Japan International Cooperation Agency（JICA）
Steering Committee of Mining Promotion Master Plan Study
of Government of Georgia

No.

Master Plan Study
on
Promotion of Mining Industry
in Georgia

Final Report

January 2002

Mitsui Mineral Development Engineering Co., Ltd.

MPN
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Preface

In response to a request from the Government of the Georgia Republic, the Government of Japan decided to carry out the Master Plan Study on Promotion of Mining Industry in Georgia. The Japan International Cooperation Agency (JICA) implemented this study.

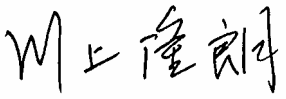
JICA sent a study team led by Mr. Yuji Nishikawa of Mitsui Mineral Development Engineering Co., Ltd. The team was organized by Mitsui Mineral Development Engineering Co., Ltd. and Japan Association for Trade with Russia and Central-Eastern Europe. There were five trips to Georgia from March 2001 to January 2003.

The study team held discussions with government officials related to the mining industry and conducted field surveys. After returning to Japan, the study team carried out further studies and compiled the final results in this report.

We hope this report will contribute to the promotion of mining industry sector and a more close relationship between both countries.

We also express our sincere appreciation to the Government of Georgia and its officials related to the mining industry organizations for their close cooperation throughout the study.

January 2003



Takao KAWAKAMI
President
Japan International Cooperation Agency

January 2003

Mr. Takao KAWAKAMI
President
Japan International Cooperation Agency
Tokyo, Japan

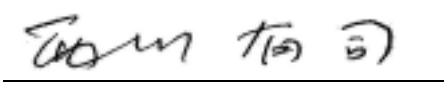
Letter of Transmittal

We are pleased to submit the report of the Master Plan Study on Promotion of Mining Industry in the Georgia to you.

This study was conducted by the Mitsui Mineral Development Engineering Co., Ltd. with the Japan Association for Trade with Russia and Central-Eastern Europe, under a contract with JICA, during the period from March 2001 to January 2003. This report was compiled and summarized the promotion and improvement measures for the basement area of the mining industry and production area through the recent condition analysis and results of the pre-feasibility study for the mining promotion in Georgia.

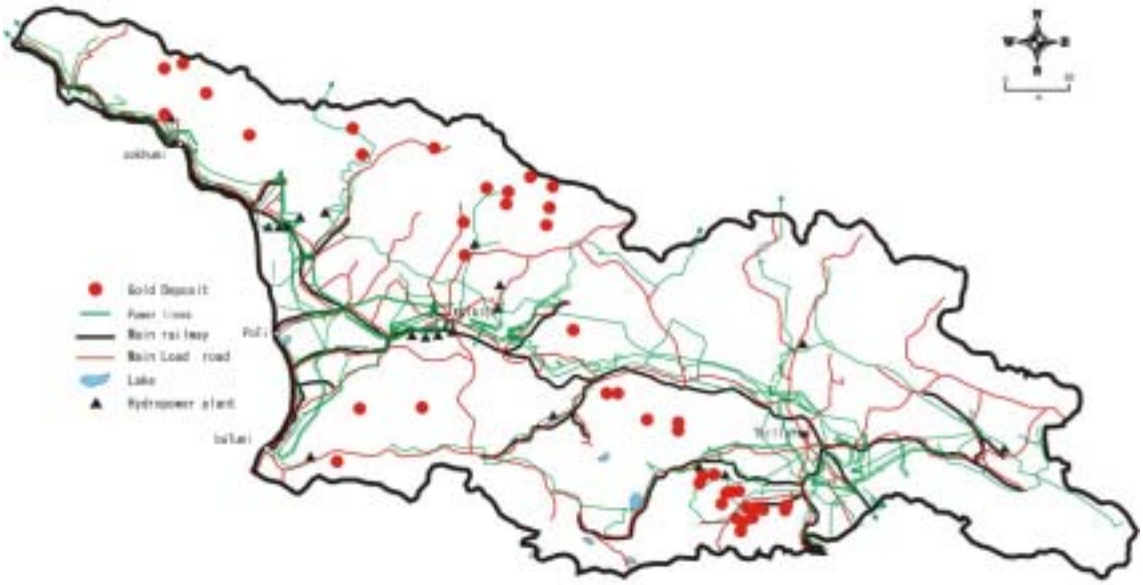
Improvement and promotion measures are positioned in the promotion Master Plan toward the recovery and growth of the economy by the mining industry promotion. We hope that the Georgia government realizes this Master Plan as the highest priority subject based on the necessity of the development of society and economy for the whole country of Georgia by pulling out of the stagnation of the mining industry in the transition to a free economy and by the recovery of productivity, promotion of investment and introduction of foreign capital.

We would like to express our sincere gratitude to the officials of JICA, Ministry of Foreign Affairs and Ministry of Economy, Trade and Industry for their support and guidance in carrying out this project. We are grateful to the officials in the Steering Committee and Working Team for this study in Georgia, JICA U.K. Office and Embassy of Japan in Azerbaijan for their cooperation and assistance throughout our field survey.

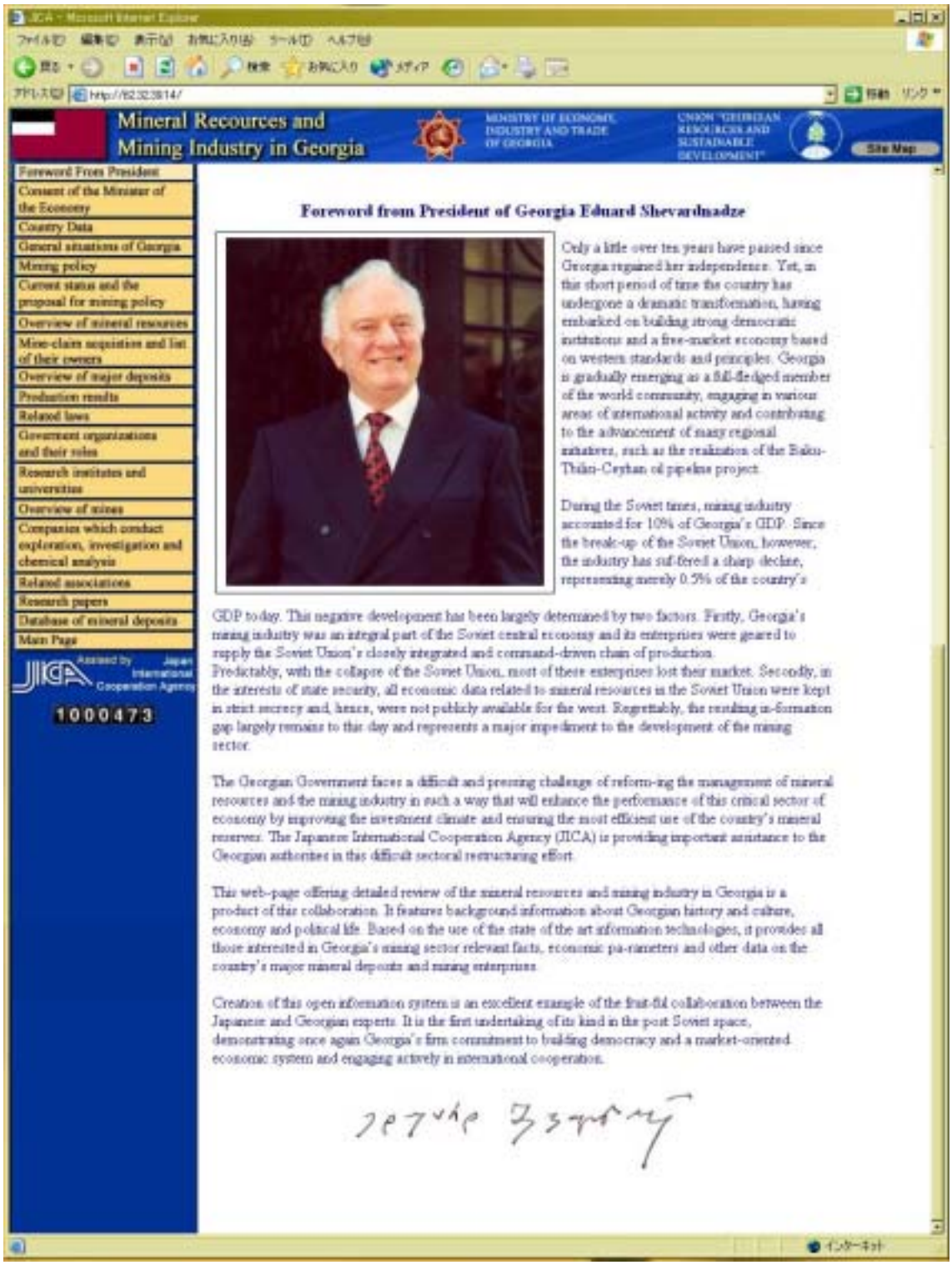


Yuji NISHIKAWA
Leader
Master Plan Study on Mining Industry
In Georgia

Transit Country – Georgia



Gold Deposits and Infrastructure in Georgia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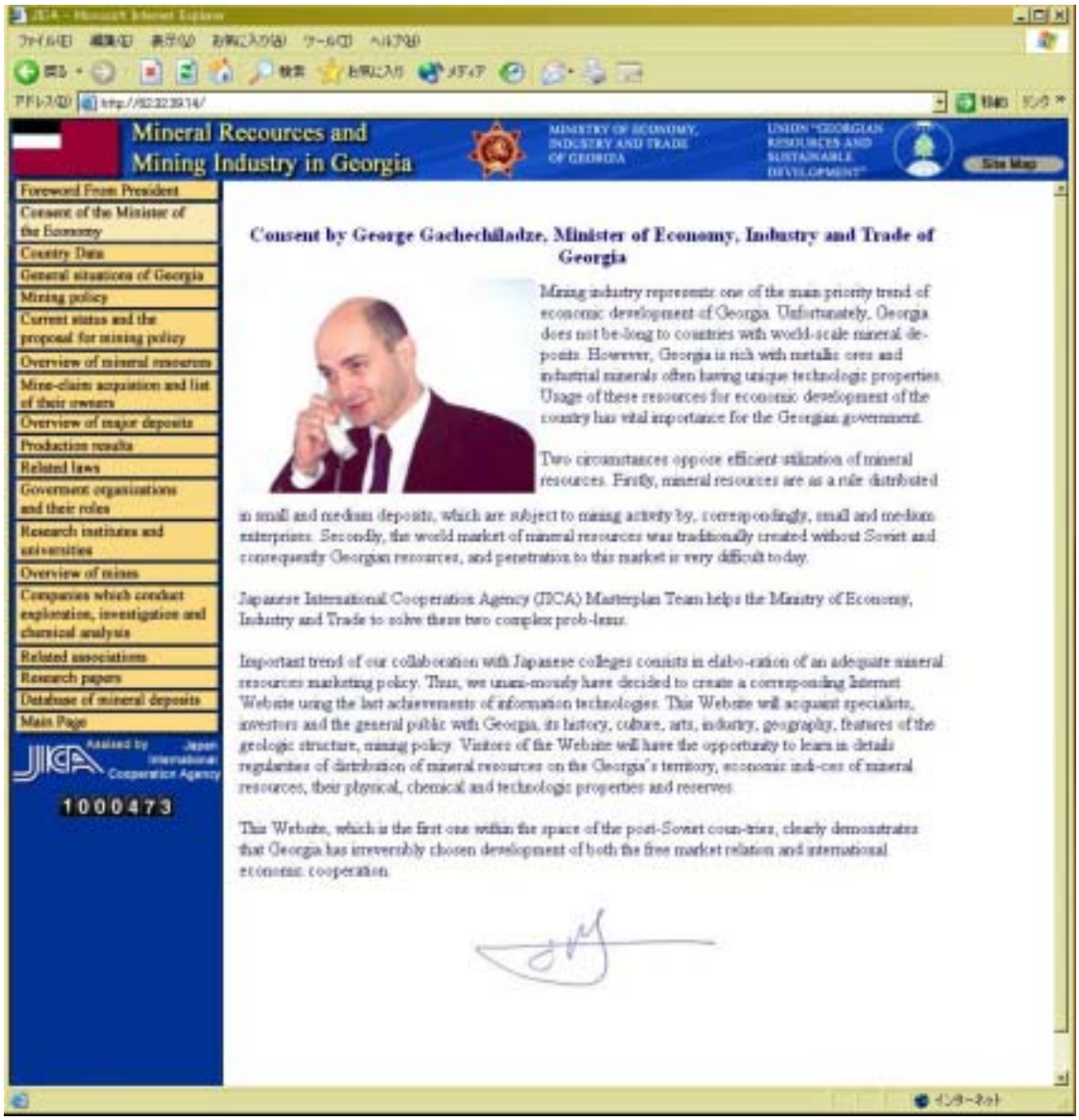
Foreword from President of Georgia Eduard Shevardnadze
Only a little over ten years have passed since Georgia regained her independence. Yet, in this short period of time the country has undergone a dramatic transformation, having embarked on building strong democratic institutions and a free-market economy based on western standards and principles. Georgia is gradually emerging as a full-fledged member of the world community, engaging in various areas of international activity and contributing to the advancement of many regional initiatives, such as the realization of the Baku-Tbilisi-Ceyhan oil pipeline project.
During the Soviet times, mining industry accounted for 10% of Georgia's GDP. Since the break-up of the Soviet Union, however, the industry has suffered a sharp decline, representing merely 0.5% of the country's GDP today. This negative development has been largely determined by two factors. Firstly, Georgia's mining industry was an integral part of the Soviet central economy and its enterprises were geared to supply the Soviet Union's closely integrated and command-driven chain of production. Predictably, with the collapse of the Soviet Union, most of these enterprises lost their market. Secondly, in the interests of state security, all economic data related to mineral resources in the Soviet Union were kept in strict secrecy and, hence, were not publicly available for the west. Regrettably, the resulting information gap largely remains to this day and represents a major impediment to the development of the mining sector.
The Georgian Government faces a difficult and pressing challenge of reforming the management of mineral resources and the mining industry in such a way that will enhance the performance of this critical sector of economy by improving the investment climate and ensuring the most efficient use of the country's mineral reserves. The Japanese International Cooperation Agency (JICA) is providing important assistance to the Georgian authorities in this difficult sectoral restructuring effort.
This web-page offering detailed review of the mineral resources and mining industry in Georgia is a product of this collaboration. It features background information about Georgian history and culture, economy and political life. Based on the use of the state of the art information technologies, it provides all those interested in Georgia's mining sector relevant facts, economic parameters and other data on the country's major mineral deposits and mining enterprises.
Creation of this open information system is an excellent example of the fruitful collaboration between the Japanese and Georgian experts. It is the first undertaking of its kind in the post Soviet space, demonstrating once again Georgia's firm commitment to building democracy and a market-oriented economic system and engaging actively in international cooperation.

President



Minister of Economy, Industry and Trade of Georgia

Master Plan Study on Promotion of Mining Industry in Georgia

Final Report

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Chapter 1. Purpose and Background of Survey

1-1 Background of Survey

Georgia became independent as a result of the collapse of the former USSR in December 1991. Georgia started economic reform such as management of law, privatization, etc. for construction of a free economic system. However, the reform has not been progressing because of political instability and racial conflict. The reform has been promoted by the support of the World Bank (WB) and IMF. The GDP has been increasing since 1996 through the introduction of its new currency, the Georgia Lari (GEL). However the financial deficit has been continuing and its economic basement is still brittle. Georgia has a structure for the occurrence of a financial deficit.

The Georgia government expects the mining industry to be like an engine pulling industries for economic development and that it has a big role in industry for the reconstruction of the government finance. The government is carrying out the arrangement of the investment environment with the most importance put on the reconstruction of its mining industry for linking the promotion of mining industry domestic metal resources (manganese, copper, lead, zinc, and gold). However, there is some foreign capital participation now. The reason is thought to be the government lacks concrete strategy and policy, and functions of its organizations are dispersed and in poor financial condition. Besides it does not have sufficient ability for making a comprehensive development plan and has not grasped the mining industry's potential for the reconstruction of its economy.

1-2 Purpose of Survey

The purpose of this survey is to make a Master Plan for the development of the mining industry and implement countermeasures in the pre-feasibility study on a specific mine and the promotion of the mining industry that had composed the core industry in Georgia.

- In Phase I, it selects a problem and compiles concrete mining industry countermeasures for the promotion plan by the survey on mainly the basement area of the mining industry
- In Phase II, the improvement countermeasures on mining are materialized by the pre-feasibility study of a specific mine with analysis of the conditions in the production area
- Technical transfer related to the mining promotion of the Master Plan survey is carried out to the organizations related to the Steering Committee members. These organizations are the Ministry of Economy, Industry and Trade who is the counterpart of this project, State Department of Geology, and Ministry of Environment Protection and Natural Resources.

1-3 Target of Survey

(1) Target Area of Survey

Target is Georgia

(2) Target Metal Type

Gold, copper, lead, zinc, manganese, silver and arsenic.

(3) Target Mine and Combinat

Madneuli Mine (Au & Cu), Uravi Mine (As), Chiatura Mine & Combinat (Mn) are the targets but the 2nd site survey is targeting the Madneuli Mine because of security reasons.

1-4 Method of Survey

In Phase 1 in this survey, the condition of economy, positioning of mining industry in macroeconomy, recent condition of basement areas of mining industry (administration, law and tax system, infrastructure, education, etc.) and production area (mineral resources, exploration, mine, environment, etc.) were surveyed. The analysis of the cause of the problem and selection of the subject was attempted. The master plan and action program for the promotion of the mining industry, as drafted were concreted.

The study of the documents and hearing from government organizations of Georgia and mining organizations related to the mining industry was basic for this survey. In addition, the master plan and action program have a possibility of realization and effect on the master plan and action program was studied through dialogue and discussion with these organizations. Also the recent condition of the information infrastructure was grasped, drawing up of the framework on the database and input of a sample for the contribution for the mining industry promotion was carried out. The design of the web site was concreted and its course became clear.

The technical transfer was attempted through the implementation of the survey and discussion to realize the action program and working team (Working Group) meeting, etc. Also the technical transfer was done through the actual practice work of the database making. The importance of the mining industry promotion, recent condition of the mining industry and necessity of the action program was recognized by the executive management staff of the Georgia government and parts of the international organizations through the mining industry seminar held by the Ministry of Economy, Industry and Trade as the counterpart. Geochemical and geophysical exploration was carried out for the confirmation of the mineral resource potentiality around the Madneuli mine. The acquired data and analysis from these exploration to phase II feasibility study was done.

The pre-feasibility study on the Madneuli mine was implemented in Phase II. Measures for improvement were concreted by the extraction of problem points through a site survey at the Madneuli Mine. The analysis of the feasibility was carried out by fixing the conditions for the economic evaluation based on the measures for improvement. The supplement survey related to international accounting standards was implemented and examined measures for improvement by the extraction of problem points on the spreading condition and actual situation in the mining industry area. For the deep understanding on international accounting standards, a seminar on this subject was carried out. Moreover, systemization by computer for the registration of licenses was studied and the web site was constructed. The transfer of technology was realized through these practical works.

An action program was purposed regarding the basement field, production field and information infrastructure by making the Master Plan Study on Promotion of Mining Industry in Georgia through Phase I and II.

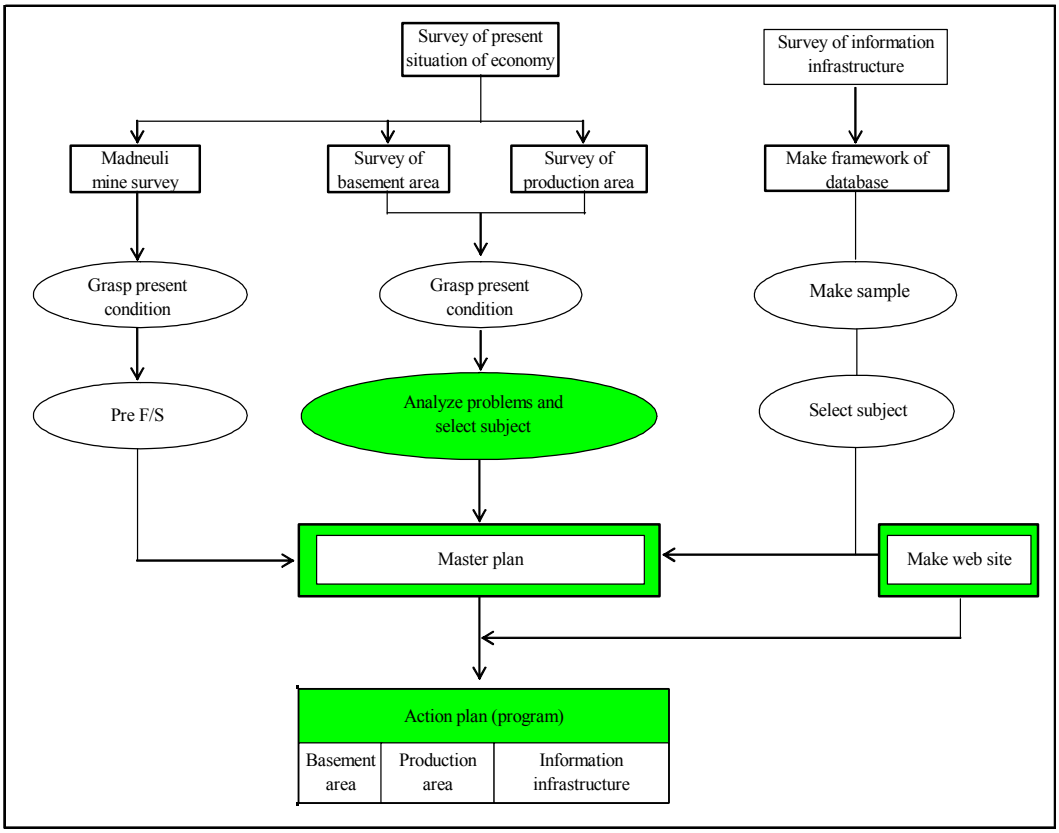


Fig. 1.1 Survey Flow Sheet

1-5 Implementation of Site Survey

(1) Implementation Schedule of Survey

The 1st site survey was the Mission of Master Plan implemented on the planned schedule by seven people from June 4- August 19, 2001 (77 days).

The 2nd site survey was the Mission of Master Plan implemented on the planned schedule by eight people from December 2, 2001-March 6, 2002 (95 days).

The 3rd survey was the Mission of Master Plan implemented on the planned schedule by seven people from June 2-19, 2002.

The 4th survey was the Mission of Master Plan implemented on the planned schedule by six people from August 22- October 2, 2002.

The 5th site survey was the Mission of Master Plan implemented on the planned schedule by six people from December 11-26, 2002 (16 days).

(2) Members of Mission

The members of the mission are as follows.

Table 1.1 Survey Schedule & Charge of Business

Name	Responsibility	Phase I		Phase II		
		1st Site Survey	2nd Site Survey	3rd Site Survey	4th Site Survey	5th Site Survey
Nishikawa, Yuji	Team Leader, Mining Industry Promotion Plan	6/ 4 ～8/ 5	12/2～12/29 1/7～2/9	6/2～6/19	8/22～9/17	12/11～ 12/26
Okada, Kunio	Economic, Financial Analysis	6/11～6/19 7/3～ 7 /23	1/20～2/3	6/9～6/17	9/16～9/21	
Marutani, Masaharu	Exploration Expert ①	6/ 5～8/5	12/2～12/30 1/17～2/10	6/2～6/9	9/15～9/25	12/16 ～ 12/24
Watanabe, Hidehisa	Exploration Expert②	7/ 6～8/10	12/2～12/30	6/2～6/9	8/22～9/1	
Murata, Masatoshi	Mineral Processing Expert	6/ 5～8/ 5	1/17～3/6	6/2～6/16	8/22～9/22	1216/ ～ 12/24
Sakai, Daigaku	Mining	6/19～8/19	1/17～3/6	6/2～6/9	8/22～10/2	12/16 ～ 12/23
Ohya, Takashi	Environmental Management	7/6～8/19	12/2～12/30	6/2～6/9		12/17 ～ 12/24
Saito, Mitsuyoshi	Coordinator	-	1/17～2/1		8/26～9/7	12/16 ～ 12/23

(3) Minutes with Georgia Side

The Japanese mission of the Master Plan held five Steering Committee meetings, with the Steering Committee which is the organization responsible for the Georgia side of「Master Plan Study on Promotion of Mining Industry in

Georgia」 and agreed on the below contents and confirmed the minutes (Progress Report 2 Appendix 2, Progress Report 1 Appendix 2).

(a) First Steering Committee on June 12th

- Explanation of the Inception Report from the Japan side.
- Explanation and exchange views about making the measures for the 「Master Plan Study on Promotion of Mining Industry in Georgia」.
- Confirmation such as course of survey, method, content, schedule, etc.
- Explanation of actual conditions of economy and mining industry, mineral resources, potential by the Georgia side.

(b) Second Steering Committee Meeting on July 31st

- Interim Report for the survey and progress of the survey by the Japan side.
- Exchange of views about the survey's interim results and progress of the Survey.
- Confirmation of methods for making database and specifications.
- Confirmation of the second site survey schedule.

(c) Third Steering Committee Meeting on January 29th

- Promotion measures drafted by the Japan side should be studied by the Working Team (Working Group).
- The result studied by the working team should be decided by the chairman (result of the content of working team on February 1st was approved by the chairman.-Japan side draft was approved).

(d) The fourth Steering Committee meeting on June 7th

- Draft Final Report should reflect the items pointed out by the working team. The Interim Report was made by the Japan Survey Team.
- The target mine for the pre-feasibility study is the Madneuli Mine.

(e) The fifth Steering Committee meeting on December 20th

- The Final Report should reflect the items pointed out in the Draft Final Report by the working team

(f) Supply of Equipment by Procurement in Tbilisi

- Japan mission procured equipment at the site by order from JICA and installed the equipment at Ministry of Economy, Trade and Industry and Ministry of Environment Protection and Natural Resources.

(4) Holding of Mining Seminar

Mining seminar was held at the Ministry of Economy, Trade and Industry on January 31st and February 1st in Tbilisi. The Ministry of Industry and Trade was the host and the union of the Sustainable Mineral Resources Development

of the NGO and JICA mining promotion master plan team were co-sponsors. Participants were Georgian government organizations such as the State Ministry, Ministry of Economy, Trade and Industry, Ministry of Environmental Protection and Natural Resource, State Department, EBRD, American Embassy in Georgia, etc., a total of over 100 people. Also the Embassy of Japan in Azerbaijan and master plan team from Japan participated.

The lecture was composed of three speeches from the Georgia side, three speeches from the master plan team and one speech from EBRD. The content of the seminar was published as proceedings after the seminar (Appendix 2).

The mining seminar was sponsored by JICA and Ministry of Economy, Trade and Industry and Trade that was held at the Ministry's Green Hall in Tbilisi on December 20, 2002. The participants were composed of the Ministry of Economy, Trade and Industry, Ministry of Finance, Ministry of Environmental Protection, State Department of Geology, mining associations, Institute of Geology, Madneuli Mine, Japan Embassy, Institute of Industry of Japan, JICA Survey Team, etc., a total of over 50 people. The web site presentation was held at the Georgia International Oil Company's conference room at Tbilisi on December 19th. The participants were from the above mining industry organizations and media of Georgia, a total of 60 people.

(5) Contract Work

a. Exploration of the surrounding area of the Madneuli Mine

- Geophysical survey — December 20, 2001 - January 20, 2002 (site survey)
  Site survey people; JSC Geology Georgian
- Geochemical exploration — December 20, 2001 - January 10, 2002 (site survey)
  Site survey people; Trans Georgian Resource Ltd.

b. International Accounting Standards Supplement Survey

- August 26, 2002 - September 25, 2002
- Survey by MJRS Ltd. (UK)

c. Web site construction

- August 29, 2002 - December 10, 2002
- Maker; IT Group Ltd.

(6) Steering Committee and Working Team Members

The Georgia side established the Steering Committee for the implementation of this project by Presidential decree for the decision-making. In the same way, the Working Team was established for examining and advancing the survey for practical work. The Japan side members discussed with the Working Team several times for the recognition of Georgia's mining condition and making the promotion for the mining industry. The Japan Team carried out joint surveys and showed the plan and promotion measures to the Steering Committee five times. The Japan team discussed with the Working Team about the content of the survey and promotion measures.

Steering Committee Members

	Name	Organization
Chairman (Actual)	G. Gachechiladze (Minister)	Ministry of Economy, Industry and Trade of Georgia
Tentative Substitute	Paata Charakashvili (Deputy Minister)	Ministry of Economy, Industry and Trade of Georgia
Members	S. Toprakashvili	Ministry of Economy, Industry and Trade of Georgia
	T. Janelidze (Head)	State Dept. of Geology
	V. Buadze	State Dept. of Geology
	A. Panchulidze (Deputy Minister)	Ministry of Environment and Natural Resources Protection
	A. Kikabidze	Ministry of Environment and Natural Resources Protection
	A. Tvalchrelidze	Independent Expert
	A. Bejanishvili (Head)	Technical Supervision State Inspection
	N. Kukuladze	Institute of Mining Mechanics
	E. Mataradze	Mining Association
	M. Ugulava (Deputy Director)	Georgian National Investment Agency

Working Team Members

	Name	Organization
Chairman	S. Toprakashvili	Ministry of Economy, Industry and Trade of Georgia
Substitute	M. Ugulava (Deputy Director)	Georgian National Investment Agency
Members	V. Buadze	State Dept. of Geology
	M. Chokhonelidze	State Dept. of Geology
	E. Mataradze	Mining Association
	N. Kukuladze	Institute of Mining Mechanics
	G. Japaridze	Independent Expert
	A. Kikabidze	Ministry of Environment and Natural Resources Protection
	G. Kemoklidze	Georgian National Investment Agency
	A. Bejanishvili (Head)	Technical Supervision State Inspection

Chapter 2. Present Conditions of Mining Industry

Georgia was positioned as a mining country in the former USSR era. Georgia had a role as the basement of raw material supply for copper, manganese and arsenic. The mining industry showed a 10% share of the GDP. Georgia has promoted reform to a free market economy by its independence. However, the base of the mining industry, which Georgia had constructed as an advanced mining industry country, has weakened by the transition to a free economy. The production amount of the mining industry has dropped and is in stagnation. The copper mine is recovering, but as a whole Georgia still has concerns such as the reconstruction of mines, promotion of exploration and development and the introduction of foreign capital.

1. Grasping the Present Conditions of Mining Industry

By the investigation of the basic fields of economics, law, taxation, organization, etc. that support the mining industry and each item, which covers the whole production fields of mining technology, mining, environment, the present situation was grasped for the examination of the promotion of the mining industry. (Table 2-1, Fig. 2-1, Fig. 2-2)。

- The raising of funds and products are a difficult situation.
- Functions of the government organizations are not sufficient.
- There are some unsuitable points in the laws and regulations.
- There are many hindering factors to exploration and development.
- The mine becomes a vicious circle management composition by the causes of lack of finance, superannuated facilities and equipment, loss of market and efficiency of productivity.

The resolution on the subjects of financial market and economic conditions for supporting the mining industry is also indispensable to areas outside of mining with the recognition of the recent mining conditions. It is necessary to reform and improve the recent conditions based on the concrete recognition of hindering factors of exploration and development and management of a vicious cycle.

Table 2.1　Present Conditions & Subjects of the Mining Industry (generalization)

Item	Present Condition	Subject
Finance	Short-term finance with high interest rate	Financial market formation, trust of bank
Tax System	Large amount, many kinds, declaration procedure	Simplify tax system
Trust of Bank	Low trust worthiness and savings amount	Political stability, decrease of underground economy
Mining Law	Prohibit transfer of license, no area limitation, acquisition procedure troublesome	Improvement by European (EU) and American standards
Mine Safety Laws	Inflexible, unsuitable for some technology	Improvement by EU & American standards
Resource Information	Difficult access, insufficient arrangement & public disclosure	Make database. Establish Web site.
Investment	Complex registration procedure, vague guarantees	Simplify procedure, concreted guarantees
Mining Industry policy	Nothing concrete, making underground resources development plan	Draft policy that defines role of mining industry in the economy, draft budget
Privatization	Unreasonable conditions, joint stock company (state company), tender failed.	Solve problems concretely for privatization
Mining Organizations	Scattered	Unified
Mining Budget	Almost nothing	Need to give priority to mining industry
Environmental Issues	Actual situation of metal pollution at each mine is unclear	Grasp pollution based on environmental survey
Mine Debt	Excessive accumulated debt	Production recovery
Operation, Management	Difficult financing, productivity decline, large costs	Financing, rationalizing
Exploration, Development	Almost nothing	Financing, information arrangement & service
Exploration Technology	USSR type, USSR evaluation technique	Introduce evaluation technique
Mining Technology	Functions and systematization insufficiency	Introduce systemization & automation
Mine Training	Consistent training, aged facilities	Repair facility
Production	Declining situation, aged facilities & damaged	Renew facility, improve quality
Infrastructure	Stopped the repair and maintenance of the road, repair of electric power facilities	Road network maintenance, stable supply of electricity

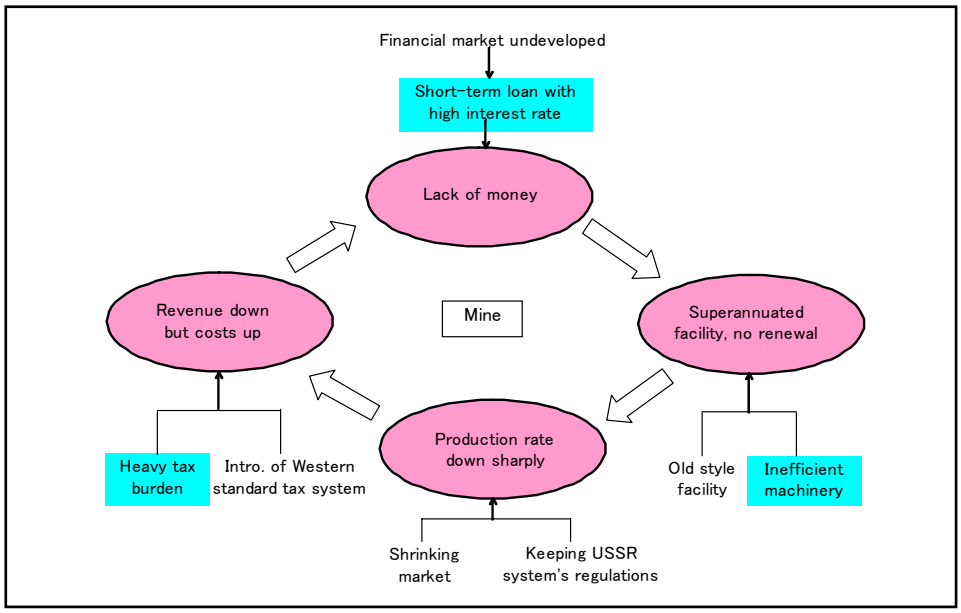


Fig. 2.1 Viscous Cycle for Mining Activity

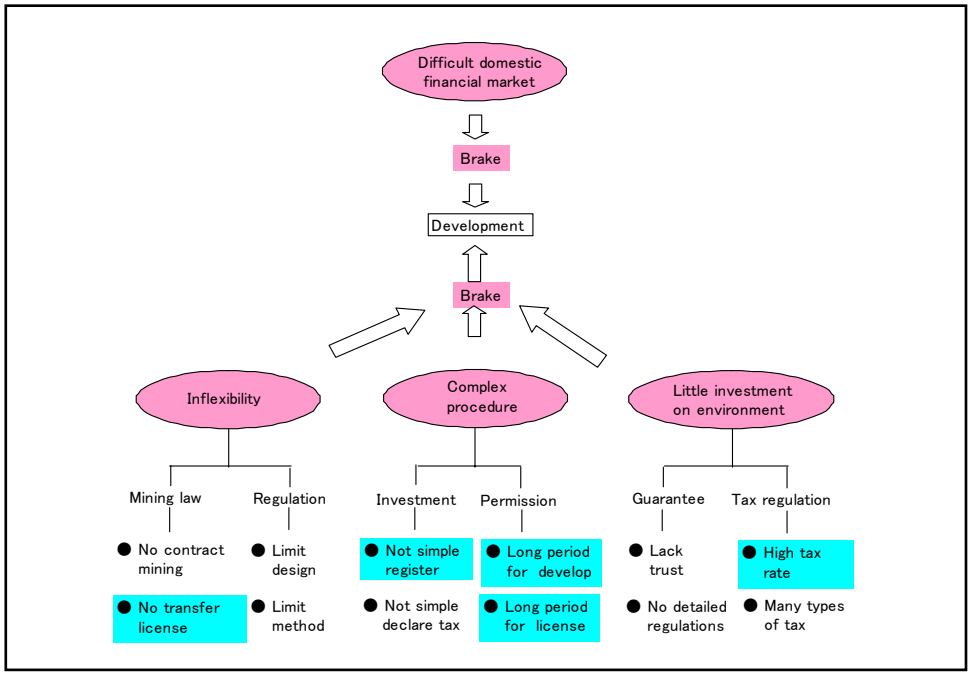


Fig. 2.2 Hindering Factors on Development

2. Present Condition of Economy

2-1 Condition of Economy

GDP (34.9% decrease in 1991) has decreased since independence but turned positive to 11% per year from the influence of business related to the infrastructure arrangement of transportation from Azerbaijan since 1995 (pipeline construction), but mining and manufacturing industries have not recovered. Its growth has slowed to stagnation with a 2.0% growth in 2000. However in 2001, the economy showed a little growth. The 2000 GDP composition is 19.2% agriculture, 12.2% manufacturing and mining, 12.5% transportation and communication, and 14.3% trade. In comparison with 1997, agriculture decreased, mining and manufacturing showed no change, and communication and transportation increased (Table 2.2).

In 1985, the mining and manufacturing industries had a 75% GDP share. The recent condition shows the mining and manufacturing industries received crushing damage by the transition to a free market economy after independence, and change of the structure of the industry. The 2000 GDP per capita was US$ 556, which is the same level as a developing country (Table 2.2, 2.3).

Table 2.2 Trend of GDP

Item	1994	1995	1996	1997	1998	1999	2000	2001*
GDP (mln GEL)	1,373	3.694	3,847	4,679	5,741	5,665	5,955	6,525
Exchange rate***	1.1	1.3	1.3	1.3	1.7	1.9	2.0	2.1
GDP (mln US$)	1.248	2,842	2,959	3,599	3,377	2,982	2,978	3,107
GDP per capita (US$)	232	535	563	657	771	524	556	581
GDP growth rate (%)	-11.4	2.4	10.5	10.8	2.9	3.0	2.0	4.5

*Estimate Reference: Transition Report Update 2002, EBRD, London, May 2002

***Annual average, GEL/USD

****GDP (mln GEL)/Exchange rate

Table 2.3 Share of GDP (%,current prices)

Sector	1997	1998	1999	2000	2001
Industry	13.3	12.3	13.0	14.0	12.5
Agriculture I	29.0	26.7	24.7	20.0	19.2
Construction	3.5	4.6	3.7	3.8	3.9
Transportation & communication	7.6	10.9	11.9	14.4	14.3
Trade	10.9	10.4	11.5	12.7	12.8

Reference: EIU Country Report May 2002, London

The total amount of exports in 2000 in Georgia was US$ 330 million that is 39% higher compared to the previous year. Main exports are food, non-ferrous metals (scrap, etc.),

electrical power, etc. The total 2000 import amount was US$ 751 million, which is 17% higher compared to the last year. The major imports are oil, oil products, energy like gas and electric power, machinery and equipment, transportation equipment and food. The trade balance has a trend with a large deficit by overwhelming imports (Fig. 2.3).

