JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE MINISTRY OF INDUSTRY AND TRADE
THE MINISTY OF GEOLOGY AND
PRESERVATION OF UNDERGROUND RESOURCES
THE REPUBLIC OF KAZAKHSTAN

No. 2

THE MASTER PLAN STUDY ON PROMOTION OF NON-FERROUS METALS INDUSTRY IN THE REPUBLIC OF KAZAKHSTAN

FINAL REPORT

MARCH 1997

MITSUI MINERAL DEVELOPMENT ENGINEERING CO.,LTD.
SUMIKO CONSULTANTS CO.,LTD.

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Preface

In response to a request from the Government of the Republic of Kazakhstan, the Government of Japan decided to conduct the Master Plan Study on Promotion of the Non-ferrous Metal Industry in the Republic of Kazakhstan and entrusted the study to the Japan International Cooperation Agency (JICA).

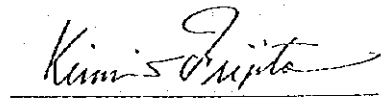
JICA sent a study team, led by Mr. Atsuo Matsuura of Mitsui Mineral Development Engineering Co., Ltd. (MINDECO) and Sumiko Consultants Co., Ltd. (SUMICON) to the Republic of Kazakhstan five times from October 1995 to January 1997.

The team held discussions with concerned officials of the Government of the Republic of Kazakhstan, and conducted related field surveys. After returning to Japan, the team conducted further studies and compiled the final results in this report.

I hope this report will contribute to the promotion of the plan and enhance the friendly relations between the two countries.

I wish to express my sincere appreciation to the concerned officials of the Government of the Republic of Kazakhstan for their close cooperation throughout this study.

March 1997



Kimio FUJITA
President
Japan International Cooperation Agency

March 1997

Mr. Kimio Fujita
President
Japan International Corporation Agency

Letter of Transmittal

We are pleased to submit to you the development study report on "The Master Plan Study on Promotion of Non-ferrous Metals Industry in the Republic of Kazakhstan".

This study was conducted by the Mitsui Mineral Development Engineering Co., Ltd. And Sumiko Consultants Co., Ltd. Under a contract to JICA, during the period of October 18, 1995 to March 27, 1997. The report was intended to make a proposal on the settlement of the master plan to restructure and promote the non-ferrous metals industry in Kazakhstan as the foundation for its economy. Our analysis was conducted from a market economy viewpoint based on our study of the present situation of the Kazakhstan non-ferrous metals industry (copper, lead and zinc) which has been in a critical condition resulting from large-scale changes in its industrial environment, independence of Kazakhstan and conversion from the former Soviet Union planned economy to market economy.

Our proposal covers the reconstruction plan of the industry structure which utilizes the underground resources of an inland country and produces profitable products, constructs a close network system of government and private sector which support this reform and realizes the reconstruction reform using overseas aid (foreign loans and investment, financial and technical support from foreign countries). Since we tried to make a feasible plan and proposal step by step through the steady efforts of the people. We believe the project will surely bring fruitful results to enable the industrial promotion of Kazakhstan and serve as a base of our future support to the country.

We wish to take this opportunity to express our sincere gratitude to the officials concerned of JICA, the Ministry of Foreign Affairs and other parties. We would also like to express our gratitude to the officials of Kazakhstan government's Ministry of Industry and Trade , Ministry of Geology and Preservation of Underground Resources, and the Japanese Embassy in Kazakhstan for their cooperation and assistance throughout our field survey.

Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,

A. Matsuura

Atsuo Matsuura
The Leader of the Survey on "The Master Plan Study on Promotion of Non-ferrous Metals Industry in the Republic of Kazakhstan"
Mitsui Mineral Development Engineering Co., Ltd.
Sumiko Consultants Co., Ltd.

Summary

Following the breakup of the Soviet Union in 1991 and the subsequent independence of the Republic of Kazakhstan, drastic changes have taken place in the republic's non-ferrous metal (copper・lead・zinc) industry. At present, this industrial base is being reconstructed, with the aim of building "an attractive industry", that will be independent and capable of moving forward in a market economy.

Although the international markets for base metals of copper・lead・zinc are mature markets, the demand for these metals is steadily increasing because they are important raw materials that support various industries. It is very important for Kazakhstan, a republic rich in natural resources, to economically develop these resources so that it can provide more value-added products in harmony with the environment. This will create an important pillar that will support the reconstruction of all its industries.

Problems facing the copper・lead・zinc industries of Kazakhstan:

・Development of stable markets (both domestic and overseas).

・Reconstruction of raw material base that is economical as an inland resource rich country

・Establishing independent production enterprise system for independent management.

(In order to solve the present problems)

① Huge debt

② Shortage of working capital

③ Superannuated production facilities

④ Lack of stable, continuous operations

(inconsistent product quality・rising costs・unreliable product delivery)

⑤ Cessation of new investments (including improvement・renewal)

・Measure for reliable supply of energy for these industries which tend to consume large amounts of energy

・Rationalizing raw material・product distribution

・Environmental protection・Establish pollution prevention measures

These problems cover all aspects of the industry.

In order to solve these problems and reconstruct Kazakhstan's industries so they contribute to the national wealth, the republic must: establish industrial reconstruction strategies based on resolute ideas and policies aimed at reconstruction and advancement. Both the public and private sectors must strive for advances in the industry by "planning, doing and observing." In other words, the republic must move forward as a whole and serve both as the focus of the movement forward and its impetus.

In this report, we make recommendations to be included in the master plan study on promotion of non-ferrous metal (copper, lead and zinc) industry in the Republic of Kazakhstan.

・Preparation and establishment of an industrial base in the target year of 2000.

・Stable industrial growth coupled with structural renovations, 2000 - 2005

・Activate the industrial structure and use high technology, 2005 -

These are our targets. Although we are taking a long-term view of this matter, the present proposals mostly emphasize short-term plans and measures. Our proposals are based on the basic policies outlined below.

[Policy 1] Establish industry scale corresponding to the promotion.

Metal production amounts should be a yardstick for determining the size of the copper・lead・zinc industries in Kazakhstan.

・Forecasting market trends for metals, all of which are internationally marketable commodities.

・Future economic potential of natural resources of Kazakhstan, an inland nation in a market economy.

・Restrict these industries for environmental preservation.

After examining the above items, we set up the metal production on the following scale:

thousand tons/yr

	Production Estimate for 1996	Production Estimate for 2000	Production Estimate for 2001-2005	Production Estimate for 2006-2010
Electrolytic copper	320	360	380	380
Lead	90	120	130	130
Zinc	160	220	280	260

[Policy 2] Preparing production systems that are suitable for the size of the industry.

Current production enterprises are classified into three categories based on their present production capital potential (personnel・material・capital・information). The implementation of maintenance of the enterprise corresponds to its category・implement reform.

・Companies that have good potential (evaluated and classified as A).

Proceed with "privatization" based as the company's flexibility, efficiency and raising capital, all of which are qualities important to private company's management, and in this manner build a sound capital enterprise.

・Companies that can be reconstructed and turned into companies with potential (evaluated and classified as B).

Depending on the special treatment of the accumulated debt, profitable assets and accumulation of capital, turn these companies into profitable companies.

・Companies that have no potential to continue in a market economy (evaluated and classified as C). If careful re-examination cannot find the company's future potential then close it down.

[Policy 3] Projects for investment in facilities:

Projects to accelerate the development of new mines having high potential and provide facility and equipment to prevent industrial pollution should be given the highest priority.

[Policy 4] Prepare an environmental protection system and aim at constructing industries that are environmentally friendly.

[Policy 5] Strengthen MIT's promotion support function

The MIT must take advantage of their public planning and authority in order to overcome the industry crisis caused by the sudden change in the base of the industry and create steady growth.

Establish policy and industry promotion toward related enterprises, supervision・inspection・strengthen the support function

[Policy 6] Provide promotion capital

① In principle, the companies themselves should be responsible for its supply of the necessary funds.

・Increase the internal finance

Retained profits - Items exempt from taxation

- Exempt reserve funds・Special depreciation

-Time limit for taxation・Exemption or limited reduction of tax

・Accelerate the smooth practical use of external funds.

As a means of direct financing: evaluate the company stock price and sell it・Introducing foreign capital.

As a means of indirect financing: Financing from export credit agency/multilateral agency

Project financing

Practical use of international financial institutions

National assistance to credit guarantee

② Cost supplement should be the basic rule for public corporation.

・Government's general accounting, investment and lending program.

・Two-step loan from international financial organizations

・Foreign aid

③ Basically, Kazakhstan should handle its own structural reforms, unprofitable businesses.

・The nation's special accounting (establishment of fund)

・Foreign aid

Summary of recommendations are as follows:

(1) Reform the constitution of the industry production organization to make it more profitable

1) Raw material bases should be restructured

- Develop new mines
- Increase・decrease production at existing mines
- Withdraw from unprofitable businesses

- Modernize production lines

① Mine

・Mining plan for potentially economical reserves in amount and quality

・Renewal of equipment and facilities to improve productivity

・Reduction of production costs

・Investment plan

② Mineral dressing (Beneficiation)

・Renewal and modernization of facilities

・Improvement of concentrate quality

・Reduction of costs of transporting concentrate

・Treatment of waste and wastewater

2) Production of raw metals

- Corresponding to a stable supply of raw materials, readjust the facility capacity so that company will be able to stabilize their operations (Target: 2001)

① Copper

・JSC "Zhezkazgantsvetmet"	Electrolytic copper: 200,000 tons/year, Own mine production
・JSC "Balkhashmed"	Electrolytic copper: 150,000 tons/year, Own mine production and toll, Irtysh blister
・JSC "UK Pb-Zn Combine"	(Blister: 70,000 tons/year, Domestic mine production) - (Irtysh Copper Smelter) Electrolytic copper: 30,000 tons/year, Irtysh Blister

② Lead

・JSC "Leninogorsk PC":	40,000 tons/year, Battery scrap (Northern Kazakhstan area, Neighboring Russian areas)
・JSC "UK Pb-Zn Combine":	60,000 tons/year, depending on lead concentrate from domestic mines
・JSC "Shymkent Lead Plant":	50,000 tons/year Concentrate mainly from mines in ・Uzbekistan ・Tajikistan (Purchased concentrate ・Toll) ・Lead waste from copper smelter ・Battery scrap (Southern Kazakhstan area, Neighboring CIS areas)

③ Zinc

・JSC "Leninogorsk PC":	100,000 tons/year, Polymetal mine in East Kazakh Province
・JSC "UK Pb-Zn Combine":	180,000 tons/year, Polymetal mine in East Kazakh Province

- Improvement of working environment conditions・improvement of pollution prevention facilities.

In particular,SO_2 gas countermeasure in sulfuric acid production and exhaust gas desulfurization

- Stable product quality and quality certification・inspection・management
- Energy conservation measures

3) Processing industry

It is necessary to restructure the metal processing industry in order to reinforce competitiveness in terms of quality and price in the world market.

- Active market development in Kazakhstan・CIS, China and Southeast Asia countries

① Secondary processing of copper and its alloys

・Secure stable customers

・Completion of reconstruction and modernization of rolled metal production at JSC "Balkhashmed". Improvement of product quality.

② Manufacture lead batteries

・Accelerate construction work at the battery manufacturing plant in Shymkent.

・Affiliated companies involved in the recycling business.

③ Processing raw zinc metal

・Promote zinc galvanizing industries in cooperation with steel industries.

・Die-casting industries meeting the demands of the machinery industries in Kazakhstan and CIS.

・Manufacturing dry battery pellets

4) Restructure operation management system

Needless to say, each enterprise has a unified operation vision and will draft and develop an important operation strategy. The management of mining, beneficiation, smelting and processing companies should be separated into divisions. Each division should clarify its income and expenditures. Moreover, each enterprise makes and executes a short-term business plan (budget) then analyzes the difference between the goals and the actual results. Quick adjustments are necessary.

- Financial management

① Division of accounts for mining, beneficiation and smelting operations.

② Concentrate purchasing conditions

③ Understand the production costs regarding sales income for each product.

- Purchase management

① Withdraw from bartering and move toward purchasing with currency.

② Reasonable levels of inventories of raw and other materials and finished products.

③ Countermeasure for purchase of stable power and energy.

④ Rationalize distribution.

- Production Management

① Production plan under the condition of continuous operation and put it into practice.

② Facility maintenance and periodic repair plans

- Personnel Management

① Allocate workers according to the needs of the production process, quality rationalization and modernization.

② Problem that part of the welfare costs should be borne by each individual worker and salary.

- Information Management

① Establish an enterprise database

② Share information within each enterprise and make good use of such information.

③ Secure and disclose secret information.

- Activation of organization

① Regarding the welfare division:

- Transfer this division to the provincial government.
- Make the division a separate enterprise.
- Establish the division as a enterprise in the third sector (semi-private company).

② Regarding the transportation division

- Make the division a separate company.
- Establish the division as a company in the third sector.

③ Make the engineering and repair division a separate company.

5) Important issues regarding the reform of the production system.

Classify the production enterprise according to its production capital potential. Specify important issues for reforming the production system. We recommend the following.

- East Kazakh Area (Polymetal)

① Developing new mines (increase the copper portion)

② Reinforce the copper smelter at Irtysh (70,000 tons/year)

③ Privatization, combining enterprises, strengthening cooperation among enterprises (building a network among enterprises)

① Businesses not related to the main business should be turned into separate companies.

- Lead smelter at Shymkent

① Accelerate realization of the lead battery manufacturing project.

② Custom smelter produces raw lead material mainly used for lead battery.

- Balkhash smelter

① Promote the development of its own mines. Close down unprofitable mines.

② Move forward the production project that uses the SX-EW process.

③ Proceed with the rationalization by changing the company's form.

(2) Market and market development

1) Perspective for base metal demand and world prices

- Increase according to the economic growth (note growth in Asia.)
- There will be no price change until 2000. Prices are expected to go up slowly after 2001.
- This market is mature. At present, there is an approximate balance between world supply and demand.
- The price of this product has poor elasticity, although prices may greatly fluctuate over the short term.

2) Market strategies for the Republic of Kazakhstan

- In order for the CIS market to recover, increase the number of customers and construct a good sales network.
- Participate in the growing Asian market (China and India)
- Establish product quality reliability and a stable supply.

3) Concrete strategic development

- Registration to LME

Stable production → Secure reliability of product quality・volume.

- Establish and nurture a Non-ferrous Metal Trading Firm.
- Establish a Trade Promotion Agency.

(3) Promote execution of the promotion plan

1) Promotion policy

- Decide on promotion measures for policy and important non-ferrous metal industry reconstruction promotion (making rules and regulations・budgetary measures)
- Cooperation of every related ministry and approval based on the law
- MIT make plans, guidance, support ・management for promotion countermeasures

-With respect to MIT and metal industry system (public corporations・semi-private companies・private companies):

① Strengthening guidance and support (Require that management committees・duty to report management information)

② Entrust to metal promotion agency the work for management support of public enterprise (except during management entrustment).

2) Establishment of promotion policy support organization (example establishment and management of metal industry policy committee)

- Exploration Agency (jurisdiction of Ministry of Geology・public corporation)
- Non-ferrous Metal Promotion Agency (jurisdiction of MIT・public corporation)
- Non-ferrous Metal Trading Firm (jurisdiction of MIT・Semi-private company)
- Trade Promotion Agency (jurisdiction of MIT・public corporation)
- Non-ferrous Metal Industry Council (voluntary group by members)

3) Roles of the provincial government

- Adjustment of employment
- Accept public welfare work (controlled by government or making semi-private company.)
- Establishment, investment ,management of semi-private enterprise for promotion of local industry company.
- Participate in Environmental Control Technology Center (・a public corporation).

4) Support through revision of laws

- Tax system: Establish a favorable tax law for industry promotion.
- Foreign capital law, provide incentive for participation to foreign capital.
- Company laws, Enterprise accounting laws

① Company inspection system (strengthen inspection・inspector from outside company)

② Adoption of exemption/depletion system

- Laws concerning privatization

① Make law for management contract system concerning time limit.

② Enact approval items to private company for underground resource industry.

- Financial countermeasures

① Project finance

② Introducing foreign capital

③ Examination for establishing Metal Industry Promotion Fund

① Special account

(4) Environmental protection

Combination of natural environment and implementation of environment protection as components for the maintenance and development of industry.

To protect the environment, prevention countermeasures must be done related by production enterprise-region-government

・Pollution control for production activity of enterprise

・Develop environmental standards and management standards

・Establishment of inspection and control system

1) Role of the Ministry of Environment

- Nationwide environmental protection
- Establishment of environmental standards

2) Environmental control and inspection by MIT

- Environmental protection to deal with manufacturing activities

3) Environmental control and inspection of each area

- Establish the Environmental Control Technology Center

4) Treatment and control of industrial waste

- Control standards
- Recovery of valuable material

5) Improving the working environment

(5) Industry information system

It is necessary to collect, sort and disclose accurate information for quick treatment for the change of enterprise management, environment condition・for introduction of foreign・promotion of foreign investment.

- Internal enterprise information system
- Foreign market information
- Establishment of industry information system and disclosure of information
- Industry statistics

(6) Aid from foreign countries

For the reconstruction and promotion of the Kazakhstan industry, technical cooperation from western countries is needed for the important issues of the industry for economical cooperation, for example foreign financial aid.

