make confirmation on the possibility of development for the next generation. \Rightarrow establish short- and long-term targets.
- Respect for rights and interest.
- Understanding of challenge and restriction.
- Public organization for thorough conformity to suitable standards.
- Scale with proven possibility for improvement and evaluation of progress.

These are basic concepts and each item is inter-related. Improvement by checking progress with the plan and long-term targets is the base. It is needed to advance development with understanding of standards and restrictions (Fig. 5-11).

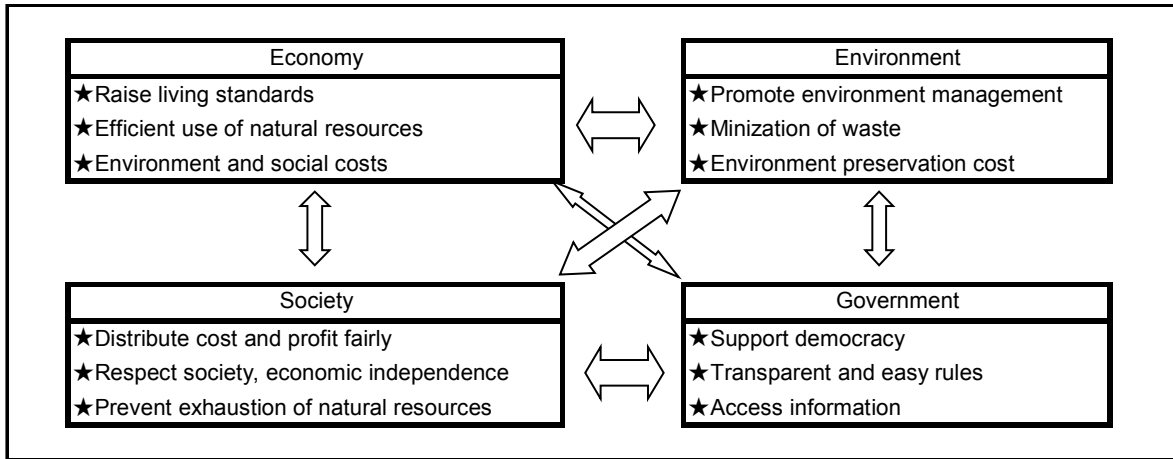


Fig. 5-11 Basic Concept of Sustainable Development

There are many subjects in the mining industry field for realizing “sustainable development” with these basic concepts. The main subjects are the role of resource development, tackling the environment subject, relation with the local society, value for information, etc. To tackle these subjects link to the promotion of the mining industry and development (Fig. 5-12).

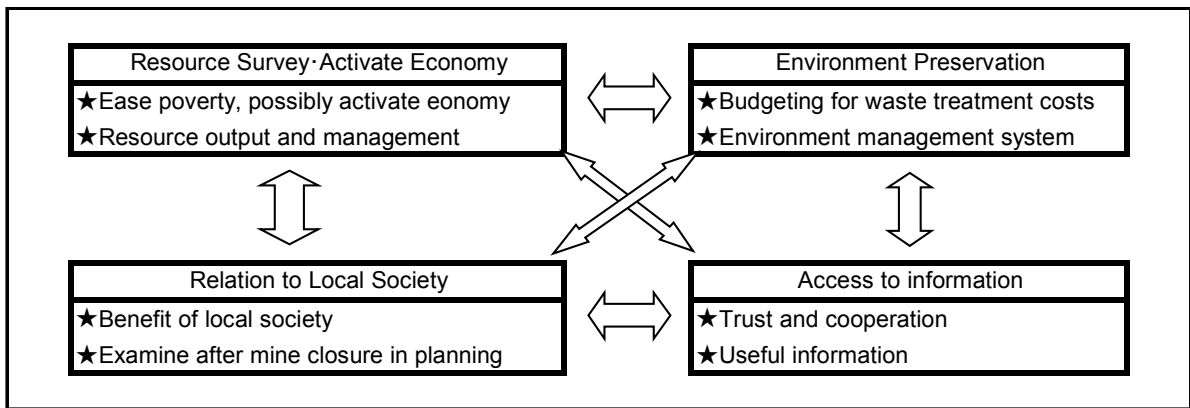


Fig. 5-12 Principal Subjects for Sustainable Development

There are important subjects, which should reform the present condition for “sustainable development”. The impact will be given for tackling the above mentioned main subjects if these reforms are not carried out.