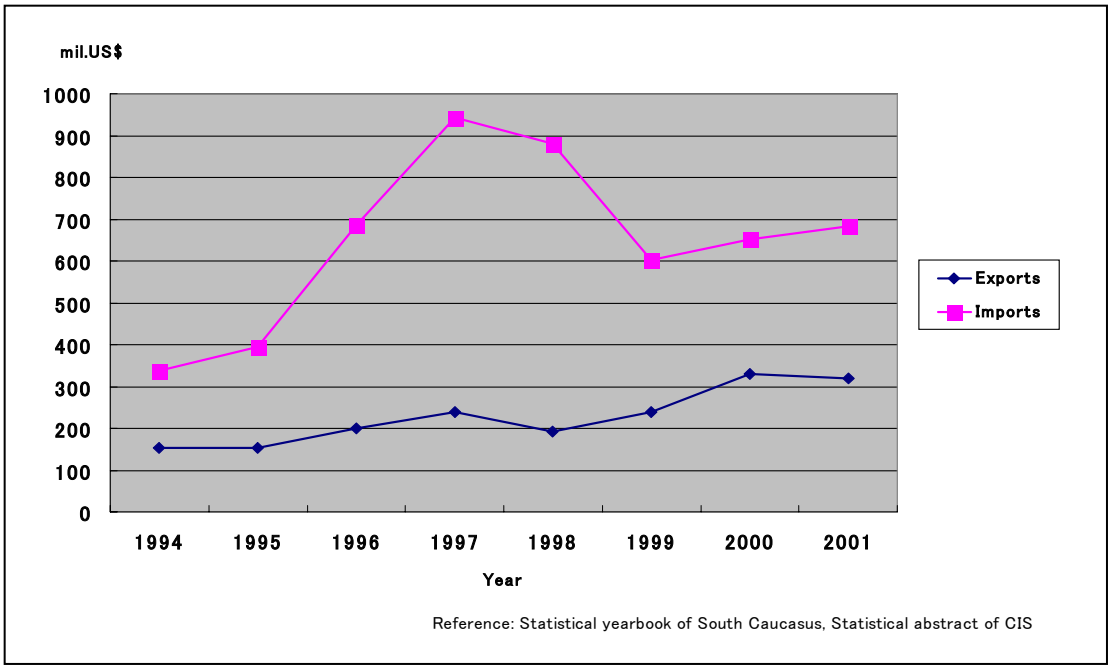


Fig. 2.3 Trend of Export and Imports

Although international organizations, country governments, foreign private companies, and Georgia domestic companies are investors, at this moment most investment is by the support of international organizations. Law and regulations are being arranged but the financial market is still not arranged. Guarantees for foreign investors are also vague. Tax system (application for tax declaration procedure, tax rate, and kinds of tax) acts like a brake. Therefore investment is not growing for many hindering factors for investment. Recent private foreign investment is a few small investments in trading, communication and transportation industries from U.S.A., Turkey and Russia (Table 2.4).

Table 2.4 Trend of Foreign Direct Investment

Amount (mln US$)	1994	1995	1996	1997	1998	1999	2000	2001*
Foreign Direct Investment, net	8	6	54	236	221	60	152	100

*Estimate Reference: Transition Report Update 2002, EBRD, London, May 2002

The central bank decreased the number of banks to 24 until the middle of 2001 by carrying

out the re-structure and adjustment of commercial banks by increasing the capital requirements, re-evaluating licenses, and restricting the new issue of licenses. The functions of private banks are still in a fragile condition. Its business is limited to short-term financing. Therefore it is difficult to give loans to the industrial sector. The bank's share in the financial market is 95% and others are insurance and securities at only 5%. Now foreign commercial banks and foreign capital participated partially in Georgia's commercial banks (5 banks), the finance is from European banks. Forming the security market has started. However the market is small scale. Corporate bond market is not formed still now. The national bond (including t-bills) market is not developed. Now the scale of the illegal economy is said to be 60-70% of GDP. Activation of various security markets is needed as one of the means for the legal capitalization of these idle assets.

Georgia had held a position of mining and manufacturing industries after the collapse of the USSR, these industries on the whole lost their market, had a shortage of parts and raw materials, and possessed superannuated facilities, machinery and equipment that caused a stagnation of investment, so Georgia's condition dropped and looked like a destruction occurred.

Now in the mining and manufacturing industries, investment is not making progress, and still is in a difficult condition for recovery. However, the transportation industry that has clearly positioned itself as a transit country for the transfer to the free economy and the communication business related to IT industries are growing. The scale of unemployment is still about 2 million people but the unemployment rate is increasing as it reached 13% in 1999 by the effect of harsh conditions of industry like the above mentioned (Table 2.5). The employment population of the mining industry was 25,000 people in 1985. In 2000, it was 5,000 people, which is one-fifth the previous scale (Fig. 2.4).

Table 2.5 Unemployment Rate

(end-year, in % of labour force)	1994	1995	1996	1997	1998	1999	2000
Unemployment rate	3.6	3.1	2.8	7.7	12.3	12.7	10.3

Reference: Transition Report Update 2002, EBRD, London, May 2002

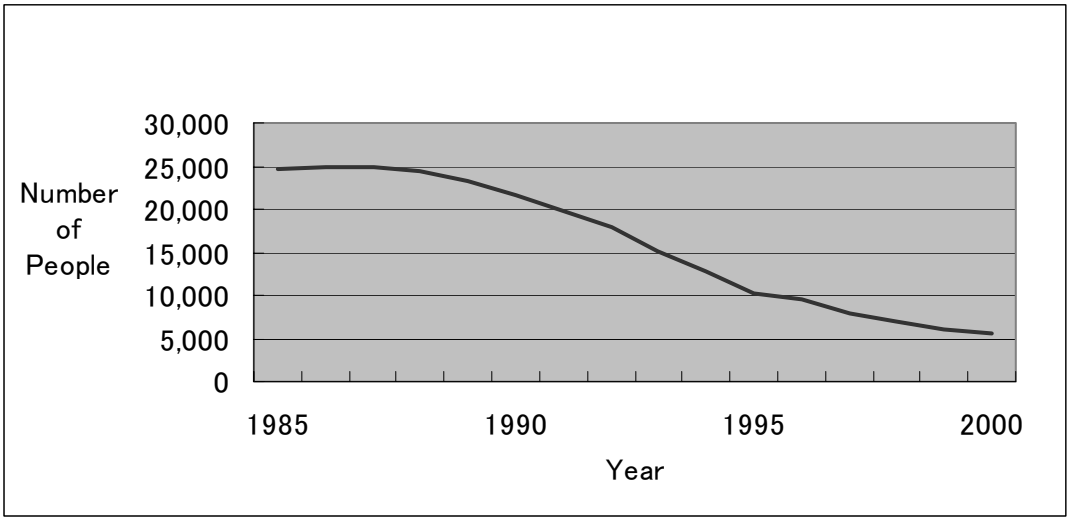


Fig. 2.4 Employment in the Mining and Quarry Sector in Georgia

The full-scale support by international organizations and some countries since 1995 have been carrying out the restructure for the free economic system on its foundation covering administration, justice, economy and society. Support targets have changed to financial reform, many types of system reform, arrangement of law system, reform and arrangement of government, construction of the infrastructure and measures for energy, and arrangement of protection of society, and countermeasure of poverty from IMF, WB, UNDP, EU, EBRD, USA, UK, Germany, Japan, Netherlands and China, etc.

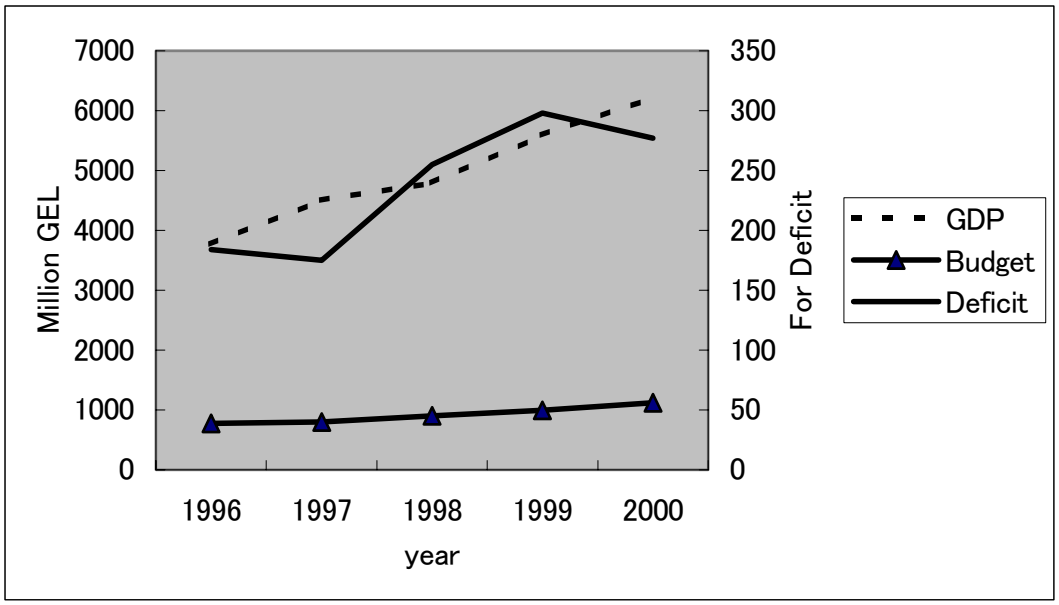
2-2 Government Budget

Priority policy of 2001 budget is social welfare, reform of health and education, stronger structural adjustment and development of economic important areas.

- Priority is social welfare and development of economy
- Improve financial constitution of deficit by increasing revenue and rationalization of expenses
- Investment target of economic development is transportation and energy

The government budget for 2001 is 1,121 million GEL (US$ 560 million). Ordinary expense is 82% and capital expense is 18%. Ordinary expense is composed of operation and maintenance of government organizations 38% (wages, materials, etc.), interest 17%, self-government body supplement 40%, and programs 5%. Capital expense is composed of two assets: acquired fixed assets 5% and repayment of debt 95%. Breakdown of ordinary and capital is expense public service 17.4%, social protection 23.8%, justice and

police 7.8%, and economic territory 6.0% such as transportation, communication, energy, mining and manufacturing (mineral resources 0.1%) (Table 2.5, Table 2.6). Revenue is 843.8 million GEL (US$421.9 million). Its breakdown is tax revenue 85% and other revenue with grants (support from international organizations) is 15%. In the tax revenue is 45% VAT, 20% excise tax, and social tax 22%. For the financial deficit, the overspending is 277.1 million GEL (US$ 140 million). For the past few years, the structure of the viscous cycle is financial deficit → loan → repayment, interest expense. There has been no big change in the cycle. On the expense side, the budget of investment and program expense for economic development is insufficient. The maintenance of the social basement is limited for the budget expenditures.



(Mln GEL)	1996	1997	1998	1999	2000
GDP	3,768	4,505	4,795	5,594	6,218
Budget	777	797	905	993	1,121
Deficit	184	175	255	298	277

Reference: The 2001 State Budget in Brief of Georgia

Fig. 2.5 Government Budget with GDP and Deficit

Table 2.6 Revenues and Expenditures for 2001 Budget

Revenue		Expenditures			
		Economic Category		Function Category	
Item	Mln GEL	Item	Mln GEL	Item	Mln GEL
VAT	320.6	Wages	354.0	General	195.2
Excise	144.1	Interest Pay.	156.0	Defense	39.8
Income Tax	16.4	Subsidies	365.8	Safety	87.5
Profit Tax	12.4	Program Exp.	45.3	Education	35.1
Customs	45.0	Capital Exp.	10.5	Health	38.1
Social Taxes	156.1	Lending	189.3	Social Sec.	266.5
Other Tax	25.7			Housing	4.8
Other Rev.	52.8			Culture	22.4
Grants	70.2			Fuel	3.5
				Agriculture	19.6
				Mining	0.9
				Transport	42.8
				Other	364.7
Total	843.3	Total	1120.9	Total	1120.9

Reference: The 2001 State Budget in Brief of Geo

The accumulated debt of the government is 680.5 million GEL for domestic financing. The support from overseas is US$ 239 million for three years since 1996 but only for structural adjustment from the IMF. The government has received loans from EU. It is condition that the government again received loans from EU for the repayment to EU. The government is in a condition of depending on the support of international organizations because of a lack of investment for the economic development and limited budget expenditures, which was caused by insufficient tax revenues, on the development of the economy. Tax revenues, T-bill sales and privatizations are the sources of government revenue. As for the T-bills, banks that have the financial power to buy T-bills are not growing. Therefore there is a limit on the issuing of T-bills in the present financial market. It is difficult for only recent ability of the government aim to make a budget for economic development.

2-3 Economic Policy

The economic policy composes of many kinds of policies based on the stability of the macroeconomy, promotion of domestic industries, introduction of foreign investment, reduction of debt, acceleration of privatization, adjustment of inflation, arrangement of covering the deficit financing, etc. Government has carried out the urgent financial policy for more reduction of expenditures, investment promotion policy with equal treatment between foreign and domestic capital by abolishing foreign capital incentive privileges,

privatization policy including selling large-scale enterprises, promotion of priority industries (Fig. 2.5, Table 2.6), using of underground resources, joining WTO, and industry policy related to raising local industry, etc. through a program of each sector. The macroeconomy is stabilizing by showing only a 4.1% rise in inflation and 2.0% GDP increase in 2000. However the GDP in terms of the US dollar shows tendency of actually decreased. Also industry only makes up 14% of the GDP. There is little foreign investment participation. The interest on short-term credit is very high (3-month lending rate was 31% in 2000), and tax revenues are not increasing. The results of these realized policies, on the whole, were not successful. The depression of the economy is continuing. Industry remains stagnant with an undeveloped financial market. Rescheduling of debt was implemented in 2001 (Table 2.7)

Table 2.7 Major Economic Policies

Area	1995	1996	1997	1998	1999	2000
Privatization & Law and Regulations	Voucher Privatization Begins	Voucher Privatization Ends	Securities Regulator Established	Law on Securities Market	Privatization Law Amended	Stock Exchange Starts
	Large-scale Privatization Started	Land Rights Trade Starts	New Law on Privatization	Adopt Free Currency Exchange	Registration of Farmland Titles	Bank Min. Capital Req. Increased
Market	GEL Introduced	First Bank Privatized	Start Market for T-bills	Major Utility Privatized	Join Council of Europe	WTO Membership

2001: IAS account introduced for all banks, External debt rescheduling

Based on hearing of government agency

The programs for the realization of policies actually are in condition that cannot be carried out sufficiently because of the small government budget. Although the financial and international trade balances show little improvement as the deficit continues, the policies should be reviewed and adapted to the present situation in Georgia. On the promotion of domestic industries, long-term credits that supply money to domestic industries are not formed because of a scarcity of domestic savings. Therefore there is a condition that industry's contribution to the GDP is not increasing. The policies for the formation of a financial market and trustworthiness of the bank are indispensable. The tax collection system and tax policy with European standards is unreasonable in the present situation, which is undeveloped in the free economy. As a result, the underground economy's growth is accelerating. It should be replaced it with a realistic policy which the underground economy money produces tax revenues and becomes the capital for the financial market. The government is strengthening its position in international transportation as a key future industry and attracting pipelines for the transportation of

energy resources in the Caspian Sea, and quickly improving and repairing its roads and railway.

2-4 Privatization

Small-scale privatization and privatization by voucher are finished in reality. It became possible to have private possession of land and use it as a way to finance enterprises. Privatization of large-scale government enterprises was started from 1999 and is being carried by being bought by foreign capital using tenders with the support of the World Bank. The Ministry of State Property Management of Georgia is carrying out the privatization based on the law of "privatization of state property" improved in May 1999. The privatization has the policy and purpose to make a competitive market and increase the ratio and quality of production of the private sector.

By the above new privatizations, the state possession of property is limited to 25%. The methods of privatization are tender, auction, transition of management right in the long term, selling directly and stock sales. Foreign capital can participate in the privatizations through tender. There is no limit on the participation of foreign companies on privatization.

About 1300 medium-large scale enterprises were privatized and it is about 80% of all enterprises for privatization. However, privatization of large-scale enterprise has not been progressing satisfactorily because limited possible finance in Georgia, high offering price and loss of the eager investor after Russian financial crisis. Although privatization was carried out, there are problems such as productivity has not been recovered, etc. by the shortage of money for the renewal of facilities and equipment. In 1999, 50 medium-scale enterprises were sold through tender, direct selling, auction and liquidation but there are examples of the selling of scrap by dismantling machinery and equipment by enterprises that acquired the stock in privatization. The government is selling state property and receiving money, and the money is used to repay the government's deficit (Table 2.8).

Table 2.8 Trend on Number of Privatizations

	1993	1994	1995	1996	1997	1998	1999	2000
Small-medium ent.	1,312	1,370	4,699	2,238	1,496	1,928	1,450	883
Founded as JSC	23	27	625	297	51	62	42	126
Founded as limited partner.	–	–	–	–	–	–	772	388
Total privat. Ent.	–	–	–	–	–	–	–	16,500
Income from priv. (mln GEL)	1.7	58.2	164.2	30.3	30.0	73.3	54.1	27.2

Reference: Ministry of State Property Management

Policy and procedure for recent privatization is based on 'Total Plan of Privatization for 2001-2003' (Ministry of State Property Management). Strategic areas such as privatization of energy, communication and transportation has a plan in progress based on the agreement with the World Bank. Georgia needs to report annually on the progress of privatization to the World Bank by partially joining the WTO. In future privatizations of large-scale enterprises, foreign direct investment should be needed. Moreover, transparency is needed for the management and financing conditions of the enterprise, and variable systems related to investment such as tax system is needed clarification. On the introduction of foreign capital on privatization, improvement of the conditions in the tender is needed.

2-5 Conditions of the Mining Industry

The mining industry in Georgia is composed of fuel such as coal, oil and energy, iron industry, non-ferrous metal industry, and industrial and construction materials. Now there is almost no coal production (2000 production was 7300 tons). This is because the market was lost in the transition to a free economic system and loss of competitiveness. All coal mines (3 sites) were shutdown or suspended except for a small part of one mine is operating. The oil industry is showing signs of recovery of production (2000 production 109.5 thousand tons) and exploration is being carried out by foreign capital. On the iron industry, production has dramatically decreased by the collapse of the division of labor system of the USSR era. At the time of independence, the production of steel was 996.5 thousand tons and in 2000 its production dropped to less than 50 thousand tons.

In the non-ferrous metal industry like copper and manganese is in the same condition. The demand for construction material like stone and industrial materials like bentonite have sharply fallen accompanied by the decline of its industry.

Only two mines are operating: Madneuli (Cu, Au, open pit) and Chiatura (Mn, open pit, underground) (Table 2.9). On the Madneuli mine, ore production has dropped to 251 thousand by the slump of sales of copper concentrate but after restructuring of management, the production has recovered to 1 million tons in 2000 (1994 to 9.3 thousand tons now around 50 thousand tons). The concentrate production at the Chiatura mine has decreased to 10 thousand in 1998 because of a lack of money (1990 production 2.591 million tons), but the combinat production between Chiatura and Zestaponi refining plant has improved its financing and the 2001 production was 63 thousand tons. It showed recovery from the bottom. The Uravi mine (As, underground) has suspended operations for financial difficulty. The Kvaisa mine (Pb, Zn, underground) is in the same condition because of the racial conflict in Ossetia.

Table 2.9 Major Mines

	Madneuli (Under operation)	Chiatura (Under operation)	Uravi (Suspended)
Formation of structure	JSC (Joint Stock Company) 98.2% Ministry of Management Property 1.8% Employees	JSC 85.037% Ministry of Management Property 7.36% Industrial capital(USA) JV 4.213% VISTA (USA) JV 3% Employees 0.39% Natural Person	JSC 75.3% TARO(UK) 24.7% Georgian government
Revenue (2000)	22,058.3 thousand GEL	5,237 thousand GEL	7,560 Rub in 1989
Product	Copper concentrate	Manganese concentrate	Arsenic metal
Production (2000)	45.6 thousand tons	25.0 thousand tons	3,553 Kg in 1989
Market	Export (Swiss Glencore has sales rights)、a part exported to Japan (5000 tons in 2000)	JSC "Zestafoni Ferroalloy Smelting Plant" Russia, Ukraina	
Employees	877 (444 at 2002 year)	2,631	—
Facilities condition	Aged, operating rate about 20%	Aged, operating rate about 15%	90% broken

The exploration and development by the government has not been carried out since independence for shrinking government finance. Recent exploration is only for gold in the Bolnisi area around the Madneuli mine by a joint venture between Australia and the State Department of Geology. There is no interest for foreign capital to new deposit development because one of the reasons is that there is no promotion of information disclosure. Besides there is no raising of finance by domestic capital. Therefore the development of a new deposit has not been implemented.

Also each mine has environmental problems such as soil and water pollution but the actual condition of environmental pollution is not grasped. Environmental problems attach a great importance but the survey of the effects to the area of environmental pollution and sphere of pollution has not been carried out for a lack of money of the mine and government.

2-6 Mining Policy

The mining industry policy in "Conception of Industry Policy" published by Ministry Economy Industry and Trade in 1999, is to expand the usage of raw materials and the development of resources. But the budget amount is not draw up, amount is little, and did not make details for materialization and nothing on the method of implementation. The budget for making the program was drawn up in 1998. However, every year the budget has been shrinking. Already 3 years have passed and the making of the plan has been

delayed (Fig. 2.6).

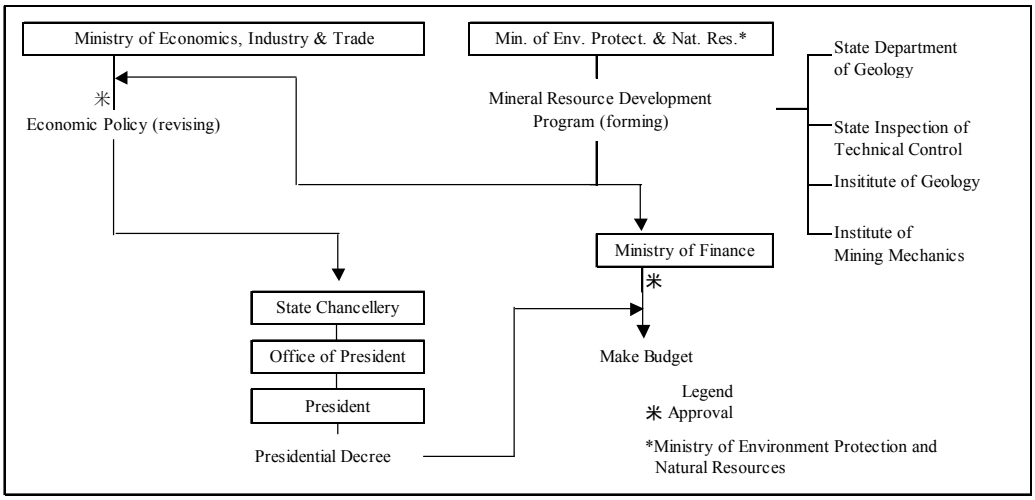


Fig. 2.6 Present Condition of Making Mining Industry Policy

2-7 Position of the Mining Industry in the Macroeconomy

The mining industry in the GDP showed 8% in 1985, 6.5% at independence in 1991 and sharply decreasing to 3 % in 2000.

The mining industry is composed of refined iron, non-ferrous metals, non-metal industry materials and construction materials. The production of all products of the mining industry has steeply decreased since independence. The mining products of the iron and non-ferrous metal industries are manganese and copper. From the production viewpoint, Mn concentrate was 2.74 million tons in 1985. That 1985 production is 50 times the amount in 2000 at 50 thousand tons (Fig. 2.7). This figure shows that mining had over an 8% share of GDP in the USSR era. The Cu production was 60 thousand tons of concentrate in the USSR in 2000, the production was two-thirds of the past USSR period. The gold reserve is 480 tons, but the production of gold is still 4.86 tons (1997-2000) still now.

Participation of foreign companies and investment to the mining industry has not progressed. An Australian company is recovering gold from low-grade gold ore in a joint venture of this mine. Several foreign companies have participated in oil and gold except the above-mentioned companies. However, these companies only have a small-scale investment in the exploration stage. The participation of foreign capital's effect to the GDP is a future subject. There is hardly any support to the mining industry from international organizations,

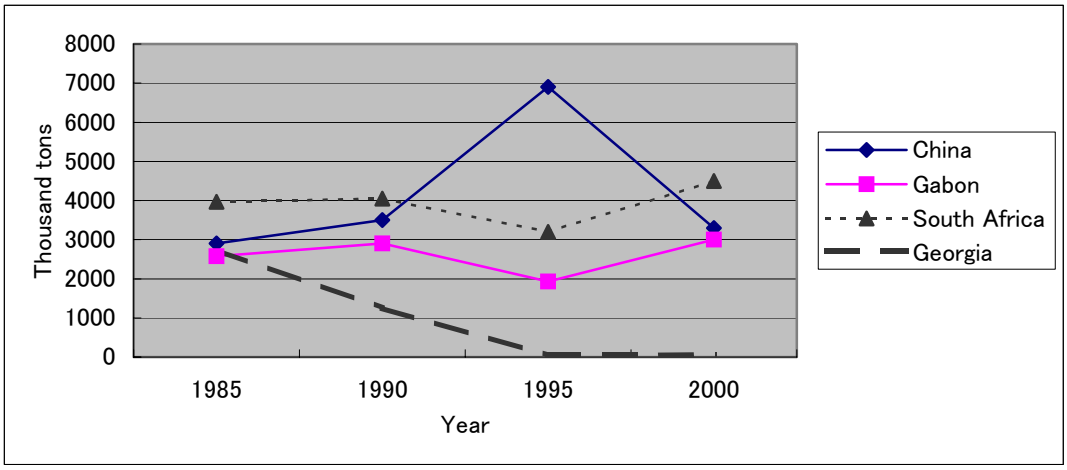


Fig. 2.7 World Top Producers of Manganese Ore

The importance of the mining industry in the macroeconomy is becoming less. From a macroeconomic viewpoint, if production of the mining industry recovers to USSR era levels, mining industry will become more important in the GDP and a pillar of its economic base. Now there are many problems in the investment climate such as the tax system, economic countermeasures and financial markets. In the recent condition, the mining industry playing a significant role to the GDP cannot be expected. For example, Georgia has 5% of the world's Mn reserves and had a level of producing 10% of the world's Mn ore in the USSR era. Therefore, improvement in the investment climate, restoration of existing mines and competitiveness, materialization of investment on target deposits and re-evaluation of mineral resource on each deposit are the subjects of the future reconstruction of the mining industry.

2-8 Condition of Mining Industry of Neighbor Countries

The mining industry is in stagnation in Azerbaijan because the mines are closed or suspended. The non-ferrous metals such as copper, zinc, tin, etc. are imported as manufactured metal such as wire, pipe, powder, plate, etc. from Europe, Russia, etc. Also scrap metal such as copper, zinc, etc. are exported. Barite, which accompanies a copper sulfide deposit, has been imported from Kazakhstan from the viewpoint of quality. Copper, lead and zinc resources exist in Azerbaijan. However, with the expanding free market economy, trade has been progressing and it places quality as the most important matter. Presently there is no copper and zinc refinery in Georgia and Azerbaijan, but Azerbaijan is not a target market for non-ferrous metals and non-ferrous metal concentrate of Georgia. In Armenia, the reconstruction of Alaverdi copper smelting plant has started. It was thought that there is a possibility of selling copper concentrate to the Alaverdi copper

smelting plant in the future.

3 Basement Areas

3-1 Mining Administration and Organizations of the Mining Industry

The administration of the mining industry in Georgia is composed of sectors such as policy, supervision, site work, and research and development. After independence in 1991, the Georgia government has been carrying out reform and reorganization of its organizations, reducing manpower, privatization, and establishing and arranging of laws and regulations for a free economy. These reforms are underway. The administration of the mining industry is becoming in a condition of low functioning. This condition resulted from the steep reduction of the budget for the mining industry accompanied by the shrinkage of the government budget and the dispersion of administration organizations. This is like a barrier for the development of the mining industry.

Many ministries and state departments are related to the mining industry. The President's Office and State Chancellery have a role for the adjustment between the ministries and state departments, making policy for the industry and reforming the administration. The Ministry of Economics, Industry and Trade has a role for making industrial policy, and supervising the administration of the mining industry, privatization and rationalization of industry. However, the mining policy reflected as a part of the industry policy is entrusted to other ministries and state departments for making policy (Ministry of Environment Protection and Natural Resources, State Department of Geology). The reason is that there is a lack of organization for the unification of the whole mining industry. Management of mineral resources, issue of license, and environmental management of the mining industry is controlled by the Ministry of Environment Protection and Natural Resources. The implementation of surveys, exploration of mineral resources, information management of mineral resources is the main roles of the State Department of Geology. The State Inspection of Technical Control supervises the technology in mining activity. Investment Promotion Center of the Ministry of Foreign Affairs and Ministry of Economy, Industry and Trade has a role for the introduction of foreign capital, which is important for the promotion of the mining industry. However, there is no organization making strategy for the introduction of foreign capital.

The budget is drafted by each ministry and state department, and the Ministry of Finance adjusts these budgets. Institutes have still maintained organizations in the USSR era. Institute of Mining Mechanics and Institute of Geology belong to the Academy of Sciences and are controlled directly by the President. The former organization is for research and

development of technology for the development and operation of mines. The latter is an organization for research on the mechanism of mineralization for exploration (Table 2.10, Fig. 2.8).

Table 2.10 Mining Industry Related Organizations' Responsible Section

	Section	Organization
State Organizations	Plan industry policy & adjustment	Office of President, State Chancellery, Ministry of Economics, Industry & Trade, Ministry of Environment Protection & Natural Resources
	Organize budget	Ministry of Finance, Ministry of Economics, Industry & Trade, Ministry of Environment Protection & Natural Resources, State Department of Geology
	Administration reform	Office of President, State Chancellery, Ministry of State Property Management, Ministry of Finance
	Industry rationalization, privatization	Ministry of Economics, Industry & Trade, Ministry of State Property Management, State Chancellery
	Mining industry administration, supervision	Ministry of Economics, Industry & Trade, State Inspection of Technical Control
	Survey, production	State Department of Geology, Ministry of Economics, Industry & Trade
	Mineral resource management	Ministry of Environment Protection & Natural Resources, State Department of Geology
	Foreign investment introduction, technical cooperation	Ministry of Foreign Affairs, Ministry of Economics, Industry & Trade, Office of President, State Chancellery
	Research organizations	Institute of Mining Mechanics, Institute of Geology, Georgia Technical University, Tbilisi State University
Private Organizations	Mining industry related societies	Georgia Mining Society, Small Mining Enterprise Association of Georgia

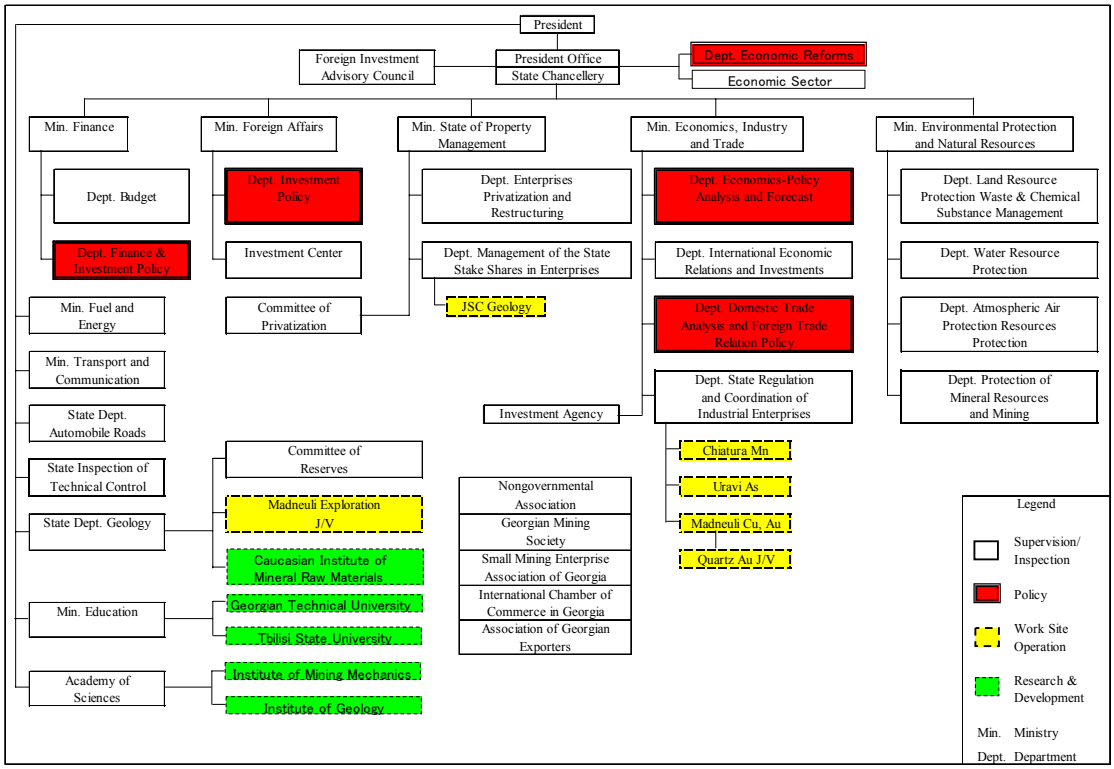


Fig. 2.8 Main Government Organization System Related to Mining Industry

Mining policy is treated as part of the industry policy. Although the organization's synthetic mining policy. functions in the Ministry of Environment Protection and Natural Resources have been fixed by law, still these functions are not working. The organization that receives the desired policy of the private sector is still not clear.

Management and supervision of the mining industry, for example on a mine, is related to the Ministry of Economics, Industry and Trade, Ministry of Environment Protection and Natural Resources, State Department of Geology, and State Inspection of Technical Control roles (Fig. 2.9). On work for exploration and development, also roles are dispersed (Table 2.11). Site work department sector of the mining industry is mines, expedition of exploration and joint ventures with foreign capital. Now these are the target for privatization or privatized.

- The government organizations of the mining industry are dispersed and organization's role is partially overlapped with other organization due to a lack of a unified organization for the mining industry. Therefore policy, management and supervision are not linked to a systemized mining industry administration.
- As the privatization is underway, the position of site work sector on the organization is not linked to the function.
- The process until the decision of important issues such as policy making is long (there are problems in the process and functions of the organizations).
- Position and role of institutions of research and private sector party of the mining industry have not become clear in the transition to a free economy.

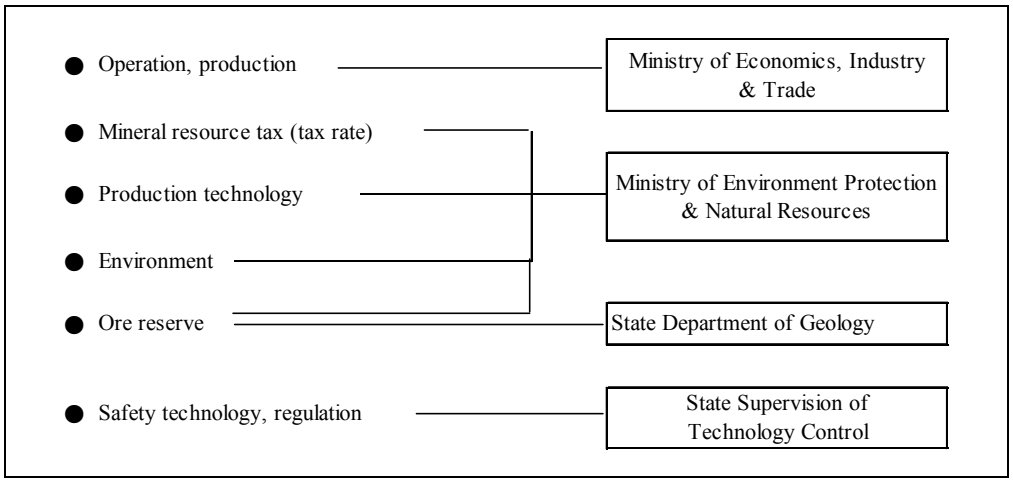


Fig. 2.9 Supervision & Management Organizations Related to Mines

Table 2.11 Main Mining Industry Organizations' Work Related to Exploration & Development

Stage	State Department of Geology	Ministry Environment Protection & Natural Resources	State Inspection of Technology Control	Ministry of Economics, Industry & Trade
Information gathering	● Safekeeping geological & deposit information ● Disclose geological & deposit information			● Investment guide ● Give tax information
		● Disclose information on environmental impact evaluation, law ● Disclose license information		
Exploration Preparation	● Technical advisor for exploration	● Examine license application ● Issue license		
Survey Exploration	● Cooperation on survey, exploration (J/V, etc.) ● Safekeeping of report on survey, exploration	● Inspect actual condition of exploration site (implementation schedule, expenditures) ● Check of environmental impact evaluation ● Management of license reduction ● Safekeeping of report on survey, exploration	● Management of safety and security of exploration technology	
Prepare Development	● Approval of ore reserves	● Examine F/S ● Examine development plan ● Examine environmental impact evaluation ● Issue license	● Examine security and safety control at the site	
Development		● Check development construction technology ● Environmental monitoring	● Safety measures, safety regulation management	
Operation	● Safekeeping of ore reserve change		● Safety measures, safety regulation management ● Safety technology management	● Management of state owned enterprises and financial affairs ● Safekeeping of operation financial data ● Privatization preparation ● Approve establishment of mineral resource tax
		● Manage ore reserve change ● Determine mineral resource tax rate and value of production for tax ● Production technology management ● Environmental monitoring		
Other Roles	● Prepare, compile and analyze geological and deposit data ● Review underground resource law	● Establish resource development program	● Revise safety measures, safety regulation	● Establish economic policy (including resource and mining policy) ● Privatization plan

3-2 Law and Tax System

(1) Underground Mining Code

Mining code was established on May 17, 1996. Georgia made this code by itself referring to the mining codes of the US•EU. There are many vague points on the transfer of the mining license and collateral use of the license, etc. There is a big difference with the mining laws of US•EU. Moreover, inconsistencies occur on management laws and regulations (Table 2.12).

Table 2.12 Basic Policy for Mining Code in Georgia

Basic Item	Basic Policy
Resource Owner	Country owns all underground minerals
License	Exploration, mining, and mining and exploration licenses
License Area	No limit. Examine license application.
License Transfer	Transfer to third party prohibited
Mineral Resource Tax	Tax rate, tax method by regulation (based on production amount & value)
Ore Reserve	Government property. Total efficient use. Government management

The mining code is incomplete and does not cover all items that are needed in a mining code. There are many items that are not broken down concerning rules and definitions. Moreover, there is a lack of definitions in the code on general items (transfer of rights, mining contract, limit of license area) in the mining law of the West. The license area is based on the consideration of the geologic conditions so there is no limit on license area. Reduction of license area and license conditions are indefinite. Concerning exploration rights, basically a license area is not transferable, and mining contract rights are not definite. The regulation on penalties for violations of people holding exploration and mining license is unclear. The content of the USSR era such as approval of ore reserves, duty of submittal of exploration information, transaction of products, production rate, and being given title from the President to the first discoverer of the deposit remains still now. There is no definition of contents for the application of mining and exploration license. Details are decided based on the evaluation of the application by the Ministry of Environment Protection and Natural Resources (Tables 2.13).

Table 2.13 Comparing Basic Items in Underground Mineral Resource Law

	Georgia	W. Australia	Chile	Japan
Exploration License	5 years + extension	5 years	Courts decide	2 years + 2 year extension
Mining License	20 years Mining & Exploration- 25 years	21 years	Courts decide	5 year + 5 years extension
Contract Mining	No	No	Yes	Yes
License Procedure	Auction/Tender	Application Tender by Governor	Application	Application
License Area Limit	No	100 hectares	1,000 hectares (exploration)	350 hectares
License Transfer	No	Yes	Yes	Yes
Ore Reserve Management	Government control		Government control	Lease owner
Ore Production Royalty	3-6% of revenue	Cu: 7.5% on ore, 5% on concentrate 2.5% on metal Au: 2.5% on net smelter return but exempt first 2,500 oz.	Unknown	Mineral resource tax

The exploration license (5 years), mining license (20 years), and mining and exploration license (25 years) are given to an applicant by holding a license tender or auction based on the mining code. The license procedure is carried out by the Ministry of Environment Protection and Natural Resources; announcement of issue of license→ application document/plan (exploration or mining) submittal→ examination→ issue of license→ pay license fee (people given license).

Ore reserve as a result of exploration is the target of management by the government because of the government possesses the underground resources. Government manages the production amount, remaining ore reserves and results of exploration for useful and synthetic usage of underground resources because of the government's ownership. The Committee of Reserves approves the ore reserves at a mine annually and development plans for the management of ore reserves. The State Department of Geology does a mine site survey for the calculation of ore reserves. The Ministry of Environment Protection and Natural Resources checks between the plan and operation status of the mine and exploration conditions. However, the management of the government seems inflexible for exploration and operation of the mine by private capital. Also the management of the Ministry of Environment Protection and Natural Resources has a role for the approval and examination for countermeasures to protect the environment from operating mines and exploration by the license owner, and carry out site inspection about the countermeasure. In addition, this Ministry punishes violators with penalties or stop operations to ban the pollution of the water, soil and air. However, the pollution standards and content are not clearly written.

(2) Foreign Investment Law

The Investment law, "Law of Georgia on the Investment Activity Promotion and Guarantees", was established on November 12, 1996.

The direct investment is prescribed by the above law and related laws such as the tax law, civil law and corporate law. This investment law was established with the purpose of the promotion and guarantee of domestic and foreign investments in the law arrangement for the transition to a free economy. The law has characteristics as follows.

- The percentage of foreign ownership of the investment is unlimited
- Domestic and foreign capital have the same rights
- Repatriation of profits is free (no withholding tax)
- Direct investment over US$ 100,000 needs to be registered
- The fields that a foreign investor needs permission are weapons, gunpowder, development and use of natural resources, banks, etc.

The "Law of Georgia on the Investment Activity Promotion and Guarantees" does not have any big problems as an investment law. Before the present law was established, the law's effective period is not finished still now. Investors are receiving special privileges. Therefore discrimination has occurred to investors under the present law.

In addition, foreign investment is not promoted. Some government organizations point out that the causes are no special privileges for foreign capital and complicated procedure for the mandatory registration of investments over US$ 100,000 in the present law.