1) International cooperation organization

- Financial aid
- Development aid

2) Technical cooperation items

- Exploration for new mines
- Environmental protection (control center・training)
- Rationalization・modernization of production

① Make feasibility study

② Energy conservation measures

⑧ Control, inspection and guarantee of product quality

- Management control (dispatch qualified consultant・training)

Recommendations will be put into a plan which is listed as one idea of the action plan. The action plan consists of:

- Actual plan for metal production
- Actual plan of supporting countermeasures
- Possibility of foreign aid to each industrial issue
- Development plans to promote governmental industry promotion policies

Currency Exchange Rate in this Report

Year	TENGE/US$	TENGE/RUR
1994	35	16.0
1995	60	13.5
1996～	65	--

* Ref. 1.66 J¥/Tenge in Fy 1995
(J¥:JAPANESE YEN)

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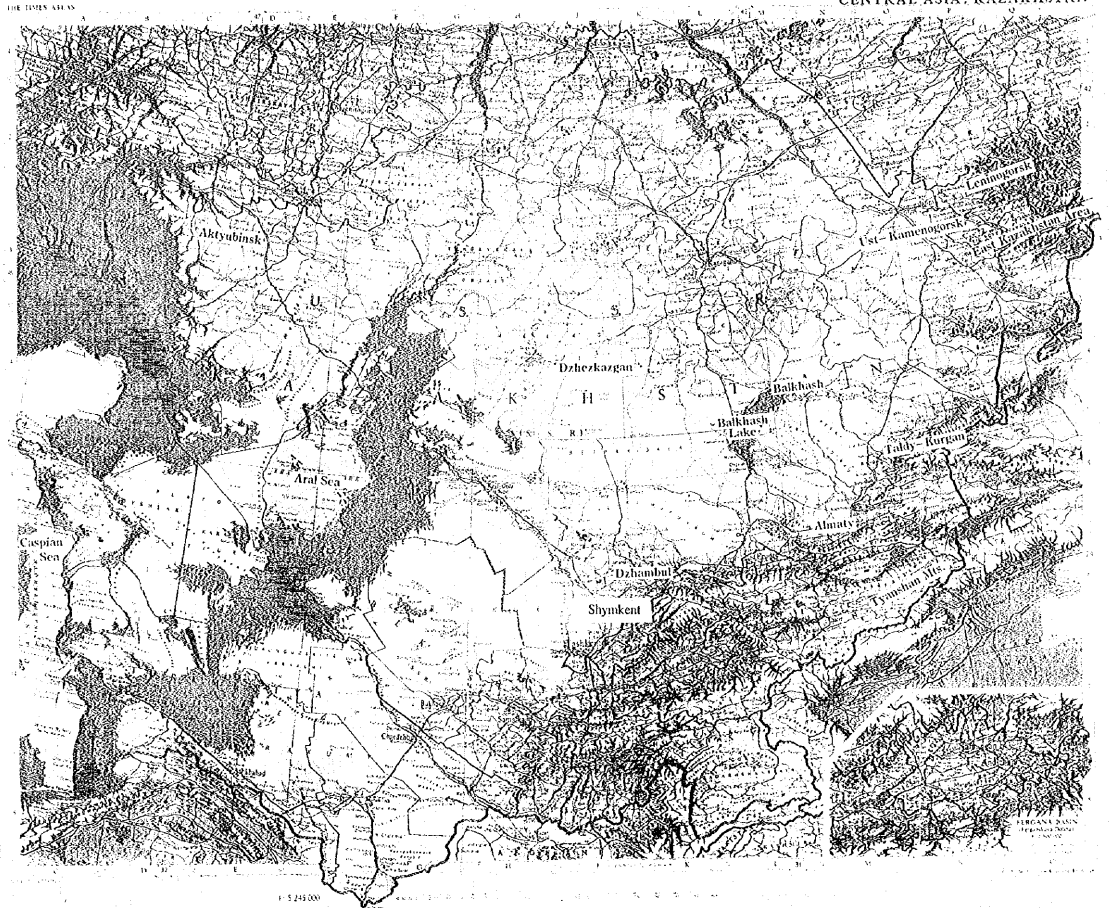


Map of Investigation Area

Outline of Survey

1. Background of Investigation

The Republic of Kazakhstan was placed under the former USSR's system principles, together with crops, mostly grain, etc., and raw material processing. It had a limited role as a natural resource republic. Republics having high value added industrial products were dependent on the other republics. Depending on the unique bartering system of the former USSR's settlement of accounts, they lacked the awareness of production costs etc. which caused the delay of technical innovation. Before the collapse of the former USSR, depending on the situation, the depression did not come quickly. When the collapse occurred, the quick liberalization caused confusion, a sharp decrease in the industrial and agricultural production and the market to decrease considerably.

When Kazakhstan became independent in December 1991, it started the transition from a planned economy to a free market economy and the arrangement of functions concerning the independent country. The main industries were mining, steel, agriculture machinery and agriculture (mainly wheat). The characteristics of their mining industry is that the non-ferrous metal industry is ranked as the most important industry and carries the country's economy because they possess an abundance of underground resources all over the country. In the non-ferrous metals, the pride of their world eminence in lead, zinc, copper and chrome output, mining over a long period at many mines, decreasing ore grade as well as exhaustion of reserves and the decreasing refinery operations are notable. For development, economic recession or transition to a new system involves confusion and inactivity from a lack of capital. Depending on the introduction of foreign capital, they are hoping for the development of many projects. Much of the equipment is superannuated so it is necessary to improve the renewal of equipment to make reasonable production. Furthermore, most countermeasures were not implemented for the mine pollution problems so many kinds of problems are becoming tangible.

Under this situation, Japan's policy is to clearly explain countermeasures to strengthen its support for Kazakhstan's transition to a free market economy during this period. In August 1992, JICA at the request of the Kazakhstan government dispatched a survey team to make projects included in the non-ferrous metal industry promotion plan. On the basis of the previous survey, the Kazakhstan and Japan governments signed the framework prescribed in the scope of work for the purpose of the survey completed in June 1995.

2. Purpose of Investigation

This survey goal was to decide on the main production of non-ferrous metal industry's promotion plan for Kazakhstan .

Kazakhstan was a raw material supply base to the former USSR and must continue to carry its role. Since the non-ferrous metal industry division had a significant decrease in production and increase in costs, it is suffering under adverse circumstances.

For international base metal goods, prices are determined by a system related to the global supply and demand.

The survey considered the above items. The survey team proposed a bold, practical and feasible plan for the actual situation. The survey team,with the above items, lead a course to the Kazakhstan government agency's counterparts for a technology transfer concerning economic methodology, production system and technical improvement etc. that are used in a free market economy.

3. Scope of Investigation

The survey scope is the base metal industry for copper, lead, and zinc (including by-products). The existing information was transmitted as well as analysis of related plans, discussions with Kazakhstan government related organizations and site survey, etc. It examined

- the present situation of the non-ferrous metal industry
- condition of society and economy (macro-economy)
- trend of world metal market
- potential of various reserves

for the purpose of restructuring the Republic of Kazakhstan economy and make measures for the non-ferrous metal industry's promotion plan, concerning one of the strategic tools, for the purpose of future economic development.

The targets of the survey's main scope are divided into the following:

(1) Central government industry promotion policy and supplementary laws and organizations.

(2) Analyze the potential undeveloped mineral deposits to accelerate the non-ferrous metal industry's promotion plan.

(3) For each production site of the copper and polymetal (lead, zinc) industries, examine production efficiency and enterprise management.

(4) Countermeasure for near future activity of exploitation, metal smelter and processing industry and their present influence on the environment.

These works are categorized by method and depend on the scope as follows:

- Make the database by the results of the site survey, define and analyze the problem points, etc.,
- Make countermeasures for the improvement of production, technology, environment and every enterprise management. Make plan for the summary of the countermeasures for the production and management rationalization plans and the non-ferrous industry's promotion plan.
- Propose countermeasure for the implementation of the promotion plan, modification of laws and action plan.

4. Implementation of Investigation

(1) Survey Implementation Organization

The survey's objective in Kazakhstan was related to their key industry which has a big influence on the country's economy, many mines, concentrators and smelters.

For this reason, a survey group was made of specialists having much experience in the management and financial systems and having technology related to mining companies and operations.

The survey team members consisted of Mitsui Mineral Development and Sumiko Consultants. The two companies established a joint venture. Other mining companies, consultants and experts knowledgable on the former Eastern block economic system were included in the group.

The discussion with the Japan side survey team and survey work was accomplished with the Kazakhstan side organized having the MIT Vice-Minister as the President of the steering committee and the Ministry of Geology Vice-Minister as the Vice-President with the working group and counterparts distributed below.

(2) Survey's Action on the Points Considered below:

① By a structured process, understand the different economic system of the Kazakhstan non-ferrous metal industry and express, depending on the adequate preparation, using understood methods on Western standards.

② Make plan considering Kazakhstan view of high priority plans etc., that is practical and possible and enables several Western countries to participate in the construction system.

(3) Survey Progress

① First Site Survey (November-December 1995)

Made inception report. Explained the policy of survey, practical methods and survey process, etc. based on the inception report to the Kazakhstan side. At the same time, gathered basic data and heard from related government organizations, implemented site survey, gathered data and defined the problem points.

② Second Site Survey (February-March 1996)

Made progress report and summary on the first survey's results and analyzed the present situation. At the same time, made future survey plan, etc. and explained it to the Kazakhstan side. The Kazakhstan side gave a high evaluation on this report. Kazakhstan stated that they hope and expect more concrete content in the Japan side proposal.

③ Third Site Survey (June-July 1996)

Visited mines, concentrators and smelters, etc. not seen the first survey, confirmed the present situation of the operations and received data.

Selected important undeveloped deposits based on the valuable data on the unexploited deposits that was obtained on the first survey and completed the survey.

Implemented survey of non-ferrous related enterprises. For the purpose of making a database, gathered and inputted data and implemented the survey's computer system.

④ Fourth Site Survey (October 1996)

After analyzing and summarizing the findings of the third site survey, we prepared the interim report and explained it to the Kazakhstan side. Based on the recommendations that were described in the interim report, both sides discussed and agreed upon the contents of the recommendations which should be made in the final report. In addition, we held a seminar in Almaty. Five experts from Japan gave a speech in their field. It was highly evaluated by the participants from Kazakhstan.

⑤ Fifth Site Survey (January 1997)

On this survey, we explained and discussed the contents of the draft final report with the Steering Committee and related organizations in the Republic of Kazakhstan. The Survey Team considered the comments on the draft final report. We completed the final report incorporating these comments.

Table 1(1) shows detailed schedule of each survey team member.

Fig.1(1) Schedule of Site Survey

	Charge		Name	Company etc	1995 Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	1996 Jan.	Feb.	Mar.
1	Leader		Atsuo Matsuura	Mitsui Mineral Development Engineering Co., Ltd.	1	13		25	1			22	14			19	30		19	26	
2	Non-ferrous Industry Promotion Plan		Takashi Mayama	Japan Mining Engineering Center for International Cooperation	1	13		25	3			22	14			19	30		19	26	
3	Management Rationalization Plan		Katsuhiro Ohtani	Sumiko Consultants Co., Ltd.	1	10		25	3			22	21			19	30		19	26	
4	Production Rationalization Plan		Hiroshi Komatsu	Mitsui Mineral Development Engineering Co., Ltd.	1	10		22	3			22	14			19	30		19	26	
5	Financial Analysis		Hiroshi Matano	The Bank of Tokyo-Mitsubishi Co., Ltd.	18	10						22	14			19	30		19	26	
6	Macro-Economy Analysis		Kunio Okada	Japan Association for Trade with Russia and Central-Eastern Europe	1	9						22	13								
7	Law, System, Organization Analysis		Miki Wazima	Japan Association for Trade with Russia and Central-Eastern Europe	18	7															
8	Metal Processing Industry Evaluation		Takehito Nishimura	Sumiko Consultants Co., Ltd.								22	21								
9	Environment	Administration	Akira Takata	CH2M Hill-Unico Environmental Servis, Ltd.	18	2						22	13			19	30				
		Technology	Yoshitaka Togo	Japan Mining Engineering Center for International Cooperation																	
10	Cu Exploration Project Evaluation		Kiyoharu Nakashima*	Sumiko Consultants Co., Ltd.	18	2															
			Siro Nishide**	Sumiko Consultants Co., Ltd.								22	21								
11	Cu Mine Evaluation (Geology)		Atsushi Takeyama	Sumiko Consultants Co., Ltd.	1	10						22	13								
12	Cu Mine Evaluation (Mining)		Seigo Akiyama	Sumiko Consultants Co., Ltd.	1	10						22	13								
13	Cu Ore Dressing		Masayuki Hisatsune	Sumiko Consultants Co., Ltd.								22	14								
14	Cu Smelting	Smeltiing	Hiroyuki Tanaka	Sumitomo Metal Mining Co., Ltd.	18	10						22	13								
		Refining	Tadashi Yoshida	Sumiko Consultants Co., Ltd.	18	10						22	13								
15	Pb·Zn Exploration Project Evaluation		Yuji Nishikawa	Mitsui Mineral Development Engineering Co., Ltd.	1	25						22	5								
16	Pb·Zn Mine Evaluation (Geology)		Mikio Takahashi	Mitsui Mineral Development Engineering Co., Ltd.	18	17						22	21								
			Wakaba Sakurai	Mitsui Mineral Development Engineering Co., Ltd.	1	10															
17	Pb·Zn Mine Evaluation (Mining)		Barry Kita	Mitsui Mineral Development Engineering Co., Ltd.	18	17						22	21								
			Yutaka Hirabayashi	Mitsui Mineral Development Engineering Co., Ltd.	1	10															
18	Pb·Zn Ore Dressing		Shoji Nakamura	Mitsui Mineral Development Engineering Co., Ltd.								22	21								
19	Pb Smelting		Etsuji Nomura	Mitsui Mineral Development Engineering Co., Ltd.	18	10						22	13			19	30				
20	Zn Smelting	Smeltiing	Atsuo Onozaki	Dowa Engineering Co., Ltd.	18	10						22	13								
		Refining	Yuji Nishimura	MESCO INC.	18	10						22	13								
21	Data Base		Fumihiko Koda	Sumiko Consultants Co., Ltd.								22	13			19	30				

* FY 1995 **FY 1996

1. Concept of Master Plan

1. Concept of Master Plan

From 1991, the Kazakhstan non-ferrous metal industry was basically changed by the collapse of the former USSR and its independence. Based on the new foundation, the non-ferrous metal industry needs to make an industry innovation development strategy and a plan to implement change at a high level.

(Past)

The Kazakhstan non-ferrous metal industry was the base for production and supply of metal under the state planned economy of the former USSR.

(Present)

Kazakhstan is located under the CIS economic region. Under the market economy, the market has changed to a global market. The non-ferrous metal industry produces valuable processed goods using underground mineral resources and produces and sells the profitable goods. The continuous development of the industry contributes to the national wealth.

(Future)

Based on the new foundation for industry, it must produce competitive goods for development and restoration. The competitive goods are as follows:

① The quality must be suitable to international standards and guaranteed.

② Be able to manage production costs that fluctuate with the international price.

③ Be able to supply stability for the client.

Establish industry organization for independent and continuous development and profitability.

Master plan for non-ferrous metal industry promotion (shown on Fig.1(2))

Escape Crisis Situation	Establish Industry's Foundation	Industry Innovation	Industry Activity Changes to High Level

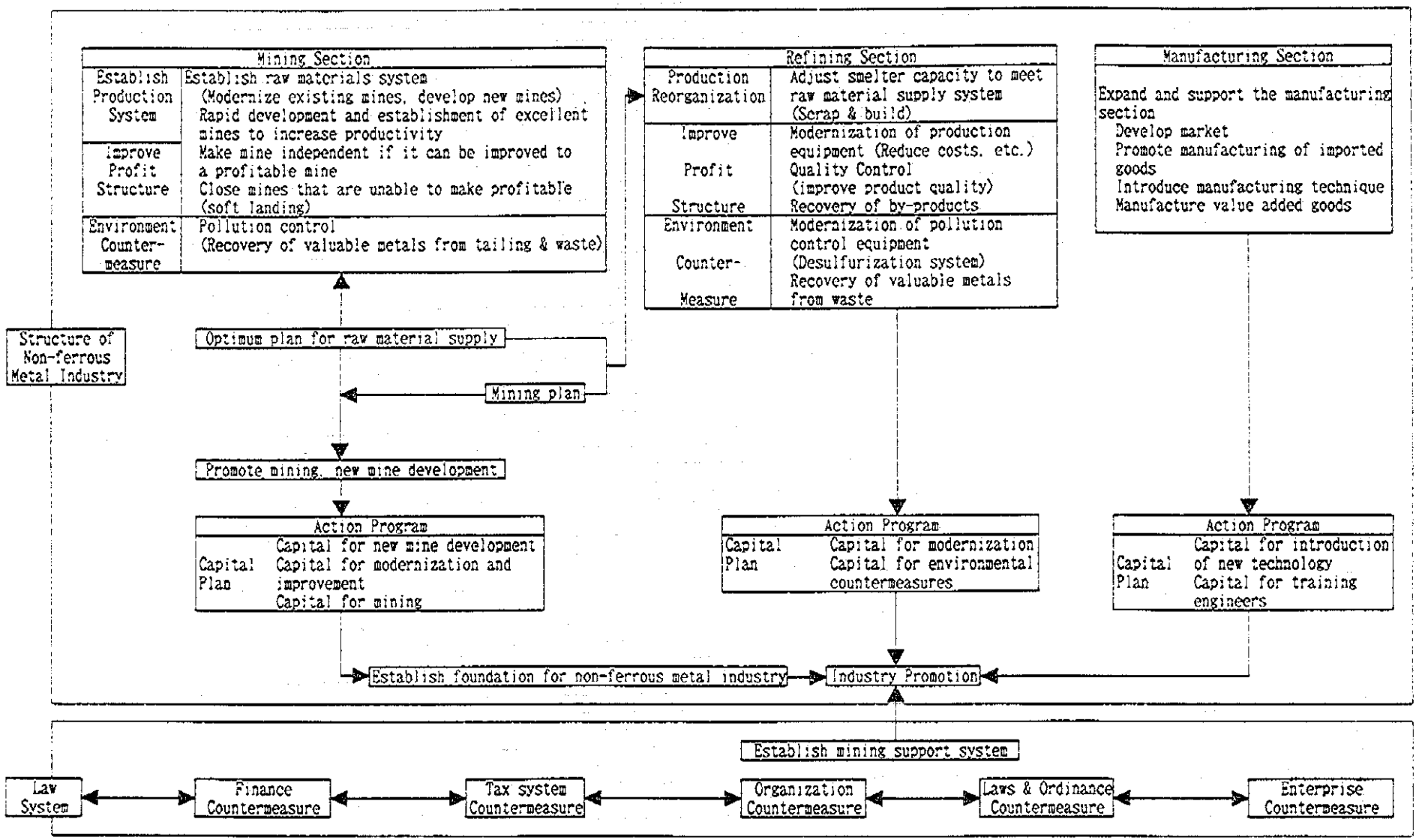


Fig.1(2) The Flow of the Kazakhstan Non-ferrous Metal Promotion Plan

1-1 Idea of Plan

Under the free market economy, the Republic of Kazakhstan's non-ferrous metal industry (copper, lead, zinc)

・Constructed an "attractive industry" to meet the market needs by offering goods to society that contributes to its development. In the global market, it must be competitive and take part in the world economy. In the future, this industry must continue to develop itself with the aim of protecting the global environment and the health and safety of its workers.

