THE GOVERNMENT OF THE PEOPLE'S REPUBLIC OF CHINA, THE GOVERNMENT OF MONGOLIA AND ASIAN DEVELOPMENT BANK

FACILITATING ECONOMIC COOPERATION IN EASTERN PARTS OF INNER MONGOLIA AUTONOMOUS REGION, PRC AND MONGOLIA

MINERALS MARKET ASSESSMENT

Prepared by:

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Political Stability
Law and Order
Attitude to Foreign Investors
Bureaucratic Efficiency
INVESTMENT CLIMATE
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Right to Repatriate Proceeds
Management Control/Equity Control
Fixed Tax Terms
Modern Minerals Legislation
Fixed Rules for Life of Mine
Guaranteed Arbitration

HOW WELL DOES MONGOLIA MEET THE NEEDS OF THE MINING INVESTOR?
GEOLOGICAL RISK
POLITICAL RISK
Political Stability
Law and Order
Attitude to Foreign Investors
Bureaucratic Efficiency
INVESTMENT CLIMATE
Right to Mine
Right to Repatriate Proceeds
Management Control
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INTRODUCTION

1. This Report is prepared by Transportation and Economic Research Associates, Inc, (TERA) pursuant to the terms and conditions of the consulting services contract (No. COCS/02-592) between the Asian Development Bank (ADB) and TERA dated July 10, 2002. The Report:
   - Estimates the market potential of mineral resources in the Project Area;
   - Identifies mineral resources;
   - Evaluates technical and financial feasibility of mineral extraction; Estimates market potential by timeline; and
   - Evaluates existing policy framework for minerals extraction in Mongolia and develops appropriate policy recommendations.

2. Mongolia has tremendous geological potential to become a major producer and exporter of minerals. There are substantial deposits of copper, molybdenum, gold, uranium, lead, zinc, zealots, rare earth elements, ferrous metals, fluorspar, phosphate and precious and semi-precious stones. Several major mining operations were developed before 1989 with the assistance of the Soviet bloc countries, but in recent years a few private-sector mining companies have commenced operations.

3. Mining is Mongolia's single largest industry, and is one of the few sectors of the economy that has not only survived the difficult economic transition of the past decade, but actually expanded. The mining sector now accounts for about 20% 50% of GDP and 86%- 45% of export earnings[1] (see appendix D)

4. Most of the expansion in the mining sector has taken place since the adoption of the "Minerals Law of Mongolia" in 1997. However, due to Mongolia's long political isolation and general lack of required infrastructure (roads, railways, access to electric power) many mineral deposits with economic potential remain undeveloped.

5. In recent years, gold mining has emerged as a high growth sector. Gold production has grown ten-fold from 1993 to 2000 and this trend is expected to continue for the foreseeable future as a result of new exploration and investment.

6. Mongolia also has substantial proven reserves of coat but these remain undeveloped due to the lack of infrastructure. Most of the current coal production is used for electricity and steam generation,

7. Mongolia also has the potential to become a significant oil exporter and there is currently one operating oil field in the eastern part of the country. Limited amounts of crude oil are currently being exported to China.

8. This document focuses principally on the potential mineral development in the three eastern aimags of Dornod, Hentii and Sukhbaatar. Due to geography and the rising demand in PRC for mineral products, the logical market for Mongolia's mineral production from these three eastern aimags is PRC. A railway would provide reliable low cost transportation from the three aimags to the Xinganmeng prefecture and beyond into other parts of PRC for consumption or export. Alternatively, a good all-weather paved highway could be used but the higher transportation costs will certainly result in less mineral development.

WHAT MAKES A SUCCESSFUL MINING INDUSTRY?

9. Many developing (and developed) countries rely on mining to make an important

contribution to their economies. In order to have a viable mining industry, the following basic components must exist, however:

- Good mineral potential;
- Stable and workable minerals-related laws that guarantee secure tenure and transfer rights for license holders;
- Stable investment climate;
- The right for foreign companies to repatriate profits;
- Acceptable rates of taxation and royalties;
- Basic pre-existing infrastructure in the form of highways, railways[2] (see appendix D) and electric power;
- Supportive government policies; and
- Transparent regulatory framework governing licensing and operations with predictable enforcement.