The guarantee to invest is described in Article 7 of the "Law of Georgia on the Investment Activity Promotion and Guarantees". But this content is general and lacks concrete definite guarantees. Clearly state the guarantor and the definite range, conditions and method of the guarantee. Introduction of an insurance system. examination of the adjustment between the investment law and laws related to investment (tax code, etc.), analysis of risk on investment and examination of safeguards and its legislation, guarantee for the investment in the mining industry, etc. are future subjects.

(3) Tax System

The tax code was made with the cooperation from USAID, WB, IMF and advanced countries, and established in June 1997. This tax code is a tax law based on the principle of a free economy, and covers taxation items, tax rate, procedure of taxation, and penalties, etc. Tax code has EU and USA standards. USAID has carried out the education of the tax code and tax affair management to the Ministry of Revenue and State Department of Tax. But since its establishment, this code has influenced the government budget because of the reduction of tax revenue each year by the complicated procedure of tax declaration, heavy tax burden on the taxpayer, tax evasion, unpaid tax and illegal trade (Abhazia, Ossetia, etc.) (Fig. 2.10).

Tax is composed of national and local taxes. The national tax is composed of not only the profit tax, income tax, but also excise tax, property tax, social tax, natural resource use tax, etc. There are six kinds of local taxes such as the enterprise activity and resort taxes, etc. (Table 2.14).

The tax related to mining industry is only a natural resource use tax and the environment impact tax. On the activity of the mining industry, the tax burden is required as follows.

Revenue	Natural resource use tax 3-6%
	Enterprise activity tax 1%
Cost	VAT 20% (goods, material, equipment)
	Social 31% (on wages)
	Excise (imported equipment & material)
Profit	Profit 20%

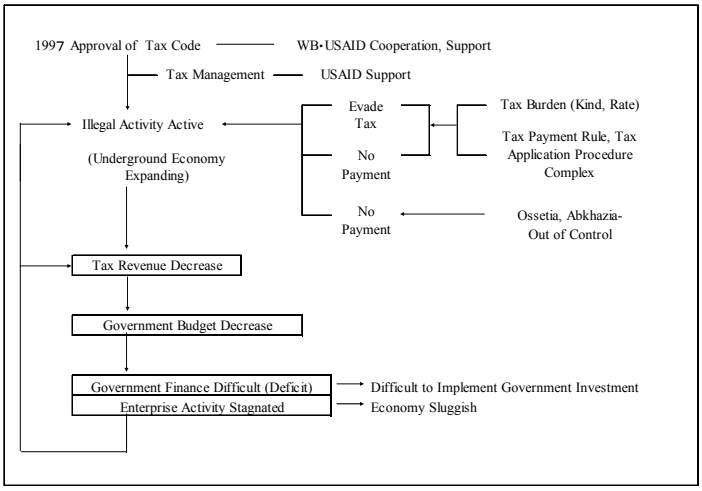


Fig. 2.10 Cause of Revenue Decrease Based on Tax Law

Table 2.14 Type of Tax and Rate of Georg ia

Section	Content	
National tax	Income tax	Based on income 12%～20%
	Profit tax	Corporate tax 20%, profit tax 10%
	VAT	20%
	Excise tax	Changes according to item
	Property tax	1～2% on value of property
	Land tax	Change depends on type of land, Non-agricultural land is 0.24 GEL/ sq. m.
	Car ownership tax	30～150 GEL
	Property tax	2% of market value
	Social tax	Wage 27%＋4%（health3%、Unemployment1%）
	Natural resource use	Price of production X amount, 0～10%, Non-ferrous metal 3～5%. Precious metals 4～6%
	Environment effective tax	Judgement of Ministry of Environment Protection & Natural Resources. Depends on type of metal
	Capital gains tax	10%
	Car entry tax	60～880 GEL
	Others	Road tax 1%、Enterprise owner tax 1%
Local tax	Enterprise activity tax, gambling tax, resorts tax, hotels tax, advertisement tax, and stamp tax	

GEL : Lari 1US$ ≒ 2Lari

Natural resource usage tax is a factor in oppressing mining activity compared with the general enterprise activity. The tax system makes it difficult to make profits on its activities for enterprises and the mining industry. Tax burden on mining industry is heavy compared to advanced and emerging market countries (Table 2.15). Enterprise is taxed on revenue, cost and profit. Activity of the mining industry has taxation on general enterprise activity and tax related to the mining industry.

In the transition to a free economy the private sector is in an undeveloped stage, the tax system of USA and EU standards limits enterprise activity and condition of no development occurs in the mining industry. On the present tax system, the promotion of the mining industry has difficulty because of taxation on revenue to the

mining industry. Now the priority industries for a target of tax privileges are energy, agriculture and export industries. Brisk activity of the mining industry by the reduction of the tax burden is a big important subject to the mining industry. As the tax revenues are decreasing by the expansion of illegal trade, commerce and business, and procedure of tax declaration, therefore examination of the tax rate and target of taxation, etc. is needed.

Table 2.15 Mining Industry Related Tax and Company Cost

Item	Georgia	Kyrgyz	Canada	Peru	Philippines
Profit tax (on profit)	20%	30%	31.97%	30%	35%
VAT	20%	20%	7%	18%	0～10%
Social tax (on salary)	27＋4%	33＋1.5%	none	none	none
Mineral resource tax	≒sales 3～6%	prod. Cost 5～15%	none	none	sales Cu 2%、Au 4%
Environment tax	none	none			
Enterprise activity tax	(sales-supply cost)×1%	none	none	none	none
Fund for mineral development	none	sales 2～15%	none	none	none

3-3 Approval & Permission, Laws & Regulations

(1) Passport of Exploration

In the USSR era for technical method and work of exploration, regulations and standards were established to keep strict compliance because all exploration was carried out by the government budget. The exploration organization, which carried out exploration, had to obey the work order for each kind of mineral and method described for each kind of mineral on the exploration passport. Now the passport still exists. However, exploration is being not carried out by the government. Therefore there is no chance to use this passport. The exploration passport is described in detail such as the line interval of the survey, sampling interval, etc. This limits the flexibility to explore and causes costs to rise. It is not suitable for a free economy. But on private sector exploration, it does not need to accept the passport regulations.

(2) Development Passport

Their standards and regulations with the same situation as exploration for feasibility studies on development and engineering, construction and operation are described because of the implementation by the government budget. Now the development passport is used for operating mines but an examination on the effectiveness of the development passport is not done because no new mines are being developed. The development passport has detailed regulations such as the cross section and size of the

tunnel, underground transportation, drilling pattern, packing of explosives in the drill hole, mining method, ventilation, mine effluent, electrical system, water supply, ventilation system, etc. Therefore flexibility is limited to the development system and size of equipment, etc. In addition, the USSR development method causes costs to increase because of low efficiency with main operation for many handling processes under a free economy. Recently, on private sector development, the risk is on the enterprise. Therefore the enterprise has yet accepted the regulations based on the development passport.

(3) Mining Preservation and Safety Regulations

Preservation and safety regulations made in the USSR era are still adopted now. The regulations are described in detailed technical specifications from a safety viewpoint such as open-pit mine, underground mine, tailings dam, etc. Supervision organization of the former USSR, which does not exist presently on an organization, exists on paper only. Maintenance and management of laws and regulations are not done from the viewpoint of technology, for example, there is no regulation on law sensitive explosives (ANFO) and slurry explosives, etc., which now is used, standard regulations of the powder is still now keeping the army standard

(4) Regulation of Ore Reserves Calculation & Procedure of Approval

Mineral reserves are deliberated, approved and registered by the State Committee of Ore Reserves which secretariat opened in State Committee of Geology. Ore reserves calculation is still controlled by the state on based the criteria standardized during the former Soviet time. After prospecting, a person or organization that has done the exploration should report the acquired reserves and grade to the State Committee of Geology and Ministry of Natural Resources and Environment Protection until next February and obtain the approval of the State Committee of Ore Reserves. Without this approval, no person and organization can obtain an exploitation license. It is necessary to do exploration following the prospecting passport. Flexible exploration would be restricted and unnecessary exploration would be implemented in some cases

3-4 Information Management of Mineral Resources

Mineral resources information is safely kept and managed by the State Department of Geology and Ministry of Environment Protection and Natural Resources. The reading and lending (private sector pays a fee) of mineral resources information is possible. It is disclosed. Safekeeping and management are not done by computer. Target of safekeeping of documents and data is survey and exploration reports, ore reserves and

feasibility studies by the government and survey and exploration reports, and ore reserves by private enterprises with a license. Information of state mines are accumulated and managed at the mine. On the other hand, information on production and management is in the Ministry of Economy, Industry and Trade. Information on the change of ore reserves is in the State Department of Geology and Ministry of Environment Protection and Natural Resources. Data on technology is at the State Inspection of Technical Control and Institute of Mining Mechanics. Geological data are at the State Department of Geology. There is multiple management. It is difficult to obtain information to wholly grasp the mine. These data are not disclosed.

Information on mineral resources is disclosed for reading and lending of documents, but information on mines is hardly disclosed. Web sites are established by each Ministry and the state such as the Ministry of Finance, and Ministry of State of Property Management with information disclosed in English. However on the mining industry, information related to industrial and construction materials are accessed on the web site of the investment center. This is not systematic information

3-5 Privatization of Enterprises Related to the Mining Industry

Privatizations of enterprises of the mining industry are targets such as mines, smelters and exploration enterprises. Mines and smelters became JSCs by privatizations. Still now the government has a majority of the stock and privatization is not promoted. The full-scale privatization of JSC related to the mining industry is the implementation of a tender or auction. The condition of the Chiatura Mine tender is to pay all the debt of the mine, show the implementation plan, production plan (first year: 50,000 tons, second year: 100,000 tons, third year: 150,000 tons and fourth year: 200,000 tons) and investment plan and supply the domestic demand, etc. and duty of continuous employment. The payment of all the debt and achievement of the production program in the tender conditions are the unfavorable conditions for the investor. The responsibility of environmental pollution with the previous production activity is not clear. The superannuated and damaged facilities and machinery are not included in the tender conditions. The conditions of the tender are established by the Ministry of Economics, Industry and Trade, and Ministry of State Property Management.

The future privatization plan has not been materialized. The international tender of the Chiatura Mine has already placed in a package with a manganese smelting plant of Zestaponi. However, there was no bidder for insufficient content of plan such as period, conditions, etc. The Madneuli Mine is the future privatization target of the Ministry of Economics, Industry and Trade. The privatization will sell stock or transfer the

management right → sell stock. The international tender of Madneuli has also been considered ,but the success on the tender conditions, like the government has carried out so far, is difficult. The establishment of the tender conditions based on Georgia side's convenience so there is little hope for investment from the Western companies. Furthermore, the management after acquisition of the management right and stock is strict under the present tax and mining codes. Assessment of the mine property based on Western standards. Show the environmental problems clearly. Implementation of an environmental survey. Guarantee of government responsibility. Disposal of debt by the government.

3-6 Accounting System

The making of accounting books became a responsibility based on the international accounting system from the "Accounting and Law of Accounting and Calculating" adopted on February 5, 1999, stock company on January 1, 2000, and bank and security company on January 1, 2001. The stock company with over 100 stockholders has the responsibility to report its financial results to the Committee of State of Security Market after the inspection of a third party. The accounting report is submitted to the taxation office at the end of the fiscal year (calendar year). The company pays the tax based on the accounting report. The taxation office did not receive the accounting report that is not inspected or accounting report with the Soviet style. This system is not spread. The transparency of financial condition of a company has not improved without a company having foreign investment. The cause is thought to be a lack of manpower (tax office), lack of understanding of company, management ability and insufficient management system. There are big differences on the treatment of accounting that the Soviet Union style accounting standard uses the cash standard, but international accounting standard (IAS) is a standard of the occurrence of transaction. Amortization in the tax system and depreciation of the accounting system is treated the same way. Necessity for using international accounting standards at the present time is few.

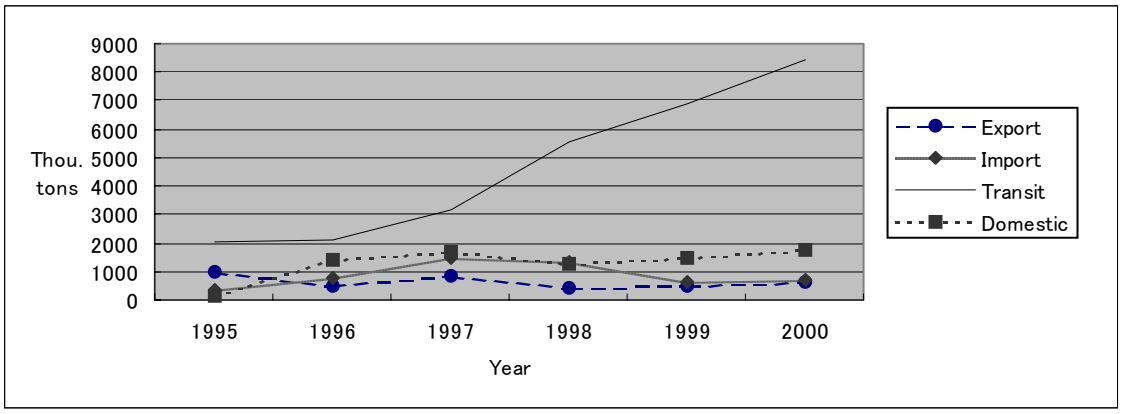
Barter settlement was used so far because of a lack of money, but it is not done officially at the present. Barter trade of goods, etc. was banned actually for taxation based on the legal obligation of showing the price of all trading with the introduction of the international accounting standards. The settlement method for buying and receiving goods is introduced based on the international accounting standards and not the Soviet method (accounting on receipt and payment of money). However this introduction is still not actually settled and it is using this barter method or Soviet Union style.

3-7 Infrastructure

(1) Recent Condition of Infrastructure

Infrastructure of Georgia, which was constructed in the USSR era, shows remarkable superannuated and damage for facility equipment and facilities. It is in the condition that has substantial arrangement and repair on the infrastructure for its suitability for a free economy from infrastructure centered on USSR (Moscow) of its facilities and equipment, and improvement is needed. Support from international organizations, etc. started the promotion for the improvement, repair of facilities because of the lack of money by the reduction of its national finance. Part of the facilities and equipment was privatized.

After the USSR collapse, the development of the transport route linked to Central Asia and China became important. The route arrangement of Central Asia-Caucasus-EU without transit through Russia was needed. This route has shortened the distance by over 1000 km compared with transit through Turkey, Iran, or Russia. The TRACECA project, which is the 21st century Silk Road plan by the EU TACIS, was started with the joining of three countries of the Caucasus, Central Asia countries, Ukraine, Bulgaria, Romania and Turkey. Georgia has a role of a central country of transit for transportation like INNOGATE project pipeline of TACIS because of its position as a "transit country" linked to the Caspian and Black Seas. Already the quantity of transit goods is increasing in railroad goods (Fig. 2.11).



Reference: Statistical Yearbook of Georgia

Fig. 2.11 Railroad Shipment Volume for 1995-2000

(2) Traffic and Transportation

Arrangement of infrastructure of traffic is a national priority subject.

The roads of Georgia including mountain areas are constructed as a network for domestic and neighboring countries (Appendix document #1). Total length of the roads is 20,215 km, joint roads of the CIS are 1,474 km, national roads are 3,326 km and the rest is local roads. In the USSR era, the construction of roads (600-700 km), bridges and maintenance was carried by the national government budget of US$ 200-250 million per year for making and arranging the network. But after independence, the budget is almost nothing. Therefore maintenance cannot be done as the collapse and damage of the roads increase. The tax revenue based on law of road fund related to roads, which was established in 1995, has become the appropriation for maintenance and management of the roads. The arrangement of repair has finally started in earnest by the initial support on the rehabilitation of roads by the World Bank in 2001. The arrangement of roads, introduction of equipment, machinery and facilities, establishment of gas stations and center for repairs, construction of transportation systems, introduction of vehicles for transportation, raising of transportation companies are urgent subjects.

The basic framework of railroads with a total length of 1,586 km including the main route across the country was already constructed and electrified. The central route of transit in the TRACECA project is Baku — Tbilisi — Poti — Batsumi. This main route in Georgia is almost double tracked but the rolling stock, electric locomotive and railroad facility are superannuated. Already the arrangement and repair is starting by the support from TACIS, EBRD, etc. The ferry network arrangement on the Black Sea, construction of ferry bridge at Batsumi and Poti and re- and trans-shipment has been carried out to reduce time and the strength of transportation to Europe because of the same track gauge as Russia 1520 mm (EU 1435 mm). The railroad connection from Armenia and Turkey to Iran, Black Sea ferry network completion, double track completion of domestic routes, introduction of new rolling stock, introduction of security facilities and system, etc. are urgent subjects.

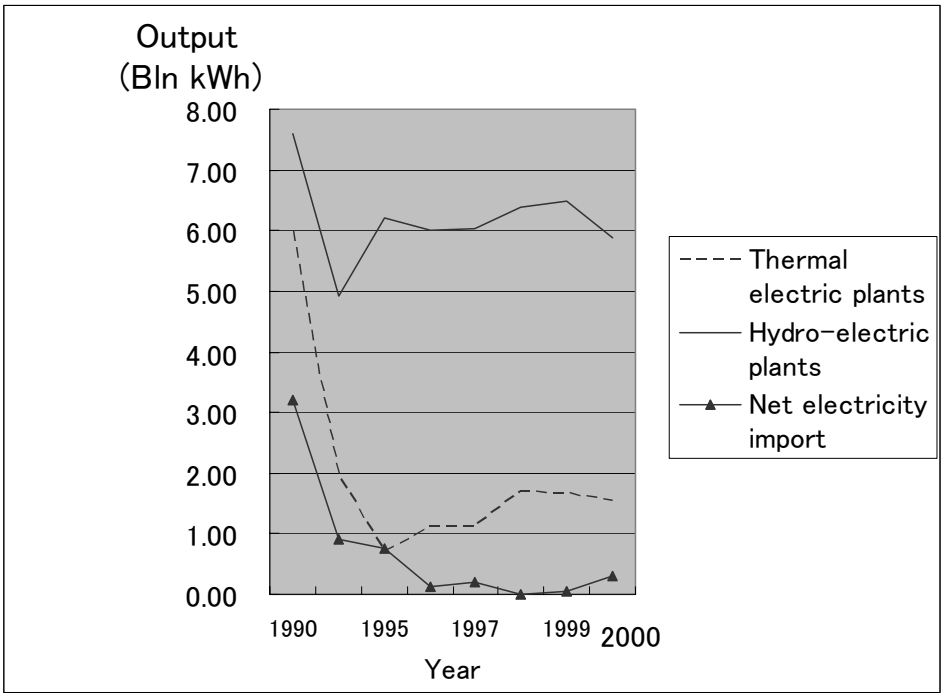
Huge financing is needed to arrange and reform the infrastructure system as a transit country under a free economy from an infrastructure system centered on Moscow. Moreover there has been a lack of maintenance and management of the existing infrastructure related to traffic and transportation for 10 years after independence. Debt will be accumulated as most of the support from international organizations is loans. Therefore the development of domestic industry is indispensable.

(3) Recent Condition and Subject of Electricity

In 1990, Georgia consumed 17.44 billion kWh of electricity and produced 14.23 billion kWh. The shortfall was supplied by Russia, Azerbaijan and Armenia. After independence, the unified structure of the electricity supply of the three former USSR Caucasus countries collapsed. Recently the consumption and production of electricity was reduced by half. The problem of the electricity shortfall has become a serious problem. The reasons are the suspension of the construction of the Fudoni hydroelectric power plants, superannuated thermal power plants and their suspended fuel supply, and superannuated and damaged supply facilities of the electricity power plants in Abhkazia. The capacity of production ratio is hydroelectric power to thermal electric power is 55/45, but recently it is 79/21 (Fig. 2.12). Hydroenergy is only using around 30% of its potentiality (100 billion kWh). Imported electricity is 17% of its consumption and supplied by Russia, Azerbaijan and Armenia. For the settlement of the shortfall of electricity and maintaining stability, urgent repair and arrangement for electric generating plants by support of the WB, EBRD, Japan, etc. has started. Privatization and lease for small-medium electric generation plants, selling of electric supply companies to foreign capital, improvement of collection on electricity charges have started. The government policy of energy is to increase the amount of generated electricity by promotion of construction of hydroelectric plants and linked to a system of energy with its neighboring countries (positioning as an energy transit country).

(4) Recent Condition of Communications

The saturation of telephone lines in Georgia is 15% (local average is 2.2%). The telephone system of Georgia is maintaining communication network lines and facilities of communication from the USSR era. Fiber optics telecommunication line in Georgia is being constructed in cities such as Tbilisi, Batsumi, etc. and is installed for digitalization. Also network telecommunication line is needed to be renewed. Communication condition has been improving by using the Internet, spreading of mobile phones, construction of international lines by joint ventures between the government and foreign capital. It is starting to be realized by Georgia's geographic position, it will become the central basement of communication lines linking the EU, Central Asia and China.



Output (Bln kWh)	1990	1994	1995	1996	1997	1998	1999	2000
Thermal electric plants	6.01	1.94	0.70	1.11	1.12	1.69	1.653	1.539
Hydro-electric plants	7.59	4.91	6.21	6.01	6.04	6.39	6.484	5.881
Net import of electricity	3.21	0.92	0.75	0.12	0.19	0.00	0.049	0.313

Reference: Sakenergo

Fig. 2.12 Electrical Power Generation Structure

(5) Recent Condition of International Support

The support for the infrastructure is from the WB, EBRD, TACIS, GTZ and Japan. The support was started since 1993. Recently, the support to each sector has finally started in earnest. It is supported by projects on roads from the WB, railroad by EU TACIS, harbor from EBRD, and electric power from the WB, EBRD, Japan and Germany. The great part of the support is loans (Table 2.16).

Table 2.16 Major International Aid Organizations' Infrastructure Projects

Sector	Organ.	Project	Category	Amount (US$mln)	Period
Road	WB	Road rehabilitation	Loan	40	2001・3～2004・12
	WB	Transportation rehabilitation	Loan	15	1999・6 completed
	Japan	Machinery for road repair	Grant	2.8	2001 Budget
Rail	EBRD	Communication with Railroad	Loan	20	1998.2 completed
	TACIS	TARALECA	Tec. Coop.	88 mln Euro	1993.5～
Bay	EBRD	Port of Poti	Tec. Coop.	6	Planning
	GTZ	Restructure Poti & Batumi	Tec. Coop.	1.3	1998・12 completed
Electricity	EBRD	Inguri Hydroelectric Plant	Loan/Tec. Coop.	40	1999・1～2001・1
	WB	Electricity rehabilitation	Loan	18	1994・12 completed
	WB	Electric power rehabilitation	Loan	52	1999・12 completed
	Japan	Electric power rehabilitation	Loan	45	1998・1～2003・1
	GTZ	Vartsikhe Power Plant rehab.	Loan	42	1997・1～

Tec.: Technical Coop.: Cooperation

(6) Problem and Subject on Mineral Resource Development

There are few problems on the infrastructure for the development of mineral resources except for parts in the Caucasus mountain range. The infrastructure has not become a hindering factor for the development of mineral resources because it almost covers the whole country by road, railroad, and electricity network. However the arrangement does not progress without the dependence on international support for indispensable matters such as the repair and improvement of infrastructure in each sector as mentioned above. In recent conditions, there are cases on the lack of electricity supply. This has a negative impact for stable operations. Beside, smelting plants are only for manganese. Copper and other metals are transported as concentrate. Therefore the arrangement of railroads, roads and trans-shipment facilities for shipping is a subject in the future (Table 2.17).

Table 2.17 Infrastructure Subjects for Resource Development

Item	Subject	Present Condition
Road	Repair & maintenance of local roads	Plan but not started
Railroad	Maintenance of Armenia line	Plan but not started
Electricity	Maintenance of power plant, establish local power plant	Plan, arranging, lack electricity
Bay	Maintenance of transshipment and loading facilities	Plan and implementing
Communication	Satellite base in district	Have plan

(7) Personnel Training

Mining education is carried out mainly at Georgia Technical University and the Tbilisi State University partially. The Georgia Technical University has 14 departments and 5,000 teachers and staff. There are 15,000 students. It has a 4-year system and a graduate school. In the USSR era, it was the biggest university in the Caucasus area

Department of Mining and Geology related to the mining industry has 18 classes. There are 600 students. Each school year has about 120 people. This department has 148 teachers and staff (professor 40, assistant professor 70, full-time teachers 38, and other assistants and laboratory staff). The department is composed of classes such as geological survey, applied geology, underground mining of mineral resources, underground structures and mine construction, strip mining, mineral resources dressing, mining machines and equipment, automation of industrial plants and technological complexes, hydrogeology and engineering geology, technology of prospecting mineral resources, geology of oil and natural gas, prospecting and survey of mineral resource deposits, management in geology and mining, treatment application of oil and gas, and mine survey. However these classes for learning mining in the department is not popular because finding a job is difficult for the decline of the mining industry. The number of students for classes related to the mining industry has sharply decreased with the decline of the mining industry.

Tbilisi State University has classes for mining geology in the department of geology but it is in a stagnant condition as the number of teachers is 10 and number of students is 8. The education is from the science viewpoint.

Tbilisi Technical University has mining facilities on geology, mining and dressing. The geology area has equipment of analysis and microscopes but this equipment are superannuated and outdated, and not sufficient as education and research equipment. The mining area has a training facility for a mine under the building, which is unique and one of a kind in the world (installed in 1986, total length of the tunnel is 1000 m, overburden is 16-30 m), and is carrying out practical education (tunneling, mining ore, transportation, support), and is a place for research and experiments such as tests on rock mechanics, tests on capability of machines, etc. However, maintenance is difficult due to a lack of money. The dressing area has a complete facility with practice (crushing, milling, gravity separation, flotation, magnetic separation, static electricity separation, others). Batch testing is possible and continuous testing is carried out on flotation. There is a lack of computers on the whole.

As the needs of society for mining engineers is decreasing and it is difficult to find a job, students learning about the mining industry have sharply decreased. Teachers are

becoming old (under 40: 4.5%, under 50: 29.7%, 50-65: 40.8%, over 65: 25%). Therefore it is difficult to introduce EU and USA education using IT and economic resources, etc. The wages of the teachers are low (US$50/month). It is a condition that there is nobody who wants to become a teacher. Beside the above, mining education facilities have a condition that is difficult to renew and maintain because of a lack of money. Therefore this brings a hindrance for education such as treatment of information and automation system.

4 Present Situation of Exploration Works

4-1 Organization of Geological Exploration

State Department of Geology is the government organization in charge of prospecting and exploration. In former USSR time, the Department of Geology played a role as headquarters and each expedition performed actual prospecting works. After independence, these expeditions were divided into more than 20 companies (approximately 1,100 personnel) according to the privatization policy of the government. But the private capital does not completely own the companies. State Department of Geology is composed of the headquarters and two regional bodies (Table 2.18).

- Headquarters: (in Tbilisi): the divisions of 1) geological, 2) hydrogeology, engineering geology & geo-ecology, 3) production & technical, 4) legal, marketing & investing policy, 5) financial, economical & accounting, 6) administrative organizational, 7) state geological control and 8) geological information control
- Regional bodies: the Department of Geology of Abhkazia in Sufumi (sought refuge in Tbilisi), Mining Geological Department of Ajarea in Batu.
- Number of staff reaches 77: breakdown of 43 in headquarters, 24 in Ajarea, and 10 in Abhkazia.

Table 2.18 Main Functions of All the Divisions at the State Department of Geology

Division	Personnel	Main Function
Geological Division	6	* Methodic guidance and surveillance over the geological exploration activities;
Hydro-, Engineering and Eco-geological Division	6	* Methodic guidance of hydro-geological, engineering-geological and geo-ecological works;
Production & Technical Division	6	* Elaborating the technical & technological policy; * Rational usage of all kinds of resources;
Division of Legal, Marketing & Investing Policy	6	* Planning and management of law-making activities;
State Geological Control Division	6	* Conducting the state control over geological exploration activities;
Financial, Economical and Accounting Division	6	* Inspection of state projects and accounting documentation;
Administrative-Organizational Division	6	* Controls of organizations, management and administration; * Ensuring the provision of the legislative acts;
Geological Information Control Division	1	* Systematization and control of the special purpose materials;
Geological, Mining and Mineral Resources Department of the Ajara Autonomous Republic.	24	* Exploration of precious and non-ferrous metals, ground waters and non-ferrous minerals;
Geological Department of Abkhazia.	10	* Creation of geological map of the Abkhazia Territory;

After independence, state exploration activity for mineral resources has been substantially delayed because of the lack of government budget accompanied with a personnel reduction. Moreover renewal of machine and equipment, improvement of technology and replacement of older engineers with recent engineering graduates have been largely delayed. Exploration activity for mineral resources in Georgia has been suspended.

Geological prospecting in Georgia depends on domestic and foreign capital. Privatized expeditions carry out geological prospecting works that have been ordered by the government. Expeditions are not easy to manage because of unpaid and delayed exploration fees. Government exploration policy is not concrete. Budget for State Department of Geology is decreasing year after year: 2,100,000 Lari in 1998 and 100,000 Lari in 2001. It budgets for administrative and personnel expenses of the Department of Geology. The main work is basic geological investigation and mineral resource investigation, except for oil and gas. Concretely regional geological investigation, mineral resources prospecting plan including feasibility study, hydrogeological, ecogeological and civil geological survey, etc. are the main projects.

Budget of State Department of Geology (thousand Lari)

1995	1996	1997	1998	1999	2000	2001
883	1,380	1,885	2,176	367	141	100

Foreign private companies of Australia (Bolnisi Gold NL: Au), Russia, France (Bibenzi), and U.K. (Tamari) hold geological prospecting licenses for non-ferrous metals in Georgia

Trans Georgian Resources Ltd. is joint venture (JV) between the State Department of Geology and Bolnisi Mining Operation NL, subsidiary of Bolnisi Gold NL. Trans Georgian Resources holds a geological and prospective license. The JV relinquished 60 km^2 from the initial 1,600 km^2 around the Bolnisi mineralized zone where the Madneuli mine is located (Fig. 2.13, Fig. 2.14).

The procedure to obtain an exploring license is at the Department of Land Resources Preservation and Mining of the Ministry of Environment Protection and Natural Resources. The applicant shall send in application form, outline of the company, financial report and exploration program. In case of multi-applicants, a tender or auction will be held and inspected. Term of inspection is 90 days in case of oil, natural gas, hot spring and non-ferrous metals. It will be publicly announced in major newspapers for 45 days, and examined in detail the remaining 45 days. Finally, the license will be issued and registered to the State.

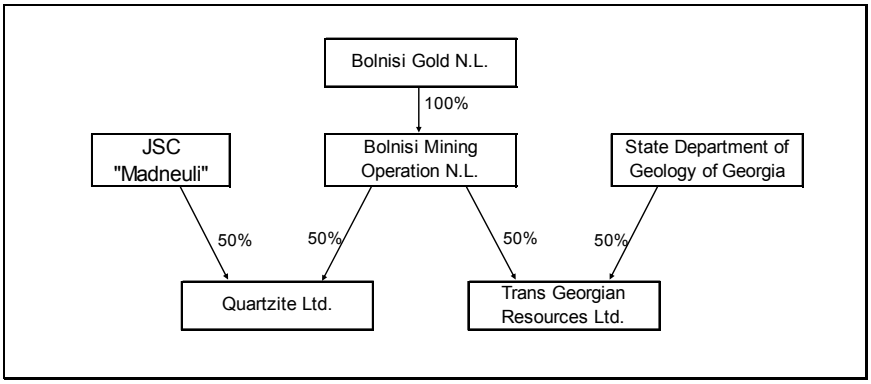


Fig. 2.13 Relationship of Trans Georgian Resources, Ltd. & Quartzite

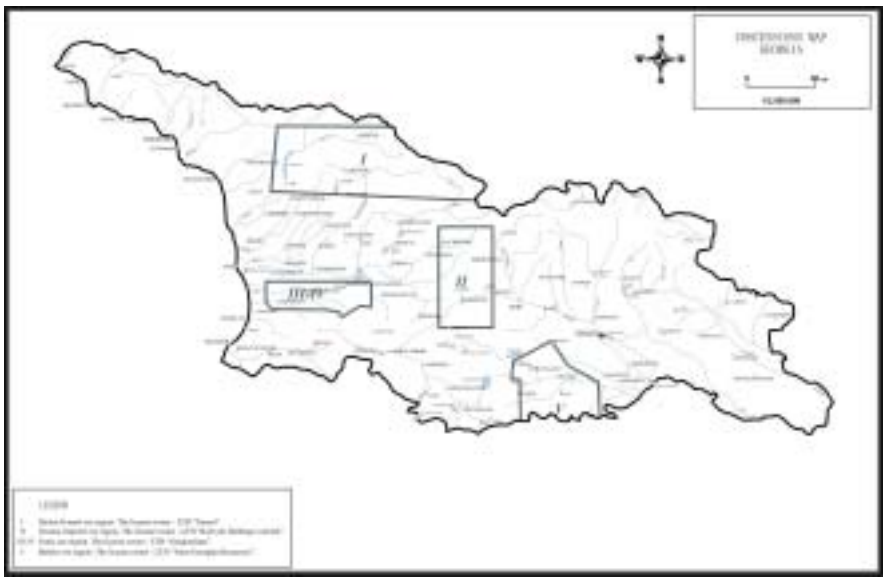


Fig. 2.14 Concessions Map of Georgia

- Ministry of Environment Protection and Natural Resources decides the boundary of the license area and term of the license according to the scale of prospecting work. The license area is a polygon with each vertex representing latitudes and longitudes.
- Application of licensing area is permitted to overlap another license area depending on the ore type.
- The result of prospecting work shall be reported every year and in the final stage to the Ministry of Environment Protection and Natural Resources. In case there is no report, the license shall be revoked and penalized.

4-2 Exploration Method and Evaluation of Ore Deposits

Geological maps of the entire country have been published on a scale of 1:50,000, and scale of 1:25,000 in important districts. The 1:200,000 scale is now being revised and will be completed by 2004. The revision is delayed because of the government budget reduction. After independence, no geological maps were printed and published. Previous maps published in the former USSR time are used presently. Exploration methods during the former USSR were standardized systematically. The method at the first stage consists of geological reconnaissance survey on scales ranging from 1:200,000 to 1:50,000, geophysical survey, geochemical survey. The second stage is semi-detailed geological survey, trenching and drilling, detailed geophysical survey and detailed geochemical survey in a promising mineralized area. The third stage is detailed survey composed of core drillings, adit and drift excavation, and reserve calculation, processing examination and feasibility study. Economical

and efficient prospecting method in the West has not spread into Georgia. Standardized exploration method in the Soviet time is still maintained.

Evaluation method of a deposit is applied to the exploration method, ore reserve calculation and classification that are standardized in the system of mineral resources classification set up in 1981. In this classification, ore deposits are divided into three main groups (explored reserves, evaluated reserves and prognostic resources), and seven categories (A, B, C_1, C_2, P_1, P_2 and P_3).

Minable reserves				Potential resources		
Explored			Evaluated	Prognostic		
A	B	C_1	C_2	P_1	P_2	P_3

At present, an individual mineral deposit in Georgia has registered metal reserves, ore reserves and grade. Reserves of categories A, B and C_1 are reliable because of very accurate three-dimensional geological data. On the other hand, reserves of categories C_2, P_1, P_2, and P_3 which are unreliable, shall be reexamined from the market economy point of view. Standard of ore reserve calculation was made in the former USSR is still applied in Georgia.

State Interdepartmental Committee on Reserve is the organization that evaluates ore reserves on the basis of the result of exploration for metals, oil, gas, coal and precious stones, and deliberates on its state registration of ore reserves. The Committee has been maintained since the former USSR period.

4-3 Control System of Geological Information

Georgian Geological Fund, former Geological Control and Depository inside the State Department of Geology, is responsible for keeping total 25,000 of all the reports, documents and data concerning of geological survey, geochemical and geophysical survey, drilling works, excavation works processing and operations since the former USSR period. Prospecting organization of the State Department of Geology and license-holding companies will submit their annual report of investigation and exploration to the State Department of Geology and Ministry of Environment Protection and Natural Resources annually in February. Those reports are kept at the Geological Fund.

4-4 Problems on Geological Prospecting

In the USSR time, systematic geological survey and prospecting were carried out over Georgia under state control and instruction. About 500 ore deposits and manifestations were discovered and confirmed.

After independence, the State Department of Geology is in charge of the prospecting

organization of the government. Governmental exploration activity has stopped because of a lack of finance, reduction of personnel, and decrepit machinery and equipment.

No prospecting and mining companies using domestic capital are growing. State Department of Geology and Ministry of Environment Protection and Natural Resources are expected to perform geological survey and exploration by foreign capital. But exploration by foreign investment is making slow progress because the geological information is in Russian or Georgian and difficult to gain access. Sales of concentrates by their own efforts are very difficult in the market economy because there is no copper, lead and zinc refinery in Georgia. New information about exploration from the West is limited because it is difficult to acquire except for information from Russia and there are few geologist and engineer who understand English.

5 Evaluation of Mineral Potential

5-1 Characteristics of Mineral Deposits and Their Distribution

Caucasus region including Georgia is divided into Greater Caucasus, Transcaucasus and Lesser Caucasus from north to south. The trend of these zones extends from WNW to ESE. Northern Caucasus corresponds to Scythian Platform of southern end of the Eurasia plate, and Southern Caucasus corresponds to the northern end of the Arabian (Iran) Plate. Caucasus occupies the adjacent zone of both plates. Each zone develops faults. The whole area of Caucasus is shown to be a tectonic zone. Many kinds of metals are deposited with relation to volcanic activity and intrusive rocks (Fig. 2.15, Fig. 2.16).

Fig. 2.15 Geological Map of Caucasus Area

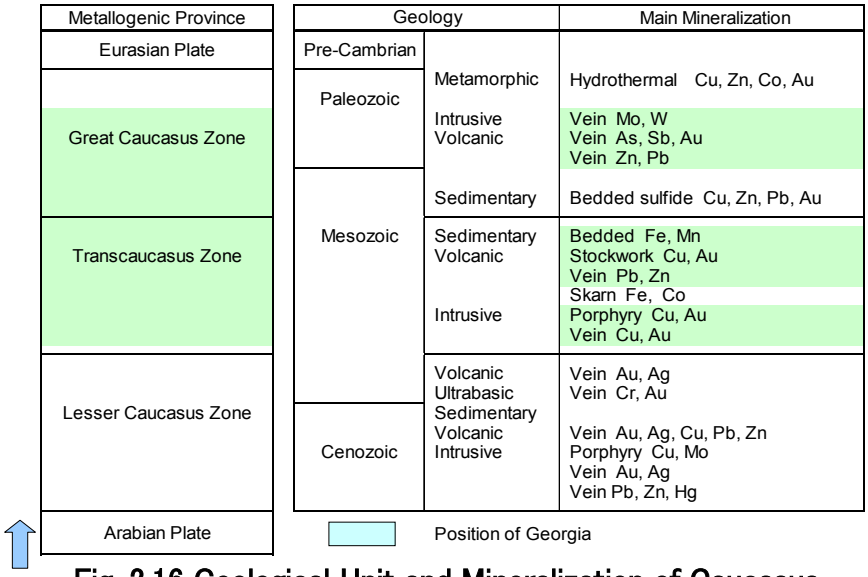


Fig. 2.16 Geological Unit and Mineralization of Caucasus

Mineral deposits in the Greater Caucasus are composed of copper-lead-zinc, molybdenum and tungsten hydrothermal vein type deposits related to Hercynian intrusives, volcanogenetic sedimentary copper deposits related to submarine volcanic activity in Devonian age, polymetallic deposits related to tholeiite basalt of earlier Jurassic age. Mineral deposits in the Transcaucasus consists of sedimentary manganese-iron deposits of Jurassic to Cretaceous age, volcanogenetic massive sulfide deposits related to calc-alkaline volcanics of Cretaceous, porphyry copper deposits, lead and zinc vein type deposits, and gold and silver vein type deposits.

Mineral deposits in the Lesser Caucasus consists of skarn deposits, porphyry copper deposits related to intrusion of late Cretaceous to Paleogene chromite deposits, gold vein, copper vein and polymetal deposits, porphyry copper-molybdenum deposits, related to Tertiary intrusive rocks

Georgia, located west of the Caucasus region, is composed of the Great Caucasus, Transcaucasus and Somheto-Kravakh zone of Lesser Caucasus. Georgia is dominant for many kinds of deposits such as manganese-iron deposits, non-ferrous metal deposits and precious metal deposits because it consists of complex tectonic zones.

Underground resources in Georgia are oil, natural gas, coal, iron, manganese, copper, lead, zinc, tin, cobalt, arsenic, aluminum, molybdenum, tungsten, mercury, antimony, gold and silver, and non-metal resources such as barite, bentonite, talc, zeolite and dolomite. Within those resources, manganese, copper, lead, zinc, gold, silver and arsenic are important. Manganese occurs around the Chiatura mine, copper, zinc and lead occurs around the Madneuli mine and the Kvaisa deposit (Fig. 2.17).