1-2 Target of Plan

1-2-1 Short-term (1996-2000) Objectives

・The industry must free itself from the crisis situation facing it.

① For profitable businesses, restructure the production activity.

② Cancel accumulated debt of every enterprise.

・Establish industry foundation in conformity to free market.

① Based on the evaluation of the economy, maintenance of country's raw material base.

② Secure the long-term stability of raw materials.

③ Establish production system depending on proper scale of production.

④ Rationalization of the management of the enterprise, maintain management system.

⑤ Improve work environment, prevent pollution, equipment installation

・Establish environment preservation and inspection systems

・Establish resource exploration and mine development systems

1-2-2 Intermediate-term (2001-2005) Objectives

・Innovation of industry and production systems

① Consistent mining・concentrating・refining process

Rationalization of Process

Modernization of Equipment

Establish Countermeasure for Energy Conservation

Rationalization of Materials Handling System

Recovery of Precious Metals from Waste

② Establish Resource Recycle System

・Innovation of Industry Structure

① Privatize profitable enterprises

② Close unprofitable businesses・Convert to new business・Countermeasure for company town

③ Restructure non-profit business

④ Establish industry information system

1-2-3 Long-term (2006-) Objectives

・Activate industry, Change enterprise high level structure

① Strengthen processing enterprise, increase market expansion for value added goods

② Strengthen research and development, product diversification

③ Consider dynamic free market change for industry group cooperative, re-organization

④ Establish promotion system for domestic demand and trade

1-3 Basic Strategy of the Industry Promotion

After its independence in 1993, the non-ferrous metal industry of Kazakhstan employed 2% of the population, produced about 12% of the GDP and earned 27% of the foreign currency so it is the main industry of Kazakhstan and important to the economy.

Presently, the Republic of Kazakhstan non-ferrous metal industry is converting from a planned economy to a free market economy. It is experiencing a progressively drastic inflation, a sharply decreased value of the tenge and other big outside changes. Producers are in a crisis condition having large debt, shortage of working capital, lack of raw materials and supplies, increase of production costs, stagnation of equipment investment, etc. They expect development and production stability under the free market economy to quickly escape from this condition.

(1) The government should rank the important measures in the non-ferrous metal industry's restructure promotion.

(2) The government is mainly responsible for the decisions on the industry promotion plan.

① Implement the action plan on the maintenance condition

② Enforce the business plan to construct the industry, implement support and guidance

③ Check plan progress with comprehensive controls

④ Revise action based on differences of plan and results

(3) Presently, enterprise crisis escape · enforce enterprise management improvement measures, entrust private management right for national company, privatization depending on national stock sale, examine results of national enterprise improvement, manage progress. Make countermeasures if there is no measurable progress at the enterprise by the end of 1996.

(4) Kazakhstan should strengthen and support the enterprise progress concerning projects that have a big influence on the industry development.

(5) Separate enterprise welfare facilities from the enterprise, accelerate this progress

(6) From the industry's long-term prospects implement the necessary functions, non-profit enterprises, country related organizations

(7) Actively accept finance, capital, support from foreign countries in accordance to the industry.

2. Industrial Plan

2. Industrial Plan

2-1 Raw Material Supply

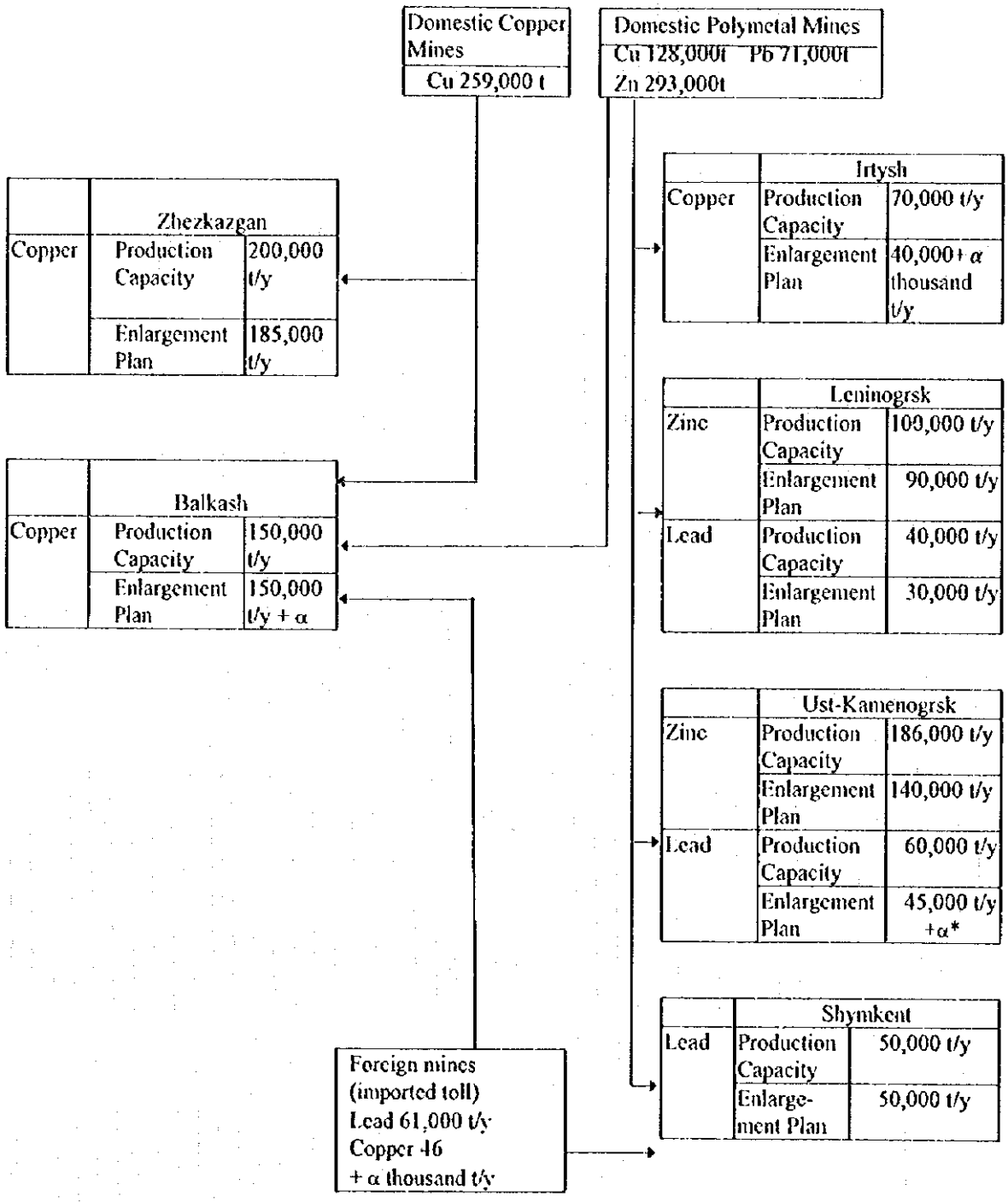
2-1-1 Supply plan

Mines that will be developed in accordance with the mine development promotion plan and their specifications are as follows:

Type of Mineral	JSC	Name of Mine	Start year of Production	Maximum Scale of Operation (1,000 t/y)				Remarks
				Crude Ore (1,000 t/y)	Metal Amount (1,000 t/y)			
					Cu	Pb	Zn	
Copper	Zhezkazgan-tsvetmet	Akchi-Spassky	2001	6,000	49	-	-	
		Zhilandinskaya	2006	5,000	52	-	-	
	Balkhasha-med	Koktau	1988	2,300	36	-	-	
		Boschekul	1999	7,000	3	-	-	
Polymetal	EKCChC	Artemyevskoye	1999	1,000	15	14	57	
	Irtysh PC	Yubileyno-Snegirkinskoye	1999	300	7	1	10	
	Zyryanovsk Lead Combine	Maleevskoye	1996	1,500	25	10	87	
	Leninogorsk PC	Chekmar	2002	3,000	3	15	51	F/S to be reviewed.
	Zyryanovsk Lead Combine	Maleevskoye Yar	2002	1,000	17	7	58	To be developed early through promoting exploration.

2-1-2 Flow of Raw Materials Supply (presumed 2000 as a model year)

The following figure indicates the flow of raw materials supply in 2000 as a model year. The balance between raw materials to be supplied by domestic mines and production capacity of smelters required to process such materials in 2000 is roughly estimated as follows.



*Slag, etc., will be moved among smelters.

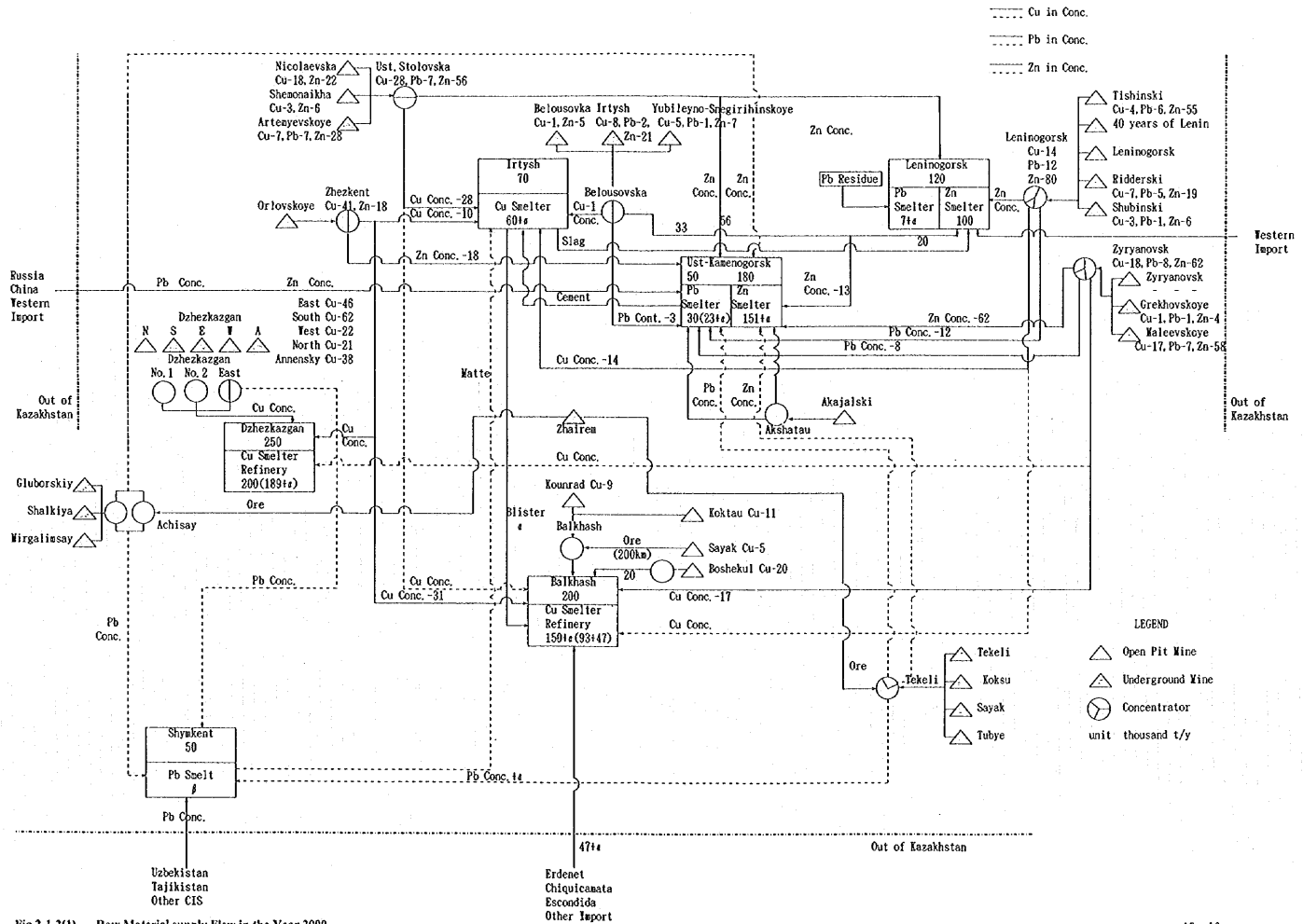


Fig.2-1-2(1) Raw Material supply Flow in the Year 2000

2-1-3 Imports and Toll of Raw Materials

(1) Raw materials of copper

- Balkhash will have to import and process the concentrates or entrust the smelting. Since 40,000 - 50,000 t/y may be imported from Erdenet mine, Mongolia, etc., production capacity of approximately 150,000 t/y should be necessary.
- In Dzhezkazgan raw materials of copper would be almost available in local mines.
- Out of the polymetal produced in East Kazakhstan Province approximately 1 million tons of raw materials of copper will be obtained.

A major part of it will be collected for use in Irtysh, and the rest will be supplied to Balkhash. Export is not recommendable unless under very favorable conditions.

(2) Raw materials of lead

- Domestic raw materials of lead for Shymkent smelter is very unstable, and a trend toward reduced production may be unavoidable. Without ore imported from Uzbekistan or raw materials of toll, the operation of this smelter may not last long.
- The only way for this smelter to survive is to purchase ore from other countries. Therefore, it is inevitable to reduce production taking into account the available raw materials. In the worst case, it would be unavoidable to abandon the smelter.
- Ust-Kamenogorsk should obtain raw materials for recycling through obtaining batteries from abroad. Now that raw materials for recycling is marketed in a borderless condition, it is indispensable to enhance the current technology level and to reduce costs so that profits may be ensured.

(3) Raw materials of zinc

It will be difficult to ensure import or export zinc. Usti-Kamenogorsk and Leninogorsk will be able to receive and process the entire amount of concentrates produced in East Kazakhstan State or its surrounding.

From a viewpoint of income and expenditure of mines, the surplus arising out of the current production capacity may be exported to Russia, Ukraine, etc. subject to examination of related regulation policies and/or promotion measures currently effective (export tax for example).

Export/import custom duties are equal and reciprocal in principle. If a country imposes export duties on concentrates, other countries will certainly impose an import tax on ores . As a result, the price of such raw materials will be comparatively high.

(4) Raw material and other raw materials

Copper and other raw materials that is smelted at Irtysh could be distributed to nearby areas such as Ust-Kamenogorsk, etc. and lead to cost reductions in freight charges, etc.. In case strict national regulations still remain, it may be difficult to export gold or silver. It will be possible to purchase gold and silver residue and other

raw materials for toll.

There will be no problem with regard to raw materials to be used in East Kazakhstan State and surrounding districts, as there are two smelters having sufficient capacity to process as well as the technological level required.

2-1-4 Long-Term View of Raw Material Balance

- Based on a world-wide prediction of copper supply and demand, increase in production has been planned to correspond with an anticipated increase in demand.
- Although increase in the capacity of smelters is also attempted, its realization is rather doubtful taking into account the remaining environmental problems. There may be an opportunity where the existing smelters are effectively utilized.
- With regard to lead, there is no possibility of increase in production of virgin metal is expected because very few mines are planned to be newly developed. Therefore, production of virgin metal will not increase much.

  However, the increase in demand is also expected, re-exploitation of polymetal mines in this country as a lead source should be reviewed.
- Demand of zinc may also increase. As a result, production will certainly increase although at a slow pace.

  Also from the above point of view, there is no doubt that the world market will take notice of the re-exploitation of polymetal mines in this country as a means to help increase in demand.

  Though the Kazakhstan zinc production will be partly covered at least by new exploitation of domestic mines to increase in production, further increase in production will be expected. In the future, a new production plan should be developed to enhance the competitiveness aiming at ore deposits of higher grade, not that of the existing low grade.

2-1-5 Tolling

One reason for the worsened achievements of the nonferrous metals industry is a shortage of domestic raw material required to activate the capacity of smelters.

As a solution to this problem, a large amount of imported materials came to be processed. Since this is conducted on the basis of entrusted processing, the costs of such materials are not included in the entire cost. As a result, the ratios of other items will be raised which leads to a change in the non-ferrous metals industry cost structure.

In case of Balkhash, tolling activities are used to a large extent. The expenses of this processing is the most important factor with both the LME prices and exchange rates being significant.

Taking into account the balance of the worldwide concentrate production and facilities of smelters, employment of the tolling system may be expanded to the existing facilities in Central Asian countries.

Lead smelters in Shymkent and copper smelters in Balkhash should increase their production by tolling to become custom smelters.

2-2 Metal and By-products

2-2-1 Present Situation of Domestic Mines

(1) Mining situation and production record in Kazakhstan

In the era of the former USSR、the Kazakhstan mine production met the capacity of the smelting facilities. An increase in the production of low grade ore was on the strength of low electric power, fuel, and transportation costs to secure the target amount of metal. However, since the collapse of the USSR in December 1991 caused the Republic of Kazakhstan economy to slide drastically. The non-ferrous metal industry was greatly affected by the decrease in demand from the Russian war industry, disorder in the customs and settlement system, etc. In particular, the ore production sharply declined in the 1990's. The following is a record of the production change in lead and zinc concentrate from 1990 through 1995.

	Smelting capacity	1990	1991	1992	1993	1994	1995
Lead concentrate	326.1	132.9 (40.8%)	121.7 (37.3%)	111.4 (34.2%)	89.4 (27.4%)	56.9 (17.4%)	37.0 (11.3%)
Zinc concentrate	292.9	277.6 (94.8%)	276.4 (94.4%)	242.9 (82.9%)	206.6 (70.5%)	152.8 (52.2%)	149.5 (51.0%)
Copper concentrate	519.0	259 (70.3%)	239.7 (64 %)	232.2 (63.2%)	199.8 (61.2%)	159.8 (49.4%)	164.6 (45.7%)

*1) Unit: 1,000 t of metal

*2) The values in parentheses ( ) indicate the operation rate of smelting facilities.

As shown in the table above, the production of both lead and zinc concentrate has steadily decreased. Compared to the 1990 figures, the 1995 lead and zinc concentrate production decreased 27.8% and 53.9%, respectively. At the same time, there was a low operation rate at the smelting facilities.