BENEFITS DERIVED FROM THE MINING INDUSTRY

10. For developing countries such as Mongolia, mining can be a very important industry. It brings with it social infrastructure in the form of hospitals, schools, housing as well as high-paid employment and skills training for employees. The earnings from both the direct mine employees and the "support" or indirect employees usually result in significant economic development in the affected region. In addition to the direct jobs created in the construction and operation of a mine, there are additional jobs created to support mining operations. This is called the "multiplier effect". For instance, in Australia, it is estimated that 2.7 additional jobs in other industries are created for each direct mining job; the multiplier is therefore 3.7 including the direct mine-site jobs. In Chile the multiplier is 4.3 and in India 6. In the mature mining state of Nevada, USA, which has existing infrastructure and support, services, the multiplier is 3. Some of these jobs are in the immediate vicinity of the mining project; for example teachers, policemen, retail clerks, etc. Other jobs are further away from the project site; for example governmental employees in the national capital and the province capital, private sector employees at the warehouses and maintenance facilities of equipment suppliers, etc. Therefore, the multiplier effect improves the provincial and national economy in every sector.[3] (see appendix D)

INFORMATION SOURCES AND METHODOLOGY

11. Information used in this minerals assessment is derived principally from two sources: interviews with both private-sector and government personnel and documents provided by them as well as other studies and reports collected throughout the study, A full listing of individuals interviewed or meetings conducted is included in Appendix A.

12. In the time available for this study it was not possible to generate original data regarding the occurrence of minerals and associated reserves in the three aimags. Therefore, the report relies on information gathered from individuals in government and the private sector as well as published reports and data.

13. The Mongolian Geological Survey, in conjunction with geological survey teams from several other countries, has been actively conducting mineral exploration in Mongolia since the 1960s. These geological field expeditions have produced a vast body of information on the geology of Mongolia, including about 5,000 geological reports most of which are available to the public. Interested mining investors have reviewed these geological reports and have taken out either Exploration Licenses or Mining Licenses[4] (see appendix D) on certain properties.

14. Therefore, working on the assumption that the most promising properties have already been acquired by private investors in this manner, the Consultant arranged to meet with the private investors holding licenses in the three aimags to discuss the geological and other technical data on their respective properties. This information forms the principal basis of the assessment of the potential of the three aimags to become producers of mineral products. In a sense, these properties would form the first generation of future mines.

15. However, the Consultant recognizes that due to the severe lack of infrastructure in the three aimags, this has likely resulted in certain properties with high mineral potential not being acquired by private investors. Therefore, to compensate for this possible oversight, the overall geological potential of the three aimags was assessed to identify promising regions, which would form the second generation of mining activity.

16. To assess the investment climate, the Consultant interviewed government personnel and mining investors. The mining investors included both Mongolian and foreign companies with either active projects {i.e. investment is already underway) or inactive projects. This provided a good cross-section of experience and opinions. In addition, relevant government documents were reviewed and selectively compared with those in other countries where similar projects have been performed [5] (see appendix D).

17. The market potential was assessed by visiting Xinganmeng Prefecture and interviewing government officials and potential consumers. Also, relevant documents, which forecast future demand for mineral products, were reviewed.