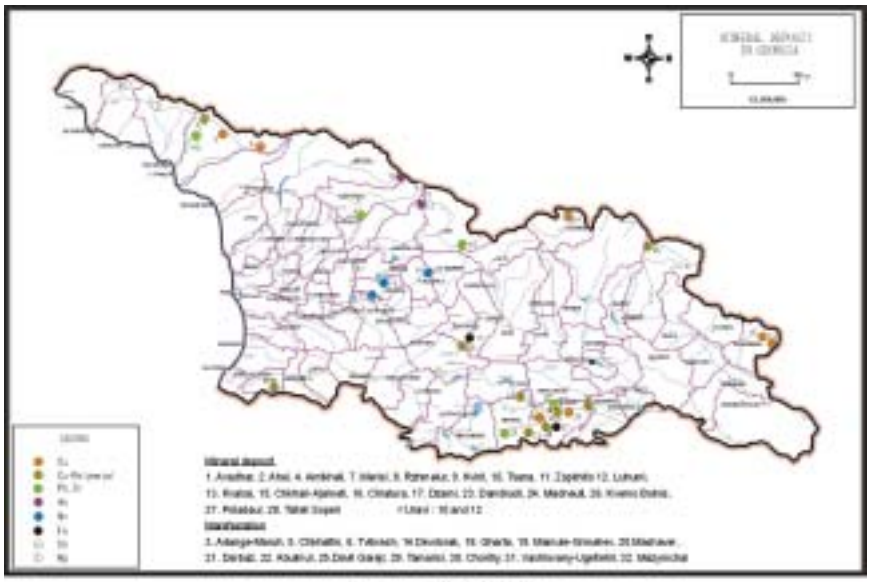


Fig. 2.17 Mineral Deposit in Georgia

5-2 Characteristics of Gold and Silver Deposits and Promising Area

At present, gold and silver in Georgia are produced as by-products of the barite-copper-lead-zinc polymetal deposit. Gold and silver are recovered as extracted gold from silicified ore or by-product of copper concentrates at the Madneuli mine. This deposit is a volcanogenetic sedimentary polymetal deposit related to late Cretaceous volcanic activity. The formation of the deposit is genetically similar to Kuroko type deposit in Japan.

Thirty mineral deposits and manifestations of the same type are situated in the Bolnisi mineralized area including the Madneuli deposit. (Sakdrisi deposit 21 tons of gold reserves, Dambludi deposit 1.9 tons of gold). Gold deposits in Georgia are classified into gold-polymetal, porphyry copper-gold, gold arsenic, gold antimony and gold placer. Almost all of these deposit are small-scale and middle-scale deposits of less than 20 tons of gold. Exploration targeting gold has been hardly performed. Low sulfide epithermal gold quartz deposits have not prospected sufficiently. Seven gold prospective areas are listed in Georgia (Table 2.19, Fig. 2.18).

Table 2.19 Georgia Metal Deposit Potential Areas

No.	Area	Deposit Type	Deposit Name
①	Adjaria	● Au･Cu polymetal	Meritsu, Vaio
②	Abkhazia	● Cu･Au porphyry	Zimi
		● Metamorphic Au quartzite	Kliche
		● Hg･Au telethermal	Akhei-Avakhari
③	Samegrelo-Zemo Svaneti	● Cu･Au porphyry	Tekhuri
		● Hydrothermal Au, Sb･Cu	Khokrili, Arshiri, Lasili
④	Kveda Svaneti-Racha-Lechkumi	● Hydrothermal Au･As･Sb quartz	Tsana, Zopkhito
⑤、⑥、⑦、⑧	Guria, Shida Kartli	● Cu･Au porphyry	Garti,
		● Epithermal Au quartz	Zekari, Vakijvari, Zoti
		● Carlin type Au	
⑨、⑩	Mtskheta, Kakheti	● Au quartz	Saketsi
		● Metamorphosegenetic Au quartz	
⑪	Bolnisi	● Volcanogenetic Au-bearing polymetal	Madneuli, Kvemo Bolnisi, David Gareji

For numbers, please refer to Figure 5.2.1

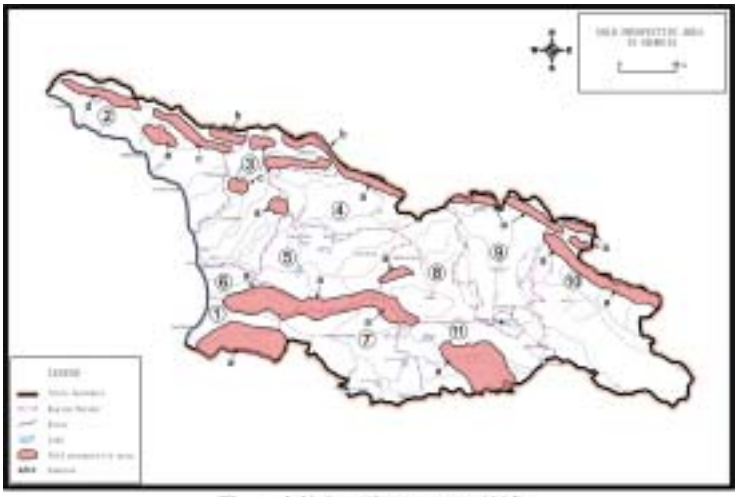


Fig. 2.18 Gold Prospective Area in Georgia

5-3 Characteristics of Copper Lead and Zinc Deposits and Promising Area

Most copper deposits distribute in the Bolnisi mineralized area. These are of copper-lead-zinc deposits in volcanic complex in late Cretaceous age. Madneuli, Kvemo Bolnisi, Davit Gareji, Tsiteli Sopeli, Dambludi deposits are known there. As for copper pyrrhotite deposits in Jurassic age, Adange, Artana and Mtsare Diki deposits are distributed in Abkhazia and Kakheti regions. Melire deposit in Adjaria, Gharta and Tsablana deposits in central Georgia are known as porphyry copper type.

Copper metal reserves are 217.5 thousand tons for Madneuli, 316.0 thousand tons for Tsiteli Sopeli, and 176.2 thousand tons for Merisi. Copper reserves of $A+B+C_1+C_2$ amount to 709.7 thousand tons. Prognostic copper metal is calculated at 1,729.8 thousand tons.

Lead and zinc deposits accompanied with a massive sulfide copper deposit are Madneuli, Sakdrisi and Dambludi deposits in the Bolnisi mineralized zone. Kvaisa and Merisi deposits in the South Ossetia are lead and zinc deposits in the Big Caucasus. Lead metal reserves ($A+B+C_1+C_2$) of these five deposits are calculated at 242.8 thousand tons, prognostic resources of lead metal amounts to 675.7 thousand tons. Zinc metal reserves ($A+B+C_1+C_2$) are calculated at 607.8 thousand tons, prognostic resources of zinc metal amounts to 1,283.1 thousand tons.

5-4 Characteristics of Manganese Deposits and Promising Area

Manganese is an important mineral resource in Georgia. In former USSR time, both Chiatura deposit located in West Georgia and Nikopol deposit in Ukraine were the most productive manganese deposits in the world. Chkhari-Ajameti, Shkmeri and Kvirila deposits are known as manganese deposits. In addition, Tetriskaro group is situated in Eastern Georgia. All the deposits were formed in sedimentary manganese deposits of Jurassic-Cretaceous age.

Manganese reserve of categories $A+B+C_1+C_2$ in the Chiatura deposit is calculated at 201.9 million tons. Also, manganese reserves in Chkhari-Ajameti, Shkmeri and Kvirila deposits are 5 million tons, 6.3 million tons and 27 million tons, respectively. Total manganese reserves in Georgia are calculated at 240 million tons, and prognostic resource amounts to 180 million tons.

5-5 Mineral Deposit and Area for Evaluation

Mineral resources that are effective for economic growth in Georgia are gold and copper. From distribution of gold deposits (Fig. 2.19) and gold reserves (Table 2.20), gold reserves in Georgia are revealed to be approximately 480 tons. But it is necessary to evaluate these reserves from viewpoints of characteristics of deposit, associated minerals and exploration results.

Highly desired deposits to be exploited are quartz vein-type, quartz network and porphyry type. Open pit mining is more desirable than underground mining. Evaluating all the gold deposits, ratio of complex ore to vein-type and porphyry-type ore shows 1:9. Gold deposits planned for open pit mining are about 60% in the vein-type and porphyry-type deposit. Ore deposits should be evaluated by these divisions.

Closely watching the distribution of gold deposits in Georgia, 16 deposits shown as No. 14 to No. 30 are concentrated in the Bolnisi mining region where 170 tons of gold reserve is estimated. This amount of gold corresponds to about 35% of the total Georgian gold reserves. Mineralization types in the area are copper-gold bearing quartz network, gold-bearing quartz network and porphyry copper-gold. These ores have less processing problems. In the III-II

millenniums BC the Bolnisi area was one of the centers of iron ore extraction and exploitation of gold placer deposits. A large Madneuli ore deposit is polymetal sulfide (Au, Cu, $BaSO_4$, Pb, Zn, Ag). It has been exploited since 1975. Around the Madneuli deposit, there is a mineralization zone that distributes many kinds of minerals. Deposits and occurrences of non-ferrous and precious metals, and barite with large total reserves and forecast resources are Sakdrisi, David-Gareji, Kvemo-Bolnisi, Tsitelsopeli, Dambludi, Tamarisi and Balichi.
Though gold placers are embedded around the area (Fig. 2.20).

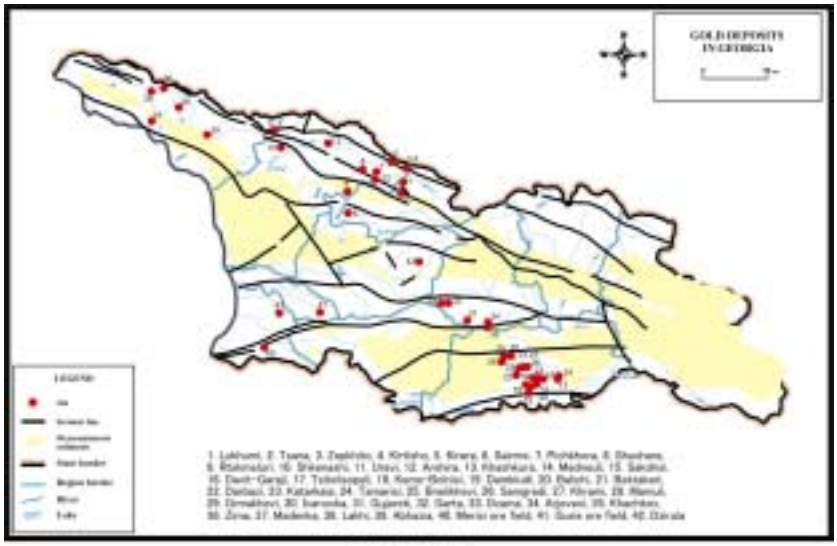


Fig. 2.19 Gold Deposit in Georgia

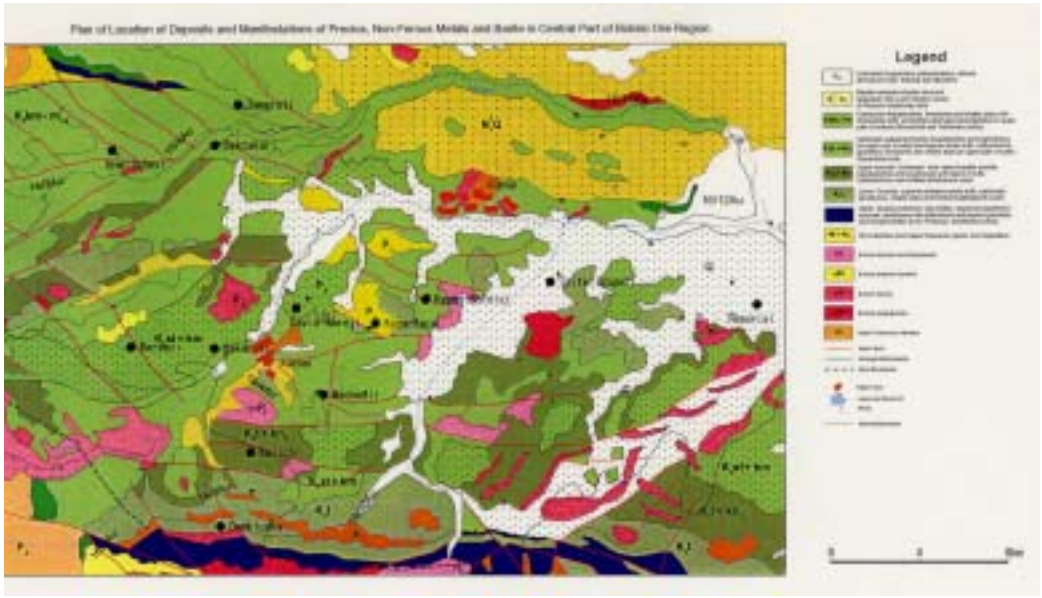


Fig. 2.20 Bolinisi Area Geology

Table 2.20 List of Gold Deposits (1)

No.	Name of deposit (manifestation)	Ore type	Mineralization type	Stage (Prospecting, exploitation)	Component	Reserves (t)	Grade	Category	Mining method (OP/UM)
1	Lukhumi	As-Au	Vein, stockwork	Mined	Au As	12.8 9,620	5 g/t 7.6 %	P1+P2 B+C1+C2	UM
2	Tsana	As-Au	Vein, stockwork	Mined	Au As	0.3 5,370	1 g/t 16.4 %	B+C1+C2 B+C1+C2	UM
3	Zopkhito	Sb-Au	Vein, disseminated	Detail prospecting	Au Sb	8.6 38,400	2.2 g/t 12.3 %	B+C1+C2 B+C1+C2	OP/UM
4	Kirtisho	Au-Pb	Vein, disseminated	Evaluation	Au Pb	1.5 15,200	2.8 g/t 2.7 %	C2 C2	UM
5	Kirara	Au-As	Disseminated	Prospecting	Au As	not evaluated			UM
6	Sairme	Au-S	Veins, disseminated	Prospecting	Au	not evaluated			UM
7	Pichkhora	Au-S	Veins, disseminated	Prospecting	Au	not evaluated			UM
8	Shushara	Au-S	Veins, disseminated	Prospecting	Au	not evaluated			UM
9	Rtskhmeluri	Au-S	Veins, disseminated	Evaluation	Au Zn	not evaluated			UM
10	Shkenashi	Au-S	Veins, disseminated	Evaluation	Au Zn	not evaluated			
11	Uravi	Au-S	Veins, disseminated	Evaluation	Au Zn	not evaluated			
12	Arshira	Au	Placer	Mined	Au	0.2	>350 mg/m³	C2	OP
13	Khashkura	Au	Placer	Mined	Au	1.5	150-230 mg/m³	P3	OP
14	Madneuli	Cu-Au	Stockwork disseminated	Operating	Au Cu	28.1 309,000	0.5 g/t 0.73 %	B+C1+C2 B+C1+C2	OP
15	Sakdrisi	Cu-Au	Stockwork disseminated	Detail prospecting	Au Cu	21.7 18,840	1.9 g/t 0.73 %	C1+C2 C1+C2	OP
16	Davit-Gareji	Cu-Au	Vein, stockwork	Detail prospecting	Au Au Cu	7.3 6.0 11,730	4.7 g/t 5.2 g/t 0.75 %	C2 P1+P2 C2	OP/UM
17	Tsitelisopeli	Cu-Au	Stockwork, disseminated	Preliminary exploration	Au Au Cu	24.4 56.8 288,400	0.8 g/t 1.35 g/t 0.94 %	C1+C2 P1+P2 C1+C2	UM
18	Kemo-Bolnisi	Cu-Au	Stockwork, disseminated	Preliminary exploration	Au Cu	5.2 4,700	2.9 g/t 0.26 %	C2 C2	OP/UM
19	Dambludi	Polymetal-Au	Vein, disseminated	Preliminary exploration	Au Cu	1.9 13,700	1.2 g/t 0.74 %	C2 C1+C2	UM

Table 2.20 List of Gold Deposits (2)

No.	Name of deposit (manifestation)	Ore type	Mineralization type	Stage (Prospecting, exploitation)	Component	Reserves (t)	Grade	Category	Mining method (OP/UM)
20	Balichi	Cu-Au	Veins, disseminated	Evaluation	Au Cu	2 40,000	1 g/t 2 %	P1 P1	OP/UM
21	Bektakari	Au-Q	Stockwork	Evaluation	Au	5.2	1.5 g/t	P1	OP
22	Darbazi	Au-Q	Stockwork	Evaluation	Au	7	1.4 g/t	P1	OP
23	Katarkaia	Au-Ba	Stockwork, veins	Evaluation	Au	10.5	1.5 g/t	P1	OP
24	Tamarisi	Cu-Au	Stockwork, veins	Evaluation	Au Cu	10.4 64,000	1.3 g/t 0.8 %	P1 P1	OP
25	Bnelikhevi	Au-S	Disseminated veins	Evaluation	Au	15	1.5 g/t	P1	OP
26	Samgredi	Au-S	Stockwork	Evaluation	Au	7.5	1.5 g/t	P2	OP
27	Khrami	Au	Placer	Mined	Au	0.9 5.1	110 mg/m³ 50-350 mg/m³	C2 P1	OP
28	Mamuli	Au-Q	Vein	Evaluation	Au	4	2 g/t	P1	OP/UM
29	Grmakhevi	Au-Cu	Porphyry	Searching	Au Cu	15 150	0.3 g/t 0.3 %	P2	OP
30	Ivanovka	Au-Q	Porphyry	Searching	Au	4	2 g/t	P3	OP/UM
31	Gujareti	Au-Q	Vein, disseminated	Evaluation	Au	2.1	2.3 g/t	C2	UM
32	Garta	Cu-Au	Porphyry disseminated vein	Evaluation	Au Au Cu	12 70 231,000	0.7 g/t 0.7 g/t 0.7 %	C2+P1 P2	OP
33	Dzama	Au-Q	Skarn	Evaluation	Au	10	2.3 g/t	P2	OP
34	Arjevani	Au-Q	Disseminated, vein	Evaluation	Au	25	2 g/t	P2	OP
35	Khachkov	Au	Placer	Mined	Au	5	300-700 mg/m³	P2	OP
36	Zima	Cu-Au	Porphyry	Evaluation	Au	65	0.3 g/t	P2	OP
37	Madenka	Cu-Au	Disseminated	Evaluation	Au	not evaluated			
38	Lakhi	Au-Q	Vein, Disseminated	Evaluation	Au	not evaluated			
39	Abkhazian	Au	Placer	Mined	Au	not evaluated			
40	Merisi ore field	Cu-Au Au-Q	Porphyry Vein	Prospecting	Au Au Cu	0.9 70 176,160	0.75 g/t 0.4 g/t 2.4 %	B+C1+C2 P2 B+C1+C2	UM/OP
41	Guria ore field	Au-Q	Vein	Searching	Au	35	2.5 g/t	P1	UM/OP
42	Dzirula	Au	Placer	Mined	Au	not evaluated			OP

The relations between gold grade and tonnage, and copper grade and tonnage in Georgia was studied (Fig. 2.21 and Fig. 2.22). These figures reveal that gold reserves are small when their grades trend high. Regional characters do not recognized. In the Bolnisi region, the following deposits are embedded: operating Madneuli mine (28 tons of gold reserves and 0.6 g/t of gold grade of crude ore); Sakdrisi deposit (21 tons of gold reserves, 1.9 g/t of gold grade) where Trans Georgian Resources company has prospected to exploit; Tsitelsopeli deposit (24 tons of gold reserves, 4.8 g/t of gold grade) where ore body is situated at a 150 m-200 m depth; David-Gareji (7 tons of gold reserves, 4.7g/t of gold grade); and Kvemo-Bolnisi (5 tons of gold reserves, 2.9 g/t of gold grade). This area has high gold potentiality in the country. Ore deposits in this area are prospective for exploration and exploitation. Although many small deposits are distributed, evaluation of each deposit, necessity of exploration and selection of developed deposit should be performed.

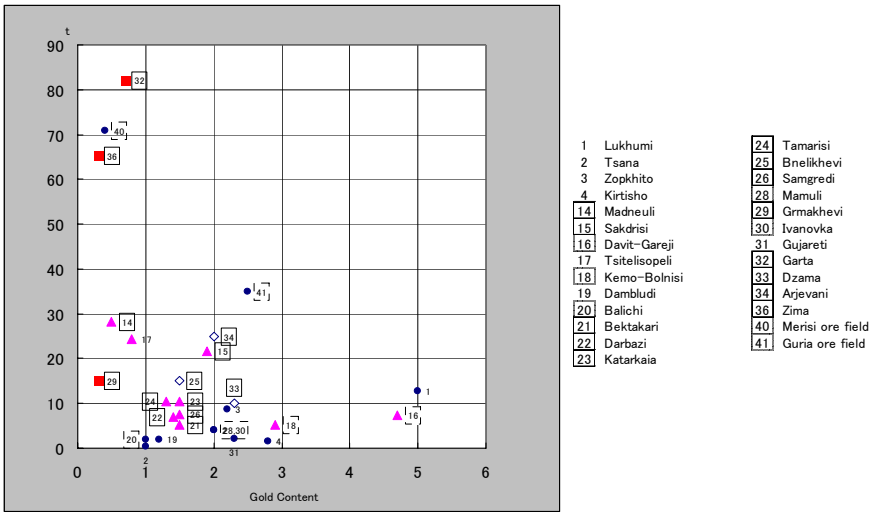


Fig. 2.21 Grade and Tonnage of Gold deposits in Georgia

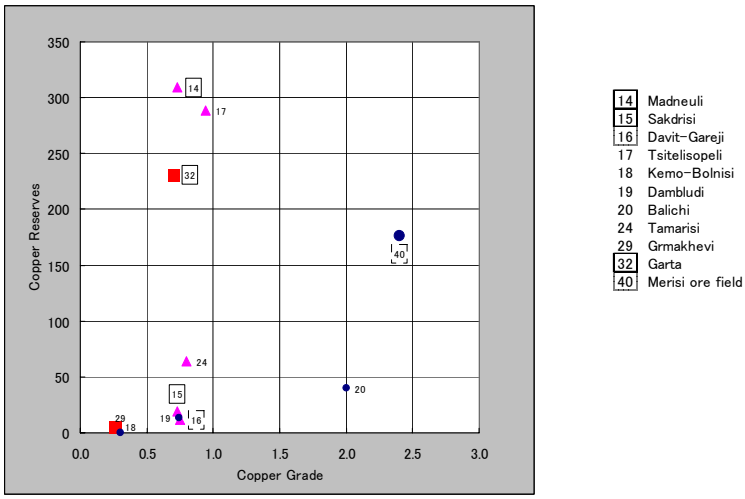


Fig. 2.22 Grade and Tonnage of Copper deposits in Georgia

6 Production field

6-1 Present Situation on Management and Operation (Madneuli mine)

Madneuli mine was opened in 1974, and has operated for 27 years as a state enterprise. In 1995, it became a joint stock company with 98.2% ownership by the Ministry of State Property Management, and 1.8% by its employees (Fig. 2.23).

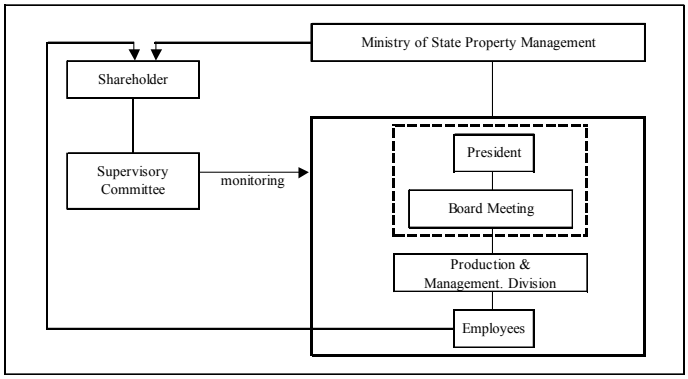
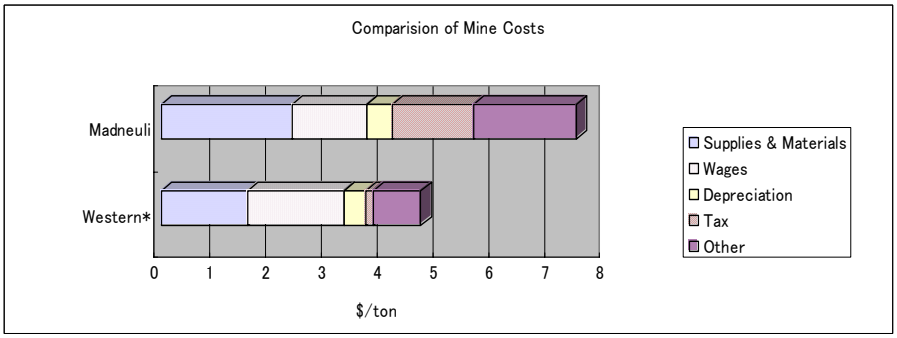


Fig. 2.23 Management Structure of Madneuli Mine

As for Madneuli mine's present management situation, production is recovering steadily. In 2001, the company had a gross profit of 0.368 million GEL (US$ 175 thousand) with revenues of 21.2 million GEL (US$ 10.1 million). The production increased 1.2 5 times as much as the previous year. In addition to the large amount of debt (US$ 5.5 million by Glencore company and city banks etc.), it is in difficult condition to make more profit due to taxes, public welfare and increased interest burden. Comparing the costs of a mine producing ore at the same rate in the U.S.A, the costs of Madneuli mine are 1.9 times higher (Fig. 2.24).



	Western* $/ton ore	Madneuli $/ton ore	
Supplies & Materials	1.55	2.34	Includes gas, electricity, water and materials
Wages	1.72	1.34	
Depreciation	0.38	0.46	Western depreciation: assume 20 year straight line
Tax	0.15	1.45	Western tax: property tax
Other	0.85	1.85	Madneuli other = company service + insurance + other
Total	4.65	7.44	Western other includes private royalties + administration
			*5000 ton per day mine in Western Mine Engineering , Inc.

Fig. 2.24 Comparison of Mine Costs of Madneuli Mine and Western Mines

In the 2001 production results are as follows; Crude copper ore grade was 0.82% and its production was 1,433 thousand tones (projected 1,200 thousand tones). As for copper concentrate, its grade was 18.61 % and production was 57.2 thousand tones. In spite of aged equipment and facilities, productivity has been increasing, supply of all parts is based on import from foreign countries such as Russia and Turkey mainly that why maintenance costs are still high. In the mining field with partial funding from Glencore Company, the renewal of mining equipment is being implemented (one CAT loader and used TAMROCK drill rig were purchased recently). Productivity is increasing. Rationalization such as the restructuring of employees, and subcontracting of transportation and blasting works at the site (ore transportation 100%, blasting works 70%) is undergoing. But now it is under a situation that the re-evaluation of the minable ore reserves because of the sharply decreasing of confirmation exploration due to a lack of finance. It can be considered that this situation is a patent influence to the mining scheme and crude ore grade from now. In the processing section, a large-scale disk filter was introduced for concentrate dewatering partially. Improvement of increasing productivity has begun by the division of flotation facilities, etc. But the production is only on copper concentrate so the production system is neither effective nor effective. There are many idle facilities at the present production scale.

Now the operating rate is more than 90%. Making a production control system for full operating system and stable operation after reduction of the number of employees, which can implement full operation with the present employees or will be an assignment in the future (Table 2.21).

The security and safety control system has been maintained in the same manner since the former USSR era. There is no investment for security and safety aspects due to a lack of finance.

Table 2.21 Present Situation & Issues at Madneuli Mine

	Present Situation	Issues
Investment	Accumulation of debt, $11 million	Repayment plan unclear
Cost	$8/ ton ore, welfare and health costs are a burden	Factor of cost is government matter
Market	Glencore (Swiss) has exclusive sales rights	No freedom for sales
	Debt (no repayment)	Must repay debt at privatization
Investment for Facilities	Aged, needs renewal, no investment for facilities	Aged facility, maintenance cost rising
		Finanacial support difficult, low productivity
Condition of Ore Sales	Cu conc. international price (LME) standard	No evaluation of Au in concentrate 10 g/t
Ore Reserves	15 million tons exists	Mineable reserves 1/2 due to present regulations (pit slope)
Finance	Large inventory, no financial power, short-term debt 80%	Lack inventory management, unprofitable
Action Plan	No intermediate-term action plan	No re-evaluation of ore reserves

The main problems of the Madneuli mine are as follows;

- Re-evaluation of mineable ore reserves

  At the present time, ore reserves of B+C1 are estimated at 14 million tones (Cu 1.05%). The C2 ore reserves amount to 5 million tones. However, by the regulations of ore reserve category, this ore reserves is not included in the minable ore. It is needed to re-evaluate the ore reserves of category C2 and perform exploration for its transition into minable ore reserves. Prolonging the operation mine life is urgent, therefore it is crucial to perform confirmation exploration of minable ore reserves by changing the regulations (Fig. 2.25).
- Countermeasures against delay of stripping works

Present mining target area is concentrated in the vicinity of the center of the pit bottom. Since the stripping works are delayed, it is under a difficult situation to maintain a stable operation (stripping ratio of 0.37 m^3/t in 2001). In order to solve the problems, it is necessary to implement the stripping works as soon as possible. On the other hand, according to the pit design so far, the average pit slope angle is 30°and stripping ratio is 2.15 m^3/t. At this point, if the pit slope angle is changed to 40°,stripping ratio would be 1.93 m^3/t and 11% of the cost would be reduced (Table 2.22). With the present pit design, the amount of stripping waste will be increased. As a result, it is under a situation that part of the ore deposits cannot be mined economically. It is an urgent matter for these stripping countermeasures, which includes the stability of the pit slope such as the design change on the pit slope.

- Plan for rationalization

  By reducing the unit cost based on the renewal of the equipment and reduction of labor cost, it is necessary to revise the present cost. As a concrete countermeasure of reduction, some points can be shown as follows.

  - Mining division; By means of review of loading machine and drilling rig, enlarging of blasting hole diameter (175mm to 250 mm), reduction of the cost of materials and expense of employees → reduction of the unit cost of $1 per ton.
  - Processing division; Changing of the flotation line, reagent, reduction of the expense of employees (50%) → reduction of unit cost of $1 per ton.
  - Indirect division; Rewrite the contract with Glencore, reduction of T/C, F/C by developing a new market

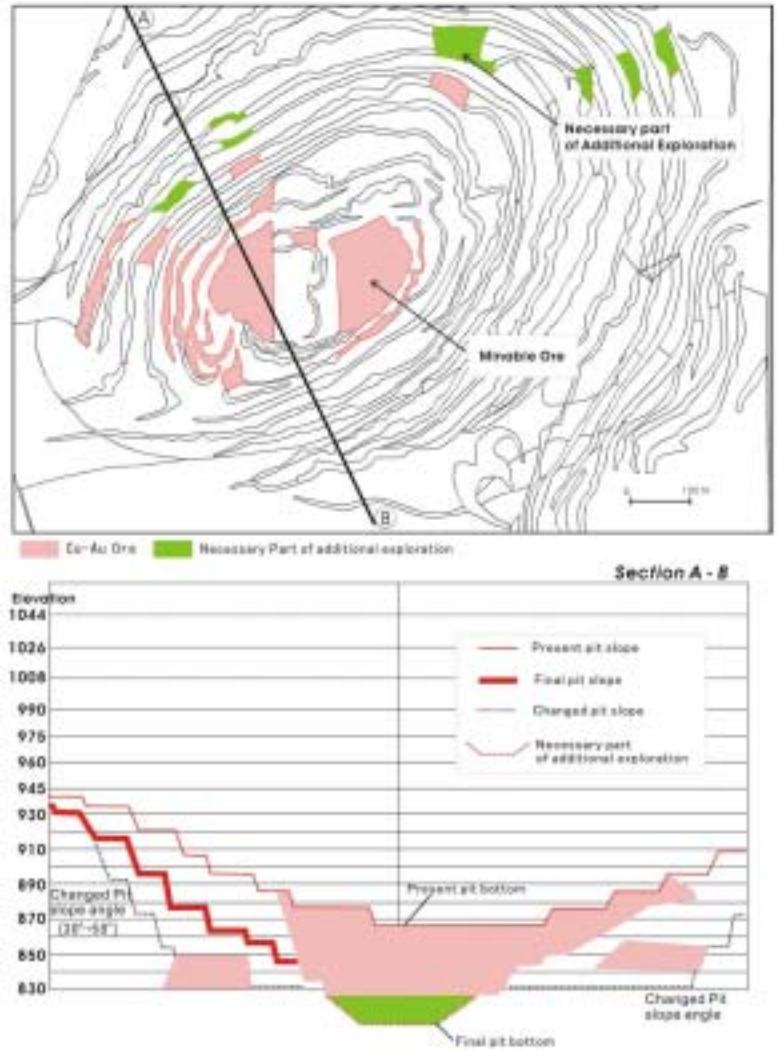


Fig. 2.25 Minable Ore and Cross-section of pit at Madneuli Mines

Table 2.22 Cost efficiency comparison table based on change of stripping ratio and pit slope angles

#	Item	Unit	Case 1	Case 2	Reduction
1	Pit Slope Angle	degrees	30 (actual)	40 (recommended)	
2	Stripping Ratio	m^3/t	2.15 (designed in 1996)	1.93 (suggested in 2002)	
3	Ore Reserves	million tonnes	14.0	14.0	
4	Stripping of waste	million m^3	30.0	27.0	3.0
5	Stripping Cost	$\$/m^3$	2.89 (actual as of 2001)	2.89 (actual as of 2001)	
6	Total Cost	million $USD	87.0	78.0	9.0

With the present costs, the break-even point of the grade is 0.77% of copper, and it is a loss of $5.53 per ton of crude ore. In order to maintain the planned break-even point of the grade, it is necessary to reduce costs o the $5.71 per ton of crude ore. In the case, the planned cut-off grade of 0.4% of copper can be maintained.

Head Grade	0.4% Cu 1.05 g/t Au of ore.	0.4% Cu 1.05 g/t Au of ore.
Recovery	86.58% Cu 44.25 % Au	86.58% Cu 44.25 % Au
Recoverable Copper Per Tonne	3.46 kg of Cu 0.46 g of Au	3.46 kg of Cu 0.46 g of Au
Costs	Per tonne ore	Per tonne ore
Mining	$ 3.07	$ 2.07
Processing	$ 2.98	$ 1.98
Indirect cost		$1.10
Sub-total	$ 8.79	$5.15
T/C,R/C of Cu	$ 7.13	$4.99
R/C of Au	$ 0.07	$0.07
Total	$ 15.99	$10.21
		(reduced)
Value@$ 1.65/kg of Cu	$ 5.71	$ 5.71
Value@$ 10.33/g of Au	$4.75	$4.75
Value@ (Cu+Au)	$10.46	$10.46
Net value	-$5.53	$ 0.25
Cutoff grade	0.77 % Cu (by interpolation)	0.4 % Cu

- Copper and gold recovery from slime

  About 20 million tones of slime (Au 0.6 to 0.8 g/t, Cu 0.17 to 0.24 %) contain of 14 tones of gold and 70 thousand tones of copper. Due to the low grade of the copper and gold in the slime, it is hard to develop economically even with the present heap leaching technology. Apart from the slime, 1.0 million tons of low-grade ore (Cu 0.3%) exists so it is necessary to develop a recovery technology for this situation such as heap leaching technology, etc.
- Deterioration of mine equipment and facilities

  Almost all the equipment and facilities have not been renewed since the former USSR era (1980's) and this fact influences productivity of the mine. It links to increase the burden of costs such as power, repair, etc. Besides, most of operating equipment and facilities are of a large capacity and not appropriate for an existing scale of production.
- Acid mine water treatment at open pit

  Rainwater percolates through ore deposits, comes to a spring, and forms an acid mine

water pond at the pit bottom dissolving heavy metals. It is necessary to repair the aged drainage pipes and ditch cause water pollution and soil contamination, and to improve the recovery rate of the copper from the acid water by utilizing recovering facilities of copper.

6-2 Present Situation on Development

Exploitation of ore deposits has been suspended since the independence. Now Trans Georgian Natural Resources Company (J/V with Australian Company) acquired an exploitation license of Sacdrisi deposits, under exploration in the Bolnisi area, and is examining to make it an enterprise. Concerning other deposits, examination on exploitation has not been implemented yet.

Regarding the economic evaluation on ore deposits, so far the Hoscord evaluation method based on investment scale and profitability had been adopted. In future, it will be necessary to evaluate existing ore deposits by adopting a Western method of evaluation and to select competitive ore deposits. Governmental organizations related to the mining industry have the right to permit and supervise the issue of licenses for exploitation and construction. Procedure for exploitation is as follows; first, after governmental approval of ore reserves, acquire a license. Next, make a feasibility report and implementation of an environmental evaluation study. Besides making an actual plan for investment, a working plan and engineering are required. These documents are submitted to the Ministry of Environment Protection and Natural Resources, and examined in the Ministry's license committee. Permission of exploitation can be given (Fig.2.26). The procedure is very complicated and requires a long time to acquire a license. After independence, there are many unknown factors due to the lack of results of exploitation.

There are no enterprises, which promote exploitation of new ore deposits. The reason is that it is difficult to access to mineral resources information making a motion of development and there are no exemptions and incentives for foreign investors, and the procedure is complicated. Moreover, a reevaluation of mineral resources is required to make clear the ability of competitiveness under a market economy. This is due to high customs duty for imported equipment for exploitation and many issues in operation such as the burden of many types of taxes. There're many issues on the various kinds of tax obligation for operation. Judging from the present situation, there is no merit for development, and inducement of foreign investors cannot be expected in near future. Because of a lack of finance and technology at state enterprises, privatized companies, and private companies, it is very hard for them to independently exploit deposits without government support (Table 2.23).

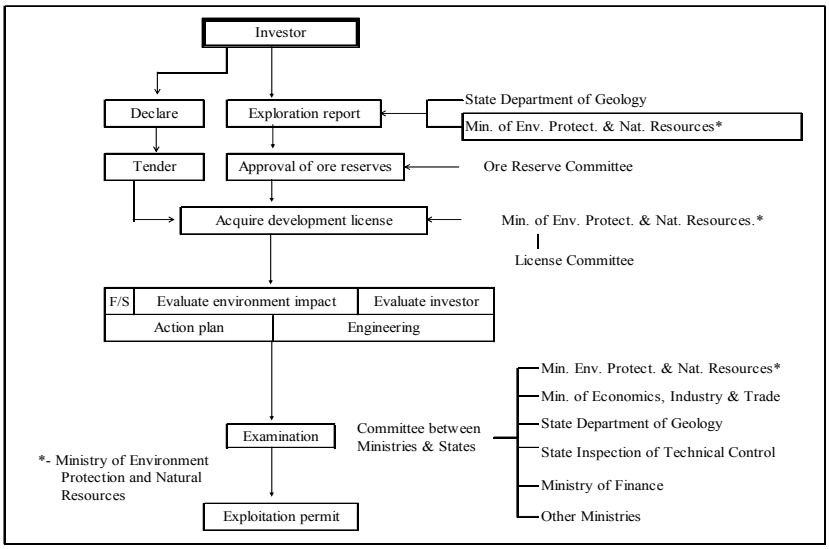


Fig. 2.26 Procedure for Acquiring Development Approvals

Table 2.23 Hindering Factors & Issues for Development

Item	Foreign Investor	Privatization, State Management, and Private Company
Finance	Financial market undeveloped	No long-term loan
Development Procedure	Complex, requires long time, unclear	Expensive, difficulty for preparation
Tax System	Customs, costs increasing	Cost increasing
Development Regulations	Uncompetitive, inflexible	Poor technical ability out of regulations
Ore Reserve	Re-evaluate ore reserve, approval procedure	Inadequate evaluation method
Investment	No guarantee, record procedure complex	No financial power
Policy & Support	None	None
Mining Law	License transfer and contract mining prohibited	

6-3 Condition of Privatization and Introduction of Foreign Investment

The target of privatization of the mining sector is mainly being put into practice at the Madneuli mine, Chiatura mine, Uravi mine (suspended in 1997) and geological expeditions has been transformed into Joint Stock Companies. Concerning Madneuli mine, the Madneuli Mine cannot privatize it due to a 5-year loan agreement with Glencore (Swiss) in 1998 and until the complete repayment of the principal loan in this period. The Chiatura mine failed in its stock sale in 2001. The Zestaponi refinery was enforced a tender for a stock sale or tendering transfer of management right by a joint package with the Chiatura Mine. But this tender ended in failure. On the other hand, JSC Geology, which was apart from the State Agency of Geology, became independent, merged with another JSC. Now the JSC Geology is a joint stock company. JSC Geology is carrying out a part of a stock sale by tendering some

of its stock.

Plan and conditions for privatization of mining enterprises should be examined for adaptation to international tendering conditions the definition of responsibility of environmental pollution by the State company's activity.