(2) Criteria of mine based on mines in Western countries

The domestic economy is in chaos due to the shift from a planned economy to a market economy. First and foremost, it is essential to stabilize the Kazakhstan's non-ferrous metal industry, a foreign currency acquisition industry. In addition, it is necessary to know the real ability of mines possessed by each industrial complex (combinat) so that the non-ferrous metal industry improves its international competitiveness and forms the basis of the Kazakhstan's economy in the future. In particular, it is not possible to know the proper metal production in Kazakhstan until the Kazakhstan mines are positioned based on the criteria common to the Western countries so a production plan for each domestic mine is made based on these results. In this context, the polymetal mine in Kazakhstan is ranked according to the following procedure.

A: To know the relationship among ore reserves, grade, and profitability which are essential assets of a mine concerning major lead and zinc mines (54 mines) in the Western countries.

B: To establish criteria to classify a mine under three categories: excellent mine, self-sustaining mine, and unprofitable mine from a relative relationship of these three factors.

C: To evaluate and classify a mine in operation and developed mine (including mine to be developed) in Kazakhstan based on the criteria established above, which are a basis of the production plan of each mine.

Fig.2-2-1(1) shows a relationship of minable ore, zinc conversion grade, annual profit of the major lead and zinc mines in the Western countries. It is clear from the above figure, most mines with a high annual profit are distributed above the zinc equivalent grade of 7.5%. Also, about 70% of the mines with a high profitability (1st place to 20th place in annual profit) are distributed above zinc equivalent metal of 1,000,000 tons. Therefore, if a mine has a zinc equivalent grade of 7.5%, it is a target for a self-sustaining mine, and a mine is judged as unprofitable if a zinc equivalent grade is below the 5% line. Also, a mine with a zinc equivalent grade of 7.5% or more and with a zinc equivalent metal of 1,000,000 tons or more is positioned as an excellent mine. While a clear correlation can not written between profitability and ore reserves, a mine with ore reserves greater than 15,000,000 tons is considered to be an excellent mine taking the future possibility of mine development into account.

The distribution of copper mines' ore reserves/copper equivalent grade is shown on Fig.2-2-1(2). The world copper mines have a minimum grade limit of 0.5 % and much expected development. In this diagram, the curved line shows the copper metal amount of 500,000 tons. The present development targets of copper equivalent above 0.5%, over 500,000 tons of copper metal and ore reserves over 20 million tons are desired.

(3) Position of polymetal mine in Kazakhstan

From the above results, based on the data of grade and ore reserves (on the basis of reserve) of 25 polymetal mines in Kazakhstan obtained in the site survey, the relationship of both factors were plotted. Fig.2-2-1(3) shows the results.

From the figure, the mines in Kazakhstan have the following features compared to those in the Western countries.

a. Although the grade is low, there are many mines with large ore reserves. For example, 9 mines have a zinc equivalent grade of less than 7.5% which is a standard of a self-sustaining mine, ore reserves of 15,000,000 tons or more and account for 36% of all the mines.

b. There are two very excellent mines. Six mines have a zinc equivalent grade of 7.5% or more and zinc equivalent metal of 1,000,000 tons or more. Both Maleevskoye and Orlovskoye Mines have a zinc equivalent metal over 5,000,000 tons. These two mines are at a level no less than the very excellent mines in the Western countries in terms of grade and ore reserves.

c. There are relatively many small-scale mines with little ore reserves. Seven small-scale mines have ore reserves less than 5,000,000 tons and account for about 30%.

Based on the above characteristics, the target mines are classified as shown below in examining the production plan of the polymetal mines (Table 2-2-1(1)).

* Development and/or promotion of increase production group: Mines with high-grade ores (zinc equivalent grade over 10%) and sufficient ore reserves. They are the foundation of the production in the Kazakhstan's polymetal mines in the present and future.
  Examples) Maleevkoye, Orlovskoye, Artemyevskoye, and Yubileyno-Snegirihinskoye
* Reconstruction by combinat group: Mines with a profitable grade (zinc equivalent grade over 7.5%) and enough ore reserves. Although they have some present problems and need some improvements, a stable production is expected until newly developed mines contribute to the Kazakhstan mining industry.
  Examples) Nicolaevskoye, Tishinskoye, Irtyshskoye
* Group out of production plan: Mines which have low ore grade (zinc equivalent grade less than 5%) or have little ore reserves and whose future development can not be expected. Mines with actual production results were shut down as early as possible. Also, mines with no recent actual production results were excluded from the production plan.
  Examples) Zyryanovskoye, Shemonaihinskoye, Mirgalimsay, Achisay, etc.

(4) Position of copper mines (refer to Table 2-2-1(2))

The copper mines (ore deposits) will be classified as follows:

- Continue operations by implementation of production rationalization
  (example) Zhezkazgan, Kounrad
- Promote the development and beginning of ore production
  (example) Boschekul, Koktau and Aktogay
- In future, develop promising ore deposits. If there is potential, need to continue exploration.
  (example) Zhilandinskaya, Zhaisan and Koksay

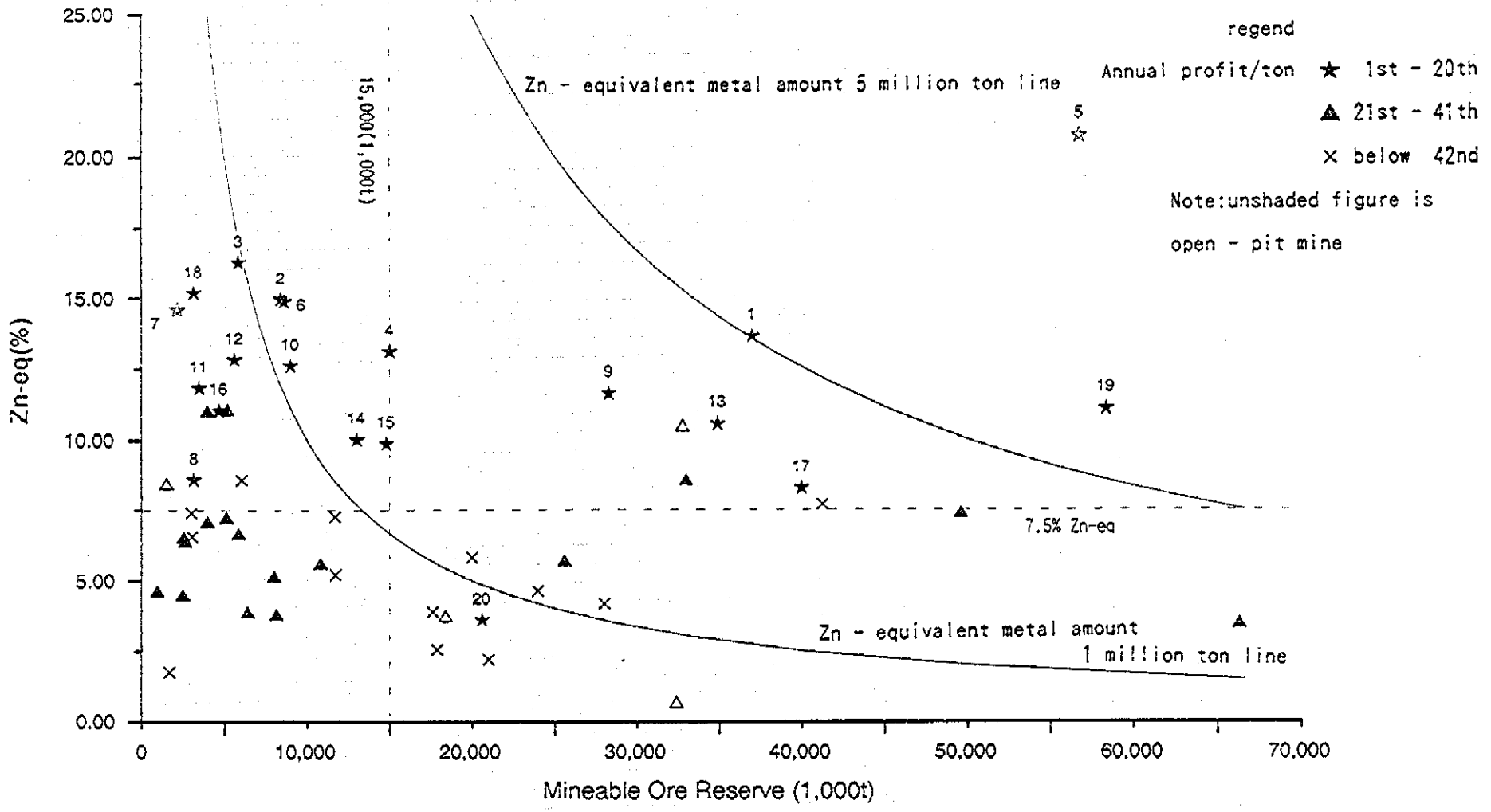


Fig.2-2-1(1) Relationship between Zn equivalent grade and minable ore of Polymetal in the world

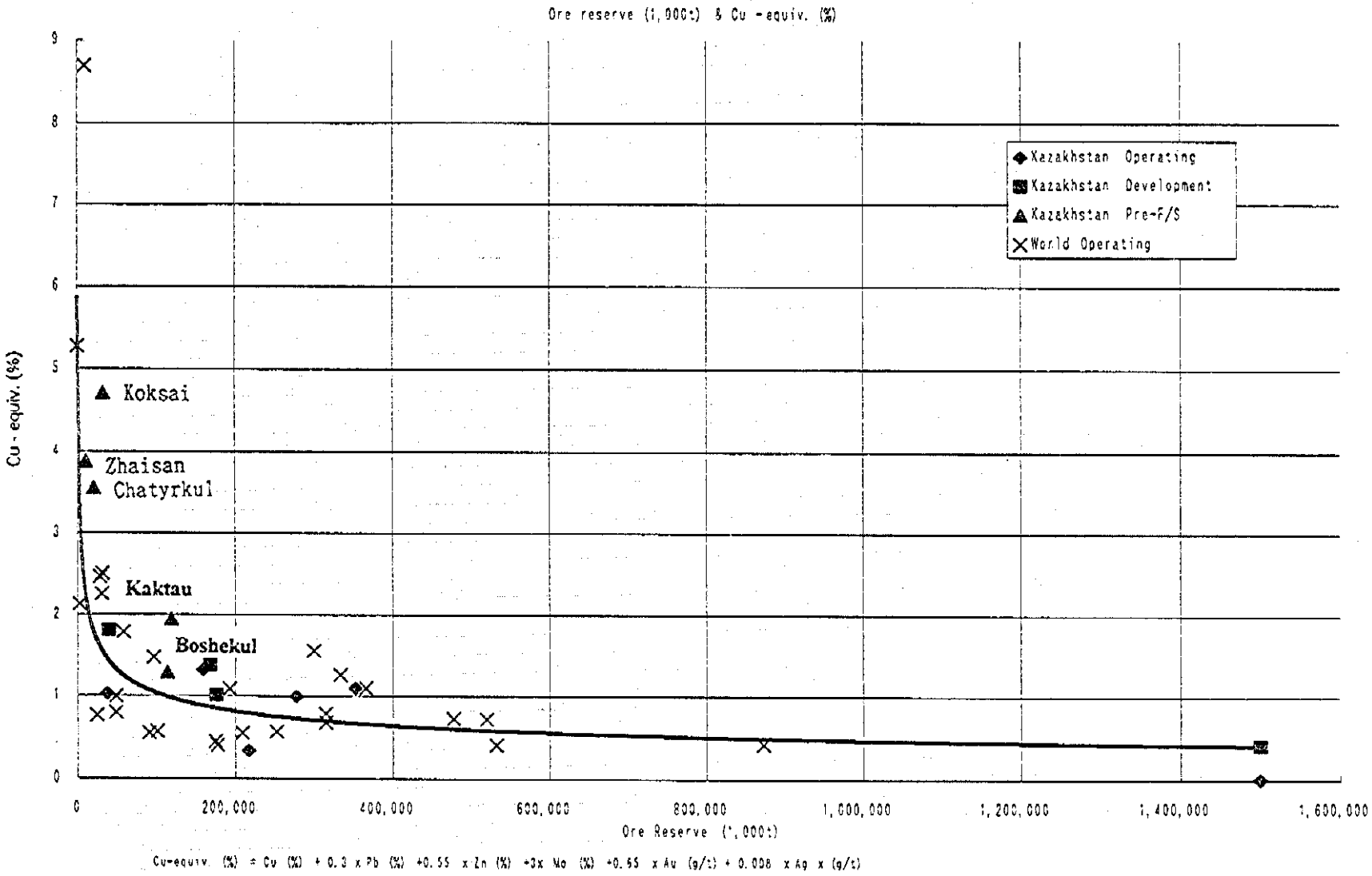


Fig.2-2-1(2) Relationship between Copper equivalent grade and minable ore of Copper mine

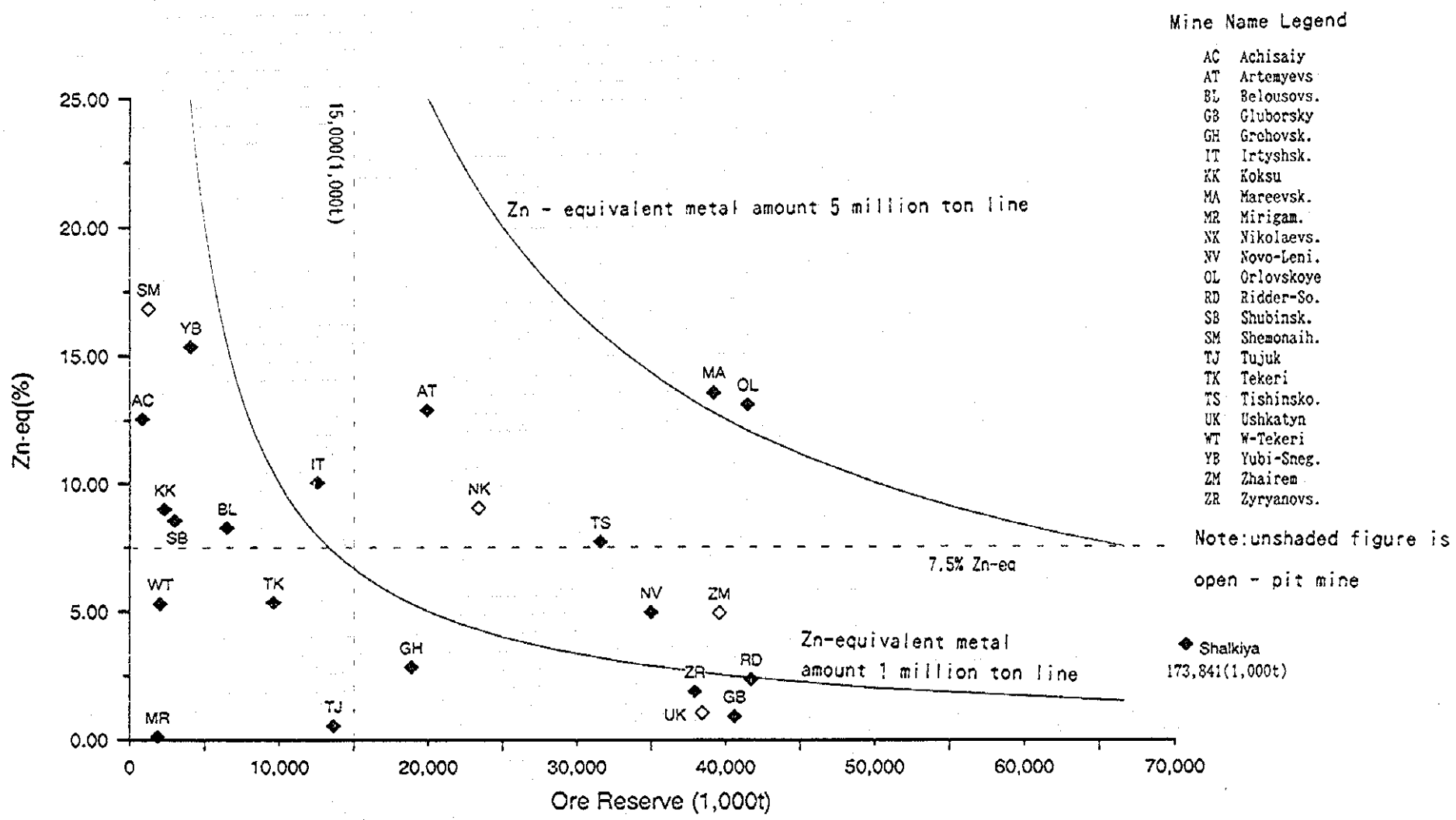


Fig.2-2-1(3) Relationship between Zn equivalent grade and minable ore of Polymetal in Kazakhstan

Table 2-2-1(1) Polymetal Mine Situation and Countermeasures for Improvement

Item	Mine Name	1995 Ore Reserves (1,000 tons)	Grade (%) Cu	Pb	Zn	Characteristics and Points of Issue	Countermeasures
Development and Promotion to Increase Production	Maleevskoye	39,211	2.60	1.19	7.84	The ore reserves and grade are sufficient. Production is occurring while the mine is being developed. However, the development is slowly progressing. There is no concentrator at the mine site. (There is a construction plan)	Promote quick development. Concrete plan for capital provision.
	Artemyevskoye	19,923	2.18	2.18	7.66	The ore reserves are sufficient and grade is high. The deep orebody has good rock conditions. The construction is partially done but has been suspended because of a lack of capital.	Promote quick development. Concrete plan for capital provision.
	Orlovskoye	41,482	4.54	1.02	3.58	The ore reserves are sufficient with an especially high copper grade of 4.54%. According to the information, the orebody is relatively shallow and has good rock conditions.	Make feasibility study that includes the examination of increasing production and modernization of the mine.
	Yubileyno-Snegirikhinskoye	4,033	4.55	0.89	5.87	This is a new deposit having a good grade but little ore reserves.	Understand the area potential. Promote area exploration.
Reconstruction by Combinat	Nicolaevskoye	23,402	2.54	0.49	3.76	There was extremely reckless mining under the former USSR period. In the near future, the is no hope to increase production. Mining is approaching the bottom of the orebody and there is a fear that the grade will decrease.	Promote stripping. Make a feasibility study that includes the provision of capital.
	Tishinskoye	31,578	0.61	1.00	6.08	Adapt the caving method. The ore recovery rate is slow. There is a possibility that the waste is decreasing the grade. Since there is much water, there is a fear of pressure on the management because of the high costs.	Make a feasibility study that icludes the improvement of mining method and examination of increasing production.
	Shubinskoye	2,967	2.18	0.55	3.97	There is not enough ore reserves.	Understand the area potential.
	Irtyshskoye	12,553	2.06	0.85	5.57	The ore reserves and grade are relatively good. This is a newly developed mine so there is unstable production.	Promote area exploration. Examine modernization of mining method.
	Shalkiya	173,841		0.90	3.31	The ore reserves are large but have low grade. There is no concentrator at the mine site. (There is a construction plan)	Examine increasing the ore grade depending on the selection of the high potential parts of the orebody. Make a feasibility study.
Others	Belousovskoye	6,463	1.33	1.25	5.11	It's mining history is old. There is a possibility that the rest of the orebody is separated and in small blocks. The location of mining is deep so the mining condition has deteriorated.	Gradually close the mine.
	Koksu	2,300		1.67	8.32	The ore reserves are very small with no expectation to increase the ore reserves. The rock and mining conditions have deteriorated so the costs have increased.	Gradually close the mine.