- Who is to pay for the loss of heritage regarding to problems such as pollution and site destruction? How will money be raised?
- If the basic recognition for the mineral resource potential contribution to the national economy is lacking, the mining industry activity is not linked to fair usage and easing poverty.
- Group correspondence like the creation of good results by companies of all sizes is needed. It is needed to live in mutual peace and prosperity.
- Organizations like the Mining Association can provide group correspondence to local society and government organizations.

MMSD drew up four steps for realization of sustainable development, namely these steps are to construct an understanding of sustainable development, to make a management system, to establish a corporation relationship in relation to the advantages and disadvantages and to establish

the ability of treatment for effective activity (Table 5-7). Armenia mining industry must attempt to promote reconstruction of mines and promotion of exploration and development in the near future. However in realization of this Master Plan, the Armenia government should study the MMSD report for sustainable development and should tackle to use the framework of sustainable development.

Table 5-7 Outline of Sustainable Promotion Method (MMSD)

Step	Subject	Contents
1	Understanding of sustainable development	Enter curriculum for mine engineer education.
		Understand related to government organization, mine manager
		Engineer, researcher understand relation between their activity and this problem.
2	Make rule at organization level and management system	Make rule for sustainable development for each organization
		Company makes a management system for this subject (It I linked to low cost and efficiency)
3	Cooperation on advantage and disadvantage of mutual relation	Build a network of the group, organization
		Communication based on individual, make adjustment
4	Construction of management ability for efficient activity	Make relations with local society from survey stage
		Implement survey of environment and society from start of project
		Make contribution plan for local society around mine
		Review law, improve transparency of information disclosure by government

7-2 Correspondence to Globalization

Globalization requires severe competition with international liberalization and decreasing metal prices in the mining field. Many countries have opened their market in the mining industry field and they have attempted the introduction of foreign capital. Multinational companies (majors), have accelerated large-scale production and scaling up of machines, equipment, etc. by investment to develop large-scale deposits and large-scale mines. Super large-scale mines producing over 500,000 tons per year of copper metal basis are in operation in Chile and Indonesia. Solvent extraction electrowinning (SX-EX method), which produces metal directly from ore, has a 20% share of copper metal production in the world. The production cost is 20% lower compared to the usual method, which produces concentrate from ore and copper from smelting concentrate. It has become highly competitive with its low cost. Large capacity equipment, machines, etc., and large-scale production need huge amounts of investment. Therefore the competitiveness of small-medium scale mining companies, which have little capital, will drop more. The majors' production ratio has an increasing tendency.

Like this trend of the mining industry by globalization, the Armenia government should study how to correspond to this trend. It is an important subject that Armenia knows how to survive, which has not high potential for a large-scale deposit to exist because of having mostly small-medium mines and deposits. The Armenia government emphasizes dependence on foreign investment. However, it is needed to recognize that foreign capital can withdraw if their profitability becomes low and they have unprofitability. It should be realized its mining industry with a target for the construction of a mining industry basement by raising domestic capital and by domestic capital. Needless to say, emphasizing competitiveness by the smelting business in an area of cheap freight, reciprocal relationships among the three countries in the Caucasus, quality control, development of high-grade deposit and systemization, etc. should be needed. Moreover, it should be thought to seek mining activity in an area by the construction of a Caucasus economic block.