6-4 Present Situation on Mining Technology

They have mining technologies from design to construction have been maintained based on technologies of the former USSR era. Some mines have tried to automate and systematize their underground mines in the former USSR era. On the other hand, feasibility study technologies are not common for using them in spite of introducing a western way of economic evaluation and method. This is still only knowledge. This is not at the stage of implementation after having enough understanding. The computer is applied to limited usage due to lack of hardware and software in the mining field.

Almost all their technologies were developed, used and accumulated in the former USSR era. It doesn't mean that each technology itself has an issue. But reduction of energy, maintenance, efficiency and automation from a viewpoint of competitiveness, etc. are insufficient because the technology is old and not improved. At this time, the most suitable way to solve the problems is by using and introducing technology for systematization and IT (Information Technology) from advanced countries from Europe and US to improve old technologies at the mines in Georgia for the near future (Table 2.24).

Table 2.24 Mine Technology Used and Example

Division	Technology	Example
Surface Mining	Open-pit method	Madneuli mine (Cu, Au)
	Open-cut method	Chiatura mine（Mn）
Underground stoping	Retreat longwall and shortwall coal mining method	Chiatura mine（Mn）
	Sub-level caving、shrinkage stoping, & sub-level stoping methods （examine introduction of trackless mining system to a part of the mine）	Uravi mine（Zn,Pb）
	Overhead cut & fill method Keeping method	Uravi mine（As）
Drifting	Horizontal drift Drift area：$4m^2$～$12m^2$ standard hand-held drill + loader	Every mine drift
Drifting	Raise boring(primary body、4 stages） Raise boring by Alimak Climber Winze	Every mine shaft
Boring	Core boring (Usual method of construction, examine the introduction of wire line method for part of construction)、(boring ability 500-600 m, latest boring diameter is 76 or 59 mm)、horizontal and inclined boring possible	All mines

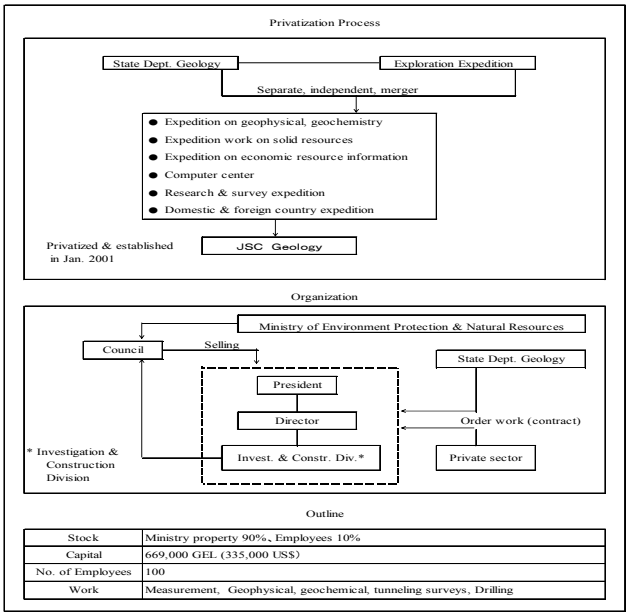


Fig. 2.27 JSC Geology Privatization Process and Organization

6-5 Recent Condition of Mineral Dressing

Operating mineral dressing plants in the country are at the Madneuli Mine (Cu, Au), Chiatura Mine (Mn) and gold heap leaching plant at the Madneuli Mine managed by a Georgia-Australia Joint Venture Company.

Among the flotation facilities at the Madneuli Mine, the copper flotation plant is under operation but pyrite and barite flotation processes are not in operation. The amount of processed ore at the mineral dressing plant in Madneuli was decreased since 1991 but has recovered to 1.5 million tons / year in 2001 by converting of flotation equipment, which is approximately 90% of the installed capacity (Fig. 2.28). Gold recovery and silver recovery at the Georgia-Australia joint venture as follows: gold – 177,355 oz and silver –76,414 oz during years 1997 to 2001. Chiatura Mine consists of six mining sites composed of mainly bedded type deposits. Each mine has an individual gravity separation plant. There is one Central flotation plant, which treats fine size ore accumulated from all six plants. The pipelines for wastewater and slime connected with tailings dump and pumps are broken, superannuated and not maintained all the slime is discharged into the river. The amount of concentrate treated by dressing plants was 1.1 million tons in 1990 and was 0.292 million tons in 2001. Dressing is basically specific gravity. Fine-grained ore is hardly recovered and fine-grained material makes a negative impact to productivity and the environment. There is no plan to repair the damaged pipeline due to a lack of financing.

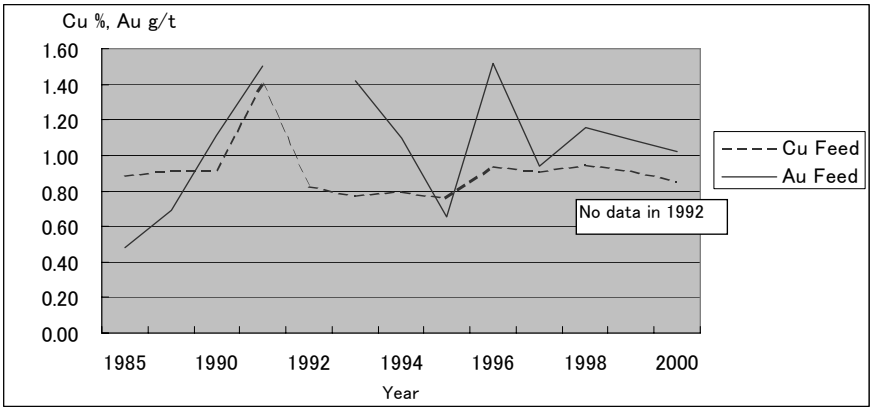


Fig. Trend of Feed Grade

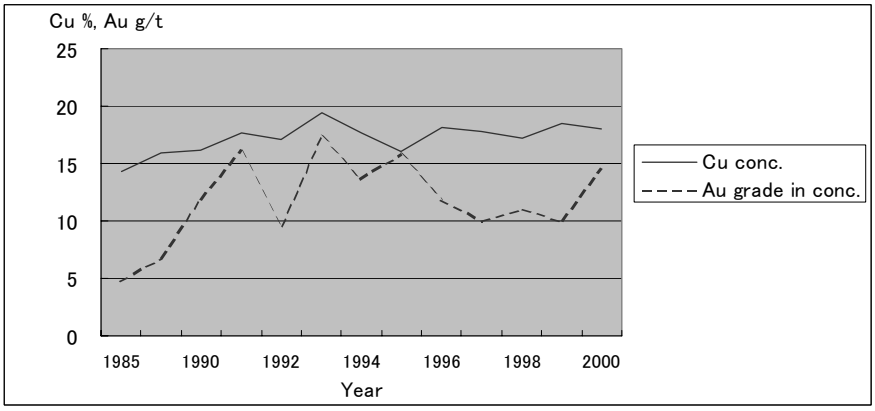


Fig. Trend of Concentrate Grade

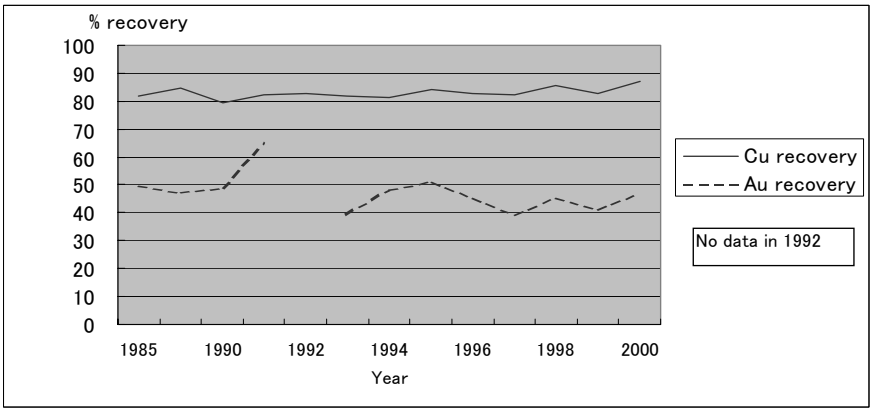


Fig. Trend of Recovery Rate

Fig. 2.28 Trend of Recovery Rate

Schematic flows of mineral dressing at the Madneuli and Chiatura Mines are very similar to those of industrialized countries and have no obvious problems. Machinery of Madneuli

dressing plants are old but well maintained. There still exists some unnecessary machinery in the dressing plant because pyrite flotation and barite flotation are suspended, though a part of the facilities are diverted as facilities of copper flotation. The plant has dual electric supply systems, and there are no problems. The flotation machine is medium size and old type. Copper grade in concentrate is relatively low, about 18%. For improving the content, additional cleaner and recycling process of middlings into grinding are necessary. Acid water at the bottom of the open pit causes environmental problems and copper is recovered from the acidic water by cementation with scraps of iron, and tailings water is discharging to the pond (Table2.25).

Table 2.25 Processing Technology & Equipment of Major Mines

Method	Flotation	Gravity Concentration	Roasting, Distillation
Equipment	Crusher, mill, mechanical flotation (rougher scavenger, 3 stage of cleaning flotation)	Crusher, vibrating screen,zig	Roasting furnace
System	Continuous system after milling process, measurement instruments partially control process	—	—
Wastewater treatment	Thickener (coagulating precipitation) Cu recovery by cementation	Coagulation and precipitation	—
Tailings Dam	Earth dam (capacity 32mln t, rest capacity 14mln.t)	Enlarging bulk height(100m～150m),rest of capa.for 20 years	—
Environmental measures	Measure for dust in crushing process	Not implemented	After halting, not implemented
Technology Development	Stopped after 1991	Stopped after 1991	Stopped after 1991

Dressing technology and technological development capability in Georgia is highly advanced. Mineral dressing technology in Georgia has been elaborated by well-recognized scientific institutes like Georgia Technical University. Now most kinds of research are suspended. Most researchers in those institutes are old and few young researchers are engaged in mineral dressing researches, and there is a big gap between generations. These research institutions are old and reforming is required partially. However most equipment is carefully handled so that it is not difficult to recover sufficient operating conditions in most equipment.

At Madneuli mine, facility of dressing plant was of the soviet -planned-economy type that is based on control of metal grade by quantity, and was suitable for treating a large quantity of ore feed. The facility is excessive. It is a factor resulting an increase of operating costs and competitiveness of this mine is quite low.

Copper grade in concentrate produced in the free-market/ or developed nations must be over 20 %. Copper concentrate with copper grade under 20 % is sold at a much lesser price. At Chiatura mine, gravity separated high quality manganese concentrate is the market commodity product of this combinat. Low quality manganese concentrate and agglomeration

concentrate cannot be sold out. Some manganese oxide ore is soft and needs to be powdered so that it is difficult to improve recovery. Moreover, it is difficult to increase the amount of ore treated because no rehabilitation of the pipeline for transporting of waste had been done and wastewater is discharged directly into the river. (Table 2.26).

Table 2.26 Present Condition of Environmental Technology and Facilities on Madneuli Mine

Item		Technology, Facilities	Issues
Mine	Wastewater	Acid water pump up, cementation treatment	Pump up from bottom of the pit
	Tailings	Tailings stockpile	Heavy metal soil pollution (partially caused by acid water)
	Dust	Spray water	Pb soil pollution by explosion
Processing Plant	Wastewater	Thickener & spigot tube	None
	Monitoring	Analysis equipment	Superannuated
	Stockpile place	Make bank	Insufficient bank slope
Au J／V	Leach liquor	Recycling system	Problem of not introducing technology from Europe & USA
	Tailings	—	
	Monitoring	—	
Surrounding Area	Soil monitoring	None	Actual condition of pollution unconfirmed
	Water quality monitoring	Analysis equipment	Superannuated

6-6 Environmental Problems

The Ministry does not have enough funds to inspect and control industries and the governmental management system does not carry out its duties sufficiently enough. The mining company normally put main priority on production and profit rather than environmental monitoring and control. There is no equipment used for environmental monitoring and control.

Environmental control technology and facility of Madneuli Mine are superannuated and actually not functioning. Chemical analysis of water was contracted to a private company, which is a U.K.-Georgia joint venture (Table 2.27).

Table 2.27 Environmental Issues at Main Mines

	Madneuli	Chiatura	Uravi
Water Pollution	● Broken old tube leaks wastewater to river (heavy metals) ● Ditch leaks acid water (heavy metals)	● Tailings outflow to river by broken tube (tailings contain Mn)	● Water pollution in river due to leftover from roasting furnace
Soil Pollution	● Dissolution of metal in low-grade ore & wastewater ● Soil pollution with dust caused by explosion of powder with Pb	—	● Soil pollution due to leftover from roasting furnace
Air Pollution	● Dust of explosion by Pb explosives made in Russia (health damage)	—	—

There are many identified environmental problems related to mining operations, arsenic water contamination at the Madneuli Mine, water pollution by slime and wastewater discharges into river from the Chiatura plants, and arsenic contamination at the Uravi Mine. Scope of possible and actual contamination have never been studied quantitatively.

It is necessary to survey the contamination quantitatively, identify the extent and state of contamination, and find the cause and origin of contamination. Countermeasures must be taken after the issue of contamination is prioritized based on the results of qualitative study. Environmental investigation and making countermeasures and implementation quickly are necessary.

7 Recent Condition and Subjects of Environment Area

7-1 Environmental Administration

Ministry of Environmental Protection and Natural Resources is responsible for carrying out environmental policy in Georgia. The primary responsibilities of the ministry are to protect the environment and to carry out sustainable and rational usage of natural resources. The primary functions of the ministry in environmental protection are enforcement of environmental laws, management and protection of the environment, and examination and permission of Environmental Impact Assessment.

State Department of Hydrometeorology is responsible to monitor the general environment at fixed stations and keep monitoring records. The Eco-police exists in the Ministry of Interior, which is responsible to enforce environmental laws (Fig 2-29).

Ministry of Environmental Protection and Natural Resources observes environmental activities by individual business entities. Monitoring Center monitors environment for environmental protection and State Department of Hydrometeorology monitors general environment. Business enterprises are obligated to monitor the environment related to their activities, but they do not fulfill the requirement because of outdated or damaged equipment and deficiencies in finance.

The environmental monitoring facility of State Department of Hydrometeorology and Eco-police are outdated or damaged because of deficiencies in finance and both agency do not function sufficiently.

Environmental problems related to industrial activities have existed since the Soviet-era, but the government has not studied well and does not understand well the current state of environmental problems.

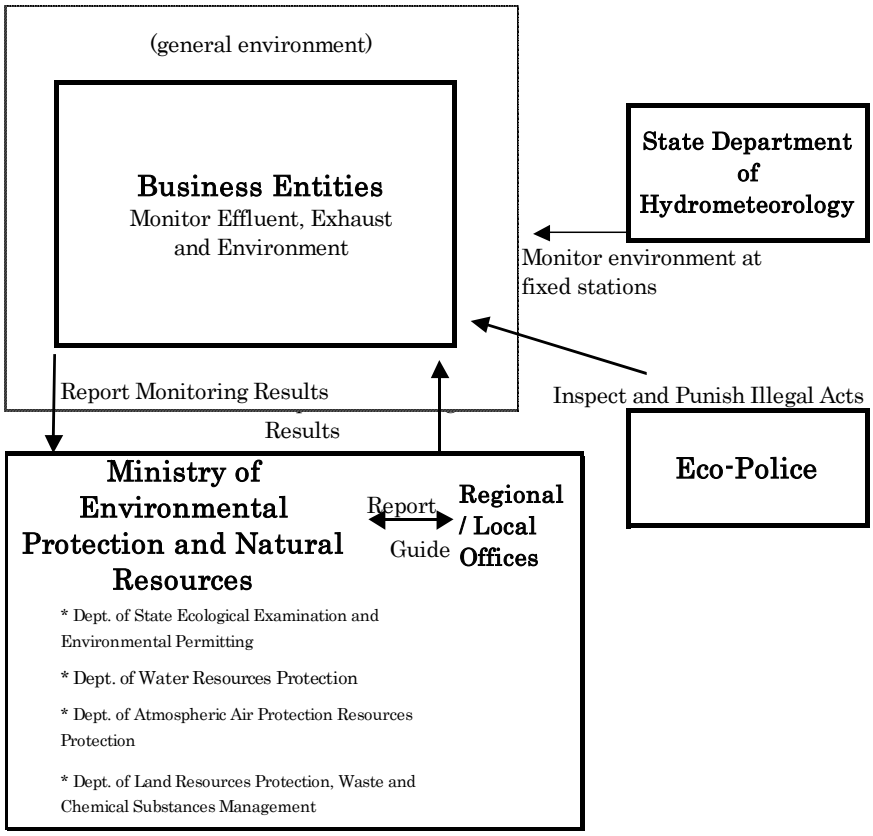


Fig. 2.29 Environmental Monitoring and Management

Annual budget for the ministry in 2001 is 1.7 million GEL (approximately 0.8 million US Dollars) and is only 0.15% of the total governmental budget. The budget can only cover personnel expenses and maintenance costs of offices but no budget is allocated for environmental maintenance or improvement investment.

After independence, laws and regulations relating environment are well prepared with assistance of international organizations, like World Bank. Laws and regulations regulate use of natural resources, and management of water, air, soil and hazardous materials. Law and regulations are similar to those of developed nations.

Heavy metal standard in potable water except arsenic is very similar to it of developed nations. Arsenic standard of Georgia is five times of WHO and Japanese standards, but the same standard as Georgia was used in many developed nations until recently (Table 2-28, Table 2-29).

Table 2.28 Georgian Law relating to the Environment

Year	Law	Year	Law
1984	Administrative Violation Code	1997	Civil Code
1994	Law on Soil Protection	1997	Law on Local Self-government
1994	Law on Plant Protection	1997	Law on Water
1995	Law on Transit and Import of Hazardous Waste	1998	Law on Hazardous Chemical Substances
1996	Law on Protected Area System	1998	Law on Nuclear and Radiation Safety
1996	Law on Natural Resources	1998	Law on Sea Area of Georgia
1996	Law on the State Environment Assessment	1998	Law on Pesticides and Chemicals
1996	Law on Environmental Permit	1998	Law on Creation and Management of Kolkheti Protected Area
1996	Law on Environmental Protection	1999	Law on the Compensation of Damage from Hazardous Substances
1996	Law on the Animal World	1999	Forest Code
1997	Marine Code	1999	Criminal Code
1997	Tax Code		

Table 2.29 Penalties and Standard of Heavy Metals in Water

Element	Penalty in GEL/ton	Standard for Drinking Water			Average Price of 1998 in	Remarks
		Georgia (μg/l)	Japan (μg/l)	WHO (μg/l)		
Cu	39,000	1,000	1,000	2,000	1,733	
Cr	39,000	100	50	50	7,576	Water standard is for Cr^{6+} only
Cd	39,000	1	10	3	617	
Pb	39,000	30	50	10	999	
Mn	3,900	100	50	500	2.40	Price:48-50% Ore Price
Zn	3,900	1,000	1,000	3,000	1,133	
As	790	50	10	10	1,014	
Fe	78	300	300	300	413	Price: Hot-Rolled steel bar

(Georgian Tax Code, US Geological Survey and WHO homepage) (GEL: Georgian GEL = about 0.5 US Dollars)

- Legislative framework in environmental field is relatively well established.
- National Action Plan in Environmental Protection has been approved by the government.

Business entities or activities of any kind dealing with relocation, construction, or sectorial development programs and projects are required to obtain an Environmental Permit from Ministry of Environmental Protection and Natural Resources. EIA report can be prepared by any eligible consultants including foreign consultants (Fig. 2-30).

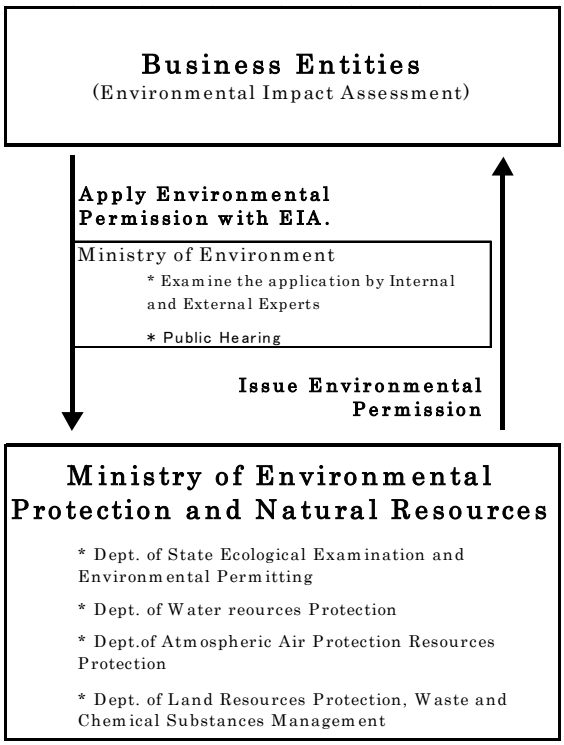


Fig. 2.30 Procedure for Environmental Permit

The Ministry of Environmental Protection and Natural Resources examines the Environmental Impact Assessment (EIA) Report by a business entity with internal and external experts. The results of the examination are publicized and the ministry invites public opinions for the activities. If the results of the examination satisfy the requirements, the ministry issues the environmental permit to the business entity. The business entity must periodically monitor the environment and report the results to the ministry.

EIA Report is required for all activities, which may have some, impact on environment and includes environmental management of monitoring, consideration for public health, risk assessment to correspond to emergency state and environmental remediation. Therefore, active conduct of business is supervised by authorities.

Environmental data of government can be disclosed to an owner of project needed for EIA upon request.

- The law is comprehensive and covers issues related to privatization etc. of enterprises and technology innovation.
- Ministry of Environmental protection and Natural Resources has jurisdiction over examination of EIA Report. Its administration is devolved to local level.
- EIA Report is disclosed. Results of EIA will be disclosed to public upon request.

Thus EIA is required for all activities, which may have some impact on environment. The business entity present the EIA Report and system to review EIA report by government is well established. There exists an environmental monitoring system. Therefore, if EIA system is to be carried out rigorously and diligently as law states, environmental protection activities and remediation effort will be accepted by public and international society.

But, Mining industry is to give large impact in environment during production and is necessary to remediate the given environmental impact with huge investment for a long time after demining. For privatization and vendition of a national mining company, the range of liability and whereabouts of responsibility for past environmental pollution by its activity is usually defined in its contract etc. Also, a considerable capital investigation over a long period of time it is needed for the remediation procedure after completion of mining activities

The following issues are remained to be considered in EIA administration:

- Because contents of EIA report covers broad range of topics, it needs to establish usage of outside consultants as an assessor. Costs needed for reviewing EIA report and other necessary administrative procedures are not written clearly. These costs are born by applicants, in effect.
- There are not many experienced environmental engineers and scientists in Georgia in environmental impact assessment.
- There exists an environmental monitoring system. but do not monitor the environment sufficiently. The monitoring system by most business entities and government agency almost do not function and monitoring report and management are formal, on an aspect of practical use.
- Because of out-dated and damaged analytical instruments and equipments, monitoring capacity in Georgia is weak. So, A environmental problem cannot be grasped then surveillance and regulation on environmental protection are not properly executed. To modernize equipments are needed.
- To reveal negative environmental inheritance of Soviet-era (heavy metal), to systemize management of environmental information, rear specialists and acquire modern environmental management technology are needed.

7-2 Current State of Monitoring

Monitoring Center of Ministry of Environmental Protection and Natural Resources monitored surface water at several stations on all major rivers at least once in every month during the Soviet-era. However, due to financial difficulty, it monitors river water at only fourteen stations twice a year (see Fig. 2-31). Atmospheric air is monitored only at major intersections in major cities by Monitoring Center. It does not monitor exhaust of industries because of

declination of volume from industrial plants.

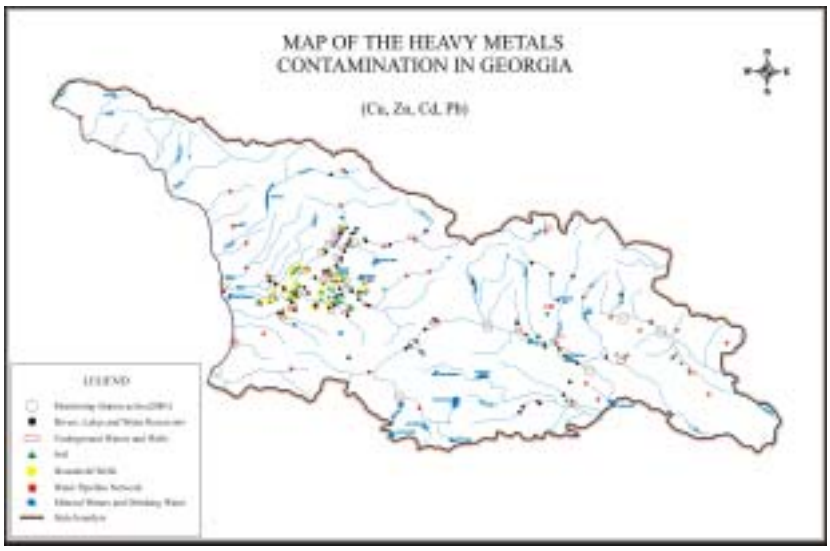


Fig. 2.31 Major Contaminated areas in Georgia

During the Soviet-era, effluent and exhaust from mining industries were treated before being discharged under the Soviet regulation and the environment was monitored. After independence, mining activity is either closed or decreased and replacement investment and maintenance have been done for water treatment systems of enterprises due to lack of funds. Water treatment facilities became closed or damaged to clean contaminated effluent and hazardous effluent is discharged from mines and factories without proper treatment. We suspect that heavy metals may be accumulated in sediments and soils along the rivers downstream of mines.

Very few industries monitor the environment and take preventive and/or countermeasures against pollution. Environmental monitoring, which laws and environmental permits require for business entities, is hardly carried out by concerned business entities because of outdated equipment, lack of environmental management and reduction of payment for contracting monitoring to a contractor. Government institutions do not monitor and manage environment properly because of lack of funds and outdated equipment.

Water quality of rivers around mines was periodically monitored during Soviet-era (in 1980's). The results showed heavy metal contents in river waters around Madneuli Mine (Cu, Zn), Chiatura Mine (Mn) and Uravi Mine (As) in 1987 and 1989 (Table 2-30, Table 2-31).

Average arsenic content in Lukhumi River, downstream of Uravi arsenic mine, is about double the Georgian drinking water standard (nine times higher than WHO standard). Water in Lukhumi River is not monitored now and arsenic pollution in Lukhumi River is not known.

Table 2.31.

Copper and zinc contents in river water, downstream of Madneuli Mine, are thirty to fifty times higher than other rivers.

Table 2.30 Heavy Metal Contents in River Water Downstream of Mines

Mine	Metal	River	Eh (mV)	Cu (μg/l)	Zn (μg/l)	As (μg/l)	SO_4^{2-} (mg/l)	Flow (m^3/sec)
Madneuli	Cu,	Mashavera	177.9	151.9	703.2		71.9	4.2
Chiatura	Mn	Kuirila	237.8	5.3	14.8		36.8	20.7
Uravi	As	Lukhumi	222.3	7.1	17.7	84.4	18.8	15.1

Contents are arithmetic average of monthly measurements of two years, 1987 and 1989.
Monitoring points are downstream of the mines.

(State Department of Hydrometeorology)

Table 2.31 Changes of Arsenic Contents in Lukhumi River
(Downstream of Uravi Arsenic Mine)

Month-year	Jan-87	Feb-87	Mar-87	Apr-87	May-87	Jun-87	Jul-87	Aug-87
As contents (μg/l)	7.5	-	8.0	8.5	9.0	70.2	90.5	-

Month-year	Sep-87	Oct-87	Nov-87	Dec-87	Jan-89	Feb-89	Mar-89	Apr-89
As contents (μg/l)	100.0	60.6	60.6	60.6	204.0	100.0	125.0	125.0

Month-year	May-89	Jun-89	Jul-89	Aug-89	Sep-89	Oct-89	Nov-89	Dec-89
As contents (μg/l)	125.0	125.0	100.0	100.0	125.0	-	-	-

Average before May 8.3 μg/l
Average after June 104.8 μg/l

(State Department of Hydrometeorolgy)

Almost no monitoring of environment is carried out for environmental protection purpose. Monitoring Center of Ministry of Environmental Protection and Natural Resources employs twenty personnel at its head quarter and three to eight persons at its local offices, but it has no vehicles to move around field, no equipments were updated and no fund is available for maintaining equipments. Monitoring Center is extremely weak as the governmental institution responsible to measure environmental conditions and record transitions of Georgian environment.

Improve and implement monitoring system, disclose monitoring data to public, establish databank and monitoring results and modernize information handling system of monitoring data are subjects.

7-3 State of Countermeasures and Prevention Activities and State of Mining-Related Waste

Potential pollution sources in Georgia is waste from the mining industry (waste rock, tailings, low grade ore stockpile, etc). These materials contain heavy metals.

Government does not and cannot officially know current situation of environmental pollution due to lacking monitoring activity. Official countermeasure against pollution does not exist in the country. Current State of Pollution Prevention Activities. Government does not and cannot officially know current situation of environmental pollution. No systematic pollution activity exists in the country. Total industrial waste was 64.5 million tons in 1988, of which hazardous waste from mining and metallurgic activities was 2 million tons. The current state of mining-related waste is scrap, barium with metal, waste from mining industry, etc.

Major waste is as follows (1988):

- Waste with cobalt: 4.8 tons
- Waste with arsenic: 1,829 tons
- Waste with lead and barium: 200,000 tons
- Waste with chromium: 72.6 tons

7-4 Assistance of International Organizations

Many International Organizations like WB, United Nations and foreign governments are assisting Georgian government in strengthening environmental institutions and regulations. International organizations and donor countries fund some international nongovernmental organizations. The National Environmental Action Plan was drafted in 2000 with assistance and participation of the WB. The action plan puts emphasis on education of government employees and strengthening institutions and regulations.

The action plan identifies forty-eight projects for the period 2000-2004. Most projects need to promote the attraction and effective use of international aid. Therefore, there is no guarantee for execution of the projects without foreign funding.

The major assistance of international organizations in environmental field is as follows:

- WB: Strengthening institutions and improvement of potable water system and sewage system.
- UNDP: Strengthening institutions and regulations
- EU countries: International environmental problems like Black Sea environment, regional cooperation and strengthening institutions.
- TACIS: Technical assistance in many fields.

7-5 **Recommendations**

The government should move ahead on The Action Plan on Environment. Monitoring capability should be strengthened. In order to get current environmental situation, Ministry of Environmental Protection and Natural Resources should move ahead on strengthening monitoring capability compiled by the ministry. Equipments should be bought and facilities should be refurbished and built by low-interest finance, e.g. EBRD loan. Capacity of monitoring staff should be strengthened through foreign expert dispatch programs and/or training in foreign countries. Personal skills should be developed in large variety of field, planning of monitoring, sampling, chemical analysis and promulgation.

- Environmental status around mines is needed to be studied. For privatization of mines, they are needed to be assessed in their ordinary asset together with environmental negative asset.
- In order to secure environmental rehabilitation after termination of mining activities, it is necessary to establish either environmental bond by mining companies or environmental fund by government and mining companies.
- Environmental administration should be promoted on the basis of transparency and public participation.

8 Recent Condition of Information Infrastructure related to the Mining Industry

8-1 Current State and Remarks

Information on mineral resources in Georgia is stored mainly by the State Department of Geology and other organizations as reports, maps and figures. For obtaining necessary information about minerals, it is necessary to look for relevant reports or maps in many offices of several government institutions. It is an extremely time-consuming process. Especially for foreign people, there is a problem of the Russian and Georgian language.

Geological information and maps like geological maps, ore deposit maps, tectonic maps and metallogenic maps were published only during the Soviet-era and hardly any publications after independence. Most published maps are on a scale over 1:500,000. Geological maps' scale under 1:100,000 cover only small areas. Topographic maps on a scale of 1:50,000 cover the entire country and were printed in Georgia. Reports on geology and mineral exploration contain references and data. To open geological information to the public systematically and efficiently, it is necessary to look for information from reports and edit the obtained information.

8-2 Web Sites

Web site about Georgia has been studied for their contents. Many government institutions and other organizations have opened their own home page. Some of them are in Georgian language and old. Moreover their updates are not enough (a few sites are carried out daily update). Many sites do not link well to other web sites. It is not easy to find the information (Table 2.32).

Table 2.32 Remarks on Web Site

Items	Current Situation	Cause
Language	Some sites are mixture of English and Georgian language. Some sites are only in Georgian language.	● Lack of funds ● Lack of translator ● Lack of personnel for data collection ● Lack of computer operator.
Link	Links are mostly short.	
Renewal	English version is not updated frequently.	
Information	Information is old.	
Contents	Most information is general not in details.	● roviders are not well developed

The Web site for Association of Small Mining Enterprises was created by the "Internet Access and Training Program (IATP) in the aid program of "International Research & Exchange Board (IREX). The plan of this site was adopted on April, 2001 and the site has been operating since October, 2001. The overview of the site (http://www.iatp.org.ge/asmegeo/) is as follows;

- Provision of the information on small mining enterprises that conforms with the market economy smoothly
- Carry problems collected at mines of participating enterprises and their requests to the government
- Show the necessity for the tax system revision on business law

Chapter 3 Madneuli Mine Pre-feasibility Study Report

1. Objectives

- Investigate the situation of the management and the production at the Madneuli mine. Attempt to extract problems and make concrete improvement countermeasures.
- By financial analysis, evaluate the profitability of the mine and present a guide for reconstruction from now.

2. Method

- Through interviews and investigation at the mine and relevant people in Tbilisi, to grasp the actual situation and collect data and information.
- The financial analysis using UNIDO's COMFAR program (Appendix I) and present situation analysis based on the collected information and data.

3. Outline of Mine

The Madneuli mine is located about 70 km southwest of Tbilisi. The mine was opened in 1974 and has been operating for 27 years as a state-owned mine. In the former USSR era, it was positioned as a copper producer for the USSR. Accumulated production of crude ore for 27 years from 1974 to 2001 is 23 million tons with copper metal 220,000 tons (average copper grade 1.01%) and gold 20 tons (average gold grade 0.98 g/t). In 1995, it became a joint stock company. Now it is composed of 98.2% ownership by the Ministry of Property Management, and 1.8% by its employees. As of September 2002, there are 444 employees (104 staff, 340 laborers).

The Madneuli deposit is an exhalation sedimentary polymetal deposit formed in andesite tuffaceous rock. At present, the ore reserve is estimated at 19,662 thousand tons (Cu 1.02%, Cu metal 200.07 thousand tons, Au metal 13.501 thousand tons). The mineralization zone is extended in an area of 1,200-1,300 m of east to west, and 400-650 m of north to south and thickness of 200-350 m. The ore bodies is underlain with a zonal distribution as follows from the top to the bottom: Barite-gold baring quartzite ore bodies (lens), barite-polymetal ore bodies (lens, stockwork), Chalcopyrite-pyrite ore bodies (lens-shaped, stockwork) and gold-copper stockwork ore bodies. Main mineralization is gold-copper stockwork zone that is developed along fractures striking east to west in the central part of ore bodies. Gold mineralization stages consist of multi-mineralization stages of copper-pyrite, barite-polymetal and gold bearing quartzite of Cretaceous age. The main ore minerals are composed of chalcopyrite, chalcocite, covelline, pyrite and barite associated with sphalerite and galena.

At present, the ore reserve is estimated at 19,662 thousand tons (Cu 1.02%, Cu metal 200.07 thousand tons, Au metal 13.501 thousand tons). The mine is operated by using an open pit, and the 2001 production was 57,000 tons of concentrate (18.61% copper, copper metal amount is 10,000 tons, and gold grade in copper concentrate is 12.24 g/t). The size of the pit is 1250 m × 1500 m. There are 18-19 benches with the projected open pit depth of 250 m. The processing plant has a capacity of 1.65 million tons of ore per year. In 2001, 1.5 million tons of ore, equivalent to 91% of its capacity, were processed. Since the fact that a majority of the mining and plant's equipment and facilities were obtained in 1974, they are superannuated. Over 70% of the equipment and facilities (dressing plant almost 100%) need to be renewed.

4. Present Situation of Mine

4.1 Management

(1) Situation of Management

After independence, productivity decreased dramatically because of the loss of market, superannuated facilities, etc. but the production has become restored since 2000. Production of copper concentrate increased to 45,000 tons. In 2001, copper concentrate of 57,000 tons was produced (Cu 18.61%). The operation rate recovered to 90%. This is the result of a little improvement of the working capital and renewal of some of the mining equipment by a loan from ABG Georgia (energy company) (in 2000) and income of a dividend (in 2000) from Quartzite Joint stock Company (QJSC), and the result of the introduction of a subcontractor and change of the organization that was realized in 2000 (including alternating managers) have given a big impact to its improvement. The 2001 annual operation result shows a profit for the whole management of the Madneuli J.S.C. because of the income of the dividend from Q.J.S.C. The financial situation of the Madneuli Mine only is in a deficit. The accumulated loan is $15 million. The management situation is still in a deficit structure (Tables 3.1, Table 3.2).

The Ministry of State Property Management mainly possesses the stock and has the responsibility of the management. Now a UK consultant has been improving the management. However, it is necessary to reduce their big debt and disclose financial information with transparency and shift (management of the joint stock company) to a management system that fits to a market economy. Now the international tender, which is oriented to perfect privatization, is under examination. It is indispensable to make good conditions that are acceptable to Western countries.

2001Operation Results (main items only)

unit : 1000 GEL

Revenue	28,492 *	(includes Cu conc sales	21,240)
Cost	28,124	(includes production cost of Cu conc	25,852)
Gross Profit	368		
Net Pofit	202		
Loan Short-term	3,126		
Long-term	1,766		

* includes dividend from Quartzite JSC

Table 3.1 Balance Sheet of Madneuli Mine in 2001

(Thou. GEL)

	01.01.01	31.12.01		01.01.01	31.12.01
Assets			**Liabilities**		
Current assets	15,104	16,227	Current liabilities	9,313	11,766
Long-term assets	13,845	14,575	Long-term liabilities	2,294	3,126
			Liabilities Total	11,607	14,892
			Equity	17,343	15,911
Assets Total	28,949	30,802	**Total liabilities & equity**	28,949	30,802

1$=2.1GEL

Table 3.2 Profit Loss Statement of Madneuli Mine in 2001

Item	Result (GEL)
Sales	21,240,257.42
Cost of goods sold:	-17,570,939.11
Gross profit on sales	3,669,318.31
Operating expenses:	-8,281,324.47
Income from operations	-4,612,006.16
Other revenues and gains:	7,251,826.91
	2,639,820.75
Other expenses and losses;	-2,271,620.57
Income before income taxes	368,200.18
Income taxes	-165,847.00
Net income	202,353.18

1$=2.1GEL

(2) Production and Sales

The Madneuli Mine concluded a long-term concentrate sales contract with Glencore in 1998 and some mining equipment such as a drilling rig, etc. were renewed with a part of the loan from Glencore. As a result, production has recovered sharply since 1999, the idled facility of barite processing was changed for use of copper concentrate production. Now it is possible to treat up to an amount of 1,500 thousand tons per year (Table 3.3). Now the mining target block is the mineral rich part is located in the center of the open pit with a low stripping ratio. As a result, stripping work has been delayed. Therefore the introduction of the countermeasure was taken for a subcontractor because the structure of the production system and transportation equipment were unsuitable for the present situation. The ore production of ore has been increasing each year.

Table 3.3 Mine Production 1991-2001

Year	Ore		Cu Grade			Au Grade		
	Feed Ore	Concentrate	Feed	Concentrate	Recovery	Feed	Concentrate	Recovery
	x1000t/ Year	x1000t/ Year	%	%	%	g/t	g/t	%
1991	790.000	34.000	1.40	17.69	82.25	1.50	15.99	64.50
1992	938.300	37.649	0.83	17.09	82.71	-	9.48	-
1993	393.531	12.739	0.77	19.41	81.75	1.42	17.27	39.00
1994	238.428	9.345	0.80	17.64	81.57	1.10	13.58	48.23
1995	534.050	23.333	0.76	16.04	84.27	0.65	15.85	51.42
1996	685.064	27.447	0.94	18.12	82.86	1.52	11.91	45.59
1997	500.967	19.867	0.91	17.78	82.32	0.94	9.98	39.33
1998	246.961	11.752	0.95	17.22	85.84	1.16	11.08	45.45
1999	957.000	39.493	0.92	18.50	83.00	1.09	10.03	41.00
2000	1,053.624	45.570	0.86	17.99	87.27	1.02	14.43	46.77
2001	1,500.459	57.189	0.82	18.61	86.58	1.05	12.24	44.25

The production consists of copper concentrate (about 70% of revenue) and gold bearing silicate (about 30% of revenue). Copper concentrate is compacted into flexible bags of 3 tons at the Madneuli Mine (by railroad branch at Kazreti station) is transferred to the Batsumi port (400 km) and is kept at a stockyard that belongs to Acharsopkimia Company. Shipment at the Batsumi port is done by the shipment facilities. As for sales, all production is sent to Glencore based on an exclusive selling right in the contract between Glencore and Madneuli Mine (expires May 2003). Glencore sells the concentrate to Europe and Asia. Before independence, the copper concentrate was sold to the Alaverdi Smelter in the neighboring country, Armenia (Madneuli Mine to Alaverdi Smelter is 80 km). Because of the trouble caused by the destruction of the Alaverdi Smelter after the latter half of the 1980's, Madneuli Mine is facing to the situation mentioned above. Presently, it is difficult to develop a market by themselves because it depends on Glencore

for selling its concentrate (Fig. 3.1).