Table 2-2-1(2) Copper Mine Situation and Countermeasures for Improvement

Item	Mine Name	1995 Ore Reserves (1,000 tons)	Grade (%) Cu	Pb	Zn	Characteristics and Points of Issue	Countermeasures
Improve Production	Zhezkazgan	611,000	1.1			Good ore reserves and grade. However, its development has been suspended due to a lack of capital.	Make a plan for highly profitable production. Promote the development of the Annensky and Akchy-Spassky deposits.
	Kounrad	217,000	0.33			The mineable ore reserve depends on the push-back of the pit wall.	Make a plan for increasing production by using the push-back of pit wall.

Present Situation of Undeveloped Deposits

Item	Mine Name	1995 Ore Reserves (1,000 tons)	Grade (%) Cu	Pb	Zn	Characteristics and Points of Issue
Promote Development	Boschekul	176,000	0.72			The ore reserves and grade are relatively good. This mine will be a very important domestic raw material supply source for the JSC "Balkhashmed".
	Koktau	46,000	1.82		0.6	The ore grade is high but the reserves are small. This mine will be a very important domestic raw material supply source for the JSC "Balkhashmed".
	Aktogay	1,430,000	0.37			The ore reserves are huge but the grade is low. This mine will be a very important domestic raw material supply source for the JSC "Balkhashmed".
Promising Undeveloped Ore Deposits	Zhilandinskaya	168,000	1.37			Exploration completed.
	Zhaisan	11,000	3.30			
	Chatyrkul	21,000	3.50			
	Koksay	294,000	0.51			No details.
	Zhaman-Aibat	119,000	1.94			Now implementing the mineral development cooperation basic survey by MMAJ.
	Samarsky	114,000	1.28			

2-2-2 Production Plan of Concentrate

(1) General

Based on the above-mentioned study results, a total of 13 polymetal mines (including partly undeveloped mines) were selected as target mines for future production plan. A long-term production plan from 1996 to 2020 was prepared for these mines. Two mines were chosen to be developed after 2000.

The following preconditions are set in developing the production plan.

① The following coefficient is used for calculating a zinc equivalent grade. Zn = 1, Cu = 2, and Pb = 0.4

② As for the dilution rate and mining/concentrator recovery rate, data of each combinat is used.

③ The ore reserves/grade is converted into reserves of minable ore/grade based on the data shown in item (2) above.

④ The development of production is as follows: Assume the minable ore reserves are 100% in 1995 and the production is carried out at 100% of the mining capacity. When the remaining ore reserves decrease to 60%, the production is carried out at 70% of the mining capacity. When the remaining ore reserves go down to 40%, the production is at 50% of the mining capacity. The production is stopped when the remaining ore reserves go down to 20%.

⑤ Unprofitable operating mines are shut down at a stage as early as possible.

⑥ There are two mines scheduled to be developed after 2000. The plans of the Chekmar Mine or Shalkiya Mine were suspended due to lack of funds in the development/production stages. However, there are mines which can be developed by making a re-examination in a new F/S. In the other case, there is a strong possibility that future exploration will discover a deposit near the Maleevska deposit and half its scale.

Based on the above preconditions, the long-term production plan (Table 2-2-2(1)) was prepared. Fig.2-2-2(1) to (3) show the changes in the annual amount of copper, lead, and zinc contained in the concentrates.

Based on the above plan, if the production is realized in each industrial complex, the following points can be pointed out in the future (in particular, after 2000).

a) The copper smelting capacity in eastern Kazakh region is about 40,000 tons a year. According this plan, there is an oversupply of raw materials for copper. Therefore, it is necessary to send copper in a smelter in another region or construct a new smelter with a capacity about 70,000 tons in the eastern Kazakh region.

b) The lead smelting capacity (except scrapping in Leninogorsk) in eastern Kazakh region is about 150,000 tons, and a very low supply of raw materials for lead is not mitigated in the future. From now on, it is required to review the scale of the smelter.

c) It is possible to supply zinc concentrate to meet the smelting capacity of 300,000 tons from 2001 to 2012. However, the supply of raw materials for zinc will drastically fall short after 2016. The strategy of the long-term exploration is too secure enough zinc ore for this period.

Table 2-2-2(1) Long term production plan of polymetalic ore

JSC	Mine Name		Ore Reserve (1.000t, 1995) grade(%)	Mining	dil. (%)	Re. (%)	Minable Ore Reserves (1.000t, 1995) grade(%)	Metal recovery in rock conc. (%)	Production & Metal Content (1000 tons/year) 1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2012	2014	2016	2018	2020	Total Production (until 2035)	Remaining Reserves (in 2035)
EKCCHC	Nikolaevskoye		23,402	O.P.	3	98	23,643		500	600	800	1,000	1,000	1,000	1,000	1,000	1,000	1,000	700	700	700	700	700	700	700	500	500	500	500	19,650	4,593
		Cu (%)	2.53				2.46	75	9	11	15	18	18	18	18	18	18	18	13	13	13	13	13	13	9	9	9	9	9	352	159*
		Pb (%)	0.49				0.48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Zn (%)	3.76				3.65	60	11	13	18	22	22	22	22	22	22	22	15	15	15	15	15	15	11	11	11	11	11	417	
	Shemonaikhinskoye		1,238	O.P.	3	98	1,251		200	200	200	140	100	100	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	990	261
		Cu (%)	3.85				3.74	85	6	6	6	4	3	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32	21*
		Pb (%)	1.34				1.30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Zn (%)	8.57				8.33	75	12	12	12	9	6	6	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	82	
	Artemyevskoye		19,923	C&F	10	93	21,473		0	0	0	200	500	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	700	700	700	500	500	500	500	16,900	4,523
		Cu (%)	2.18				1.96	74	0	0	0	3	7	15	15	15	15	15	15	15	15	10	10	10	7	7	7	7	7	246	21*
		Pb (%)	2.13				1.96	73	0	0	0	3	7	14	14	14	14	14	14	14	14	10	10	10	7	7	7	7	7	243	
		Zn (%)	7.66				6.89	82	0	0	0	11	28	57	57	57	57	57	57	57	57	40	40	40	28	28	28	28	28	958	
Leninogorsk PC	Tishinskoye		31,578	SLS	15	95	35,293		900	1,000	1,000	1,000	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	840	840	840	840	840	840	600	600	28,230	7,063
		Cu (%)	0.61				0.52	72	4	4	4	4	4	4	4	4	4	4	4	4	4	3	3	3	3	3	3	2	2	105	20*
		Pb (%)	1.00				0.85	60	5	5	5	6	6	6	6	6	6	6	6	6	6	4	4	4	4	4	4	3	3	141	
		Zn (%)	6.08				5.17	88	44	45	45	55	55	55	55	55	55	55	55	55	55	38	38	38	38	38	38	27	27	1,284	
	Ridder-Sokolnoye 40 Years Limit		48,716	SLC	25	90	50,059		2,240	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350	39,590	10,469
		Cu (%)	0.49				0.33	72	6	7	7	7	7	7	7	5	5	5	5	5	5	5	3	3	3	3	3	3	3	105	21*
		Pb (%)	0.47				0.33	60	5	5	5	5	5	5	5	4	4	4	4	4	4	3	3	3	3	3	3	3	3	84	
		Zn (%)	1.17				0.88	88	17	19	19	19	19	19	19	19	14	14	14	14	14	14	10	10	10	10	10	0	0	306	
	Shubinskoye		2,967	SLS	15	95	3,316		80	200	200	200	200	200	200	200	200	140	140	140	140	100	100	100	100	50	0	0	0	2,690	626
		Cu (%)	2.18				1.85	72	1	3	3	3	3	3	3	3	2	2	2	2	2	1	1	1	1	1	0	0	0	36	15*
		Pb (%)	0.53				0.49	60	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	8	
		Zn (%)	3.97				3.33	88	2	6	6	6	6	6	6	6	4	4	4	4	4	3	3	3	3	1	0	0	0	80	
Irtysh PC	Belousovskoye		6,463	SLS, C&F	25	97	8,359		200	200	200	200	200	200	200	100	0	0	0	0	0	0	0	0	0	0	0	0	0	1,500	6,859
		Cu (%)	1.33				1.00	50	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	82*
		Pb (%)	1.23				0.94	60	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	8	
		Zn (%)	5.11				3.83	70	5	5	5	5	5	5	5	3	0	0	0	0	0	0	0	0	0	0	0	0	0	40	
	Irtyshskoye		12,553	SLS, C&F	25	97	16,235		340	300	300	500	700	700	700	700	700	700	700	490	490	490	490	490	350	350	350	350	350	13,120	3,115
		Cu (%)	2.06				1.55	70	4	3	3	5	8	8	8	8	8	8	8	5	5	5	5	5	4	4	4	4	4	142	19*
		Pb (%)	0.81				0.61	55	1	1	1	3	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	45	
		Zn (%)	5.53				4.18	72	10	9	9	15	21	21	21	21	21	21	21	15	15	15	15	15	11	11	11	11	11	395	
	Yubileynoe-Snegirikhinskoye		4,033	SLS, C&F	25	93	5,216		0	0	0	100	200	300	300	300	300	300	300	210	210	210	210	150	150	150	80	0	0	4,130	1,086
		Cu (%)	4.55				3.41	69	0	0	0	2	5	7	7	7	7	7	7	5	5	5	5	4	4	4	2	0	0	97	21*
		Pb (%)	0.85				0.67	65	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	18	
		Zn (%)	8.80				6.40	76	0	0	0	3	10	10	10	10	10	10	10	7	7	7	7	5	5	5	3	0	0	138	
Zhezkent MCC	Orlovskoye		41,482	C&F	7	95	42,374		900	900	1,000	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	840	840	840	840	840	33,700	8,674
		Cu (%)	4.54				4.22	80	30	30	34	41	41	41	41	41	41	41	41	41	41	41	41	41	28	28	28	28	28	1,038	20*
		Pb (%)	1.02				0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Zn (%)	3.58				3.33	45	13	13	15	18	18	18	18	18	18	18	18	18	18	18	18	18	13	13	13	13	13	505	
Zyryanovsk Lead Combine	Zyryanovskoye		37,893	SLS, SLC	35	94	54,856		680	500	500	500	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,580	53,276
		Cu (%)	0.16				0.10	68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	97*
		Pb (%)	0.64				0.42	80	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	
		Zn (%)	1.29				0.84	80	5	3	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	
	Grebnevskoye		18,867	SLC	21	96	22,927		430	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	280	13,910	9,017
		Cu (%)	0.56				0.44	68	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	42	35*
		Pb (%)	0.46				0.36	80	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	40	
		Zn (%)	1.52				1.20	80	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	134	
	Maleevskoye		39,211	SLS, C&F	7	98	41,319		500	550	600	600	1,000	1,200	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,000	1,000	1,000	1,000	1,000	750	750	33,100	8,219
		Cu (%)	2.60				2.42	70	6	9	10	10	17	20	25	25	25	25	25	25	25	25	17	17	17	17	17	13	13	568	20*
		Pb (%)	1.19				1.11	60	3	4	4	4	7	8	10	10	10	10	10	10	10	10	7	7	7	7	7	5	5	270	
		Zn (%)	2.84				2.29	80	29	32	35	35	58	70	87	87	87	87	87	87	87	87	58	58	58	58	58	44	44	1,931	
	A (Oktekmar)		57,400		3	98	57,992		0	0	0	0	0	0	500	1,000	2,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	2,100	2,100	2,100	1,500	1,500	46,500	11,492
		Cu (%)	0.22				0.21	48	0	0	0	0	0	0	0	1	2	3	3	3	3	3	2	2	2	2	1	1	1	41	20*
		Pb (%)	0.80				0.78	65	0	0	0	0	0	0	3	5	11	15	15	15	15	15	11	11	11	11	8	8	8	233	
		Zn (%)	2.37				2.10	80	0	0	0	0	0	8	17	34	51	51	51	51	51	51	35	35	35	35	25	25	25	783	
	B (Maleev Yar)		20,000		7	98	21,075		0	0	0	0	0	0	0	0	0	0	200	400	800	1,000	1,000	1,000	1,000	1,000	700	700	700	16,800	4,275
		Cu (%)	2.60				2.42	70	0	0	0	0	0	0	0	0	0	0	3	7	14	17	17	17	17	17	12	12	12	284	20*
		Pb (%)	1.19				1.11	60	0	0	0	0	0	0	0	0	0	0	1	3	5	7	7	7	7	7	5	5	5	112	
		Zn (%)	7.84				7.29	80	0	0	0	0	0	0	0	0	0	0	11	23	47	58	58	58	58	58	41	41	41	980	

Metal contents in concentrate :

Cu	73	76	84	100	115	128	132	138	137	128	126	125	126	123	119	105	94	90	80	78					
Pb	19	20	19	24	31	40	45	47	50	55	56	56	57	54	49	45	41	35	30	29					
Zn	154	163	171	203	249	293	316	318	325	342	347	349	355	350	316	294	273	254	206	202					

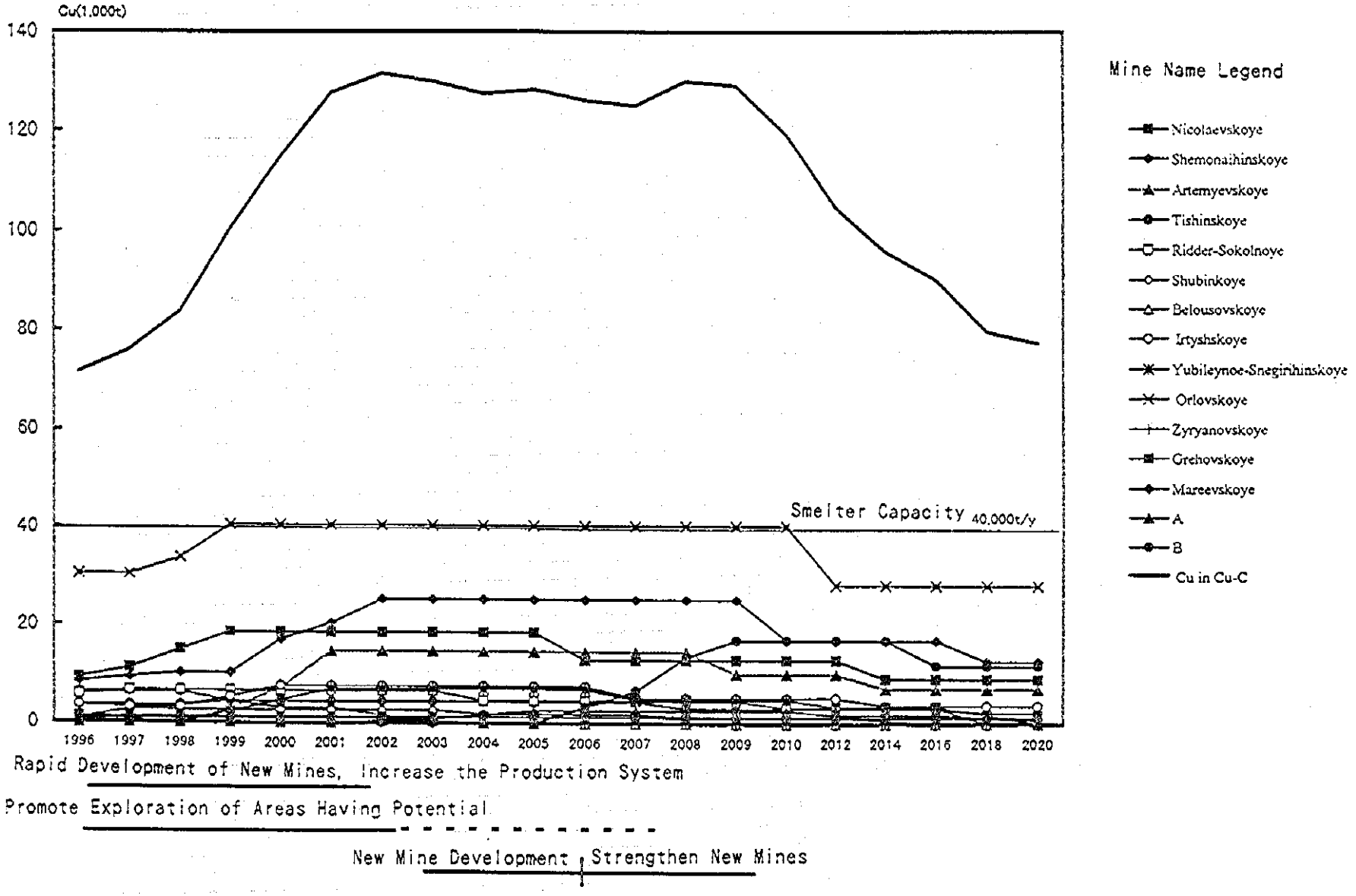
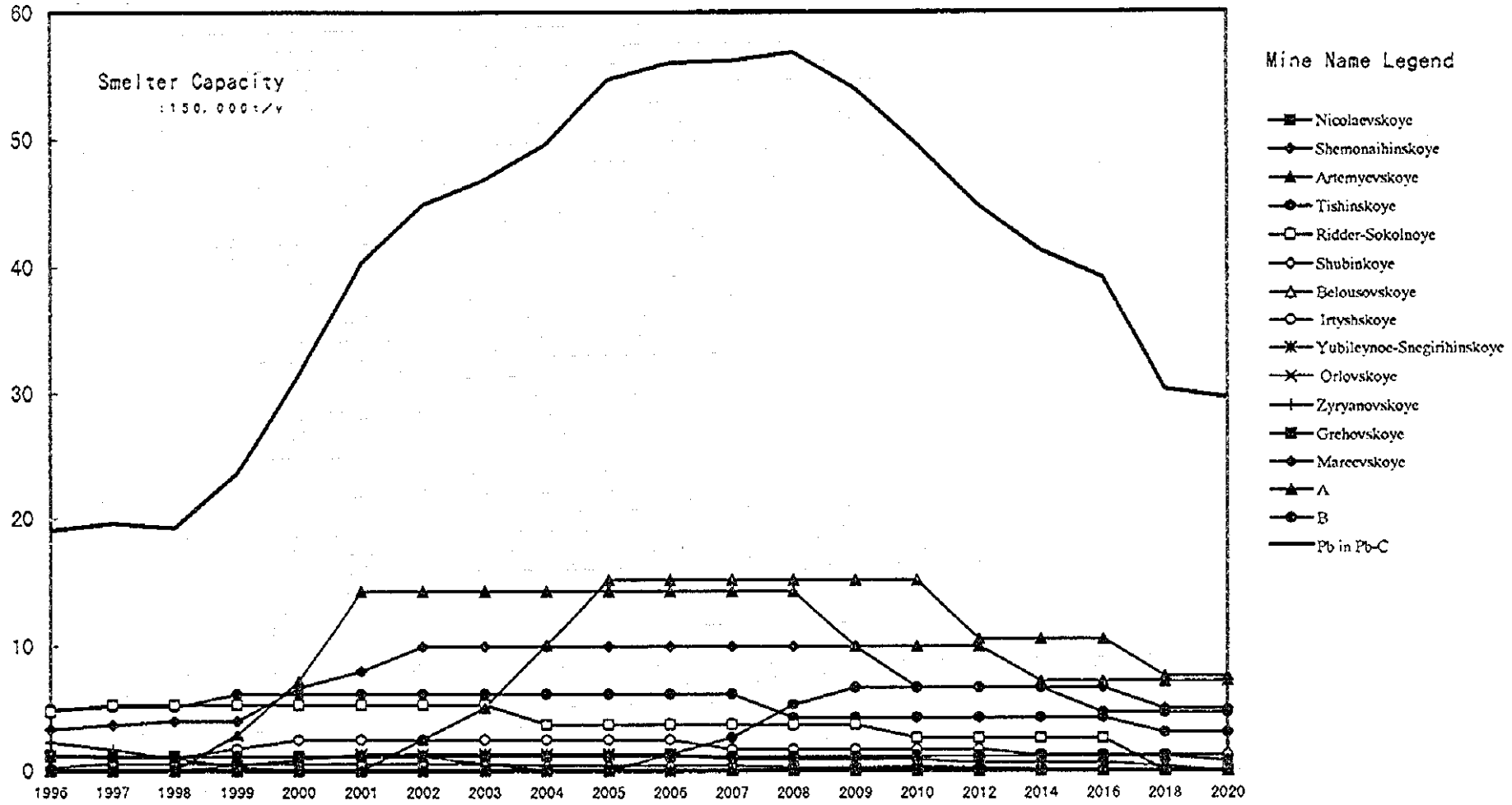