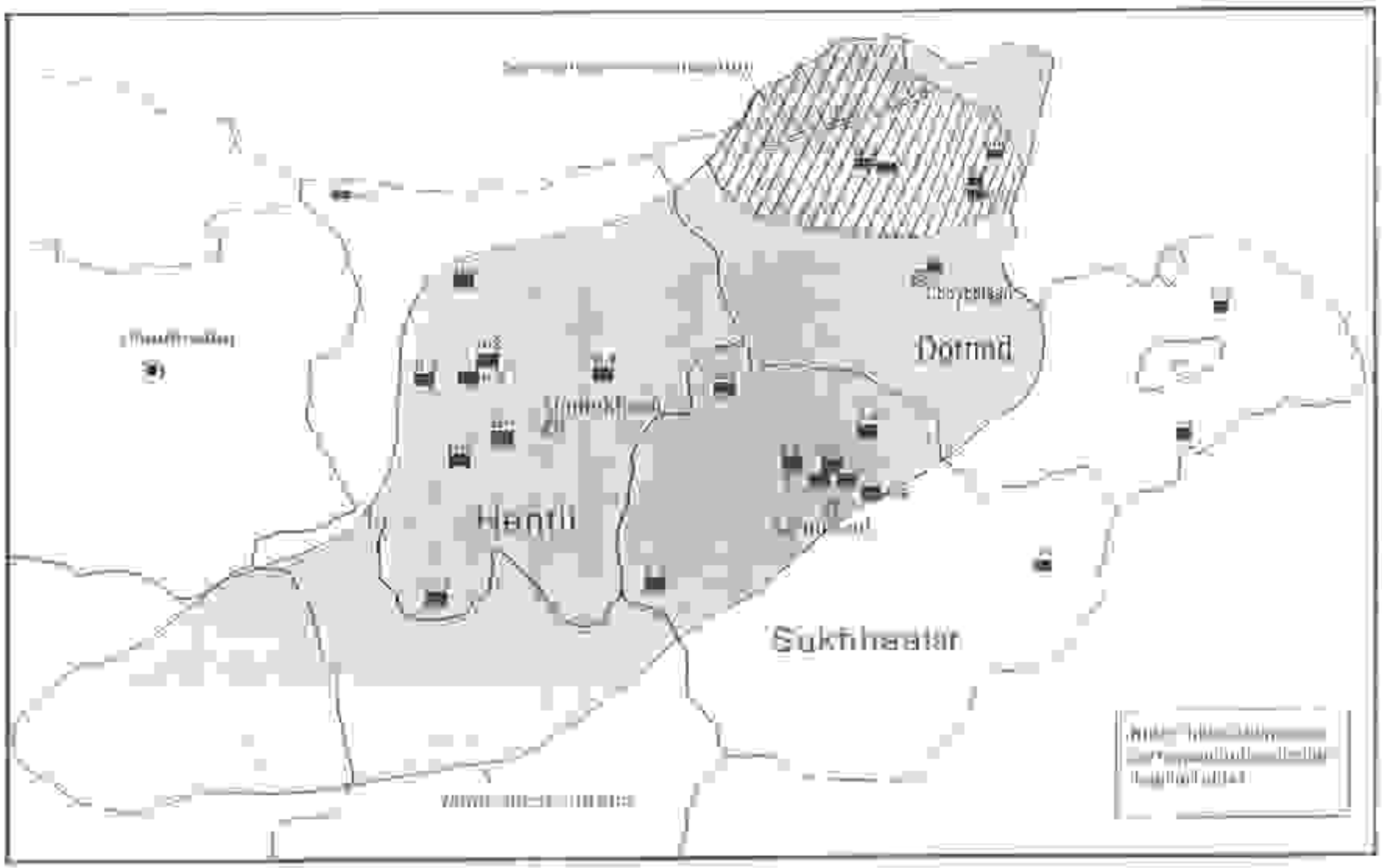
HIGH PRIORITY PROPERTIES FOR FUTURE DEVELOPMENT

18. Based on public information, all of the mineral deposits that have been identified in the three aimags forming the Project Area are indicated on Figure 1 and are listed in Table 1. Appendix B lists the interviews conducted and primary sources of information used by the Consultant in evaluating the minerals development and export potential from the Project Area in Mongolia.

Table 1: Mineral Deposits in the Mongolian Project Area

Dornod Aimag	Sukhbaatar Aimag	Hentii Aimag
D1 Aduunchuluun coal	S1 Tumurtiin ovoo zinc	H1 Chandgan tal coal
D2 Ulaan base metal (lead)	52 Talbulag coal	H2 Mungun-Undur base metal (silver-tin)
D3 Tsav base metal (lead)	S3 Tumentsogt (Anas) fluorite	H3 Navchit Gol iron ore
D4 Murugtsug fluorite	S4 Yugezer tungsten	H4 Tugalgatain Nuruu lead
D5 Bulangiin Hooloi coal	S5 Ulziit gold	H5 Deed Kumyr tin-tungsten
D6 Allan go! sand	SG Hoi hudag iron ore/zinc	H6 Undur Tsagaan tungsten
D7 Mardai uranium	S7 Salaa tungsten	H7 Bor-Undur fluorite
D8 Tamsag oil basin	S8 Aryn nuur molybdenum	H8 Berkh (Delgerkhaan) fluorite
D9 Placer gold deposits in Ulz Gol area	S9 Baruun-Urt sand	H9 Tsagaan Chuluut tungsten-molybdenum
010 Salhit base metal	S10 Salhit base metal	

Source: Compiled by the Consultant,


Dormd
Hanfi
Sukhmeatar

19. The following undeveloped properties were selected based on a review of available technical information and technical advice provided by senior personnel[6] (see appendix D) from the Mineral Resources Authority of Mongolia. As shown in Appendix B, interviews were conducted {where possible) with senior personnel from the mining companies or license holders.