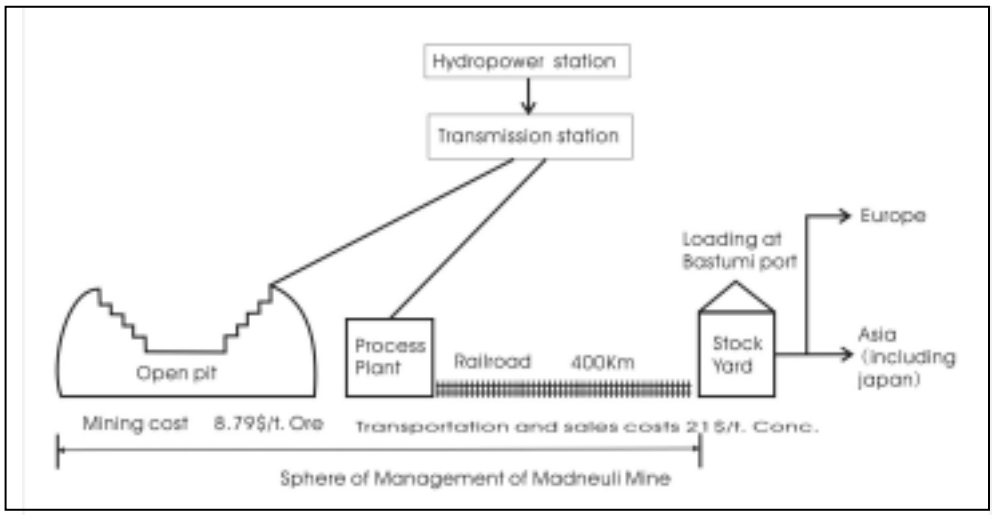


Fig. 3.1 Sphere of Management of Madneuli Mine

4.2 Structure

Management has been done by a board consisting of five board members. In the field of management, there are the administration, production, sales, and procurement divisions. The production division is composed of the departments of open pit, processing and safety. The total number of employees is 444. The production division has 402 people, which is the main part of production (Fig. 3.2).

As the advisor to management (mining engineer), a consultant is dispatched from the UK. The environmental protection is composed of three specialists including the production division.

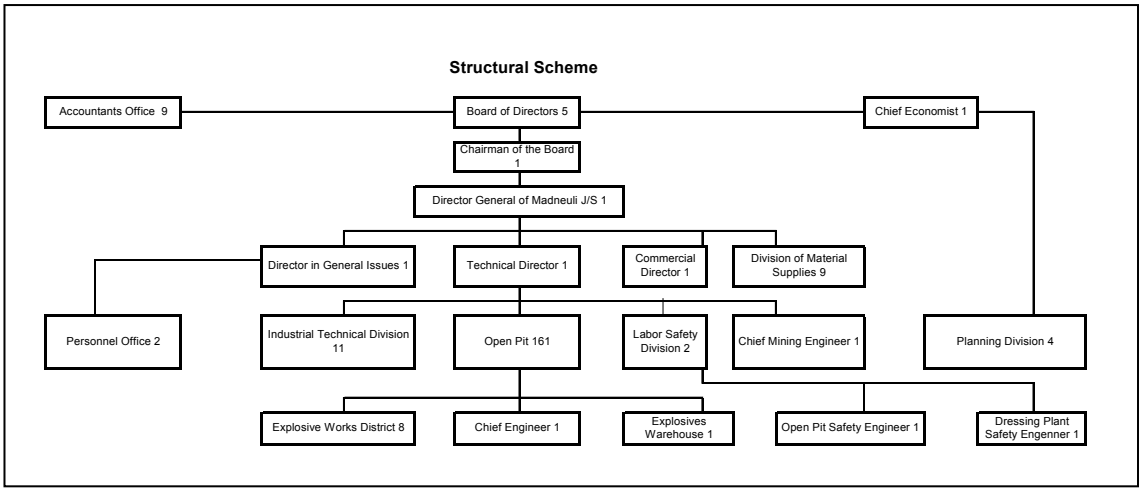


Fig. 3.2 Structure of Madneuli Mine

4.3 Reserves, grade and Exploration Activity

The latest ore reserves of the Madneuli mine is as of January 2001.

Standard of ore reserve calculation of the Madneuli mine is based upon the standard (named "condition") that had approved in 1979 by the State Committee of Ore Reverses. According to the standard, the cut-off grade of the Madneuli mine is 0.4% of copper. The ore scope on the state balance reserves (that corresponds to ore reserves in the international standard) has been set up with over 0.4% of copper grade.

(1) Ore reserves (Balance reserves)

Ore reserves and grade of the Madneuli mine is shown in Table 3-4 that is obtained from Geology Sector of the mine. Ore reserve of categories B+C1+C2 is reached a total of 19.7 million tons with 200 thousand tons of copper and 1.02% of copper grade, and 13.5 tons of gold and 0.69 g/t of gold grade. Total 27 ore blocks are composed of a block of category B, nine blocks of category C_1 and seventeen blocks of C_2. Ore reserve of category C_2 makes up 28% of all the ore reserves.

(2) Minable ore reserves

In the Madneuli mine, ore scope of the balanced reserves has been reset up by the boundaries of the designed final open pit. Minable reserves are calculated amounts of ore, metal and grade based on assay data of the drilling work.

Table 3.4 Ore Reserves in Madneuli Deposit

Category	Ore reserves					Minable reserves				
	On State Balance (A)					Within the Open Pit Design (B)				
	Ore	Cu		Au		Ore	Cu		Au	
	thou t	%	thou t	g/t	Kg	thou t	%	thou t	g/t	kg
B	3,362	1.23	41.49	1.00	3,361.90	3,362	1.23	41.35	1.00	3,361.90
C_1	10,881	1.00	108.33	0.60	6,506.89	9,731	0.99	96.64	0.57	5,554.58
$B+C_1$	14,243	1.05	149.82	0.69	9,868.79	13.093	1.05	138.00	0.68	8,916.48
C_2	5,419	0.93	50.25	0.67	3,632.65	1,274	0.89	11.39	0.69	1,701.02
$B+C_1+C_2$	19,662	1.02	200.07	0.69	13,501.44	14.367	1.04	149.39	0.69	10,617.50

Minable ore reserve of categories $B+C_1$ is reached a total of 13.1 million tons with 138.0 thousand tons of copper and 1.05% of copper grade. Minable reserves of category C_2 is calculated 1.3 million tons with 11.4 thousand tons of copper and 0.89 % of copper grade.

The sum total $B+C_1+C_2$ amounts to minable ore 14.4 million tons with copper 149.4 thousand tons and 1.04% of copper grade. As a result, mining recovery is calculated to be 100% in category B, 89% in category C_1 and 24% in C_2 category.

In order to rank the minable reserves of category C2 up to category C1, approval is

necessary by the State Committee of Ore Reserves and also necessary to make the boring distance shorter from 40 meters grid to 20 meters grid.

(3) Crude ore

Crude ore of category $B+C_1$ is calculated to be 13.5 million tons with 129.6 thousand tons of copper and 0.96% in copper grade. The ore of category C_2 is calculated to be 1.3 million tons with 10.7 thousand tons in copper and 0.81% of copper grade. The sum total $B+C_1+C_2$ amounts to crude ore 14.9 million tons with copper 140.3 thousand tons and 0.94% in copper grade (Table 3-5).

Table 3-5 Minable Crude Ore in Madneuli Deposit

(as of 01.01.2001)

Category	Minable crude ore							Selectivity of mineral processing*		
	Ore	Cu		Au		Ag		A	B	C
	thou t	%	thou t	g/t	kg	g/t	t	Thou. t	Thou. t	Thou. t
B	3478	1.12	38.83	0.91	3156.82	3.24	11.27	3478		
C_1	10066	0.90	90.75	0.52	5215.75	2.60	26.14	3046	2774	4248
$B+C_1$	13544	0.96	129.58	0.62	8372.58	2.76	37.41	6524	2774	4248
C_2	1318	0.81	10.70	1.21	1597.26	2.42	3.19		1318	
$B+C_1+C_2$	14862	0.94	140.27	0.67	9969.83	2.73	40.59	6524	4092	4248

*Selectivity in mineral processing

A: easily dressed B: medium dressed C: hardly dressed

(4) Exploration Activity

In the Madneuli mine, drilling exploration for obtaining additional ore reserves is finished in 1980'. Since that time, conformation exploration of annual length of 6,000m to 7,000m had been implemented for the planned mining block in next year.

However, from 1987 till 1994 those explorations had hardly carried out because the mine had been in financial difficulty. For three years from 1995 till 1997, confirmation drilling had been carried out ranging from 2,000m to 3,000m a year. In 2000 and 2001, drilling length did only 170m and 110m, respectively because of a lack of finance.

In 2002, owing to good financial condition, the company has been putting drilling prospect into effect for total length of 10,000 to 15,000 meters within and around the open pit. The confirmation drilling work focuses on upgrades from category C_1 reserve to B reserve and from category C_2 to C_1 reserve by drilling of 50 to 150m in depth. The company has contracted out orders for the drilling work to Canadian prospecting enterprise. The slime has been taken by rotary drill machine. The geology department of the mine examines extracted slime and analyzes assay of slime samples.

4.4 Production Technology · Management

(1) Mining

The production scheme is based on the result of the previous year and they do not have a long-term production plan. The present cut-off grade is over 0.4% copper. The minable ore is 21.471 million tons (Table 3.6). The dilution is regulated at 9-10%. The grade difference between the ore reserve (Cu 1.05%) and crude ore (Cu 0.82%) is very big, the increased mixing of low-grade ore is thought to increase the actual dilution (about 20-30%). It is necessary for the combinat to use a management system.

Table 3.6 Cut-off Grade and Ore Reserves

Cut-off grade	Ore reserve (Thou. t)	Cu (%)	Au (g/t)
0.2	35,948.380	0.77	0.67
0.3	28,039.736	0.94	
0.4	21,471.000	1.02	0.80
0.5	18,850.060	1.10	
0.6	14,536.225	1.42	
0.7	12,222.449	1.5	
0.8	7,980.644	1.61	

The open pit's size is 250 m in depth and 1500 m x 1250 m. Present mining blocks are I-B and III-C1 and 20-40 m left of the final projected open pit bottom. After blasting, the broken ore is transported to the plant

(6 km away) by 30 ton trucks and 42 ton trucks. Production is 3,900 tons per day. The present shape of the pit and mining block are as follows (Fig. 3.3, Table 3.7)

Table 3.7 Outline of Present Open Pit

Items	Specifications
Long Axis and Short Axis	1,500 m×1,250 m
Pit slope angle	20° - 34°
Existing benches	18-19 benches (depth 250 m)
Bench height	Ore: 10-12 m Overburden: 15-18 m
Bench width	25-35 m
Bench angle	65° - 75°
Bench crest (berm)	10-11 m

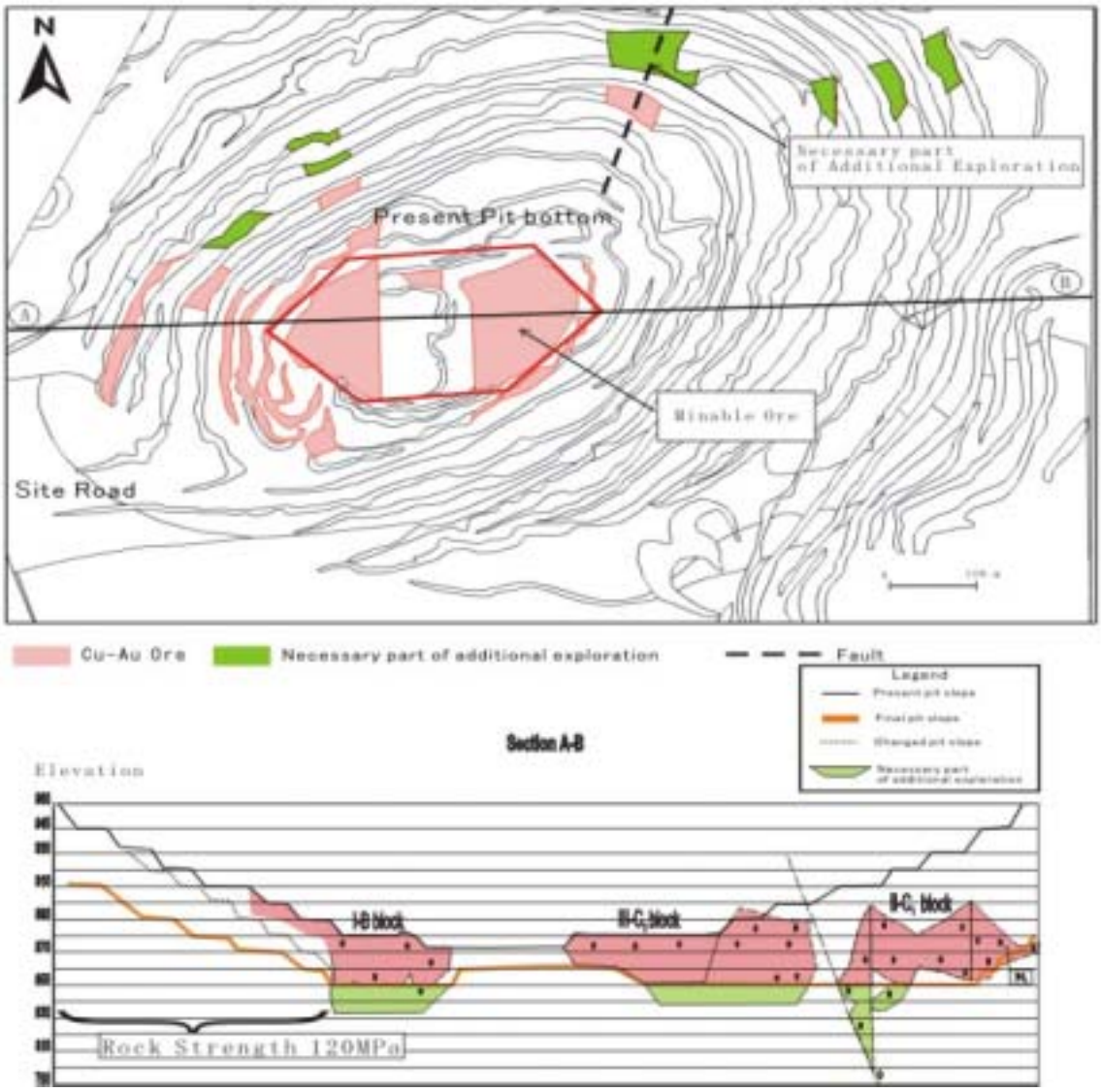


Fig. 3.3 Open Pit Cross Section

- West side of the pit bottom, I-B block (minable ore 3.362 million tons 1.23 % copper, 1.00 g/t gold)
- East side of pit bottom III-C_1 (ore reserves 2.54 million tons 1.09% copper 0.66 g/t gold)
- Cut-off copper grade is over 0.4%

Main facilities are as follows; electric power shovel, hydraulic drilling rig, bulldozer, wheeled loader, grader, etc. Except for the TAMROCK hydraulic drill rig and Caterpillar wheeled loader, all the equipment was purchased in the former USSR era (1983-1990). They are all aged and cannot be operated. Further, they are heavy,

low mobility and low drilling efficiency (one-third of the ability of TAMROCK drilling rig) and used for stripping works where much soft rock exists. At the working face, where exists much hard rock, they are using a drilling rig of TAMROCK, but there is much trouble with the hydraulic system due to the many impurities in the hydraulic oil.

The regular operating system has two shifts per day (12 working hours) for 365 days a year. From 1999, they started hiring a subcontractor and after that, the ratio is increasing each year. Now the transportation work at the open pit depends 100% on the subcontractor. They have 14 42-ton trucks. They are paying operating costs such as fuel (subcontractor costs column $0.21/ton-km).

The relation of subcontracting is 30% loading, and drilling and blasting 70%. Technical level of the subcontractor is inferior to that of the workers of the mine. It will take training and time to give the whole contract for drilling and blasting works, etc. As for other problems, it can be picked up that the Madneuli supervisor lacks experience in control of the subcontractor so they cannot give appropriate directions on management and safety on such areas as drilling and blasting works in spite of the increase of the ratio of subcontractors. On the other hand, the merit of using subcontractors is as follows;

① Good arrangement for a variety of production amount
② Cost reduction
③ Reduction of the number of workers (management division, miscellaneous division)
④ Decreasing the asset tax with the reduction of assets such as trucks, deduction of depreciation (Table 3.8)

As noted the stripping ratio in 2001 was 0.37 m^3 / ton about one-fifth of the scheme of 1.93 m^3 / ton. Preparation for the stripping work for the next mining part is delayed due to the deduction of the cost. This situation only means that the cost load is postponed in the future.

Grade control is implemented by sampling analysis of the drilling powder at bench drilling and qualification of geologists by their own eyes after blasting and after that crude ore is transported. But, the actual dilution is not clear due to insufficient quality control.

With the comparison of the grade of the mining block with the actual grade, it is necessary to control systematically after digitizing of the grade map in each operating block.

Table 3.8 Main Equipment and Facilities at Open Pit

Unit：GEL

Description	Main Type	Size	Quantity	Year of purchasing	Total depreciated cost	Utility	Characteristics
Electric Excavator	EKG-10	5-10 m^3	5 units (2 operating)	1983-1990	8972.67	2units full operating, many troubles with electricity	Crawler type, low mobility
Bulldozer	DZ-330	109 – 330 kW	8 units (3 operating)	1991-2001	100147.1	3 units full operating	Much exhausted gas
Drill Rig	SBSH-100 TA	175 - 250 mm	4 units (2 operating)	1989-2000	32591.91	2units full operating many troubles with hydraulics	Unit made by FUSSR heavy and low efficiency of drilling
CAT Loader	T-170		1 (operating)	2000	12946.62	1unit operating	Much exhausted gas
Dump-truck	Belaz-75405	30 tonne	21 units (5 operating)	1986-1999	728186.24	As spare, 5units operating	Low speed Much exhausted gas

(2) Processing

The flow sheet of the processing plant is the general copper flotation method (Fig. 3.4).

The feed ore is accepted at the processing plant, broken with a jaw crusher and secondary cone crusher (open circulation) and milled by a two-step ball mill (closed circulation).

In regular flotation, concentrate is obtained by a copper flotation system in the ordinary case, but a rough flotation obtains concentrate by a two-step or partially three-step cleaner. The regrinding facilities for regrinding tailings of cleaner and concentrate of the cleaner have not been installed. Tailings are sent directly to the pond by a pump. The overflow of the pond is recycled as processing water. Acid water at the open pit is treated by cementation, which replaces copper with an iron powder. Tailings and tailings liquid are sent to the pond.

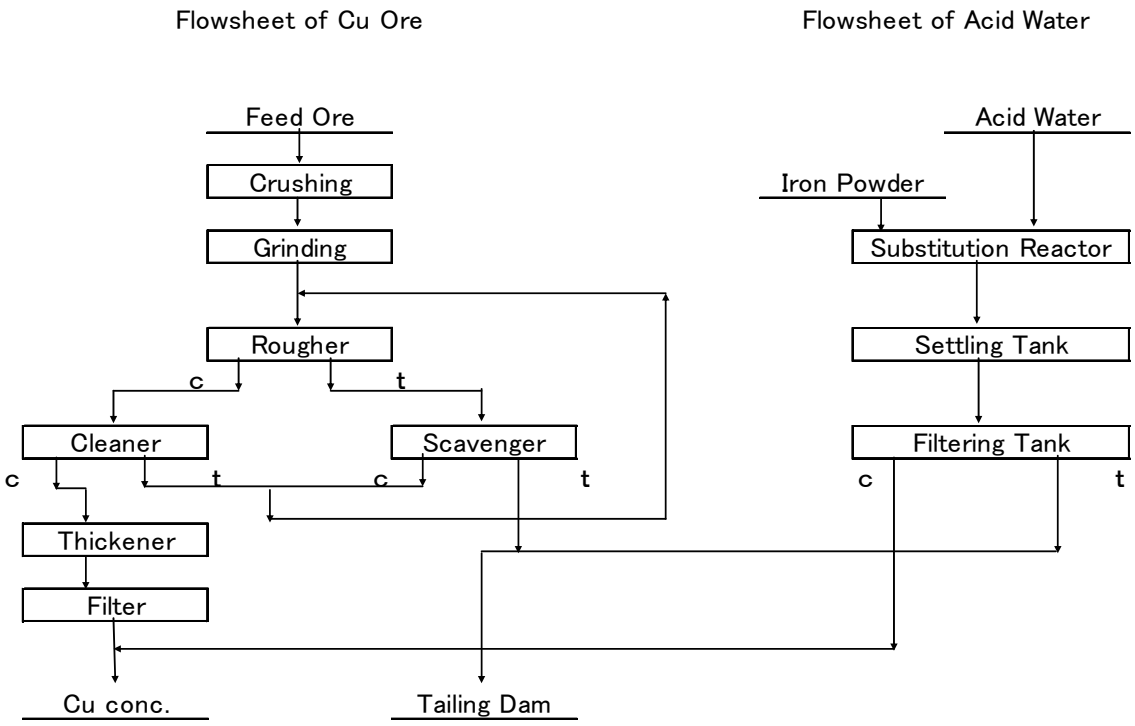


Fig.3.4 Flowsheet of the Madneuli Plant

On the other hand, the West demands production of a concentrate grade a little over 20%, but as shown on Table 3.10 the Madneuli Mine has not progressed to a copper concentrate grade of over 20%.

Facilities of the plant were installed at the opening of the mine in 1974. Control of the processing operations is insufficient despite being partially instrumented. The main processing equipment is shown in Table 3.9. This equipment has not been renewed except for the ceramic filters. Now they are examining the installation of a large-scale copper flotation tank.

The operating system is as follows; three shifts a day and 360 operating days. In the former USSR era, they had controlled the operation of processing to maintain the copper grade of the concentrate at 16% to maintain the recovery rate of gold in the copper concentrate. But after starting to sell the copper concentrate to Western countries, it is urgent to increase the concentrate copper grade. Looking at the 2001 production results, it can be seen that the copper concentrate grade often exceeds 20% and it is improved. However, the annual average grade is still below 20% (Table 3.10). Actually quick action such as implementation of processing tests by using drilling powder sample of the bench part at changing of ore quality, is not of practical use. In order to realize as soon as possible a grade more than 20%, it is necessary to have a quantitative process and

grade control system that includes the mining section like the Western countries.

Table 3.9 Main Machinery of the Processing Plant

Machinery	Type	Quantity
Jaw Crusher	15x21	1
Cone Crusher	medium	1
	fine	2
Screen	GIT-51-N	2
Ball Mill	MShR 3.2x	9
Classifier	IKSN-24	6
Floatation Machin	FM-6.3	24
	FM-3.2	90
	FM-1.5	10
Filter	Disktype	4

Table 3.10 Monthly Production of Processing Plant

Year	Ore		Cu Grade			Au Grade		
	Feed Ore t/Year	Concentrate t/Year	Feed %	Concentrate %	Recovery %	Feed g/t	Concentrate g/t	Recovery %
2001 Ave	125,038		0.82	18.61	86.58	1.05	12.24	44.25
January	95,299		0.60	13.48	74.04	1.30	16.99	43.61
February	116,513		0.845	18.53	85.99	1.51	11.36	29.55
March	125,260		0.75	18.50	88.45	1.32	10.65	29.12
April	107,106		0.90	22.52	87.95	1.25	16.97	47.46
May	145,287		0.915	20.65	88.87	0.78	7.80	39.35
June	133,160		0.90	18.09	90.57	0.78	7.90	45.34
July	133,848		0.87	18.21	84.71	1.12	17.31	62.44
August	115,256		0.88	17.05	83.70	0.69	8.58	53.94
September	139,537		0.67	18.90	83.12	0.79	10.32	38.06
October	151,645		0.60	18.12	83.70	1.18	22.47	53.16
November	131,428		0.84	17.70	88.13	0.79	7.47	39.36
December	106,120		1.10	20.44	91.77	1.35	14.50	53.14
Total	1,500,459	57,189	0.82	18.61	86.58	1.05	12.24	44.25

(3) Management Division of Consumable Goods and Materials

The division consists of six people. The role is a support for the production division. The main materials of the mining section are explosives, detonators, bits, etc. Main consumable goods and materials of the processing section are reagents, balls, etc. Among all the materials, at the Madneuli Mine, these costs are shared approximately 30%.

Inventory control is implemented by budgeting of the amount of the necessary procurement at the time of the budget making, monthly inspection of the inventory of each consumable good and material and procurement for supplying. As noted, they have a one-year inventory of reagents. Every quarter, they make procurement with the delivery time of two months. More than 90% of the goods and materials are procured from Russia. There is no trouble with delivery and quality. Presently, the inventory

control and procurement methods have not changed since the former USSR era (Table 3.11).

Table 3.11 Main Materials and Goods

Category	Materials and Goods	Unit Price	Country Where Purchased
Mining	Explosives (AN-FO)	$0.2／kg	Turkey, Ukraine
	Detonator	$1.9／Unit	Russia, Ukraine
	Bit	$374／Unit	Russia
Processing	Collector	$1.0／kg	Russia
	Frother	$0.4／kg	Russia
	Ball	$0.4／kg	Russia

(4) Transporting and Loading Concentrate

Copper concentrate containing 9-10% moisture is put into 3-ton flexible compact bags by a belt conveyor. The 30-ton cargo is taken by train to the Batsumi port that faces the Black Sea, about 400 km from the Madneuli Mine. At the Batsumi port, the cargo is kept temporarily at a stockyard and the bags remain unopened. After analyzing, the cargo is shipped.

(5) Infrastructure

A single 110 kV power line from the "Khram-2" Hydro-electric Power Generating Station (situated in Georgia) supplies power to Madneuli substation. The Madneuli substation supplies power to (110 kV/10kV/6kV) the Madneuli Copper Combinat. There are also two electric power transmission lines of 110 kV- the "Dmanisi" and "Bolinisi" lines. The supply is stable due to good maintenance of electric power facilities in spite of the fact that most of these facilities are old. Power consumption of the processing division shares about 90% of all, and next is the mining division. Current power consumption is 10-12 MW per year.

(6) Environment Countermeasure

As an environmental countermeasure, they adopted a cementing method (in displacement of iron) concerning the recovery of copper from acid water (pH 2.4). Tailings are transferred to a pond. In this method, much displaced ferrous ions such as Fe^{2+} occur instead of cupric ions so it causes the problem of iron hydroxide. For this problem, special countermeasures were not adopted.

Table 3.12 Power Consumption in Each Division

Feeder	KV	Substation	Power consumption Thou kV	Main Equipment
Open Pit	10	Distribution substation 10/6 kV	3, 012	Electric excavators, drill rigs, pumps
Processing Plant	6	Distribution substation 10/6 kV	48,250	Mill, crushers, pumps, flotation sections etc.
Repair shop	10	Distributing Substation 10/0.4 kV		Various
Administrative Office	10	Distributing Substation 10/0.4 kV		Various
Tailings	10	Distributing Substation 10/0.4 kV		Pumps
Total			52,882	

4.5 Administration Division

The administration division plays the role of maintaining the welfare facilities such as schools, hospital, hot water facilities and boiler, stadium, hall, etc. After 1995, they slowly transferred these facilities to the local government and abolished some facilities. As a result, they have reduced the maintenance and control tasks of the welfare facilities. Now they only have a restaurant. The safety management division has two people. The production division controls safety and instruct about the operation. A total of 18 employees are placed in the control and sales division.

Serious problems associated with the electric power supply.

Water is supplied from one principal source by gravity from a 6000 m^3 potable water reservoir situated near the Madneuli Mine. Water from the Khromi River supplies water to this water reservoir. The amount of stored water is stable and there is no problem with a shortage of water.

Total water consumption- 72 thousand m^3/ month.

4.6 Selling Conditions of Concentrate

The selling condition of the concentrate is based on the contract between Glencore and Madneuli mine as shown in the Table 3.13. Comparing Madneuli's sales condition with the same general quality of concentrate, their T/C and R/C is about 50% higher so that the price they receive for the concentrate is 35% cheaper. The precise comparison is not available due to the well-kept secret of the selling condition and the price of Glencore to the smelters.

The trading fee is generally (in case of Japan) 1-2% of the concentrate price. If Madneuli

Mine sells the concentrate, they could increase their profit by 50% (for instance, the present price of concentrate is $210/ton, after the change of the selling conditions, $320/ton). Moreover, if they sell it to the Alaverdi smelter in the neighboring country, Armenia, transportation costs can be reduced.

Table 3.13 Selling Conditions of Concentrate at the Madneuli Mine

Standard of copper price	Electric copper (LME)								
Grade of copper in 2001		Cu	Au	Ag	Pb	Zn	As	Sb	Hg
	Max	22.52	22.47	22.32					
	Min	17.05	7.47	9.96					
	Ave	18.61	12.24	16.71					
Condition of custum concentrate	Formula of culcuration of price : Based on Contract Terms as below								
	Condition of bonus and penalty : No								
	T/C : $130 per one tonne of Cu conc., R/C : $0.12 per pound of Cu conc., R/C : $ 0.16 per one gramme of Au								
	Evaluation of Au and Ag: Au -9.00 - 12.00 g/mt, Ag - 20.00 g/mt								
	Evaluation of moisture : actual : 9 - 10%, checked at the loading port (Poti/Batumi)								
	Condition of quotation of Au and Ag: three month quatation according to the average quatation period of London Metal Bulletin								
	Transportation route : From Madneuli to Batumi by railway, FOB at Batumi port Railway - $8.45 Batumi Service Charges - $9/t								
Client	GLENCORE								
Others									

4.7 Operating Costs

(1) Production Costs

The production costs are sorted into the mining cost, stripping cost and processing cost (Fig. 3.5). In 2001, the mining cost was $2.07/ ton of ore and the stripping cost is $1.01/ ton of ore for a total of $3.07/ ton of ore. The processing cost was $2.98/ ton of ore. Therefore the direct production costs are $6.05/ ton of ore. The administration cost is $2.74/ ton of ore from the breakdown of operating cost, and the total cost in 2001 is $8.79/ ton of ore. It shows $0.56/lb and is almost the same as that of assumed average cost of western countries, $0.60/ lb. But actually, the amount of stripping is about one-fifth of the scheme. In the case of implementation of stripping as a scheme, the cost is assumed to be $0.82/ lb, near to the actual figures. The cost is 30% higher than the average cost of western countries (Tables 3.14-16).

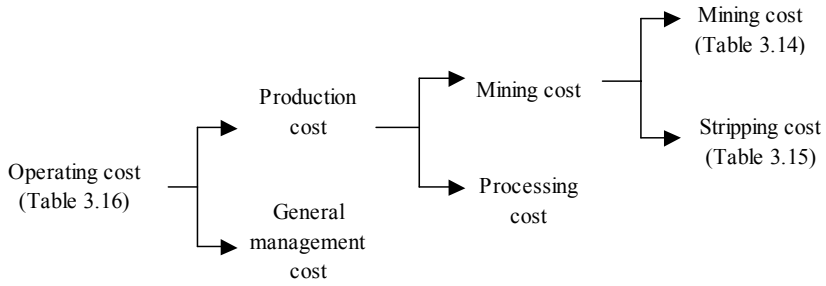


Fig. 3.5 Relation of Each Cost

Table 3.14 Mining Cost (2001 year)

(Production 1,500,459 t of crude ore)

Items	Actual in 2001	Cost		Unit Cost
		Variable	Fixed	
	Thou. GEL	Thou. GEL	Thou. GEL	$/t of crude ore
Auxiliary materials	540.0	540.0		0.17
Paid to subcontractors	3,150.1	3,150.1		1.00
Power	41.0	41.0		0.01
Water	0.4	0.4		0.00
Fuel	94.9	94.9		0.03
Salary fund	109.3		109.3	0.03
Social fund deductions	33.8		33.8	0.01
Depreciation	181.9		181.9	0.06
Workshop expenses	1,490.2		1,490.2	0.47
Transport cost	873.6	873.6		0.28
Total mining cost	**6,515.2**	**4,700.0**	**1,815.2**	**2.07**

Table 3.15 Stripping Cost (2001year)

Items	Actual in 2001	Cost		Unit Cost
		Variable	Fixed	
	Thou. GEL	Thou. GEL	Thou. GEL	$/t of crude ore
Auxiliary materials	312.8	312.8		0.10
Paid to subcontractors	1,943.2	1,943.2		0.62
Power	46.6	46.6		0.01
Water	-			0.00
Fuel	48.6	48.6		0.02
Salary fund	46.5		46.5	0.01
Social fund deductions	15.4		15.4	0.00
Depreciation	51.8		51.8	0.02
Workshop expenses	566.8		566.8	0.18
Transport cost	138.9	147.7		0.04
Total stripping cost	**3,170.6**	**2,498.9**	**680.5**	**1.01**

Furthermore, the exploration cost up to 2001 was $20/m using former USSR made boring machinery. In 2002, the cost is $30-50/m.

Table 3.16 Operating Cost (2001)

Items	Actual in 2001	Cost		Unit Cost
		Variable	Fixed	
	Thou. GEL	Thou. GEL	Thou. GEL	$/t of crude ore
Cost of crude ore	9,685.8			3.07
Auxiliary materials	3,253.0	3,253.0		
Power	1,978.6	1,978.6		
Water	38.1	38.1		
Salary fund	539.9		539.9	
Social fund deductions	167.5		167.5	
Paid to subcontractors				
Workshop expenses	3,406.4		3,406.4	
Dressing cost	9,383.5	5,269.7	4,113.8	2.98
Production direct cost	19,069.3			6.05
Production indirect cost etc.	8,621.1			2.74
Total operating cost	**27,690.4**			**8.79**
Production of crude ore(thous. t)	**1,500.459**			
Amount of Concentrate(t)	**57,189**			

(2) Labor Costs

The labor costs are 5% of the direct costs and cheap. Main labor costs are shown below. So far, the deduction of labor cost is of little effect to the influence of management improvement. But in the future, the increase of labor costs can be assumed and it is necessary to examine its countermeasure (Table 3.17).

Table 3.17 Main Salary and Wages

Items		Salary and Wages
Engineer		700-800 GEL/month
Administration		Manager 1000-1200 GEL/month
Wages	Site workers	400 GEL/month
	Office workers	200 GEL/month

(3) Other Costs

Other costs are as follows: electricity $0.02/kWh, water $0.04/ m^3, fuel $0.35/l (diesel). Compared to the cost of Chile and Peru as advanced mining countries, they are fairly low (Table 3.18).

Table 3.18 Comparison Table of Miscellaneous Costs

	Georgia	Chile	Peru	Japan
Power	$0.02/kWh	$0.03/kWh	$0.09/kWh	$0.2/kWh
Water	$0.04/$m^3$	$0.39/$m^3$	$0.88/$m^3$	$1/$m^3$
Diesel Oil	$0.35/L	$0.39/L	$0.46/L	$0.8/L

4.8 Loans Payable

There is no scheme for the intermediate- to long-term raising of funds. Based on the long-term selling contract with Glencore, the Madneuli Mine is keeping $1,800 thousand of loans payable. The condition of the loans payable is not clear due to the well-kept secret, but the monthly repayment of capital is done by recovering the sales payment. So far, there is no problem for obtaining working capital. In addition to this, they have a loan payable from the Tbilisi Bank as a short-term loan. There might be a possibility of a lack of working capital after the expiration of the long-term contract with Glencore. In the temporary case of a shortage of capital, it is possible to obtain a short-term loan of one month with a 30% annual interest rate from the city bank, but the financing scheme is necessary (Table 3.19).

Table 3.19 Liabilities (GEL)

Liabilities	Fiscal Year Balance	Notes
Current Assets		
Accounts payable (AP)	5,132,969	
Loan	3,689,151	City bank
Tax payable	2,938.397	Interest rate; 30%、term 1 month
Expense payable	5,061	Tax
Total liabilities	11,765,578	
Fixed liabilities		
Long-term AP	3,125,811	Mainly Glencore
Total liabilities	3,125,811	

4.9 Depreciation and Evaluation of Assets

(1) Depreciation

In the tax code, depreciation method is divided into groups by the type of each fixed asset and can be depreciated up to 100% by the declining balance depreciation method (Table 3.20). As an actual problem, there are some cases that fixed assets should be depreciated by the law, but in fact some fixed assets still remain undepreciated as fixed assets. It is

necessary to be depreciated based on the law.

Table 3.20 Groups of Fixed Assets

Group number	Type of fixed assets	Depreciation level as percentage
1	Passenger automobiles, automobile and tractor equipment for use on roads; special instruments; sundries and accessories; computers, peripherals and equipment for data processing and storage	20
2	Automotive transport rolling stock; trucks, buses, special automobiles, and trailers; machines and equipment for all sectors of industry and the foundry industry; forging and pressing equipment; electronic equipment; construction equipment; agricultural machines and equipment; office furniture	15
3	Railway, sea, and river transport vehicles; power machines and equipment; turbine equipment; electric motors and diesel generators; electricity transmission and communication facilities; pipelines	8
4	Buildings, structures	7
5	Assets subject to depreciation not included in other groups	10

(2) Evaluation of Assets

There are many cases that facilities and equipment were procured in the former USSR era from 1974 to 1991 entered into accounts as assets and were evaluated.

For instance, in the Group 2 of the mining field (main production facilities, depreciation rate 15%), 143,374.63 GEL should be on the books as to account for the procured equipment from 1974 according to the standard, but actually 499,734.12 GEL is on the books now. These machines and facilities should be evaluated as completely depreciated, but they are evaluated as assets under depreciation even though some of them such as loading machine cannot be used. Therefore, the assets have been evaluated unreasonably.

4.10 Tax

Payable taxes at the Madneuli Mine are as follows: tax on the use of natural resources, tax on the pollution of the environment by hazardous substances, property tax, land tax, business tax, road tax, profit tax, VAT (value added tax) and tariff. In addition for the social welfare system, social tax, health care, employment fund and other social taxes are obliged to be paid. The total amount of these taxes is $2.968 million GEL in fiscal year 2001, and the total that is obliged to be paid is $4.016 million GEL. It is 17% of the total cost and a burden to the mine management (Table 3.21).

Table 3.21 Tax Rate and Basis（2001）

	Rate	Basis	Remarks
Natural resource use tax	4% gold 5% copper	Concentrate	Paid monthly
Pollution tax on environment by hazardous materials	0.5%	Revenue	Calculated on ton of hazardous waste discharged to the air or water. Tax rate differs for each region. Maximum concentrate limits determined by the Ministry of Environmental and Natural Resources Protection. Paid quarterly.
Property tax	1%	Property	Based on previous year property value. Amount charged at end of the year.
Land tax	Unused land of company		State Department of Land Management sets the tax.
Business tax	1%	Profit	Paid semi-annually
Road tax	1%	Concentrate	Paid quarterly
Profit tax	20%	Balance	Paid three times a year
VAT	20%		No VAT on copper concentrate exports
Tariff	Export～0.15%、Import 15%		Imports 35% including VAT 20%
Social tax	33%	Before tax on salary	Social tax 27%, health care 3%, employment tax 1%. In addition, receiver of salary pays social tax 1% and health tax of 1%. Costs are summed.
Income tax	12～20%	Individual income	Tax charged on income received. Costs are summed.

The amounts of taxes and the final remainders per taxes

Tax	Accrued sum in 2001 (GEL)	Paid sum in 2001 (GEL)
VAT		
Highway users' fund	-215,447	265,439
Entrepreneurship	-133,192	187,655
Social insurance	-1,291,158	167,224
Healthcare fund	-180,680	0
Employment fund	-45,225	0
Profit tax	-138,176	293,675
Income tax	-828,927	855,000
Property alienation	-3,343	3,343
Water supply	-2,581	0
Land use	-139,365	411,018
Property	-151,026	111,155
Natural resources use tax	-805,689	590,919
Ecology tax	-81,457	83,000
Total	**-4,016,266**	**2,968,428**

("-" means liability and "+" means surplus)

5. Issues to the Present Situation

5.1 Ore Reserves and Grade

- Regarding reserves and grade of the State owned mine, approval of the State Committee of Ore Reserves is necessary. Calculation of minable crude ore and grade is re-calculated by adding boring data of detailed exploration and sampling data, so it is reasonable to take a long time for that. It is necessary to simplify the calculation by making coefficients (assessed ratio) based on the difference between the average grade of each block and actual average grade, if the actual loss in each process is considered.
- The ore reserve of category C_2 is not equal to the minable ore reserve. Proved exploration for making ore reserve of category C_2 to category C_1 is excessive due to the regulation. Because of the matter of approval of the State Committee of Ore Reserves, it is not approved without complying with the regulations. A suitable form for a market economy should be made by changing the procedure, for instance, approval to notification. Flexible exploration is needed taking the geological condition into consideration.
- Judging from its possessed ore reserves, supply of copper ore would be less than 10 years to keep the present production amount. It is necessary to implement exploration for new deposits immediately as the next supply base in order to make possible the expansion of the mine life clear. Presently, it is very hard to design a long-term scheme.