Fig. 2-2-2(1) Forecast of Change in the Long-term Copper Raw Material Supply (metal amount conversion)



Rapid Development of New Mines, Increase the Production System

Promote Exploration of Areas Having Potential

New Mine Development | Strengthen New Mines

Fig. 2-2-2(2) Forecast of Change in the Long-term Lead Raw Material Supply (metal amount conversion)

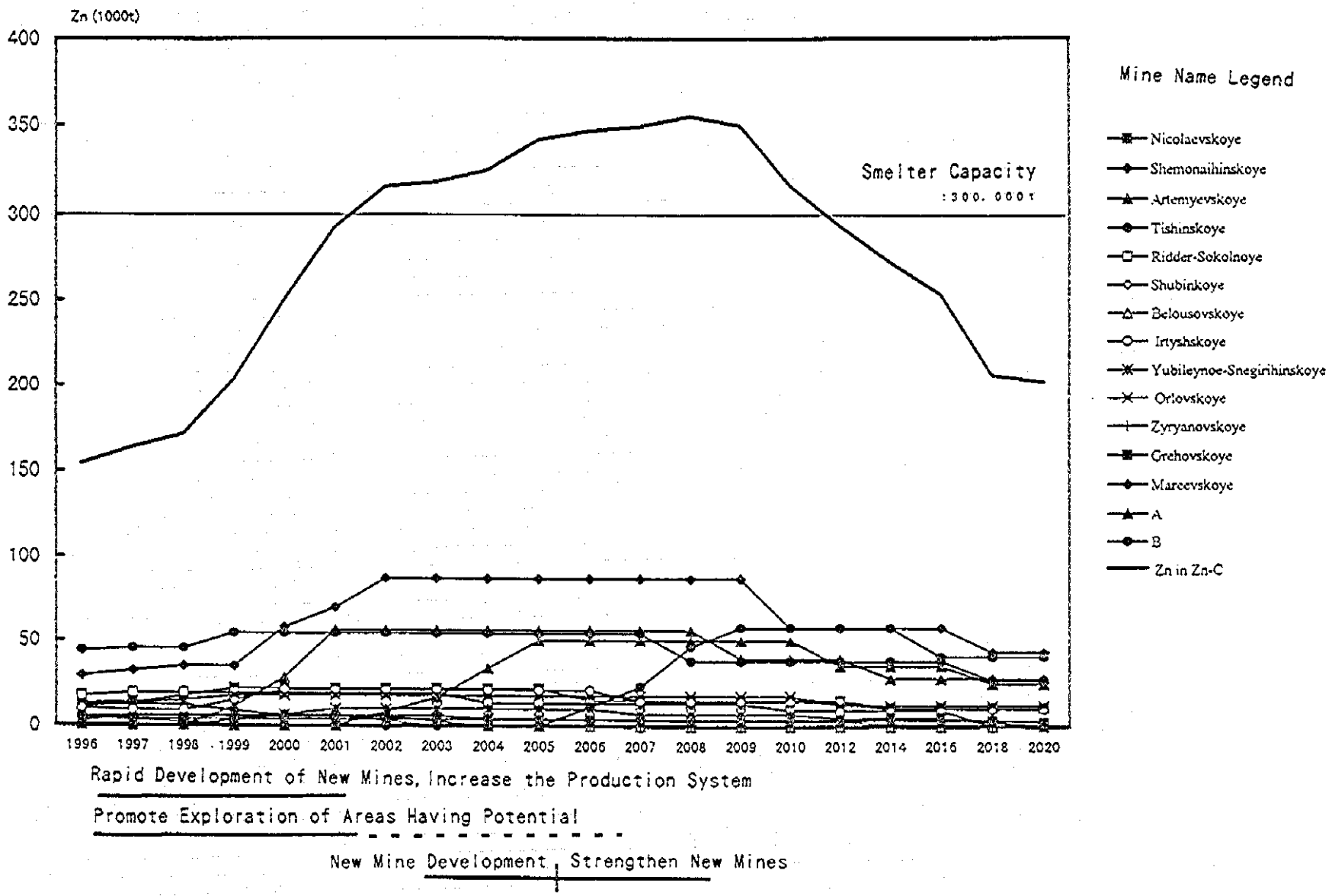


Fig. 2-2-2(3) Forecast of Change in the Long-term Zinc Raw Material Supply (metal amount conversion)

(2) Earnings and expenses of production plan (draft)

Based on the above-mentioned production plan, a draft of smelting in 12 polymetal mines (except Ridder - Sokolnoye) was prepared. The earnings and expenses are calculated under the conditions that concentrate is delivered to the smelter.

The present debt is excluded from this calculation. The conditions of the earnings and expenses are developed as follows:

① Concentrate grade and recovery rate

They are set for Cu, Pb, and Zn based on hearing data and actual results of two or more years at each mine. Some Au and Ag are not indicated in the grade of crude ore, but are indicated in the concentrate.

② Price quotation

The standard price of base metal for copper, lead, and zinc is LME. Au and Ag are set at a recent prices of COMEX and Handy & Harman.

Copper: 1.0 $/lb

Lead: 600 $/t

Zinc: 1000 $/t

Gold: 400 $/TOZ

Silver: 5 $/TOZ

③ Smelting recovery rate

General conditions used in the ore buying condition are adopted.

Copper concentrate: 1.1 unit reduction, Au 80%, Ag 85%

Lead concentrate: Recovery rate of 90%, Au 1.0 unit reduction 80%, Ag 85%

Zinc concentrate: 8% reduction 85%, Ag 4 toz reduction 70%

④ Smelting cost (T/C, R/C)

Copper concentrate: T/C 80 $/t, R/C 8c/lb

Lead concentrate: T/C 150 $/t

Zinc concentrate: T/C 180 $/t, T/C scale at 1000 $, ±13 c/t, Ag R/C 5.5 c/TOZ

As for penalty, an example in the ore buying conditions in the Western countries is set for As, Sb, Hg, etc..

⑤ Land freight rates

Concentrate is distributed according to the raw material flow chart and the freight is calculated from the railroad freight table.

⑥ Insurance

0.077% DMT for a loss (including penalty for delay, exemption for a loss up to 1%) before arrival at a smelter.

⑦ Direct cost

Concentration cost: A value estimated from the actual results at each mine (including F/S) and mines of the same scale with similar conditions is adopted.

Head office cost: Welfare expenses and management cost

⑧ Loan

* All the long-term debts are for investment and deferred for 4 years. Annual interest of 5%.
* Obtain a short-term loan if there is a shortage in working capital and repay the loan when there is a working capital surplus. Annual interest rate of 7%.

The ore selling conditions (including payment condition), interest, etc. are negotiated with the other parties when necessary and vary in each lot that is negotiated. If the cost is within 70% of the income of crude ore per ton, the financial cost can be absorbed.

(3) Earnings/expenses and investment of individual mine

① JSC "EKCChC"

- Nicolaevskoye

An investment is made in the stripping work for two years to bring the working pit-slope close to 27 degrees as planned and correct it to a safe angle for operation. At the same time of deep development, an investment is made in reinforcement and renewal of heavy machinery (including changing to large scale machinery). If a production of 1,000,000 t/year is achieved, a stable management is possible to continue.

- Shemonaihinskoye

No investment is made because the mining is drawing to its close.

- Artemyevskoye

This deposit situated near the Kamiahinskoye Mine (mined out) will be developed within three years and begin production.

An investment of $70,000,000 is made for the development and improvement of a concentrator. A modern large-scale trackless mining system is adopted for mining.

The plant will be brought into full capacity of 1,000,000 t/year in 2001. Although an initial investment is quite substantial, it is possible to recover the investment and gain profits.

After the primary smelting is conducted on copper concentrate in the Irtysh Copper Smelter, part of it is transported to Balhash Smelter and lead and zinc concentrate is transported to Ust-Kamenogorsk.

② JSC "Leninogorsk PC"

- Ridder - Sokolonoye & 40 Years Lenin Mines

Since the base metal grade of this mines are low and the gold and silver grades are good, this concentrate is rather a gold concentrate. We obtained data in a hearing that the concentrate contained 3.5 tons ($50 million) of gold per year. When this is added to the earnings, it is possible to break even. This is excluded from the summary table.

- Tishinskoye Mine

Since the ore reserves are large, a plan for production increase is made. An investment is made in the improvement of transporting facilities of the #16 level and renewal of the mining machinery. Production will be increased from 970,000 t/year to 1,200,000 t/year.

Earnings of $28/t of crude ore are expected at this mine. The total cost should be held down to about $25/t. A drastic improvement in the mining and concentration cost is required.

The mining cost needs to be reduced from $18.74/t (actual performance) to $14/t and the management cost from $10.58/t to about $5/t so that a total cost reduction of $10/t is required.

- Shubinskoye Mine

The maximum production should be 200,000 t/year.

Like the Tishinskoye Mine, the reduction in mining cost is important. The sublevel stoping method is adopted. A cost of $19.17/t (actual performance) needs be reduced about 20% and the management cost of $10.58/t must be also cut down. Since a reduction of $3 to 4 in the total cost will bring a profit, urgent reforms are needed. An investment in renewal of the machinery and replacement of parts should be made as early as possible to minimize accumulated deficits.

③ JSC "Irtysh PC"

- Belovsouvskoye

The history of the operation is long and ore reserves are being depleted. The target production is set at 200,000 t/year for about 8 years. It is advisable to close or scale production down at the mine because it is difficult to make a drastic improvement on earnings and expenses even if there were no lack of parts nor delay in backfilling.

- Irtyshskoye

The production has slumped to 300,00 t/year. It is necessary to make an investment in the repair and improvement of facilities for 5 years to raise the production to 700,000 t/year. Unless the production is secured, debts will accumulate due to its fixed costs The 1994 mining cost ($39.10/t) was extraordinary due to the extremely small production amount so the cost could not be used. Compared to a mine with the same conditions and scale in the Western countries, the calculation is made at $18.41/t. Unless the mining cost is lower than this value, the operation cannot be continued. Energy conservation, improvement in productivity (personnel cut) and reduction in welfare expenses needs to be examined.

- Yubileyno-Snegirihinskoye

This mine is developed for a maximum scale of 300,000 t/year. The mining and processing system are built for about $24,000,000. Though this mine is small, a good profit can be expected. It is desirable to complete the development within three years.

④ JSC "Zhezkent MCC"

- Orlovskoye

An investment should be made mainly in the machinery and facilities so that a stable operation can be maintained. The main theme is improvement in the copper recovery rate and zinc concentrate grade. Reprocessing of tailings is difficult because of problems in the establishment of technology and cost.

⑤ JSC "Zyryanovsk Lead Combine"

- Zyryanovskoye

Ore reserves are nearly exhausted and mining should be brought to an end. Preparations for dismantlement should be made without an investment to reduce deficits.

- Grehovskoye

The mining and concentration costs are at a normal cost level. Since the ore grade is low, the income is small. Therefore, the high grade ore in the ore reserves should be selected for mining.

- Maleevskoye

This is a first-class mine in terms of both ore reserves and grade. It should be developed as early as possible. A system with a maximum production of 1,500,000 t/year should be established with an investment of $80,000,000. Since the opening of this mine is the center of the non-ferrous metal industry promotion plan in Kazakhstan and the return on investment is high, funds can be easily obtained. This is one of the projects that the country should put its efforts.

2-2-3 Raw Material Supply Plan

(1) Polymetal

Raw materials of polymetal are found at the JSC "Tekeli Pb-Zn Combine" in Southern Kazakh, JSC "Sary-Arkapolymetal" in the central part, and the JSC "Achpolymetal" in Western Kazakh. The production of base metal in the regions other than Eastern Kazakh Region is in serious depression.

1) Polymetal Combine in the Southern and Western regions

- JSC "Tekeli Pb-Zn Combine" is scheduled to be slowly closed.

After its closure, processing is performed by a special legislation.

- JSC "Achpolymetal"

The Gluborskoye, Shalikiya, Mirgalimsay Mines, etc., and show poor profitability except for production only barite. The production of concentrate of base metal should be limited to only the production of barite. It should be separated from the entire raw material supply concept.

- Zhairem Mine

It has no concentration plant. Since railroad transportation of raw materials over a long distance to Tekeli or Achisai is not profitable, this system must be stopped. The freight rates have a rising trend. The transportation of crude ore to Tekeli, a distance of 1,100 km, costs about $8 per ton or $120 per ton of concentrate.

Profitability should be decided by reviewing the feasibility study mainly concerns the construction of a concentration plant at the mine site. The plan should be revised. If it is feasible, it should be added to the polymetal promotion plan.

2) Polymetal Combines in the East Kazakhstan Area

Sources of lead and zinc in Kazakhstan are unevenly distributed near the East Kazakhstan State. Since this region has two major lead and zinc smelters at Ust-Kamenogorsk and Leninogorsk · Irtysh Copper Smelter which are close to Russia so these combines have an advantage over others.

With the existing mines in operation in this region and deposits to be newly developed, a long-term production system can be established.

- 1996 to 2000

- The operating mines will continue but the preparations to gradually close the Shemonaihinskoye and Zryanovskoye Mines will be gradually made. Delay in stripping is corrected and improvement in transportation facilities in the lower levels, etc. are conducted in the Nicolaevskoye and Tishinskoye Mines, respectively to increase production. These three mines including Orlovskoye should provide the major production until the newly developed mines start production. Strict cost reduction, improvement in facilities, and repair and rationalization should be implemented.
- Preparations for a new mine should be started.

  The Maleevskoye, Artemyevskoye, Yubileyno - Snegirihinskoye should be top priority national projects as three major newly development projects.

- 2001 to 2005

- New developed mines will produce at full capacity and non-ferrous metal industry promotion plan is complete.
- Exploration should be reinforced to secure ore reserves 10 years later.
  Accumulated financial resources should be effectively used thorough favorable policies such as depletion deduction system, etc..
- Development of a deposit near Chekmar and Maleevskoye should be studied and preparations for development should be started.

- 2006 to 2010

  Since the major mines such as Nicolaevskoye, Tishinskoye, etc. have a decreasing production trend, increase the production from new deposits near the above-mentioned Chekmar and Maleevskoye.

3) General concept for production and processing of concentrate

- Production of polymetal will be carried out at five combines and 13 mines. In the period of 1996 to 2010, the income and expenditure for each mine (except Ridder) was calculated. The total income which included profitable and unprofitable mines was calculated at $5,000,000/15 years.
- If an investment in mine development and renewal of $235,000,000 (average $15,000,000 a year) is made during this period, total production activity can be continued.
- A mine sells concentrate to a smelter as a product (invoice). A smelter gains profit by the difference of its actual processing cost and metal price received based on the metal condition which depends on the recovery rate and its by-products. Also, the copper ore which cannot be processed in the Irtysh Copper Smelter is transported to the Balkhash Smelter and exported to foreign countries if necessary from the viewpoint of management of a mine.
- At present, there is no cost calculation system to show the difference between the raw material supply side and smelting side so it is necessary to make this clear. Under a management system of the Western countries, it is possible to clarify the problem. Kazakhstan does not have this system. Kazakhstan non-ferrous metal industry can not survive from the competition nor be managed under a free market system.
- It is desirable to closely follow the production system of a mining industry operating under a market economy and management techniques in the Western countries.
- It is desirable to establish an industry promotion policy for example favorable tax system for foreign capital when necessary and other support in the 1996 to 2010 period.
- Since the enterprises are related with each other, it is a very important matter to disclose and obtain information including the technology and management.