8. Information Disclosure and Use of Web Site

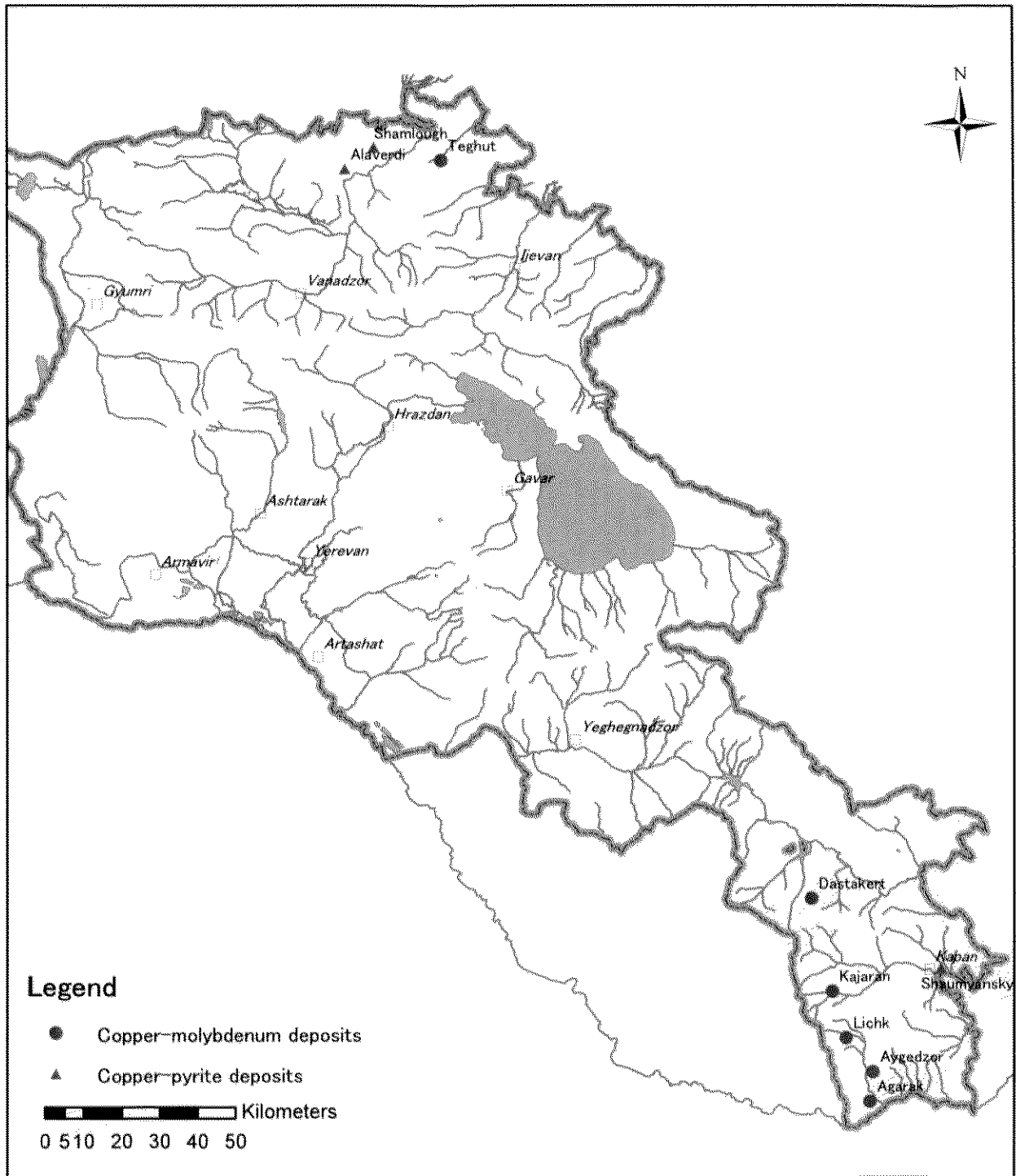
The fund and subsidy for the mining industry promotion should be used with a limited term and limited usage, which was mentioned in this Master Plan already. It is indispensable to secure transparency for having an efficient functional subsidy. It is needed to make a consensus of the nation about the understanding the administration of the subsidy, its procedure and limit to a target by information disclosure. Mineral resource use tax is thought to be one of the sources for the mining fund. However there is a possibility that the reduction of tax revenue by incentive privilege of the tax system could produce fear to accelerate more reductions of tax revenue. Development of industries including the mining industry and protection of the environment should be in harmony. Presently the development of industry is positioned with the importance of the environment in the trend of the great importance placed on environmental protection in the whole world. Therefore it is needed to study that the source of the fund for the mining fund is from the environment tax, but it is important for securing transparency for this fund. Establishing of a fund is difficult without making a consensus of the nation.

Disclosure is a principle for the realization of subsidy and fund. It is desirable to use the web site, which was constructed by this survey as a place for information disclosure. Now the web site has been made in English. However, it is important and useful as a place for making a consensus of the nation by making the site in the Armenian language.