5.2 Production Field

(1) Mining

- At the present moment, the cut-off grade is over 0.4% of copper. From 1979, this figure has been fixed and does not show a cut-off grade that reflects the present metal price and production cost for the cut-off grade so it is necessary to examine this figure.
- The production scheme is made annually. Considering the tendency of the market is not enough. A production plan is necessary based on a long-term plan formed on the market tendency.
- Regarding stripping, as a result of 2001, the stripping ratio is 0.37 m^3/t, which is about one-fifth of the scheme (1.93m^3/t). Preparation for stripping is delayed for the next production phase. From now, stripping is loading to the total cost. It is necessary to implement stripping schematically based on the production scheme.

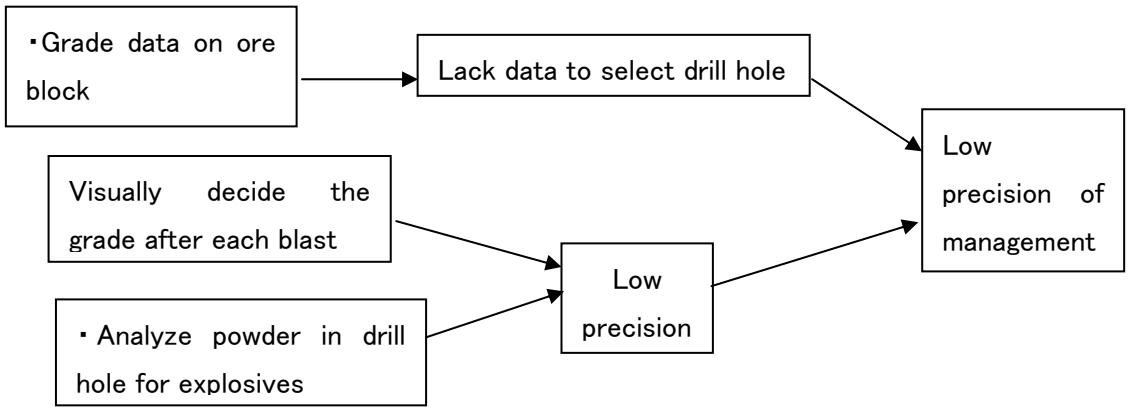
- Aged drilling rig and excavator, which were procured in the former USSR era, are still used. They are all old and have a low efficiency (Table 3.22). Furthermore, Russian made machinery used is slow and has a low mobility. There is much trouble with the electrical and hydraulic systems and this loads on the cost of maintenance

Table 3.22 Comparison Table of Drilling Results (March-September 2002)

Country Where Purchased	Type	Units	Total Drilling Length	Drilling Length per Month
Former USSR	SBSh-250	1	36,553m	5,222m/M
Western Countries	D50KS	1	122,380m	17,483m/M

Source: TAMROCK

- Present grade control is by the method described below, and is insufficient to the production control of mining, which takes a serious view of production grade of crude ore and is not systematized (production grade of crude ore is 0.82% copper to 1.05% copper in the minable grade. In 1993, the average grade of copper concentrate for the past 10 years is the highest by 19.3%. It is considered as one of many reasons that insufficient grade control of crude ore causes preventing the concentrate grade from rising. System, which makes accuracy increase, is required according to the actual data.



(2) Processing

- With the present processing flow chart, regrinding of middlings is impossible because middlings of flotation is not returned to the grinding process. For this reason, neither the upgrade, nor increasing the recovery ratio can be expected.

- Cleaning steps of the flotation process are lacking for more than one (presently, existing two steps), which increase the concentrate grade.
- From the mining to the processing division, there is no consistent quality control system.
- Partial instrumentation is adopted in order to control the operation of processing, but it is not sufficient. Facilities for instruments are also aged.

5.3 Indirect Field and Others

(1) Indirect Field

- The number of people who understand the meaning of IAS (International Accounting Standards) is small, and the management, which does not use IAS.
- Necessary data on production and management control (for instance, ore reserve and its grade, the number of sampling, unit mine cost, etc.) are not systemized. They also do not reflect enough to the actual control.
- There is no scheme for repairing and overhaul so repair is done when needed. Control based on a result is needed.
- Disposition of personnel is not efficient, and they are holding a surplus of people.
- Because they put priority to keep operating, they have a large inventory of materials and consumer goods. It is necessary to make a database of results and control the amount of inventory based on results.

(2) Environment

- Because of a lack of finance, the environmental management system is not sufficient. Monitoring is carried out partially, but because equipment is old and analysis is doubtful in precision, it cannot be said that it is quick.
- The present situation on contamination caused by heavy metal is not clear, because the environmental survey on contamination accompanied with the production activity in the former USSR era is not implemented.
- Wastewater treatment facility is aged and partially damaged so there is a possibility of a leakage of wastewater.

(3) Information

- Changing of circumstances of the market is remarkable. Without reflecting the information of the market to the production activity, it is not linked to the management, which secures a profit.
- Accounting is needed to be strategically used in management. It is necessary

to still promote the strengthening of accounting information sharing so it is reflected in its management.

- Acquiring method of information is limited and disclosure of information is not done.

(4) Others

- The intermediate- and long-term management scheme and direction of management is not clear.
- After the long-term selling contract with Glencore expires, there is a possibility of lack of working capital due to no intermediate – and long-term financial procurement schemes. Furthermore, the management constitution of the Madneuli Mine may not be able to provide financing and working capital due to the annual appropriation of profit.
- The contracting system is flexible to the cost based on the production amount. On the other hand, selection ore from waste easily becomes loose with eyes after blasting so the control of operations and safety such as drilling, blasting and hauling, etc. are becoming insufficient.
- From the legal point of view, depreciation of mining equipment and facilities or write-offs are possible, but actually it is not implemented based on the law.
- The number of items on taxation is so many and the tax share is 17% of the total cost so it is loading much to management. Some taxation is incurred on revenue. In the case of making no profit, the load of taxation is serious and causing trouble.
- Regarding the selling condition of concentrate, the price of T/C and R/C is approximately 50% higher than the general price of western countries.
- There are many fixed assets that have no value (for instance, aged machinery, etc.) and their asset value is very low.
- There is no awareness of the production activity (productivity, quality control, etc.) under a free market system and consciousness based on the former USSR system still remains (Table 3.23-24).

Table 3.23 Issues and Improvement Points for Madneuli Mine (basic fields)

Item	Issues	Improvement Points
	Change management of Ministry of Economy, Industry and Trade	Privatization (hold tender)
	Lack medium- and long-term operation plan	Operation plan with importance on cash flow
	Lack analysis operations and cost consciousness	Analyze operations
Operation	Lack management view under market economy	Operation strategy with importance to profit
	Depend on trader for sale of production	Survey and secure market
	Insufficient understanding of IAS	Use IAS, transparent management
		Operation plan includes repaying loan
	Insufficient use of IAS	Financial management based on IAS
	Many superannuated assets	Dispose of superannuated assets
Finance	Difficulty raising funds	Lower city bank interest rate,
		provide medium- and long-term loans
	Principle to keep financial data secret	Transparency, disclose information
	Little profit, huge debt, difficulty investing	Management links operations and finance
	Lack flexibility on exploration and development passport	Abolish former USSR rules, establish guidelines
Law & Regulation	(regulation)	under a free market economy
	Exploration costs increase for reserve approval, regulation and	Ore reserve management is the responsibility
	procedure, takes a long time and delays production	of the business
	Many items, heavy cost burden	Reduce tax for limited period
Tax System	Agreement of tax and accounting methods on depreciation	Link accounting and tax methods
	VAT procedure for barter method	Transparency, simplification
Inventory Control	No deliberate management, own too much stock	Management plan based on actual data
Procurement	Much procurement from CIS, insufficient examination of	Examine efficiency, price, maintenance and
	information to procure suitable goods	other considerations
Work Process	No deliberate management, own too much stock	Promote IT, company intranet (share information)
	Arrangement of human resource redundancy	Proper personnel and arrangement
Human Resources	Lack management of contractor	Train manager
	Lack knowledge and information for transition to market economy	Increase English ability, absorb and spread
		information and knowledge by the Internet
	Actual state of heavy metal pollution from production activity	Implement pollution survey
Environment	in the former USSR is not clear	
	Superannuated and damaged wastewater facilities	Renew facilities
	Insufficient monitoring system	Complete monitoring system, watch environment

Item	Example of Concrete Countermeasure and Method
Management	Introduction of EBRD TAM program.
	Request to EBRD from government organization.
Finance	Raising funds is needed to study and judgment by Ministry of Finance and State Bank.
	For other finance, introduction of the EBRD TAM program.
Law・Regulations、Tax Law	A study is needed by the government and Ministry of Finance. Request to the EU about the survey of tax law improvements and role.
Inventory Control, Procurement, Administration Treatment	Introduce computers to combinat. Make practical use of systemization.
	Gather Internet information.
	Inspect Western mines.
Human Resources	Improve Madneuli Mine by itself.
	Refer to support program of international organizations in the appendix in the Final Report.
Environment	Environmental pollution survey (model survey realized) under request to Japan government.
	Concrete request to EU.

Table 3.24 Madneuli's Issues and Improvement Points (production)

Item	Issues	Improvement Points
	Cut-off grade is fixed at 0.4% Cu	Examination of cut-off grade reflects market conditions
	Lack ore reserves, only 10 years life	New deposit exploration and development
Ore Amount,	C2 ore reserve is 28% of ore reserve	Promotion of confirmation exploration
Grade and	Accounting of minable coarse ore quantity by (9.2%)	Allow minable coarse ore quatity to reflect the
Exploration	by uniform waste rock mixing percentage	measurement value of waste rock mixing
	Calculation of minable ore reserve by uniform coefficient	Review minable rate of every block
	Undeveloped data management by digitalization	Make database and ore reserve and grade map using GIS
	Big grade difference in minable ore and produced ore	Increase ore reserve by lower cut-off grade (improve assessment rate)
Mining		Improve mining efficiency, processing results by stable production
	Delayed stripping, lack stripping expense	Re-evaluate low grade gold ore and reduce stripping costs
Mining	Superannuated, low efficiency	Renew sequentially
Equipment		
	Management has low precision on produced ore grade	Systemization of ore grade management linked to processing
Production	Insufficient contractor management (safety, operations)	Train managers
Management	Lack of planned production	Planned production based on market conditions
	Lack of management on gold grade	Production plan that includes gold grade management
	Lack use of actual production value to production activity	Make database of actual production value
	Cannot maintain 20% Cu concentrate grade	Investigate simple separation of flotation product,
Processing		analyze mineral and factors
		Regrind middlings, increase capacity of cleaning flotation,
		change type of flotation machine
	Big change in processing and ore grade	Balance and stabilize mine ore prodution (blending)
Processing	Superannuated, motor efficiency low	Scale up the flotation tank, Examine tank reduction by deeper tanks
Equipment	Insufficient instruments	Examine purchase of necessary measuring machine receptacle
		and automated process control
Supply	Procurement from CIS, overstocked due to long delivery	Proper ordering by unifying the procurement management
of Goods	period	Implement planned maintenance
	Abundant ferrous iron produced during copper recovery	Storage place, impact investigation on water circulation
Environment	process from acid water	Examine the use of low grade copper ore
		Examination of SW-EX
Information	Limited information source	Gathering information on Internet, etc.

Implementation of concrete countermeasures for improvement is desired to be carried out by the Madneuli Mine itself except the above * marked. * It is necessary to introduce cooperation from to international organizations.

6. Recommendations, etc.

6.1 Promotion of Exploration

(1) Area around the Madneuli Mine

Geophysical survey (TDIP method) and soil geochemical survey implemented around the northeastern part of the Madneuli Mine. The prospective zones extracted by geophysical anomaly of low apparent resistivity high chargeability and geochemical anomaly of high score zones of the factor representing gold and silver mineralization where ore deposits might be embedded, respectively are distributed to the eastern extended part of the open pit and five to six sites around the part of the hematite vein of the Demursu deposit.

Therefore, geological exploration would be carried out in these promising sites after obtaining the exploration license. It is suggested that detailed geophysical survey of IP method or electromagnetic method would be implemented and drilling exploration works with 300-500 m length would be carried out in these promising areas.

(2) Targeted ore reserve

It is assumed that ore reserve obtained by the drilling work around the deposit as follows. The interval between drilling holes is 20m and average length of drilling is 300m and number of drill hole is thirty-two. Mineralization zone of approximately the length of 40m would be conformed by a drilling of 300m lengths in and around stockwork type deposit experientially. It is assumed that ore reserve of 42,000 tons would be obtained by an average drill hole. While drill hole confirmed mineralization is only one hole in two holes in probability. As an example, annual obtaining ratio of ore reserve is assumed to fall down 20 % because of decrease of promising site. The conditions of calculation of crude ore is minable recovery 90%, mining loss 6.1% and dilution 9.23%.

Obtained ore reserve per 300 meter of drilling is calculated as follows:

40m(H)×20m(L)×20m(W)×2.65(t/m^3)□42,000t

Table 3.25 Target ore reserves in Madneuli mine

(Thousand tons)

	2002	2003	2004	2005	2006
Crude ore	14,860	12610	11,440	10,160	8,800
Mined ore*	▲ 1,500	▲ 1,500	▲ 1,500	▲ 1,500	▲ 1,500
Obtained ore reserves	660	520	410	320	250
Obtained crude ore	600	480	370	290	230
Crude ore at end of year	13,960	12,940	11,810	10,600	9,330

Mined ore is constant as same as 2002 year.

(3) Further copper resource of supply and prospecting situation

Several copper-gold deposits distribute in the Bolnisi area including the Madneuli mine. These deposits are genetically similar to copper-gold deposit in volcanic rocks of the Late Cretaceous period. They are composed of Tsiteli Sopeli, Kvemo Bolnisi, Davit Gareji and Dambludi deposits. Copper metal reserves with over C_2 category is assumed to amount to 288.4 thousand tons in Tsiteli Sopeli, 12 thousand tons in Kvemo Bolnisi, 12 thousand tons in Davit Gareji and13.7 thousand tons in Dambludi (Table 3.26). Within these deposits, the Tsiteli Sopeli deposit has large amount of ore reserve and potential reserve, and its quality of ore is good for mineral dressing (gangue mineral is mainly quartz, does not include arsenic). The location of the deposit is deeper in comparison with other deposits. The Tsiteli Sopeli deposit is considered to be the next copper resource of supply (Figure 3-6).

Table 3.26 Ore reserves and grade of Tsiteli Sopeli deposit

	Ore (thousand t)	Cu (ton) Grade (%)	Au (kg) Grade (g/t)
Category (C_1)	10,573	120.9 (1.14)	9,982 (0.94)
Category (C_2)	20,243	167.5 (0.83)	14,444 (0.71)
Category (C_1+C_2)	30,816	288.4 (0.94)	24,426 (0.79)
Prognostic resources (P_1+ P_2)	42,192		56,829 (1.35)

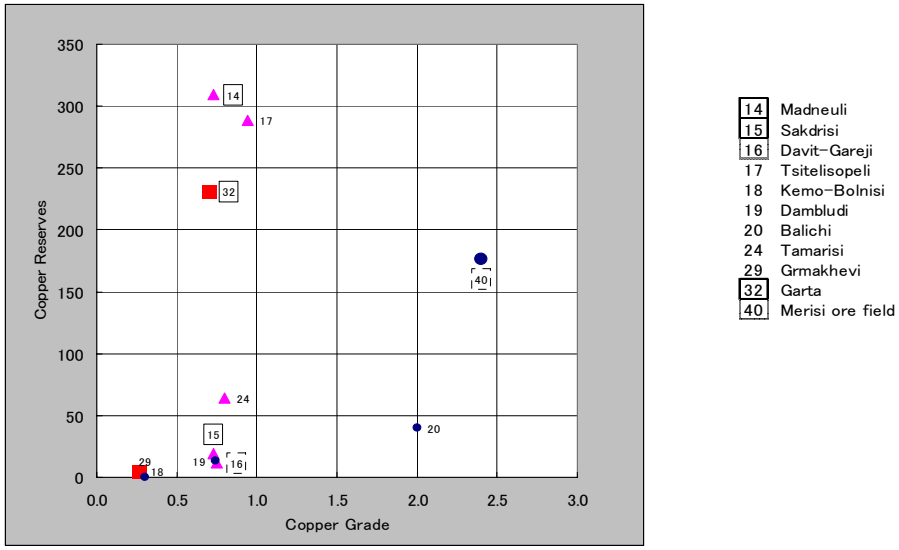


Fig. 3.6 Grade and tonnage of Copper Deposits of Georgia

The Tsiteli Sopeli deposit is located in 10km to northeast of the Madneuli mine and in 14km to southeast of the Bolnisi town. The deposit is blind and is bedded at 150m to 200m depths from the surface covered with alluvial deposit. The deposit is mainly composed of stockwork mineralization of chalcopyrite-pyrite-quartz. Morphology of ore bodies is formed as veins nests and lens.

Drilling length had been done for a total of 190 thousand meters with a drill hole interval of 60m. Mineralization extends to 300m in east-west direction, 280m in depth. The thickness of mineralization varies 1.5-2m and 270-290m, in average 40-70m. The deposit consists of 50 ore bodies.

Western and central parts of the deposit has been explored. While in eastern and northeastern parts where it is expected to reveal the existence of gold-quartz and gold-copper ore for underground development. The further detailed exploration in the Tsiteli Sopeli deposit is assumed to be started since 2005 for five years, because the Madneuli mine would be less than 10 million tons of ore reserves in 2005. For final two years feasibility study

would be investigated.

It is assumed that the ore reserve obtained by the core drilling around the deposit is as follows. The interval between drilling holes is 30m and average length of drilling is 300m and number of drill hole is thirty. Mineralization zone of 40m in average thickness would be conformed by a drilling. It is assumed that ore reserve of 100,000 tons would be obtained as the average by one drill hole. While drill hole confirmed mineralization is only one hole in three holes in probability.

Obtained ore reserve per 300 meter of drilling is calculated as follows:

40m(H)×30m(L)×30m(W)×2.8(t/m^3)□100,000t

Table 3.27 Drilling prospecting and target ore reserves at the Tsiteli Sopeli deposit

(Ore: thousand tons)

	2005	2006	2007	2008	2009
Drilling	10,000m	10,000m	10,000m	10,000m	10,000m
Ore reserve (C_1+C_2)	30,810	31,810	32,810	33,810	34,810
Obtained ore (P_1→C_2)	1,000	1,000	1,000	1,000	1,000
Total ore reserves	31,810	32,810	33,810	34,810	35,810

6.2 Grade Control

(1) Ore Reserve and Grade

The grade of the minable reserves and grade of minable crude ore reserves, which are calculated by ore reserves, are the base of production grade and influence production control. Therefore, it is necessary to raise to a high precision of control.

- Revision of mining recovery and dilution in each block every year.
- Examining of subdividing the blocks taking the geological conditions into consideration.
- Making a database for digitizing and grade distribution using GIS (Geographic Information System) and corresponding to the change of the cut-off grade. In the future, making a system that links to the production control.

(2) Crude Ore Grade

In order to control the crude ore grade with high precision by implementing short drilling and analysis of samples at the working faces and for around the margins of the deposit and low-grade part, it is important for grade control of minable ore. In the case of massive sulphide deposits, grade control with high precision influences the production control (scheme and result)

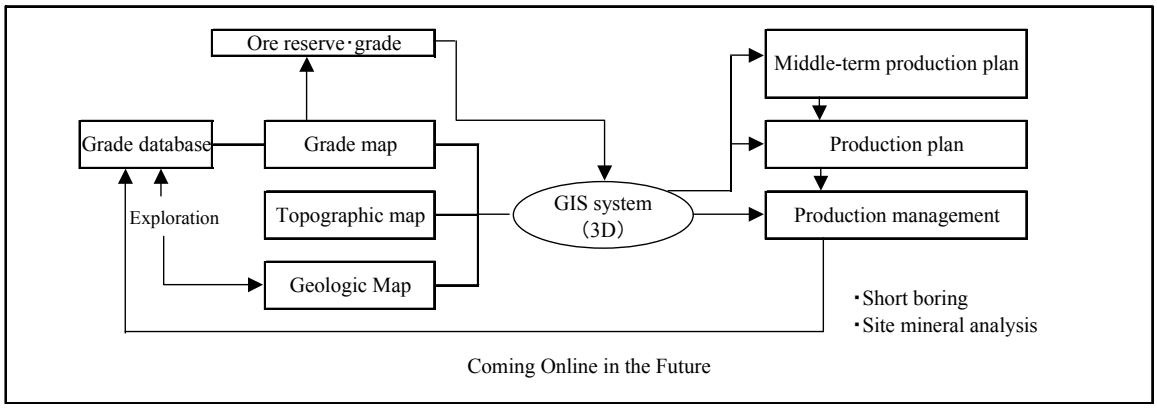


Fig. 3.7 Production System for Introduction to GIS System

- Side-by-side comparisons of each grade such as calculation of ore reserves, short core boring and samples of working face.
- Making a grade map of crude ore.
- Combination of working face, which meets the market price, and production control (grade control).
- Make quick analysis (renewal of equipment analysis).

(3) Consistent Control System from Mining to Processing

There does exist high selectivity ore of mineral processing and low selectivity ore in each block for mineral processing. It is considered that the degree of separation of a simple grain with ore mineral and the difference of the accompanied mineral causes this situation. Because the grain is not re-milled in the present flow chart, there is a lack of separation of the grain with copper minerals. From the viewpoint of selectivity of mineral processing, the difference of mineral and grade, etc., a consistent control system is needed based on implementation of a revision of the existing result of study by obtaining some new points of view of occurrence of ore mineral through microscope observation and measurement of grain size, etc.

- Jointly owning data between mining division and processing division.
- Controlling and classifying of the difference of selectivity of mineral processing based on mineral property (variety of mineral, size of mineral, etc.).
- Confirmation of the existence or not of the difference between the variation of the mineral property and the selectivity of the processing within the block.
- Systematization of comparison of concentrate grade, production grade and grade of working face.

(4) Examination of Changing the Bench Height

The present bench height is planned 10-12 m in the open pit. The length of the blasting

hole is added to the sub-drilling to the bench height. On the other hand, the shape of the ore body is not uniform and there is the existence of the part where the thickness of the ore body is less than 10 m by the result of the confirmation exploration. The blasting hole length is uniform, not related to the shape of the ore body and only adapted to the height of the bench. By this condition, drilling, charging and blasting are implemented. It is supposed that dilution is increased at the part of the block where the shape of the ore body is thin.

- Study of the pattern of bench height, which fits to the thickness of the ore body's shape. Study on blasting method, which is divided into two times to the bench height.
- Precisely grasp the ore body shape and plan a blasting scheme based on the results of the analysis of the drilled powder while drilling.
- Precisely select the broken ore after blasting and implement grade control.

6.3 Stripping Countermeasure

At present, the load of the stripping cost is small in the total cost. This means that the target of the minable blocks is selected based on the low stripping ratio for stripping. In the future, target of minable blocks are; 1-B, III-C_1 and XI-C_1. The stripping ratio of these parts is 2.15 m^3/ton so the load of stripping costs is increasing ($2.89/$m^3$, total $87 million). Re-evaluation of copper and gold grade and changing the pit slope angle are considered as countermeasure for the reduction of stripping costs.

(1) Re-evaluation of Copper and Gold Grade in Stripping waste

It is considered that the stripping part is located in the upper part of the copper deposit and it is formed a mineralized zone with low-grade gold. It is necessary for this mineralized zone with gold, which is subject to a stripping part that the re-evaluation of the existing data, analyzing for partial sampling, short drilling and examination of the possibility are implemented and the waste rock consisting of low-grade gold is studied for selling to JSC "Quartzite" (Fig. 3.8).

- Stripping cost would be reduced if the stripping waste can be sold as low-grade ore.
- Re-evaluation of stripping has the potentiality for improvement of profits.
- Necessity of examination comparison to stripping cost and the economic effect of stripping.

(2) Changing of the Pit Slope Angle

The pit slope needs to be decided considering the slope stability based on the strength of

the bedrock, geology (existence of a fault or slip face) and effect of underground water. The pit is divided into nine sections based on study results by the Institute of Rock Mechanics, etc. The slope is 27-37˚ by the plan in 1982 (plan in 1997 the slope is 34-41˚). The present average pit slope is about 30˚, so if the pit slope angle is changed 10 degrees on average from 30 degrees at present to 40 degrees, the total amount of stripping waste would be reduced by 11% and a cost of $ 9 million. Concerning this revision of the pit slope angle, it is examined at the Institute of Rock Mechanics and Mining Geological Center. Furthermore, it is needed to re-examine the confirmation of stability of the pit slope, necessity of anchor bolts and wire anchor and the influence of land slip at the bench.

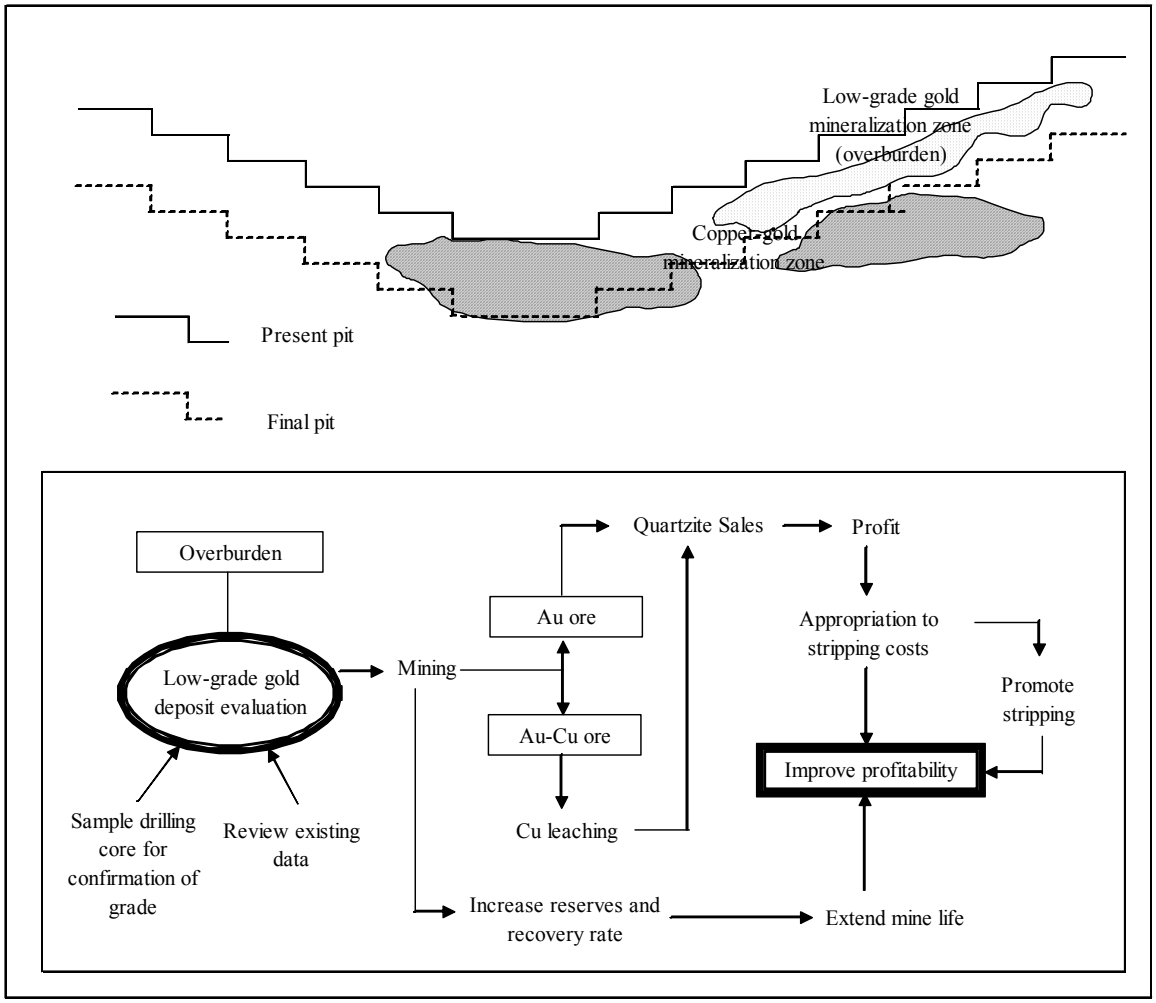


Fig. 3.8 Model of Evaluation of Low-grade Ore and related Profitability Improvement

(3) Stripping Scheme Based on Intermediate- and Long-term Mining Plan

For long-term stable management, it is necessary to draw up a stripping scheme based on the intermediate- and long-term production plan. Present management may be

profitable in the near future. But there is a high possibility that it may make situation worse for the intermediate- and long-term.

- Making a stripping plan linked to the mining plan.
- Intensive investment of stripping expense.
- Examination of countermeasure protecting the pollution of heavy metals at the stripping waste dump.

6.4 Production System

There is little room for big changes in the production system to maintain the present production scale. In the work flow chart for drilling→charging→blasting to loading and transportation, it is necessary that reduction of loss time by time study and establishment of a continuous working system linked to increased working efficiency. Also it is needed to renew the superannuated equipment and increase working efficiency. For instance, it is vital to improve productivity by the introduction of a computer system like a MED system (3-D production plan development in US, Appendix I) used for mine design and planning system that is linked to production control by a database for records of production, existing geological data, ore reserve and grade.

If the cut-off grade is reduced and ore bodies are combined, large-scale mining would be possible. It is possible to establish a structure of expanding production with large-scale mining equipment and additional processing facilities. Also it is considered that the results of processing may become more stable by simplifying the grade and production control (Fig. 3-9).

(1) Establishment of production plan and control system by using computers

Production control system is becoming common by using computers in mining. The utility of global positioning system (GPS), for instance, implementation of system by instruction of location to mobile with attaching GPS by imputing GIS data by management of on-site survey and hand-held equipment for analysis of ore grade of the working face linked to the on-line data system becomes a comprehensive plan and operation control system.

- Production system is linked to a computer system such as GPS, database and MED system.
- In the future, linking to an on-line system of grade and GPS system.
- Making a network between the production field and indirect field, and the joint owner of information.

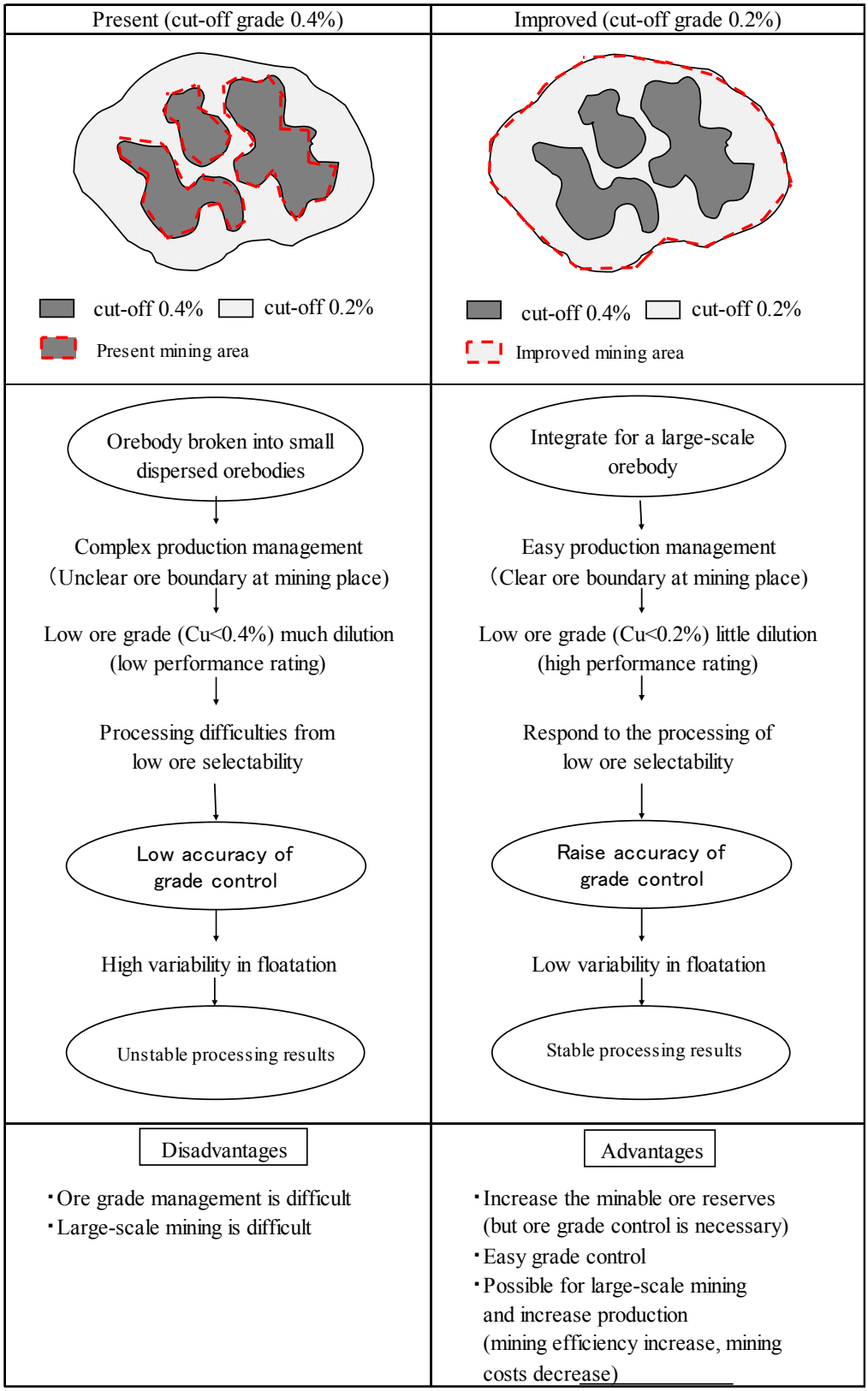


Fig. 3.9 Concept of Orebody Integration by Lowering Cut-off Grade

(2) Reduction of cut-off grade

In case the cut-off grade is reduced (Cu 0.4%→0.2%), the area of mining block is increased 123,000 m^2 (152,000 m^2→275,000 m^2) (Fig. 3.10). Ore reserve would increased 15 million tons (21 million tons→36 million tons) (Table 3.6). The difference between the grade of ore reserve (Cu 1.05%) and grade of produced ore (Cu 0.82%) is considered due to the increase of dilution and direction of mining recovery.

The coefficient, which is added to dilution and mining recovery, is assumed to be the ratio of assessment. The present ratio of assessment shows 78%, but it is assumed that the ratio would become 90% by reducing the cut-off grade because of making it possible for gathering and large-scale mining blocks.

For instance, in the case of III-C_1 block, the grade of crude ore copper is 0.85% with a cut-off grade of 0.4%. At a cut-off grade of 0.2%, the block would be 0.78% Cu so there is no big difference. Although the value of becomes from $11.9/ton to $10.9/ton, the value of the whole block for the minable ore is increased $10 million (present value of minable ore of $30 million→future value of minable ore of $40 million) for reduction of the stripping cost. This means there is an advantage to reduce the cut-off grade so it is necessary to examine realizing an expanding production system and increasing profitability.

- The ratio of assessment increases (78%→90%) for the reduction of the cut-off grade (Cu 0.4%→0.2%). On the other hand, the grade of the crude ore does not decrease so much (Cu 0.85%→0.78%).
- Cost reduction by introduction of an efficient production system and ore body with large scale.
- Examination of the advantages of expanding production and profitability (ore reserve, amount of production, grade and investment).

6.5 Cost Reduction Countermeasure

There is much room for cost reduction due to the lack of experience under a free market economy. The consciousness of cost reduction has just started so it is necessary to make it fixed firmly from now on. It is considered that the cost reduction countermeasures is as follows; by making production efficient by renewal of equipment, restructuring of personnel based on the revision of the job content and appropriate arrangement of staff and workers, reasonable inventories based on the procurement of raw materials and parts, preventing excess inventories and uniform control system linked to the data of inventories.

It is possible to reduce 30% of the cost per ton of crude ore with the cost reduction analysis and implementation to each division (Table 3.28).

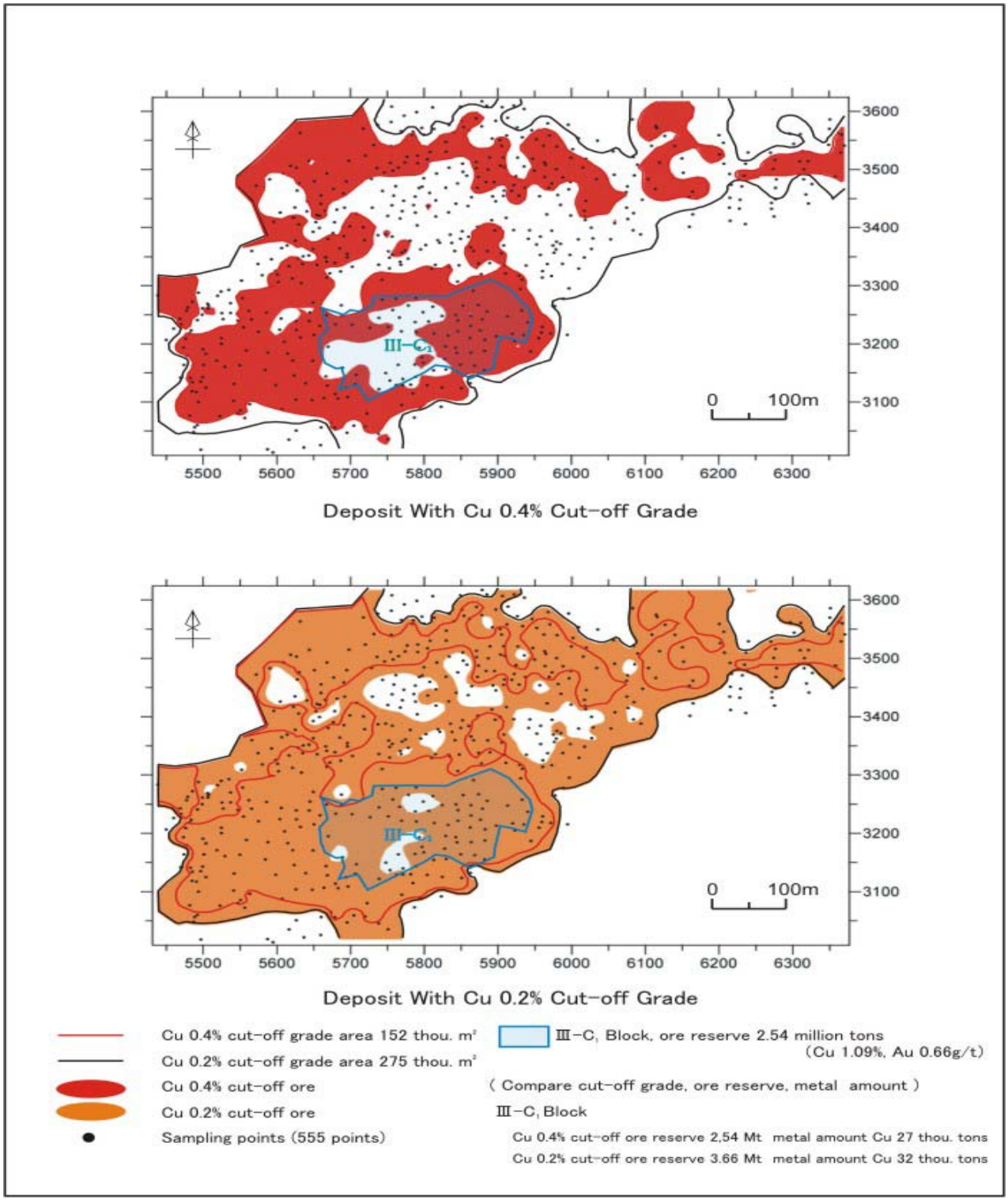


Fig. 3.10 Madneuli Mine Target Minable Block (B+C)

Table 3.28 Countermeasures of Cost Reduction

	Present	Cost Reduction	After Reduction	Concrete Countermeasures
Mining Costs	$3.07	$1.00	$2.07	Increasing efficiency by the introduction of new equipment
Processing Costs	$2.98	$1.00	$1.98	Personnel rationalization, new reagents for dressing
Administration Costs	$2.74	$1.64	$1.10	Personnel rationalization
Refining Costs (Cu)	$7.13	$1.89 (30%)	$5.24	Revision of contract or new customers (Armenia and Bulgaria)
Refining Costs (Au)	$0.07	—	$0.07	Present
Total	$15.99	$5.53	$10.46	

(1) Improving efficiency by renewing of mining equipment and facilities

Presently, much equipment and facilities are superannuated, damaged and has a high maintenance cost at the open pit are the causes of the decline in efficiency. It is required to make finance strategically. The renewal plan for equipment and the plan for raising money for the procurement of them should be drafted up strategically so productivity by renewal should be reflected to the production plan. For instance, renewal of drilling rigs makes the drilling efficiency three times more than the old rigs (Tables 3.22, Table 3.28).