Tumurtiin Ovoo Project (License Holder: ~~metalimpex Co~~ Tsairtminerals LLC.) [7] (see appendix D)

20. The Tumurtiin-Ovoo zinc deposit is located 12 km from Baruun Urt, the capital of Sukhbaatar aimag. The main ore body extends for approximately 800 meters (m) with an average of 200-230m, and an average thickness of 14m, Maximum depth of the central zone of the deposit has been determined to be 480rn. The deposit is reported to contain 7.7 million tones of ore with an average grade of 12, 43% zinc and 0.024% cadmium.

21. The project is a joint venture (JV) between the Chinese company, Chinese Non-Ferrous Metal Corp.(51%), and the Mongolian company, Metalimpex (49%). There is insufficient water at the site and a hydrology study was performed to locate the quantities of water required. The study located sufficient water from deep wells (100m) located about 30 km away. Total planned production by use of open pit methods is about 300,000 tones per year (tpy) ore yielding 65,000-70,000 tpy of concentrates

22. Construction is reported to start in September 2002[8] (see appendix D) and continue through 2004 with production starting in 2005. Reserves are sufficient for 25 years at the planned production rate. Total investment is reported to be U.S.$42 million of which U.S.$25 million is in the form of a Chinese "soft" loan at 3% interest arid the balance from a Chinese bank at 5.6% interest.

23. The concentrates will be shipped in 2.5-tonne bags by road to a rail terminal and then by rail. Two transport alternatives are being considered:
    - From Baruun Urt to Choibalsan (200 km by road), by rail to Russia then by rail to Harbin, China.
    - From Baruun Urt to Sainshand, Mongolia (340 km by road) then by rail to Shenyang, China.

Mardai Uranium Project (License Holder: Central Asia Uranium Co.) [9] (see appendix D)

24. Central Asian Uranium is a JV with World Wide Minerals Inc. of U.S., Mongolian Government, and Priargunsky Mining and Chemical Association, a Russian company. The ownership shares in the JV are 58%, 21% and 21% respectively. The project involves re-opening the open pit and underground uranium mines located at Mardai in Dornod aimag about 110 km northwest of Choibalsan.

25. Uranium production commenced in Mongolia in 1988 and continued sporadically until 1996. Run-of-mine ore was transported 500 km north by rail to the Priargunsky mill in Russia where it was processed into U_3O_8 (yellow cake). All production came from the Mardai open pit. Cumulative production for this period approximated 1.2 million lbs. Of yellow cake. ~~U3O8 f' yellow cake) and was tfansperted 509 km north by rail to the Priargunsky mill in Russia, All production came from the Mardai open pit.~~

26. In 1999, the Mongolian Government assumed responsibility for protecting the entire infrastructure at Mardai. However, since that time much of the critical infrastructure (70

km of power lines and substantial quantity of poles and a reported 90 km of rail track) has been removed.

27. Capital requirements are estimated at about U.S. $25 million[10] (see appendix D) but this will likely have to be increased due to the ongoing removal of critical infrastructure[11] (see appendix D). Construction is reported to start in 2003 with production commencing 2004. Plans are to produce three million lbs. of yellow cake per year and sales to Russia have been secured at U.S.$12-15 per lb.

Ulaan Deposit (License Holder: A/a Dalai Far East) [12] (see appendix D)

28. The Ulaan polymetallic (lead/zinc/silver/gold) deposit is located in Dornod aimag about 12 km from the Mardai uranium mine. The deposit is reported to contain 68 million tones of ore estimated to contain 2.0% zinc, 1.2% lead, 53 g/metric ton silver, and 0.21 g/metric ton gold. Aza Dalai Far East has a 25-year license to operate the mine.