① Concentrate supply system

The raw supply system is different between JSC "UK Pb-Zn Combine" and JSC " Leninogorsk PC". JSC

"UK Pb-Zn Combine" has a custom smelter while JSC " Leninogorsk PC" has a smelter attached to the mines. The raw material supply resources for the JSCs are as follows:

	UK Pb-Zn Combine	(own mine)	Leninogorsk PC
(Buy ore)	Zyryanovsk Lead Combine		Tishinski
	Irtysh PC		Ridderski
	Zhezkent MCC		40 Years Lenin
	Karagailinski MCC	(Buy ore)	Zyryanovsk Lead Combine
	Achpolymetal		Akshatau Ken-Baiytu Combinaty
	Akshatau Ken-Baiytu Combinaty		Achpolymetal
	Tekeli Pb-Zn Combine		Ust-Talovsk

Both combines are managed by Ridder Invest Company in entrustment. It seems that the raw material has a planned distribution. Now the JSC " Leninogorsk PC" is supplies the ore mainly by its own mines and the rest is supplied by JSC "Zyryanovsk Lead Combine". It seems that another raw material are supplied to Ust-Kamenogorsk. This distribution of raw material is expected to have under mentioned effects.

- Clarification of raw material supply plan
- Clarification of production plan based on above
- JSC "UK Pb-Zn Combine" is located at an important point from surrounding mines so transportation is easy. In the case of raw material transportation to JSC "Leninogorsk PC", all raw materials are carried via Ust-Kamenogorsk so transportation is high.
- In case of zinc smelting, depending on kind and volume of impurity included in the raw material, it is necessary to change the operating method of the purification process. Therefore, the same raw material is easy used for the operation method. As a result, it is possible to reduce the cost and increase the purity.

② Other raw material supply

In case of zinc smelting, raw zinc oxide that is produced from the fuming process of lead smelting is used for raw material. Ust-Kamenogorsk and Shymkent lead smelting have fuming processes. Crude zinc oxide produced from fuming from Shymkent is treated at the JSC "UK Pb-Zn Combine". Now, it is better to continue this operation which is expected to have the below effects.

- Transportation cost to Ust-Kamenogorsk is cheaper than to Leninogorsk.
- The quality of crude zinc oxide is different between production from lead smelting fuming process an zinc smelting Waelz process. Now the crude zinc oxide, produced by the lead fuming process, is traded.

(2) Domestic Copper Production Plan

- The copper production plan is made under the below conditions.

The raw material supply is based on Table 2-2-3(1).

- Dzhezkazgan smelter treats only raw material from Dzhezkazgan and Zhilandinskaya Mine.
- Balkhash smelter will basically produce 150,000 tons per year regardless of the raw material supply situation.

- Irtysh copper smelter will produce only blister and increase the production to 65,000 tons per year starting in 2004.
- Ust-Kamenogorsk smelting and refining factory will increase its production from 2000 and it will treat 30,000 tons per year blister produced by Irtysh smelter.
- The rest of the blister produced at the Irtysh smelter that now goes to Ust-Kamenogorsk will supply the Balkhash smelter until 1999.
- Supply of Erdenet and Chile concentrate will continue until 1999.
- Some concentrate produced at Dzhezkent will be supplied to the Balkhash smelter and EKCChC concentrate will supply the Balkhash smelter until 1999. After 1999, Irtysh smelter capacity will be increased to 40,000 tons per year.

- Raw material supply and copper production plan is shown on Table 2-2-3(2) to (4).

Concentrate will be imported from foreign concentrators for example, Erdenet, Chile, etc., but there still is a lack of enough concentrate.

Even if concentrate imported from stable foreign concentrators, there will be a lack of concentrate for the planned copper metal production.

After 1999, it will be necessary to develop new resources. If it is possible to develop domestic copper mines, the copper production will be stable at 380,000-400,000 tons per year.

Table 2-2-3(1) Mine-Concentrator Production Plan (JSC "Zhezkazgantsvetmet" and JSC "Balkhashmed")

Combine	Mine Name	Ore Reserves (Kt, 1996) Grade	Mining	Dil. (%)	Re. (%)	Minable Ore Reserves (Kt, 1995) Grade	Metal Recovery in each Conc. (%)	Production & Metal Content (Kt/year) 1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2012	2014	2016	2018	2020	Total Production (Kt) (until 2035)	Remaining Reserves (Kt) (in 2035)
JSC "Zhezkazgantsvetment"	East Zhezkazgan	86,003	U/G	7	80	73,981		5,830	6,000	6,000	6,000	6,000	4,700	4,100	3,350	3,350	3,350	3,350	3,350	3,350	0	0	0	0	0	0	0	59,330	14,651
		Cu(%) 1.00				0.93	82	44	46	46	46	46	36	36	26	26	26	26	26	26	0	0	0	0	0	0	0	452	20%
		Pb(%)																											
		Zn(%)																											
		Ag(g/t)																											
	South Zhezkazgan	139,219	U/G	7	80	119,758		7,620	7,600	7,600	7,600	7,600	7,600	7,600	5,300	5,300	5,300	5,300	3,800	3,800	3,800	3,800	3,800	0	0	0	0	97,220	22,538
		Cu(%) 1.07				0.99	82	62	62	62	62	62	62	62	43	43	43	43	31	31	31	31	31	0	0	0	0	793	19%
		Pb(%)																											
		Zn(%)																											
		Ag(g/t)																											
	West Zhezkazgan	42,702	U/G	7	80	36,733		3,280	3,280	3,280	3,280	3,280	3,280	3,280	2,350	2,350	2,350	0	0	0	0	0	0	0	0	0	0	30,010	6,723
		Cu(%) 0.88				0.81	82	22	22	22	22	22	22	22	16	16	16	0	0	0	0	0	0	0	0	0	0	201	18%
		Pb(%)																											
		Zn(%)																											
		Ag(g/t)																											
	North Zhezkazgan	62,009	O/P	7	96	64,009		3,700	4,000	4,000	4,000	4,000	4,000	4,000	2,800	2,800	2,800	2,800	2,000	2,000	2,000	2,000	2,000	0	0	0	0	50,900	13,109
		Cu(%) 0.68				0.63	82	19	21	21	21	21	21	21	15	15	15	15	10	10	10	10	10	0	0	0	0	264	20%
		Pb(%)																											
		Zn(%)																											
		Ag(g/t)																											
	Annensky	134,200	U/G	7	80	115,441		2,350	2,350	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	2,800	2,800	2,800	2,800	2,800	2,800	2,000	2,000	91,900	23,540
		Cu(%) 1.25				1.16	82	22	22	38	38	38	38	38	38	38	38	38	38	27	27	27	27	27	27	19	19	876	20%
		Pb(%)																											
		Zn(%)																											
		Ag(g/t)																											
	Akchi-spassky	220,899	U/G	7	80	190,020		0	0	0	0	0	1,500	1,500	3,000	3,000	3,000	3,000	4,500	4,500	4,500	4,500	6,000	6,000	6,000	6,000	6,000	139,800	50,220
		Cu(%) 1.06				0.99	82	0	0	0	0	0	12	12	24	24	24	24	36	36	36	36	49	49	49	49	49	1,130	26%
		Pb(%)																											
		Zn(%)																											
		Ag(g/t)																											
	Zhilandin-skaya	121,000	O/P	7	96	124,903		0	0	0	0	0	0	0	0	0	0	2,500	2,500	5,000	5,000	5,000	5,000	5,000	5,000	3,500	3,500	99,500	25,403
		Cu(%) 1.37				1.27	82	0	0	0	0	0	0	0	0	0	0	26	26	52	52	52	52	52	52	37	37	1,040	20%
		Pb(%)																											
		Zn(%)																											
		Ag(g/t)																											
	Total	Production						22,782	23,230	24,880	24,880	24,880	25,080	22,780	20,800	20,800	20,800	20,950	20,150	21,450	18,100	18,100	19,600	13,800	13,800	11,500	11,500	568,660	
		Metal Content						169	172	189	189	189	191	191	162	162	162	172	167	182	159	159	169	128	128	105	105		
		Grade						0.99	0.99	0.93	0.93	0.93	0.93	1.03	0.95	0.95	0.95	1.00	1.01	1.03	1.05	1.05	1.05	1.13	1.13	1.11	1.11		
JSC "Balkhashmed"	Kounrad	212,000	O/P	7	97	221,118		7,800	8,000	8,000	8,000	8,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	5,600	5,600	4,000	4,000	4,000	176,600	44,518
		Cu(%) 0.33				0.31	75	18	18	18	18	18	9	9	9	9	9	9	9	9	9	9	13	13	9	9	9	406	20%
		Mo(%) 0.005				0.005																							
		Au(g/t) 0.015																											
		Ag(g/t) 0.62																											
	Sayak	7,400	O/P	40	95	11,717		2,000	2,000	2,000	1,400	1,000	1,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9,400	2,317
		Cu(%) 1.15				0.69	75	10	10	10	7	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	49	20%
		Mo(%) 0.004				0.002																							
		Au(g/t) 0.40																											
		Ag(g/t) 6.0																											
	Total	Production						9,800	10,000	10,000	9,400	5,000	5,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	5,600	5,600	4,000	4,000	4,000	4,000		
		Metal Content						28	28	28	25	14	14	9	9	9	9	9	9	9	9	9	13	13	9	9	9	9		
		Grade						0.35	0.34	0.34	0.32	0.34	0.34	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.28	0.28	0.27	0.27	0.27	0.27		
	Koktau		O/P			40,000		0	0	180	1,000	1,000	1,000	1,000	2,300	2,300	2,300	1,150	1,150	1,150	1,150	1,150	1,150	1,150	1,150	1,150	1,150	31,780	8,220
		Cu(%)				1.82	83	0	0	2	11	11	11	11	27	34	36	35	17	17	17	17	17	17	17	17	17	416	21%
		Mo(%)																											
		Au(g/t)				0.2																							
		Ag(g/t)																											
	Boshekul		O/P			116,000		0	0	0	3,500	3,500	7,000	7,000	7,000	7,000	7,000	7,000	4,900	4,900	4,900	4,900	4,900	3,500	3,500	3,500	3,500	139,300	36,700
		Cu(%)				0.65	86	0	0	0	20	20	39	39	39	39	39	39	27	27	27	27	27	20	20	20	20	779	21%
		Mo(%)																											
		Au(g/t)																											
		Ag(g/t)																											
	Actogay	1,445,018	O/P	4	95	1,430,000		0	0	0	0	0	0	0	0	0	0	9,000	9,000	18,000	18,000	18,000	18,000	27,000	27,000	36,000	36,000	828,000	602,000
		Cu(%) 0.384				0.37	90	0	0	0	0	0	0	0	0	0	0	34	34	75	75	76	76	102	102	138	120	2,873	42%
		Mo(%) 0.008				0.008																							
		Au(g/t) 0.030				0.029	51																						
		Ag(g/t)																											

Metal contents in concentrate :

Cu Total	197	201	219	245	234	255	250	237	244	249	259	254	310	284	289	302	276	278	287	211
JSC "Zhezkazgantsvetment"	169	172	189	189	189	191	191	162	162	162	172	167	182	158	159	169	128	128	105	105
JSC "Balkhashed"	29	29	30	56	45	64	59	75	82	84	114	87	128	126	130	133	148	148	182	106

Table 2-2-3(2) Raw Material Supply-Copper Production Forecast (1996-2010)

		1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Concentrate Production:																
(Contained Cu T.T.) Total	E. Kazakhstan	72	76	84	100	115	128	132	130	127	128	126	125	130	129	119
	JSC "Zhezkazgantsvetmet"	169	172	189	189	189	191	191	162	162	162	172	167	182	156	156
	JSC "Balkhashmed"	28	28	28	25	14	14	9	9	9	9	9	9	9	9	13
	Koktau-Chilisai			3	15	15	15	15	35	35	35	35	17	17	17	17
	Boshekul				20	20	39	39	39	39	39	39	27	27	27	27
	Aktogai											34	34	75	75	76
	Total	269	276	304	349	353	387	386	375	372	373	415	379	440	413	408
Concentrate Supply to:																
(Contained Cu T.T.)	JSC "Zhezkazgantsvetmet"	169	172	189	189	189	191	191	162	162	162	172	167	182	156	156
	JSC "Balkhashmed"	74	75	86	127	119	109	104	124	124	124	158	128	169	169	174
	JSC "Irtysh PC"	22	26	31	36	41	41	52	62	67	67	67	67	67	67	67
	Total	265	273	306	352	349	341	347	348	353	353	397	362	418	392	397
Balance of Supply-Demand																
(Contained Cu T.T.)		4	3	-2	-3	4	46	39	27	19	20	18	17	22	21	11
Concentrate Import From:																
(Contained Cu T.T.)	Erdenet	30	25	20	15											
	Chile	25	20	20	15											
	Others	12	18	9	9	26	46	51	31	31	31		27			
	Total	67	63	49	39	26	46	51	31	31	31		27			
Blister Supply from JSC "Irtysh PC" to:																
(Contained Cu T.T.)	JSC "UKPb-Zn Combine"	7	8	10	15	30	40	50	60	65	65	65	65	65	65	65
	JSC "Balkhashmed"	14	17	20	20	10										
	Total	21	25	30	35	40	40	50	60	65	65	65	65	65	65	65
Cathode Production	(T.T.)															
(Smelter Recovery 97%)	JSC "Zhezkazgantsvetmet"	164	167	183	183	183	185	185	157	157	157	167	162	177	151	151
	JSC "Balkhashmed"	150	150	150	169	150	150	150	150	150	150	153	150	164	164	169
	JSC "UKPb-Zn Combine"	7	8	10	15	30	40	50	60	65	65	65	65	65	65	65
	Total	321	325	343	367	363	375	385	367	372	372	385	377	406	380	385

Table 2-2-3(3) Raw Material Supply-Lead Production Forecast (1996-2010)

		1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Concentrate Production:																
(Contained Pb T.T.) Total	JSC "EKCChC"				3	7	14	14	14	14	14	14	14	14	10	10
	JSC "Leninogorsk PC"	10	11	11	12	12	12	12	12	10	10	10	10	8	8	7
	JSC "Irtysh PC"	2	2	2	3	4	4	4	4	3	3	3	3	3	3	3
	JSC "Zyryanovsk Lead Combine"	6	9	6	5	8	9	11	11	11	11	11	11	11	11	8
	Chekmar							3	5	10	15	15	15	15	15	15
	Maleevsky Yar											1	3	5	7	7
	Total	18	22	19	23	31	39	44	46	48	53	54	56	56	54	50
Battery Scrup																
(Contained Pb T.T.)		24	25	27	29	32	32	32	32	32	32	32	32	32	32	32
Raw Material Supply to:																
(Contained Pb T.T.)	JSC "Leninogorsk PC"	24	25	27	29	32	32	32	32	32	32	32	32	32	32	32
	JSC "UKPb-Zn Combine"	18	22	19	23	31	39	44	46	48	53	54	56	56	54	50
	JSC "Shymkent Lead Plant"															
	Total	42	47	46	52	63	71	76	78	80	85	86	88	88	86	82
Balance of Supply-Demand																
(Contained Pb T.T.)		-31	-25	-28	-24	-16	-8	-9	-7	-10	-10	-9	-1	-1	2	-2
Concentrate Import From:																
(Contained Pb T.T.)	Almalik	32	32	42	47	53	53	53	53	53	53	53	53	53	53	53
	Others	31	25	28	24	16	8	9	7	10	10	9	1	1		2
	Total	63	57	70	71	69	61	62	60	63	63	62	54	54	53	55
Lead Production (T.T.)																
(Smelter Recovery 95%)	JSC "Leninogorsk PC"	23	24	26	28	30	30	30	30	30	30	30	30	30	30	30
	JSC "UKPb-Zn Combine"	47	45	45	45	45	45	50	50	55	60	60	55	55	50	50
	JSC "Shymkent Lead Plant"	30	30	40	45	50	50	50	50	50	50	50	50	50	50	50
	Total	100	99	111	118	125	125	130	130	135	140	140	135	135	130	130

Table 2-2-3(4) Raw Material Supply-Zinc Production Forecast (1996-2010)

		1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Concentrate Production:																
(Contained Zn T.T.) Total	JSC "EKCChC"	23	25	30	42	56	85	82	79	79	79	72	72	72	55	55
	JSC "Leninogorsk PC"	63	70	70	80	80	80	80	80	73	73	73	73	55	55	55
	JSC "Irtysh PC"	15	14	14	23	33	36	36	34	31	31	31	22	22	22	22
	JSC "Zhezkent MCC"	13	13	15	18	18	18	18	18	18	18	18	18	18	18	18
	JSC "Zyryanovsk Lead Combine"	38	39	41	40	62	74	91	91	91	91	91	91	91	91	62
	Chekmar							8	17	34	51	51	51	51	51	51
	Maleevsky Yar											12	23	47	58	58
	Total	152	161	170	203	249	293	315	319	326	343	348	350	356	350	321
Concentrate Supply to:																
(Contained Zn T.T.)	JSC "Leninogorsk PC"	75	75	80	90	100	100	106	106	111	119	111	106	100	94	89
	JSC "UKPb-Zn Combine"	77	86	90	113	144	156	166	183	194	207	200	200	194	194	161
	Total	152	161	170	203	244	256	272	289	305	326	311	306	294	288	250
Balance of Supply-Demand																
(Contained Zn T.T.)		-32	-50	-47	-30	5	37	43	30	21	17	37	44	62	62	71
Zinc Production (T.T.)																
(Smelter Recovery 95%)	JSC "Leninogorsk PC"	80	90	85	90	90	90	95	95	100	107	100	95	90	85	80
	JSC "UKPb-Zn Combine"	86	100	110	120	130	140	150	165	175	186	180	180	175	175	145
	Total	166	190	195	210	220	230	245	260	275	293	280	275	265	260	225

2-2-4 Production Plan of Metal

Table 2-2-2(1) shows the results of an operation plan of a smelter based on the mining plan shown in Table 2-2-4(1).