(End of Summary of the Report)

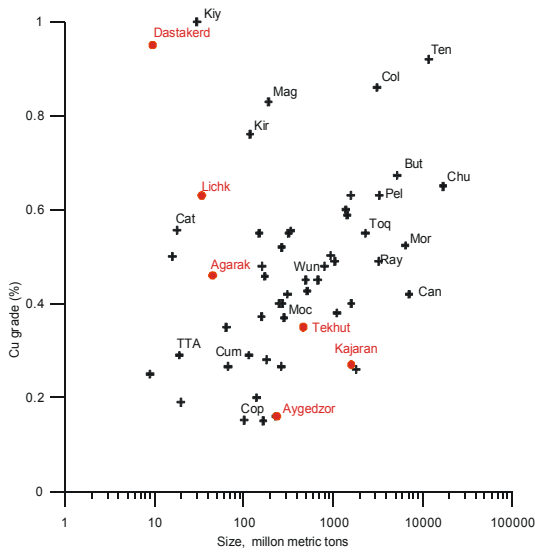
Appendix

Appendix 1

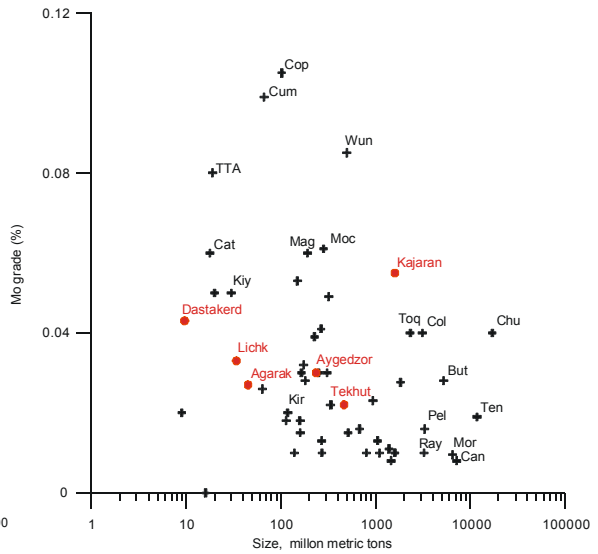


Location Map of Copper-Molybdenum and Copper-Pyrite Deposits in Armenia

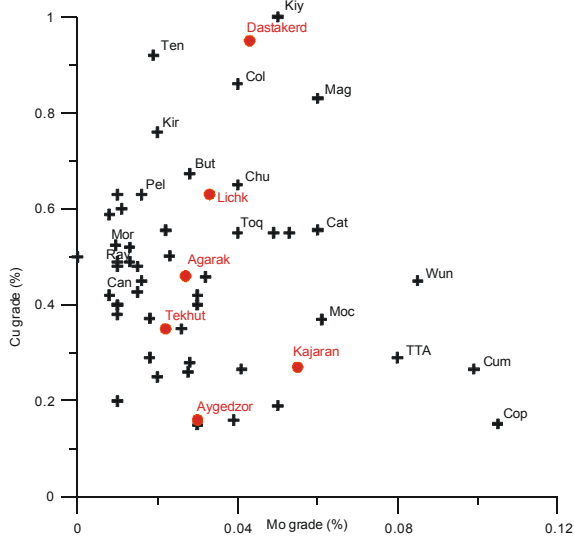
Appendix 2



Cu grade - tonnage diagram



Mo grade - tonnage diagram



Cu-Mo GRADE OF PORPHYRY Cu-Mo DEPOSITS

● : Deposits in Armenia
 + : Deposits in the World

Ore Reserve and Grade of Principal Copper-Molybdenum Porphyry Deposits

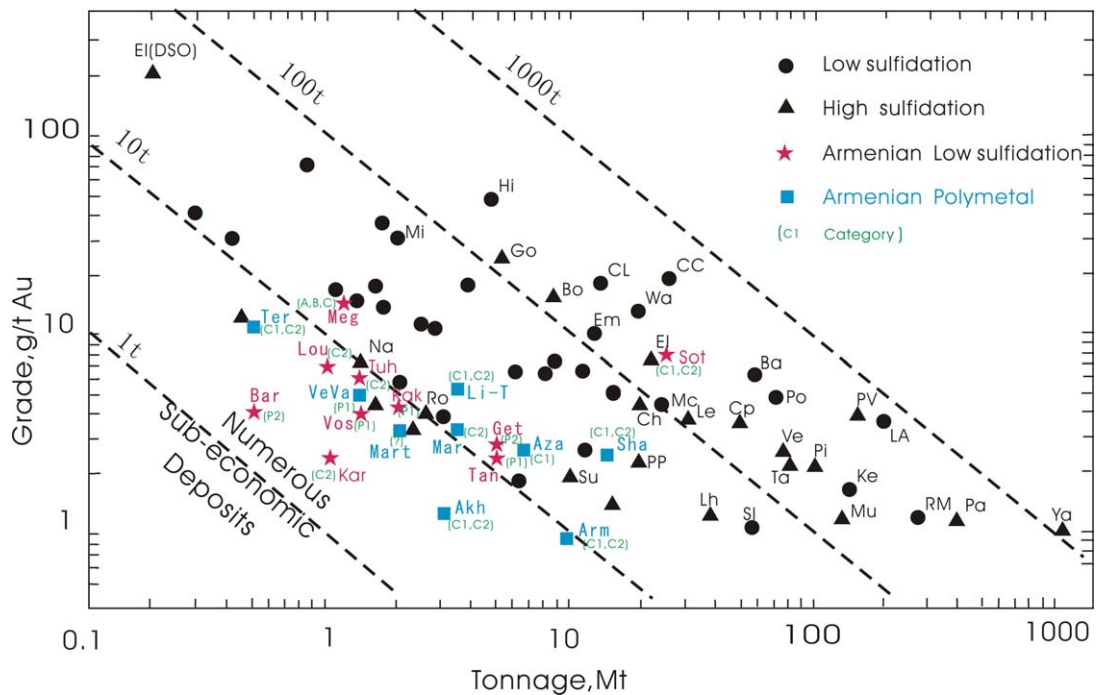
Butt=Continental/Butte,USA : Can=Cananea,Mexico : Cat=Catheart Mt.,USA : Chu= Chuquicamata,Chile : Col=Collahuasi,Chile : Cop=Coppin Gap,Australia : Cum=Cumobabi, Mexico : Kir=Kirwin,USA : Kiy=Kiyalykh-uzen,Russia : Mag=Magistral,Peru : Moc=Mococa, Colombia : Mor=Morenci- Metcalf,USA : Pel=Los Pelambres Chile : Ray=Ray, USA : Ten= El Teniente,Chile : Toq=Toguepala,Peru : TTA=Taca Taca Alto,Argentina : Wun= Wunugetushan,China

Appendix 3



Location Map of Gold and Gold-Gold-Polymetallic Deposits in Armenia

Appendix 4



Ore Grade and Reserve Diagram of Hydrothermal Gold Deposits (modified from GOLD IN 2000, p263)