29. Ulaan was extensively explored by Soviet geologists who were working at Mardai at the time and several mining feasibility studies were prepared. Plans were based on sharing the Mardai infrastructure and using the Mardai workforce. Although a railway was constructed linking the two locations, Ulaan was never put into production. The rail was in place through 1997 but has since been removed.

30. All information was collected and feasibility studies have been completed by the Soviets. According to these studies[13] (see appendix D), initial mining would be by open pit methods after which underground mining would be employed. Three alternative scenarios were examined in the feasibility studies; these are further discussed in the Economics of Mining Section.

31. The ongoing removal of critical infrastructure at Mardai presents a significant financial obstacle to development of Ulaan. The project has been presented previously at Investor Conferences in Canada and Korea.

Altan Gol Silica Sand Deposit (License Holder: Shine Eh Gobi Company) [14] (see appendix D)

32. The company holds a mining license over a 200 million-tones reserve of high quality silica sand located in Dornod province about 400 km by road from Choibalsan and 45 km south of Sumber sum. Several processing studies conducted in 1986-1991 indicated that the in-place quality is from 90-92% SiO2but this could be increased after upgrading to 98.5%, which is the required quality for windows. It is reported that the Korean company, Daewoo, evaluated the project but opted not to proceed.

Tsav Deposit (License Holder: MAK-Mongolian Alt Corporation) [15] (see appendix D)

33. The Tsav deposit is a hydrothermal polymetallic deposit containing lead, zinc, silver and minor amounts of gold. It is located in the Dornod aimag about 120 km from Choibalsan and 16 km from the nearest rail connection. The deposit has been the subject of extensive evaluations, first by Mongolia from 1983 to 1988; then by the Soviets from 1988 to 1990; and then most recently by the Japanese from 1993 to 1995. As a result, 21 ore bodies were discovered throughout the deposit, of which 11 were studied in greater detail.

34. The Soviets conducted extensive exploration using both trenches and boreholes. In addition, they sunk a vertical shaft, the head frame of which still stands together with

miscellaneous surface buildings. The shaft was presumably used to gather additional exploration data as well as to conduct test mining. It is the Consultant's estimate that at least U.S.$10 million (in current terms) was expended on the assessment.

35. In the early to mid-1990s another assessment was conducted by the Japanese using funds provided by the Japan International Cooperation Agency (JICA). As part of the assessment, an inclined slope was sunk and more tests mining and detailed metallurgical testing was performed. Ore reserves were estimated at 1.5 million tones at 1, 5 grams/tone (g/t) gold; 263 g/t silver, 6.4% lead, 4.0% zinc and 0.2% copper.

36. Ore dressing tests were performed at an on-site pilot plant. These were followed by the preparation of a comprehensive feasibility study in 1996, which concluded that the project was infeasible with rates of return ranging from -3% to +8%[16] (see appendix D). MAK is currently looking for financing to place the project into production. However, there is limited interest due to the current low metal prices. MAK officials stated that if financing was in-place today, it would take about 3 years to place the project into production.

Bulangiin Hooloi Coal Deposit (License Holder: None)

37. This deposit is located in Dornod aimag. about 300 km from Choibalsan. No company holds a license over the deposit, which is indicative of the limited attractiveness of the deposit due to its lack of infrastructure and Nig distance to a major market. However, its location close to Arxan in Xinganmeng Prefecture would increase its attractiveness if low cost rail or road transportation were available.

38. Total resources are estimated to be about 120 million tones. The Mongolian Mining Institute performed a feasibility study in 1987 indicating the existence of a 30 m coal seam and low stripping ratios. The as-received coal quality was estimated to be about 3,500 Kcal/kg.

The Northern Part of Dornod Aimag

39. The northern part of Dornod aimag, indicated as a highly mineralized zone on Figure 1, deserves special mention. 1 his area has many potential projects, which almost form clusters due to their close proximity to each other, but none are big enough on their own to support the cost of significant new infrastructure. The Consultant believes that the introduction of new infrastructure and perhaps even shared milling facilities will result in the rapid development of mining in this area.