Copper, lead and zinc can be produced by the present production capacity. However, since No. 2 electrolysis plant now out of operation in Ust-Kamenogorsk must be put into operation in the middle period, the expenses for maintaining this plant are required. On the other hand, the production of copper in a polymetal mine will double the present level.

Therefore, it is necessary to examine improvement, expansion and construction of the copper smelting facilities in Gulbokoe, Ust-Kamenogorsk, and Balkhash.

Table 2-2-4(1) Production plan

	Early period (1996 to 2000)		Middle period (2001 to 2005)	Latter period (2006 to 2010)
1. Amount of production	1996 (T/Y) (S document)	2000 (T/Y) (Estimate)	2005 (T/Y) (Estimate)	2010 (T/Y) (Estimate)
Lead SHYMKENT	30,000	50,000	— — ALMALIC, Toll, Lead slag — 50,000	— — ALMALIC, Toll, Lead slag — 50,000
UST-KAMENOGORSK	47,000	— — KAZAKHSTAN — — 45,000	— — KAZAKHSTAN — — 60,000	— — KAZAKHSTAN — — 50,000
LENINOGORSK	23,000	Battery scrap 30,000	Battery scrap 30,000	Battery scrap 40,000
Total	100,000	125,000	140,000	140,000
			Amount of production at mines≒ 60,000 (peak period)	Amount of production at mines≒ 50,000
Zinc UST-KAMENOGORSK	86,000	130,000	186,400	145,000
LENINOGORSK	80,000	90,000	106,500	80,000
Total	166,000	220,000	292,900	225,000
			Amount of production at mines≒300,000 (peak period)	Amount of production at mines≒225,000
Copper UST-KAMENOGORSK	6,600	30,000	65,000	65,000
* Sulfuric acid	267,500	393,500	565,800	472,500
2. Facility plan				
(1) Roasting plant facilities				
UST-KAMENOGORSK			<--------->	<--------->
LENINOGORSK	<--------->			<--------->
(2) Sulfuric acid facilities				
SHYMKENT			<--------->	
UST-KAMENOGORSK	<--------->			
LENINOGORSK	<--------->			<--------->
GULBOKOE	<--------->			
(3) Installation of sulfur burning facilities	<--------->			
(4) Copper electrolytic facilities in UST-KAMENOGORSK	<--->			
(5) Copper smelting facilities in GULBOKOE			<--------->	
(6) Proper facilities plan in SHYMKENT	<--------->			
3. Process improvement plan				
(1) JAROSITE process in LENINOGORSK	<--->			
4. Quality improvement plan	<--------->			
5. Establishment of management technology system	<--------->			
6. Establishment of cost management system	<--------->			

* The production ratio of sulfuric acid to metal is assumed as follows:

Copper	2.0
Lead	0.5
Zinc	1.3

2-2-5 Production Situation of the Sulfuric Acid

The production plan of sulfuric acid cannot be made by judging only the market situation because sulfuric acid production is a by-product from the smelting of non-ferrous smelter.

Based on report of survey team about the mineral resources and smelters in Kazakhstan, the amount of sulfuric acid that will be produced as a by-product is about 1,000,000 tons a year in 2000 (estimated value) which is nearly equal to the production in 1995 to 1996. The current production of sulfuric acid is made from pyrite and sulfur is about 480,000 tons. This oversupply problem can be solved.

If sulfur fixed rate is increased, sulfur production will also increase and cause an over supply on the market. In this case, the sulfur dioxide exhaust gas from the smelter is changed to gypsum and sold on the market.

The balance of sulfuric acid in fiscal 1994 to 1995, Kazakhstan exported 25% of the total domestic production in fiscal 1994 and imported 6% of the consumption the following year. However, as shown in the following export/import data, considering that the land is vast and the production and consumption places (chemical industrial area) are far apart, a judgment cannot be made only from the domestic supply demand balance.

Export/import statistics of sulfuric acid in Kazakhstan in FY 1992

Export Russia	30,000 ton	Import Russia	599,000 ton
Turkmenistan	81,000	Kyrgyzstan	32,000
Ukraine	1,000	Tadzhikistan	1,900
		Uzbekistan	13,000
		Estonia	2,100
Total	112,000 ton	Total	648,000 ton

(Data on Customs Clearance in Kazakhstan Trading Bureau)

According to the data, the actual exports and imports of sulfuric acid totaled 760,000 tons, but the difference between the imports and exports were only 536,000 tons as indicated according to statistical information.

Sulfuric acid is a liquid powerful agent that may require a tank or tank truck having a special structure for its storage and transportation. As for supply and demand, it is reasonable that a consumer selects a stable supplier because of such factors as period, transportation distance, transportation condition, etc.. Therefore, under these circumstances, the responsibility of supplier was not fulfilled. Due to a decline in the non-ferrous smelting industry, they were not responsible for the sulfuric acid deliveries. In this situation, the phosphate fertilizer producing companies which are the main consumer of sulfuric acid could not operate continuously. If this condition continues, these customers will depend on foreign makers as a stable supplier. In the worst case, the domestic production base is transferred to a foreign country.

When examining the supply demand balance of sulfuric acid, it should be considered that it is difficult to store so it is better to supply the sulfuric acid for not only the annual production but also seasonal factors which are

included in the production/demand plan that will be made. In case of Japan, shipments of sulfuric acid for the fertilizer industry vary greatly due to a seasonal fluctuation in the consumption of fertilizer. If there is also a similar fluctuation in Kazakhstan, considering the market structure in which most of the consumption for industrial use depends on the fertilizer industry, it is necessary to secure a stable market by developing and nurturing other new markets.

In order to have a stable market and make a plan for the future of supply and demand of sulfuric acid, a stable continuing operation on the supply side is the biggest factor. It is the most important for each non-ferrous metal smelting company and each combine to gain the confidence of consumers in aspects of quality, delivery, price, and quantity.

Reference data (Supply demand of sulfuric acid in Russian economic bloc)
From International Trade Committee SULPHER Working Party.

New Sulfuric Acid Production (1000 Tons As 100% H_2SO_4)

	1992				1993			
	Ele.-S	Pyr.	Smel.	Total	Ele.S	Pyr.	Smel.	Total
Russia	6000	1650	1400	9050	5390	1650	1200	8240
Ukraine	3000	0	0	3000	1850	0	0	1850
Others	3044	1250	980	5274	2285	450	1335	4070
Former USSR	12044	2900	2380	17324	9525	2100	2535	14160

Sulfuric Acid Consumption (1000 Tons As 100% H_2SO_4)

	1992				1993			
	Total P-Fert.	Total Fert.	Non Fert.	Total	Total P-Fert.	Total Fert.	Non Fert.	Total
Russia	6029	7217	1834	9050	5453	6445	1795	8240
Ukraine	1336	1699	1032	2731	642	911	899	1770
Others	2560	2995	2278	5274	1737	2036	1982	4018
Former USSR	9925	11911	5144	17055	7832	9392	4636	14028

Kazakhstan is included in others and the production in 1993, is 1,179 tons, accounted for about 30% of others.

2-2-6 By-products Related to Polymetal

(1) Bismuth

Bismuth production at Shymkent is below. Ust-Kamenogorsk produces a 12% bismuth lead alloy. Our survey team did not receive information on quality but it seems that bismuth is produced by electrolysis refining and dry refining methods so a high purity of bismuth is produced. Bismuth production is as follows.

Production (kg)	1994	1995 (10 months)	
Shymkent	82,067	37,300	
Ust-Kamenogorsk	29,300	33,300	12% bismuth lead

Recently, the world bismuth production is 3,100~3,200 tons while Japan's production is about 500 tons. In Japan, bismuth is produced as a by-product from lead production. Since there is a reduction of lead smelting plants, it is not expected that bismuth will be produced from new raw material. In Kazakhstan, it also seems the lead smelting plants are decreasing so bismuth production is not expected to increase. There is no big change in demand for bismuth. The 1995 demand in Japan is below. The forecast is not clear but now bismuth is used for electronics and catalysts.

	Percentage(%)	Note
Electronic industry	44.0	ferrite, blister, semi-conductors
Alloy, additive	25.5	Aluminum, malleable cast iron
Alloys	3.1	low melting temperature
Medicine	1.4	
Catalyst	4.9	
Others	21.0	
Total	100.0	

In case of electronics and the catalyst industry, it is necessary to increase the purity. The purity in Japan is shown below.

Bismuth (%)	Ag	Pb	Cu	Fe (ppm)
≧99.999	3	3	1	1

(2) Cadmium

The amount of production and quality (standard) in JSC "UK Pb-Zn Combine" and JSC "Leninogorsk PC" are below.

Production (1,000 kg)	1994	1995 (10 months)
Ust-Kamenogorsk	601	381
Leninogorsk	746	291

Quality Standards	Cd	Zn	Pb	Fe	Cu	Tl (%)
Ust-Kamenogorsk Standard	99.96	0.0004	0.02	0.0002	0.01	0.001
Leninogorsk Standard	99.96	0.0004	0.02	0.002	0.01	0.003
Japan Standard	>99.99	<0.002	<0.006	<0.002	<0.003	
Japan Actual A	99.996	0.0001	0.0016	0.0001	0.0012	
Japan Actual B	99.998	0.00004	0.0006	0.00004	0.0005	

Cadmium production for the world and Japan are 18,000-20,000 ton as and 2,600 tons, respectively. Cadmium is produced as a by-product from zinc production so cadmium production depends on zinc production. From the 1970's, cadmium was considered as a health hazard. The demand for cadmium has greatly changed. It was used mainly for material for plating, pigment and as a stabilizing agent for the processing of vinyl chloride. However, this demand has been reduced drastically because of the health problem so a surplus condition developed. Recently, the western countries especially Japan are depending on the development of cadmium for battery use. The cadmium situation has changed from a surplus to it being imported. The 1995 demand in Japan is below. Now, demand for batteries use is expected.

	Percentage(%)	Note
Battery use	83.7	
Pigment	6.1	
Alloy	3.0	
Vinyl Chloride (as a stabilizing agent)	0.0	in 1994, 0.3%
Plating	0.0	in 1994, 0.4%
Others	7.2	
Total	100.0	

If Kazakhstan intends to use cadmium for battery use but its quality is poor. The Kazakhstan method of purification is able to highly purify the cadmium so it seems it can strengthen the process control.

(3) Zinc Oxide

The survey team did not investigate the zinc oxide manufacturing process. However, Kazakhstan side has big expectations for zinc oxide production so the survey team checked the quality by information it received. In Japan, the standard B is not used. The main use of zinc oxide are rubber and electronics. etc.,

Production

Ust-Kamenogorsk	not clear
Leninogorsk	about 1,500 t/year

Quality standard

	ZnO	Zn	Pb	As_2O_3	Cl	I-HCl	Water Soluble (%)
Ust-Kamenogorsk	>95.0						
Leninogorsk Standard A	>98.0	<0.05	<0.3	<0.1	<0.05	<0.2	<2.0
Leninogorsk Standard B	>95.0	<0.1	<0.5	<0.1	<0.05	<0.02	<2.0
				Cd			
Japan Standard A	>99.5		<0.03	<0.01			
Japan Standard B	>99.0		<0.3	<0.1			

In Japan, zinc oxide production is about 70,00 tons per year with demand in 1994 as follows.

	Percentage(%)	
Rubber	50.4	
Paint	3.6	
China & ceramics	2.0	
Medicine	0.1	
Glass	1.7	
Pigment	0.9	
Others	41.3	electronics, etc.,

In Japan, from the viewpoint of pollution control, the zinc oxide used for rubber is of high purity and electronics need to be higher purity.

(4) Lead Oxide

Shymkent and Iitysh produced lead oxide (litharge, red lead). The first step in the process is the molten lead metal becomes litharge by air oxidation. Next, the litharge becomes red lead by oxidation in the kiln. At both combines, the demand of the litharge is small so all the litharge is changed to red lead and sold.

Product and quality standards are shown below.

Production

Shymkent 3,800-4,000 tons per year

Irtysh 1,500 tons per month (capacity)

Production Standards

		PbO	Met.Pb	PbO_2	Fe	Moisture	on Screen (%)
Gulbokoe Litharge Standard	Residue	>98.7	<0.5	<0.2	<0.005	<0.3	<0.3
		PbO_2	Pb_3O_4+PbO				
Shymkent Red Lead Standard		74.5	26.0				

Production Standards						Cu
Japan Standard Litharge	Residue	>99.5		<0.001	<0.1	<0.002
		Pb_3O_4	T-Pb		Moisture	
Japan Standard	Red Lead	>97.0	>90.0		<0.1	

The production of litharge and red lead is not understood. The Japanese production of litharge and red lead are 38,000 and 9,000 tons, respectively. The demand according to use is below.

	Red lead	Litharge (%)	
Paint	35.7		
Glass Tube	6.2	50.0	
Ceramics	11.8	0.1	
Optical Glass	5.2	3.1	
Glass	8.7	5.2	
Battery	5.7		
Vinyl Chloride		28.6	
Production Stabilizing Agent			
Dry Agent		0.6	
Pigment		5.4	
Rubber		0.6	
Other	26.7	6.4	electronics
Total	100.0	100.0	

In the near future, the demand of lead oxide is expected to increase for the use of tube bowl glass and electronics. At the same time, the recycling of lead oxide is increasing which means that new lead consumption is not expected. It is necessary to consider higher purification.

(5) Others

The survey team could not receive information about the manufacturing process and product quality of the under mentioned products. Under these circumstances, we can not comment on the below mentioned products. Therefore, we referred to the product standards described in the company catalogue.

1) Product Standard

Indium (%) (ppm)

In	Fe	Cd	Cu	As	Ni	Sn	Hg	Pb	Tl	Zn
>99.97	<10	<40	<10	<10	<0.5	<20	<50	<50	<10	<30

Thallium (%) (ppm)

Tl	Fe	Cd	Cu	Pb	Zn
>99.98	<10	<30	<30	<100	<30

Selenium (%) (ppm)

Se	Fe	Cu	Pb	Hg	As	S	Al
>99.0	<100	<50	<50	<50	<50	<200	<50

Tellurium (%) (ppm)

Te	Se	Pb	Cu	Al	Fe	Ag	Sn	S
>99.96	<100	<10	<20	<8	<10	<10	<30	<200

Zinc Sulfate (%)

Zn	Fe	Mg	Cu	Cl
>30.0	<0.5	<1.4	<0.02	<0.2

2) Comment

◎ Indium

The world demand is about 50-60 tons per year. In Japan, almost all the amount of is used for electronics industry with other uses being alloys and accessories. The quality for electronic use is below. Kazakhstan's quality is not used for this demand.

(%) (ppm)

In	Fe	Cd	Cu	Sn	Pb	Ti	Zn	Al
>99.99	<5	<10	<5	<30	<15	<10	<5	<5

◎ Thallium

There is no production in Japan. It is used to effectively improve the glass characteristics but it is very poisonous. Therefore, customer use is very difficult.

◎ Selenium

The total production in the western countries is about 1,800 tons but in Japan, it is 600 tons. Selenium is produced as a by-product of copper. The 1995 demand in Japan is shown below.

	Percentage
Electronics Industry	45.6
Glass	6.8
Chemicals	5.3
Pigment	5.1
Others	37.2
Total	100.0

The quality of selenium made in Japan is below.

	(%)								(ppm)
	Se	Fe	Cu	Te	Mg	Ni	Mn	Al	Ag
Electronics	>99.995	<0.5	<0.5	<0.5	<0.1	<0.5	<0.1	<0.5	<0.1
Glass	>99.9								

This quality is unsuitable for the electronics industry.

◎ Tellurium

The total production in the western countries is not clear. Japan produced 60 tons per year. The tellurium demand is for free cutting steel and chemicals. The production quality of Kazakhstan is sufficient for these uses but in the near future the electronic industry use is considered. Higher quality is needed for the electronics industry.

◎ Zinc Sulfate

In Japan, zinc sulfate production is 20,000 tons per year. The demand is mainly for synthetic fibers and other uses are for plating and mineral processing agent. The necessary quality differs according to the use. The quality made in Japan is low.

$ZnSO_4$	Fe	Mn	Cl	(%)
>55.0	<0.003	<0.005	<0.05	

2-2-7 Gold and Silver

In Kazakhstan, the matter of gold and silver is a national secret but the survey team did receive some information on production. At the JSC "UK Pb-Zn Combine", we could see silver refining process, Moebius method. We could not see the gold refinery process but it seems that the Wohwill method is adopted. The Kazakhstan side did not disclose the slime parting process. This process has very compact equipment. This parting process is very important because it is related for the recovery of platinum, palladium and osmium. Production and quality of gold and silver are below.

Production	1995	Jan-Sept 1996
Gold	10,070 kg	7,811 kg
Silver	370,992	312,319

Quality Standards

	(%)										(ppm)				
	Au	Ag	Cu	Pt	Pd	Pb	Fe	Zn	Bi	Sn	Mg	Cr	Ni	Sb	Rh
Gold	>99.990	<50	<10	<10	<30	<10	<10	<10	<10	<10	<5	<5	<5	<10	<10

	(%)								(ppm)
	Ag	Au	Cu	Pt+Pd	Pb	Fe	Zn	Bi	Te	Rh
Silver	>99.990	<6		<10	<20	<10		<10	<2	

(1) Gold

The 1995 world gold production is 2,272 tons. The production for CIS countries, Russia and Uzbekistan was 227 tons, 142 tons and 64 tons, respectively. Production, product quality and demand in Japan are shown below. Kazakhstan's gold needs more purification if it is used in industry.

Production	1993	1994	1995
	106,427 kg	103,108 kg	117,749 kg

Quality (%)

	Au	Ag
Gold	>99.997	<0.0005

Demand	Percentage
Health(dentistry)	4.9
Industry	17.8
Accessory	30.1
Art	0.8
Private possession	36.4

Other	10.0
Total	100.0

(2) Silver

The world silver production was 20,000 tons in 1995. Production, product quality and demand in Japan are shown below. Kazakhstan's silver needs more purification if it is used in industry and photography.

Production	1993	1994	1995
	2,148,460 kg	2,006,975 kg	2,059,795 kg

Quality	(%)				(ppm)
	Ag	Cu	Pb	Fe	Bi
Silver	>99.999	<2	<1	<1	<1

Demand	Percentage
Photography	50.3
Industry	31.2
Accessory	2.0
Dentistry	1.6
Other	14.9
Total	100.0