Ba=Baguio,Philippines : Bo=Boliden,Sweden : CC=Cripple Creek,Colorado : Ch=Chinkuashih,Taiwan : CL=Comstock Lode,Nevada : Cp=Chelopech,Bulgaria : EI=El Indio,Chile : EI(DSO)=El Indio direct shipping ore : Em=Emperor,Fiji : Go=Goldfield,Nevada : Hi=Hishikari,Japan : Ke=Kelian,Indonesia : La=Ladolam,Papua New Guinea : Lh=Lahóca,Hungary : Le=Lepanto,Philippines : Mc=McLaughlin,California : Mi=Midas,Nevada : Mu=Mulatos,Mexico : Na=Nansatsu district deposits,including Kasuga,Japan : Pa=Pascua,Chile : Pi=Pierina,Peru : Po=Pogera,Papua New Guinea : PP=Paradise Peak,Nevada : PV=Pueblo Viejo(oxide+sulfide),Dominican Republic :Ro=Rodalquilar,Spain : RM=Round Mountain,Nevada : SI=Sleeper,Nevada(average ore) : Su=Summitville,Colorado : Ta=Tambo,Chile : Ve=Veladero,Argentina : Wa=Waihi,Martha Hill,New Zealand : Ya=Yanacocha,Peru
 Akh=Akhtala : Arm=Armanis : Aza=Azatek : Bar=Bartsravan : Get=Getik : Kak=Kakavasar : Kar=Karaberd : Li-T=Lichkvas-Tey : Lou=Lousajour : Mar=Marjian : Mart=Martsiget : Meg=Meghradzor : Sha=Shahumian : Sot=Sotk : Tan=Tandzut : Ter=Terterasar : Tuh=Tuhmanuk : VeVa=Verin Vardanazor : Vos=Voskedzor