- Making renewal plan for equipment based on intermediate- and long-term production plan and finance.
- Appropriate selection of equipment and selection of country for improvement.
- Numerical expression on the concrete improvement of production based on the renewal and control in implementation.

(2) Appropriate arrangement of personnel

It is necessary to adjust the excess of workers with the personnel plan of each division based on the intermediate- and long-term production plan. Especially the number of workers in the indirect field, which is redundant. From now, adjustment should be started because increasing of personnel cost is considerable in the future.

- Making the personal plan based on the production plan.
- Efficiency of work by introduction of control system by using computers.
- Analysis of effectiveness on reduction of personal and implementation.

(3) Inventory control system

Excess inventories lead to waste of materials and parts and cause increasing costs.

The amount of inventories should be optimized the necessary amount based on database of production data, past records, and appointed date of delivery and investigation of substitutes and various supplying countries should also be examined (Fig. 3.11).

- Systemization of inventory control based on production data, etc.
- Adjustment of procurement by financial control and inventory control.
- Making a budget for the amount of inventory and procurement with a plan.

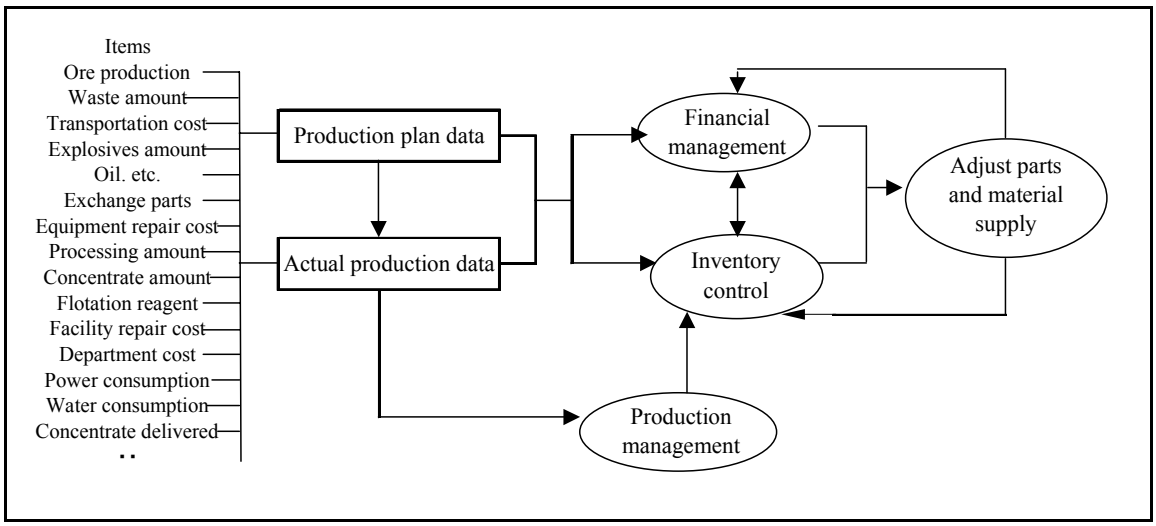


Fig. 3.11 Inventory Control System

6.6 Development of Market

Madneuli Mine is in the period of reconstruction under a free market, the present concentrate sale contract with a trader has put the operation of the mine in a severe condition, and in a lack of stable financing (evaluation of gold, T/C, R/C, etc.). Repayment of a loan to the trader is a heavy burden for management. It is necessary to secure a market by itself or through a trader (company) as preparation for the expiration of the contract. For this matter, improving the quality and maintenance of a 20% copper grade in the copper concentrate and making a good condition leads to more profit. These improvements make investment for the renewal of equipment and reconstruction of the control system, etc.

- Implementation of marketing researches and secure potential users.
- Judging from the price of freight, the Europe has an advantage and is a target for concentrate sales. Armenia (Alaverdi smelting plant) is more profitable.
- Establishing the foundation of stable management by making a long-term sales contract. Increase the copper grade of the concentrate by quality control is the only prerequisite.

- Collecting information on the international trend of the mining industry and metal price trend and expanding the knowledge on the copper business.

6.7 Tax Reduction Countermeasures

Tax, which is 11% of the cost (real payment is 11%, duty of payment is 17%) is a serious load to the mining management and cannot make a profit easily. Reconstruction of the Mine is very difficult without realization of a tax reduction countermeasure (proposed in the promotion plan in Chapter 4) in the period of reconstruction and arrangement of the mining industry in the master plan. The government should collect the tax in its sphere with the possibility for the development of a mine although, there is a severe condition in the national finance, increasing the tax revenue is an important role of the government with its right of tax collection and taxation. It is considered that the present tax system may force the mine to suspend operations. It is necessary for the government to examine and implement immediately countermeasures for reducing tax so that the company can invest profit for its reconstruction expense.

- Countermeasure for reducing tax with a time limit in the period of the reconstruction of the mine.
- Countermeasure of tax incentive privilege based on a reconstruction plan.
- Simplification of the procedure for payment of tax and transparency.
- Limitations on the sphere of excise tax regarding imported materials and parts, which are used in mine production.

6-8 Asset Countermeasures

Improvement of content of assets is indispensable for reconstruction of financial constitution by revising the depreciation based on IAS and write off bad assets. Because actual assets evaluation is not implemented, if financial evaluation by the present balance sheet is done, it would become estranged with no relation to reality. It is requested to break away from the asset evaluation method of the former USSR style and evaluate assets under a free market economy. If it is not improved , it will influence the participation of foreign investors accompanied with privatization. From the viewpoint of characteristics of mining industry, there is a difference between depreciation by accounting and the tax code. Therefore it is necessary to improve the present situation, which the accounting of depreciation follows the treatment of the tax code. The depreciation system should be revised by the government, and the government should arrange to implement appropriate asset accounting by IAS.

- Reconstruction of the financial constitution by asset evaluation based on

European and American standards/

- Write off of bad debts
- Depreciation based on IAS.

6-9 Privatization

It is necessary for the Madneuli Mine that is managed by the government to prepare and arrange the following for the complete privatization: qualifying of the sphere of responsibility by the government to environmental contamination, appropriate evaluation of assets (write-off of bad debts), financial reports by IAS, management scheme and intermediate to long-term production plan and investment scheme, etc. Presently, rapid privatization is not easy. As a method of implementation, sales of stock and transferring them are considered.

(1) Sales of stock

As a form of privatization by the sales of stock, the following is considered: ① sales of all stock to foreign investor, ② merger with foreign investor and the government having a minor share, ③ all stock sale to domestic capital, ④ merger with domestic capital and the government having a minor share, ⑤ merger of foreign investor and domestic capital, etc.

Among them, ③ or ④ is desirable for the implementation of activity of the Madneuli Mine as roles of development of the mining industry in Georgia and exploitation of the Bolinisi area where exists the Madneuli Mine. But the possibility of realization of ③ or ④ is small by the present Georgian economic ability. Concerning ⑤ , at present, if the share of the domestic capital is small, it would be possible, the case of ② is more desirable because the profit flows to the foreign investor in the case of ①. In the future, it is considered to become the case of ⑤ from the case of ② in the future.

Therefore, participation of foreign capital is a subject of privatization by the sale of stock. It is the method of privatization that sales to a foreign investor are done by tender or direct negotiation with a potential investor, etc. In the case of selling stocks, it is necessary to note the following matters: re-evaluation of the present assets, qualification of net assets and deficit (what cannot be evaluated as assets)) and part, which excepts depreciable part among the net assets is the sales target.

- Holding of a tender, establishment of conditions of a tender being made by standing on the Western side (sphere of free market economy).
- Examination of merit and demerit of sales of stock to foreign investors.
- Through seminar on investment for the mining industry (necessity of supporting by international organizations such as the World Bank, etc.), appealing to foreign

capital.

- Re-evaluation of present assets and quantifying of the sales target.

(2) Transfer of Stock

Presently, the participation of foreign investors is difficult, and it takes a long time to prepare and arrange the tender. It is desirable to spend the profit on the development of the mining industry in Georgia by domestic capital for realizing contribution of the Madneuli Mine to the Georgian economy and becoming a role of an engine for the mining industry.

It can be thought to establish a stock holding company (for instance, Georgian mining and smelting company) minimized the capital of stock possessed by the government and transfer stock (Fig. 3.12).

As the method of establishment of the stock holding company, stock exchange system and cast-off skin system etc. are picked up. The stock exchange system means the following: in case that one company named A makes another company B subsidiary, stocks of company A and stock of company B, which the shareholders of company B hold are exchanged for each other. The stock shares of company B, which shareholders of company B hold are dealt with a present value at transferring. In case that the present value of the stock of company B is higher than the historical price, profit from the transfer is occurred. It is necessary to examine introducing measures of postponement to imposing tax. A cast-off skin system is the way how to remain headquarters s a stock holding company after making each division and each subsidiary. As a matter, transfer of bond and credit is needed and further, big expenses for the procedure are also required due to accompanying with investigation and inspection. After transferring of stock, expense for the reconstruction is obtained by selling and management is improved by securing stock dealings by the bank and selling of stock through the stock market. It is necessary to examine the revision of the government order or Ministerial ordinance and tax code.

- Examination for possibility of establishing a stock holding company and reality and issue as receivers of stock shares.
- Study for the possibility whether the bank can receives stock
- Examination of returning to the government for transferring stock shares.

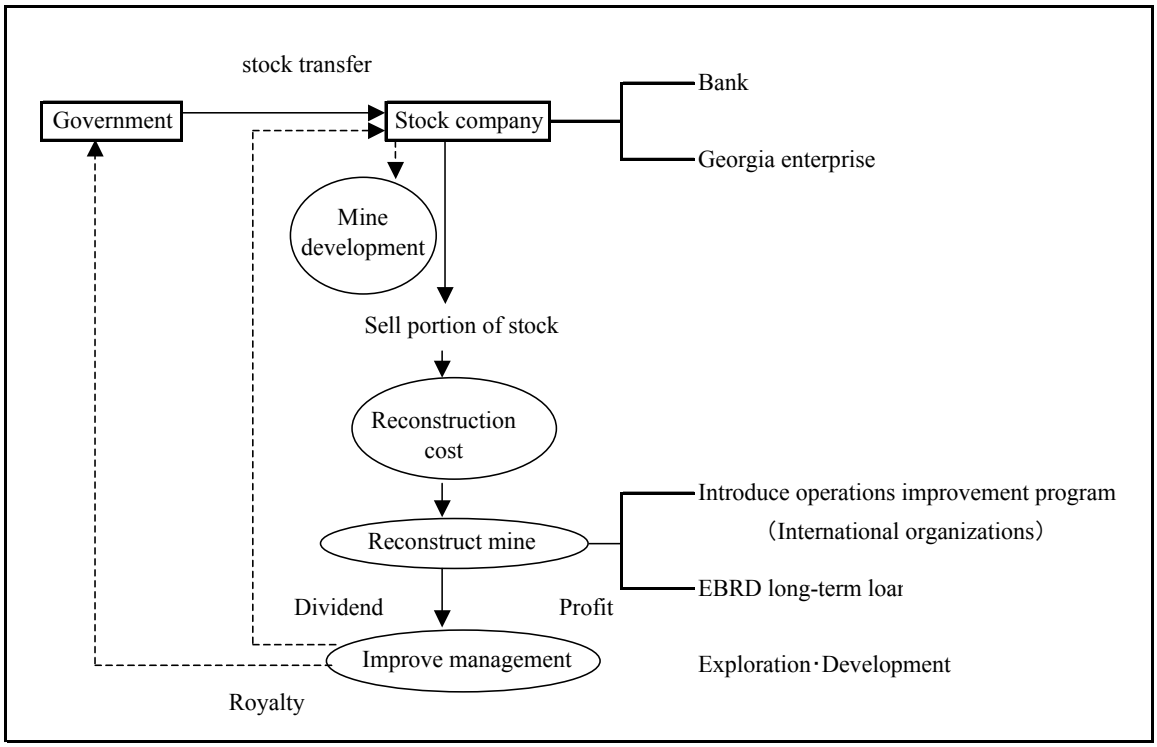


Fig. 3.12 Operations Improvement Based on Madneuli Stock Transfer

6-10 Environmental Countermeasures

Concerning environmental countermeasures of the Madneuli Mine, the following items are needed: implementation of investigation on environmental pollution, making plan for the implementation of countermeasures against environmental pollution, implementation of construction of environmental countermeasures, repairing and installing equipment and facilities for environmental control, establishing of control system of monitoring (Table 3.29).

Table 3.29 Madneuli Mine's Environmental Countermeasures

Item	Content
Environment survey	Investigate the range and degree of heavy metal pollution,
	clarify pollution mechanism
Environment pollution measures	Draft countermeasure plan and calculate its cost
Waste water facility	Repair and renew damaged and superannuated facilities
Monitoring equipment	Install water monitoring equipment, water analysis equipment
Monitoring system	Systemize the environmental supervision system,
	make environmental database
Treat acid water	Measure for heavy metal pollution source, install discharge
	prevention facilities
	Use low grade ore treatment (select ore pile for processing)

Under the present situation of management, investment for environmental control and its countermeasure is difficult. Technical assistance and financial support from international

organizations and countries are indispensable.

As for the environmental control model mine for mining activity, the government should make the budget.

- Implementation of investigation on environmental pollution
- Establishment of environmental control system
- Making plan for countermeasure against environmental pollution.

6-11 Information

To obtain information by the Internet is becoming easy with the development of information technology. It is possible to obtain information on the mining industry production, technology, exploration activity, development of deposits, trend of metal price, law, and policy, etc. The information also are effective by using for management and production activity. The environment of the market economy is changing dramatically in the progress of internalization. It should use the information from the Internet to the operation. Information should become common in each sector and should be linked to the improvement in production and management (Fig. 3.13).

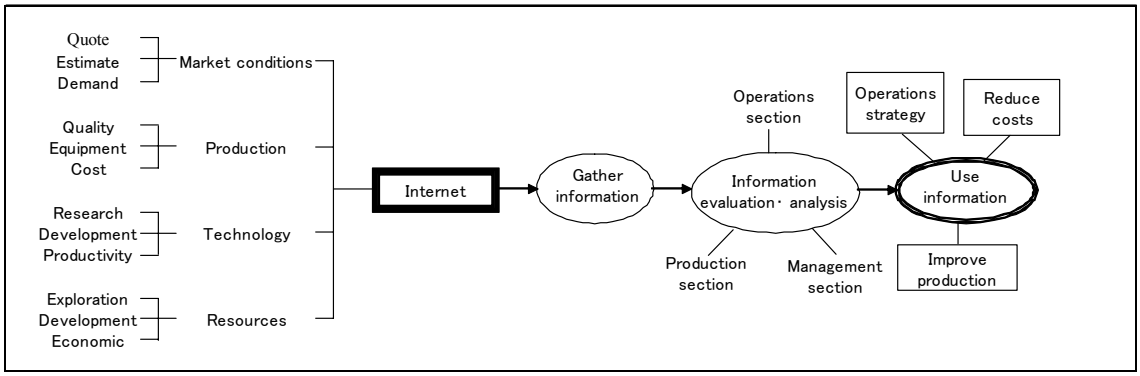


Fig. 3.13 Use of Information

7. Making Conditions for Cash Flow Analysis

In order to grasp the guideline and profitability for the future reconstruction of the Madneuli Mine, recommendations mentioned before is considered and conditions for cash flow analysis was set up.

7-1 Viewpoint for Analysis

- Proposal on present and improved model for getting maximum profit based on the present situation.
- Assumption of privatization (note; no consideration of the revenue from selling the state company with privatization)

- Completely break away from the former USSR system (necessary conditions are the revision of laws and regulations, and abolish regulations)
- Searching for a model to increase the production scale, which the advantages of scale are reflected.

7-2 Establishment of Conditions

A. present case (1.2 million tons per year) is the case without a big investment, which is an extension of the present operations. B. expansion case (1.8 million tons per year) is the case assuming the maximum ore production by the implementation of a minimum amount of investment and the improvement of the facilities as much as possible. In the case B, the investment amount is obtained by increasing working efficiency, reducing the operating costs, etc. The sensitivity analysis is implemented on the revenue from the metal sales (based on metal price of copper and gold).

(1) Common Conditions

1) Production System

- Number of shifts---mining : 2 shifts/day processing: 3 shifts/day
- Area of contractor mining

Drilling and blasting works	80%
Transportation	100%

2) Sales

In this feasibility study, as customers of the sales of copper concentration, Glencore as present customer, Eastern Europe (for instance, Bulgaria) and Armenia (Alvaerdi smelter) are assumed.

- All products are being sold in this pre-feasibility study.
- Payment of copper concentrate from buyers is based on C.I.F. at a smelting plant. Working capital during that time (ordinarily the amount of 2-3 months) is required, but in this pre-feasibility study, it is not considered.

3) Investment and Financial Plan

It is assumed that 2004 is the first year of reconstruction, and initial investment is implemented in 2003. Case A is the present case (1.2 million tons of ore produced per year). In the investment for keeping the present production amount, reducing production costs will partially renew the mining equipment.

Case B is production increase case (1.8 million tons of ore produced per year) is to renew the mining equipment for production increase. (Tables 3.33, Table 3.35). Concerning the initial expense for production, for case A, the investment is from its own

money and case B (1.8 million tons per year) is assumed a long-term loan by the EBRD, etc.

- In this pre-feasibility study, repayment of present liabilities is not included.
- It is assumed that a loan of EBRD, etc. is possible. Therefore the feasibility study is required in 2003 for obtaining the loan. Moreover expense of feasibility study is not counted.

4) Others

It shows the division between variable cost and fixed cost of production cost used in this pre-feasibility study and common condition (Tables 3.30 and 3.31). Production cost is based on the assumption of effect of rationalization by means of improvement.

Table 3.30 Cost Breakdown

	Variable Costs	Fixed Costs
Production Department	Goods	Labor
	Electricity	Repair
	Water	Management (direct department)
	Explosives	
	Transportation (inside mine)	
	Outside order	
Management Department	Transportation (shipment)	General management cost (direct department)

Table 3.31 Production Operating Costs

		Unit	Unit Cost	
			1.2 Mt/year	1.8 Mt/year
1.Variable Costs				
	Ore	US$/t-ore	1.49	0.90
	Stripping	US$/$m^3$-ore	0.79	0.50
	Processing	US$/t-ore	1.67	1.35
	Administration	US$/t-ore	2.74	2.00
2.Fixed Costs				
	Mineral	US$/t-ore	0.58	0.278
	Stripping	US$/$m^3$-ore	0.473	0.222
	Processing	US$/t-ore	1.31	2.00
Operating costs			8.30	6.97

Table 3.32 Common Assumptions on Condition

Item	Conditions				Remark
Analysis Period	10 Years				
Currency Exchange	US$ 1$=2.1GEL				
Price (concentrate)	Cu: 1650 $/Mt Au: 290 $/TOZ				International average price from 1/2000 to 7/2002
Tax	Using Master Plan Promotion Measures				Handling of other taxes follows. Road tax (1% of sales) It appropriates a fixed sum for land, property and other taxes. VAT and customs excluded and are tax exemption.
	Item	No Tax Break	Tax Break	Remarks	
	Resource Use Tax (Cu)	5%	2%	Sales	
	Resource Use Tax(Au)	4%	2%	Sales	
	Corporate Tax	20%	10%		
	Social Tax	33%	6%	Labor Cost	
	Business Activity Tax	1%	Exempt		
	Environment Tax	0.5%	0.5%	Sales	
Escalator	None				
Depreciation	Need to make judgement on repayment considering present owner (take out worthless assets)				Based on IAS Pre-F/S does not consider
	Heavy machinery, 10 %/year Uniform equipment, buildings				Depreciation rate for heavy machinery (20%), equipment (15%), buildings (7%)
Loan	Short Term City Bank interest rate 30%				Working capital is a targetl (when IRR is negative, no borrowing).
	Long Term 5 % Fixed Deferred until year 5 Equal repayments in 10 years				Loan assumed from EBRD, JBIC, IFC, etc. but EBRD is used as an example.
Operating days	365				
Labor	Engineer 700～800 GEL/Mo. Wages 400 GEL/Mo.				Unit Costs for 2002
Sales Commission	1 %				
Exploration Expense	It needs to re-invest from the cash flow, but it is excluded the exploration because this pre F/S grasps the possibility of raising it.				

(2) Present case A

1) Investment.

Mining equipment is renewed for reducing production costs. Productivity increases and mining costs are cut 10% by this investment.

Table 3.33 Investment Amount (present case)

	Type	Quantity	2003
Electric Excavator	992G	1	$ 1,280,00
Drilling Rig	D50KS	1	$550,000
Total			$1,830,000

2) Other

Conditions of production costs in the present case are shown as below (Table 3.34)

Table 3.34 Present Case Expected Conditions

Item	Conditions	Remarks
Ore production	1.2 Mt per year	Present 1.2 Mt per year
Concentrate grade	Cu: 18～20% Au: 12.24g/t	Present Cu: 18%
Ore grade	Cu: 0.8%	
Recovery rate	85%	
Initial investment	1,8300,00$	Rock drill and loader (1 each)
Re-investment	None	
Concentrate sales point	East Europe	Assumes Bulgaria, etc.
	Armenia	Alaverdi smelting plant
T/C	130$/t-conc	Present condition
T/C	85$/t-conc	East Europe
T/C	80$/t-conc	Armenia
R/C	44.97～50.27 $/t-conc	
Employees	444	Present personnel

(3) Case of increasing production B.

1) Investment

Facilities and equipment are renewed for making production increase. Stripping is delayed, therefore their payment is as an investment expense. (Table 3.35)

Table 3.35 Investment Amount and Mining Equipment (expansion case)

	2003 $ thousand
Mine facilities･equipment	4,160
Processing facilities	1,000
Other costs	
Environmental control equipment	100
Monitoring equipment	100
Stripping cost	6,324
Total	11,684

Details of Mining Equipment

	Type	Quantity	2003 $ thousand
Electric Excavator	992G	2	2,560
Drilling Rig	D50KS	2	1,100
Bulldozer		2	300
Loader		1	200
Total			4,160

2) Other

Conditions of production costs and production increase case are shown below (Table 3.36), in this case arrangement scheme of workers and staff is also shown below. (Table 3.37).

Table 3.36 Expansion Case Expected Results

Item	Terms	Remarks
Ore production	1.8 Mt per year	Present 1.2 Mt per year
Concentrate grade	Cu：23% Au：12.24g/t	Present Cu: 18%
Ore grade	Cu：0.8%	
Recovery rate	85%	
Initial investment	$5.36 million	Rock drill and loader (2 each) Loader (1), ore dressing (increase cleaner, etc.)
Stripping cost	$6.324 million	Stripping amount 9.3 Mm^3
Re-investment	None	
Concentrate sales point	East Europe	Assumes Bulgaria, etc.
	Armenia	Alaverdi smelting plant
T/C	130$/t-conc	Present condition
T/C	85$/t-conc	East Europe
T/C	80$/t-conc	Armenia
R/C	58.2$/t-conc	
Stripping comparison	1.92	Present 2.15
Employees	317	Present personnel 444

Table 3.37 Plan for Distribution of Staff

Item	Staff	Remarks
Mining Department	92	Excluding contractor
Processing Department	147	A part for contractor
Management Department	78	Over staff level
Total	317	

8. Cash flow Analysis

(1) Result of Analysis

The present case (A) and expansion case (B) is provided as basic type cases. Seven cases were set up by the combination of concentrate sales point accompanied by the conditions of sales (Table 3.38). The profitability in the case of the introduction of tax incentives (privilege (proposed in the promotions measures) in each case was analyzed. Sensitivity analysis was carried out in the case of 20% change to the metal price fluctuation. Analysis was carried out by using COMFAR Expert III, which was developed by UNIDO. Improvement to the balance sheet arrangement was not considered because the evaluation of the resent undepreciated asset balance is different due to the former USSR calculation method.

Analysis is a 10-year cash flow based on assumptions. Measures of analysis are net present value (NPV) and an internal rate of return (IRR).

Table 3.38 Cash Flow Analysis of Case Studies

	Case		Production 10,000 t/yr	Selling Condition	Tax System	Cost Reduction	Profit Before Tax	Profit After Tax
Present Condition	1	1-1	120	Present	Present	Present	Deficit	Deficit
		1-2			Improved		Deficit	Deficit
	2	2-1		Present	Present	Improved	Deficit	Deficit
		2-2			Improved		Deficit	Deficit
	3	3-1		Bulgaria	Present	Improved	Deficit	Deficit
		3-2			Improved		Deficit	Deficit
	4	4-1		Armenia	Present	Improved	Profit	Deficit
		4-2			Improved		Profit	Profit
Expansion	5	5-1	180	Present	Present	Improved	Profit	Deficit
		5-2			Improved		Profit	Deficit
	6	6-1		Bulgaria	Present	Improved	Profit	Deficit
		6-2			Improved		Profit	Profit
	7	7-1		Armenia	Present	Improved	Profit	Profit
		7-2			Improved		Profit	Profit

On the present cases (cases 1,2,3,4), the results of analysis showed improvement of profitability of IR 43% with a $1.618 million NPV. Only in the case of tax incentive privileges and selling conditions to the Alaverdi smelting plant of the neighboring country, Armenia. The other cases are not sufficient only for the reduction of costs, improvement of concentrate sales condition without improvement of the tax system, effectiveness will

not be shown. On the expansion cases (cases 5.6.7), the case of selling concentrate to the Alaverdi smelting plant becomes profitable. The NPV is $6.989 million and the IRR is 36% in the case with the tax incentive privilege. In the case without the tax incentive privilege, profitability shows improvement that NPV is $1.489 million and IRR is 24%. In the remaining case, also profit before taxes becomes profit and profitability is largely improved. Also if the concentrate is sold to Eastern Europe (Bulgaria smelting plant) and a small tax incentive privilege is considered, there is a possibility that the NPV would be positive.

- Expansion of production, cost reduction, the grade up of the concentrate, sales condition, and tax incentive privilege become the conditions of the biggest improvement of profitability.
- There is little effect from the improvement on profitability by only the reduction of costs.
- To sell the concentrate to the Alaverdi smelting plant has an advantage because of the freight cost.

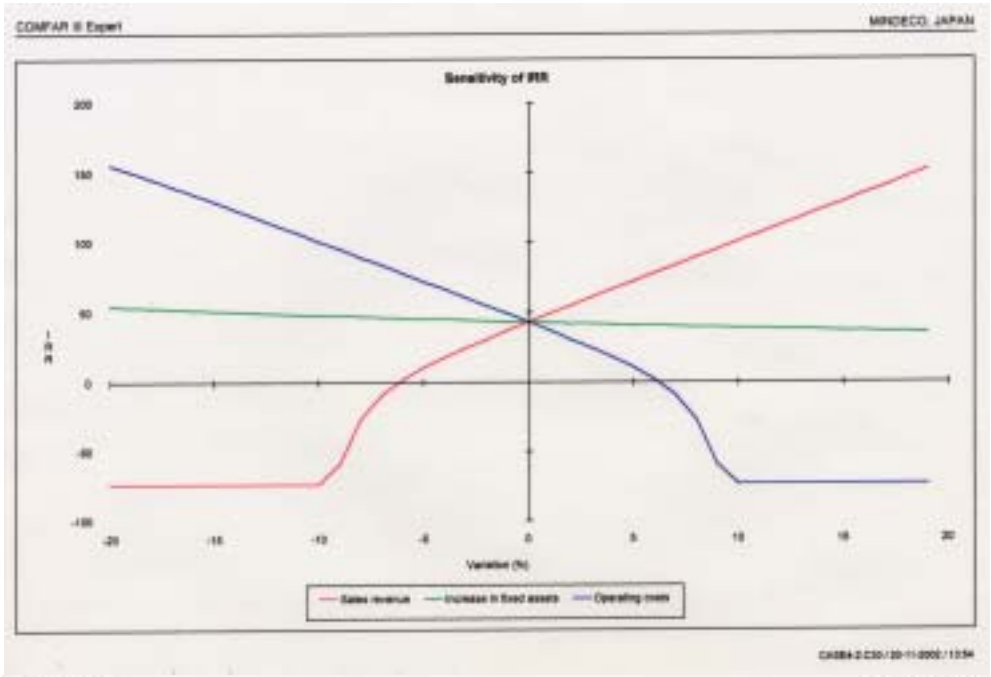
In the sensitivity analysis, the metal price, which gives a big impact was treated as a variable figure. On the case of 4-2, the drop of 6.3% (Cu $1650 to $1550, gold $290 to $270) of the metal price makes the IRR negative. On the analysis result, case 7-2, even though the metal price is decreased 20% (Cu $1650 to $1320, gold $290 to $230), IRR became positive.

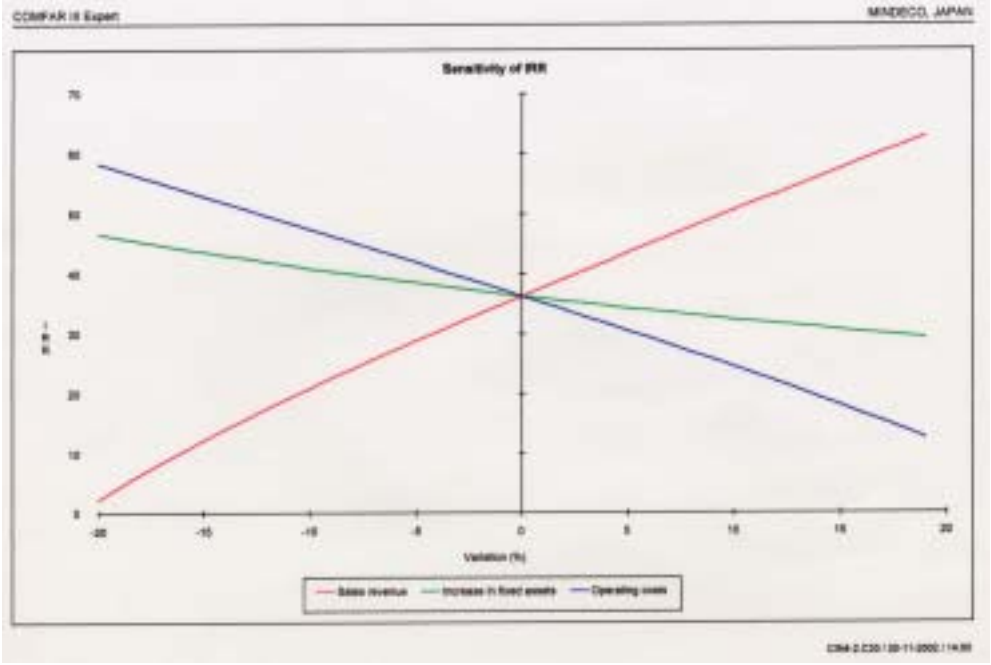
- Best case is to sell the concentrate to the Alaverdi smelting plant with tax incentive privileges.
- In the best case in the present cases is (1.2 million tons per year) the breakeven price of Cu $1550 and gold $270.

Table 3.39 Cash Flow Analysis Results of Case Studies

Concentrate grade	% of Cu		18	18	20	20	20	20	20	20
Metal market price	$/Mt (Cu)		1,650	1,650	1,650	1,650	1,650	1,650	1,650	1,650
	$/Toz (Au)		290	290	290	290	290	290	290	290
Sales condition change	$/conc-t (T/C)		130	130	130	130	85	85	80	80
Stripping rate change	m^3/t		2.15	2.15	1.92	1.92	1.92	1.92	1.92	1.92
Mine cost change	Variable cost (%)				20	20	20	20	20	20
	Fixed cost (%)				30	30	30	30	30	30
Processing cost change	Variable cost (%)									
	Fixed cost (%)				30	30	30	30	30	30
Management cost change	Fixed cost (%)				30	30	30	30	30	30
Tax incentives	VAT (%)		Exempt	Exempt	Exempt	Exempt	Exempt	Exempt	Exempt	Exempt
	Natural resource use tax (%)	Cu	5	2	5	2	5	2	5	2
		Au	4	2	4	2	4	2	4	2
	Related taxes (%)		Exempt	Exempt	Exempt	Exempt	Exempt	Exempt	Exempt	Exempt
	Income tax (%)		20	10	20	10	20	10	20	10
	Social tax (%)		33	6	33	6	33	6	33	6
	Business activity tax (%		1	Exempt	1	Exempt	1	Exempt	1	Exempt
Profit before tax	in thousand $		▲ 3,579	▲ 3,579	▲ 1,082	▲ 1,082	▲ 34	▲ 34	1,514	1,514
Profit after tax	in thousand $		▲ 4,912	▲ 4,212	▲ 2,433	▲ 1,721	▲ 1,523	▲ 737	10	804
Net Profit	in thousand $		▲ 4,912	▲ 4,212	▲ 2,433	▲ 1,721	▲ 1,523	▲ 737	▲ 292	652
NPV(20%)	in thousand $		▲ 20,681	▲ 17,748	▲ 11,317	▲ 8,333	▲ 7,466	▲ 4,192	▲ 2,300	1,618
IRR	%		N/A	N/A	N/A	N/A	N/A	N/A	-55%	43%

Item			Case 5-1	Case 5-2	Case 6-1	Case 6-2	Case 7-1	Case 7-2
Ore	thousand tons/year		1,800	1,800	1,800	1,800	1,800	1,800
Ore grade	% of Cu		0.8	0.8	0.8	0.8	0.8	0.8
Recovery rate	% of Cu		85	85	85	85	85	85
Concentrate grade	% of Cu		23	23	23	23	23	23
Metal market price	$/Mt (Cu)		1,650	1,650	1,650	1,650	1,650	1,650
	$/Toz (Au)		290	290	290	290	290	290
Sales condition change	$/conc-t (T/C)		130	130	85	85	80	80
Stripping rate change	m^3/t		1.92	1.92	1.92	1.92	1.92	1.92
Mine cost change	Variable cost (%)		40	40	40	40	40	40
	Fixed cost (%)		30	30	30	30	30	30
Processing cost change	Variable cost (%)		20	20	20	20	20	20
	Fixed cost (%)		30	30	30	30	30	30
Management cost change	Fixed cost (%)		30	30	30	30	30	30
Tax incentives	VAT (%)		Exempt	Exempt	Exempt	Exempt	Exempt	Exempt
	Natural resource use tax (%)	Cu	5	2	5	2	5	2
		Au	4	2	4	2	4	2
	Related taxes (%)		Exempt	Exempt	Exempt	Exempt	Exempt	Exempt
	Income tax (%)		20	10	20	10	20	10
	Social tax (%)		33	6	33	6	33	6
	Business activity tax (%		1	Exempt	1	Exempt	1	Exempt
Profit before tax	in thousand $		644	644	1,989	1,989	4,009	4009
Profit after tax	in thousand $		▲ 950	▲ 151	216	1,110	2,215	3120
Net Profit	in thousand $		▲ 1,078	▲ 216	▲ 182	911	1,414	2719
NPV(20%)	in thousand $		▲ 8,959	▲ 5,319	▲ 5,188	▲ 602	1,489	6,989
IRR	%		−9%	5%	6%	18%	24%	36%


COMFAR III Expert
MINDECO, JAPAN
Sensitivity of IRR
IRR (%)
Variation (%)
Sales revenue
Increase in fixed assets
Operating costs


COMFAR III Expert
MINDECO, JAPAN
Sensitivity of IRR
IRR (%)
Variation (%)
Sales revenue
Increase in fixed assets
Operating costs

(2) Considerations

Ore production of 1.2 million tons per year is possible for a 10-year operation based on the present ore reserve at the Madneuli Mine. The operation at a cut-off grade of 0.4% copper is making it difficult for the continuity of ore production at 1.5 million tons per year. The expansion to 1.8 million tons per year is difficult, if a new deposit is not found and developed. Until a new deposit is discovered, the forecast of strengthening the production potential of the operations for the development of the new deposit can be confirmed, it is indispensable to operate at 1.2 million tons per year. On the other hand, the expansion of the production system may be built up by the reduction of the cut-off grade from 0.4% to 0.2% copper. It is indispensable to be able to deduct the cost to make an incentive tax privilege and to improve the selling conditions. However, it is needed to think about the tax incentive privilege system for flexible operations based on the metal price. It is possible to cover the amount of the tax by the rise of the metal price. There is a possibility that the facilities of the Alaverdi smelting plant are insufficient to receive concentrate of the Madneuli Mine (under reconstruction). However, it is desirable to sell the entire amount of concentrate to the Alaverdi smelting plant in the future to reduce the freight cost. To secure ore reserves is a most important subject for the production amount of 1.8 million tons of ore per year even though the copper cut-off grade will drop. The promotion of exploration around the Madneuli Mine for potential deposits should be carried out. To carry out he exploration is difficult due to the recent financial condition of the Madneuli Mine. Therefore in reality, it is needed to improve the production structure by making a profit on the production amount of 1.2 million tons per year. It is needed to accumulate money from a part of the profit for the increasing production and investment for exploration by building an expanded production system. The draft scheme to build up the structure of increasing the feasibility of the Madneuli Mine is firstly 1.2 million tons per year production, and next the expansion of production to 1.5-1.8 million tons per year (Fig. 3.16).

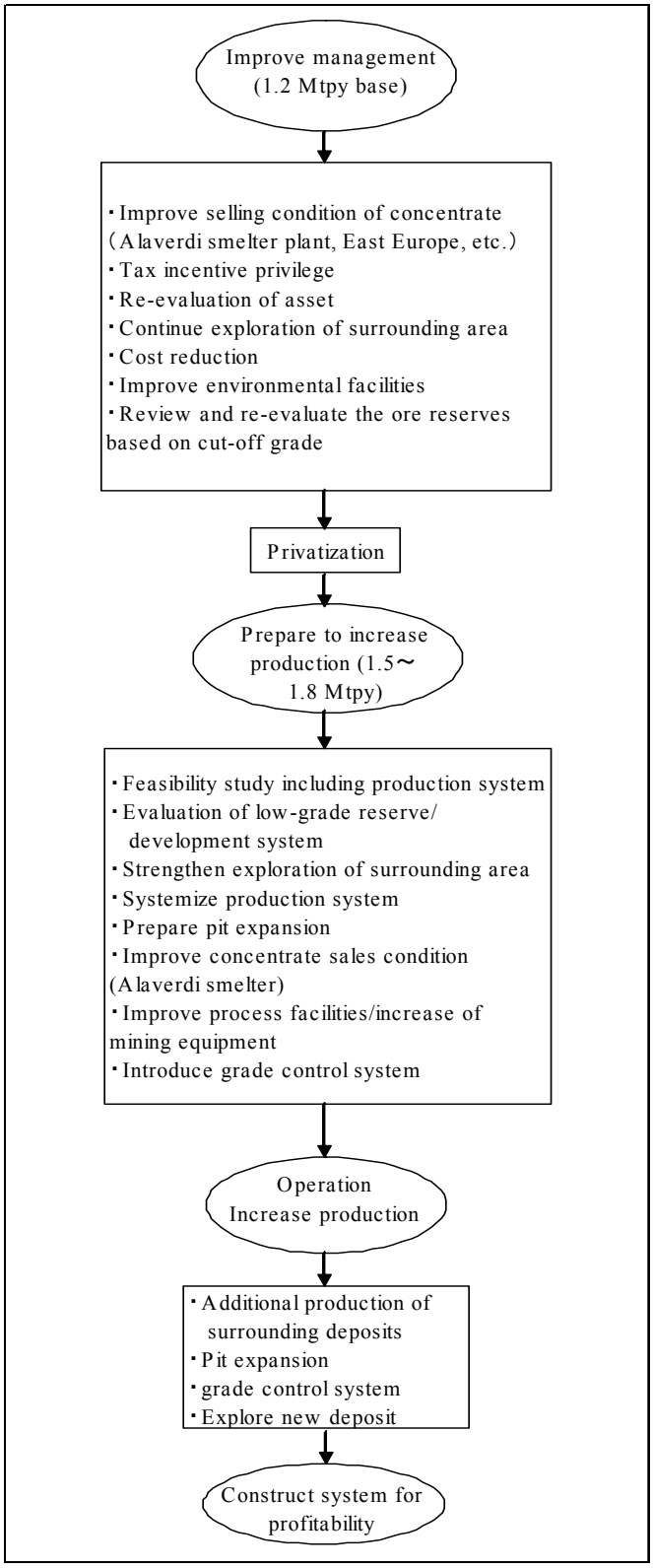


Fig. 3.16 Draft Scheme for Making a System to Increase the Profit of the Madneuli Mine