Placer Gold Mining Deposits

40. There are several small placer gold mining deposits in the Project Area that are expected to be placed into production over the next several years. [17] (see appendix D) However, the impact of these projects on local employment and infrastructure, particularly transportation, is minimal. The mining operations are generally small and produce insignificant amounts of gold using limited equipment. Primary gold projects, such as Boroo Gold require much more capital to implement arid impact the locat economy to a much greater extent. They also produce much more gold. Accordingly, this assessment does not include the likely development of placer mining in the Project Area.

Other Mineral Deposits

41. A full listing of the available geological data for the three aimags is included in Appendix B. In addition to the deposits discussed above, there are a number of other deposits that are considered to be less attractive at this time. However, this is a preliminary assessment as additional exploration may increase the attractiveness of the projects. Some of these deposits are described below:
    - Mungun Undur Silver Deposit located in Hentii aimag, about 80 km from Undurkhaan, the capital.

    - Ariin Nuur Molybdenum and Copper Deposit located in Sukhbaatar aimag, about 115 km from Choibalsan. Which is a rail head for a ten-year period from the early 1970s through the early 1980s the following activities were performed: geological mapping, preliminary exploration using trenches and boreholes (400 m spacing), geochemical sampling, ground magnetic and gravimetric surveys.

    - Undur-Tsagaan Molybdenum and Tungsten Deposit located in Hentii aimag, about 80 km from Undurkhaan, the capital. Metallurgical testing and laboratory analyses have been performed in Mongolia. Bulgaria, and Czechoslovakia,

    - Yuguzer Molybdenum and Tungsten Deposit located in Sukhbaatar aimag, about 170 km from Baruun Urt. the capital. Extensive work to prove up the deposit has been done to-dale including about 11,000 m of trenching, 1,400 m of adit development (to access the ore body) and 2,000 m of borehole drilling. In addition, about 1.500 tones of ore have been metallurgic ally tested. the deposit was originally opened in 1940 after which a mine, named Chono Gol. Was developed in 1942. The mine operated until 1955.

EXISTING MINES WITH EXPORT POTENTIAL

Fluorspar Mines (License Holder: MongolRostsvetment Mining & Trade Corporation) [18] (see appendix D)

42. Hentii aimag has several operating fluorspar mines owned by Mongol Rostsvetment. The mines ship a total of 120,000 tpy of concentrate (90-95% purity) to Russia for use in the chemical industry. In addition, 80,000 tpy of run-of-mine product (75% purity) is shipped to Russia for use in the metallurgical industry.

Aduunchuluun Coal Mine (License Holder: Aduunchuluun Coal Mining Company) [19] (see appendix D)

43. This mine, located on the outskirts of Choibalsan, was constructed in 1954 and operated originally as an underground mine before converting to an open pit operation in 1969. The mine ships directly to the Choibalsan power station. The capacity of the mine is 600,000 tpy but current output is only 300,000 tpy. I he mine exports minor quantities of coal via rail north into Russia and has reportedly obtained a new contract to increase exports to 200,000 tpy. The contract price is U.S.$6 per tone FOB mine

44. The Consultant observed easy mining conditions at the site. The stripping ratio is 1:1.3, which should result in very low costs. In-place coal quality is stated to be 3,000-4,000 Kcal/kg with typical quality being about 3,200 Kcal/kg.

ECONOMICS OF MINING

45. The economics of mining are strongly affected by a variety of factors including technical risk, fluctuating commodity prices, high capital requirements and long lead

times to place the mine into production. These are discussed below.

Technical Risks

46. Mining is considered to be a high-risk business. The principal reasons for this include the following:

47. **Geological Uncertainty**. Geological uncertainty covers a variety of problems including reliability of estimates of the amount of mine able reserves and the corresponding grades. Associated with this is the potential presence of unforeseen geological problems such as faults. The only way to reduce geological uncertainty is to undertake additional exploration, which increases initial costs. Various statistical techniques are used to reduce geological uncertainty, but it can never be eliminated in a cost-effective manner. The best that mining companies can do is reduce the geological uncertainty to an acceptable level.

48. The problem of geological uncertainties is illustrated by the actual experience of three Mongolian mining projects.

49. *Boroo Gold*. [20] (see appendix D) This project, now in the construction stage, was originally the subject of a Mongolian/East German JV from 1969 to 1989. After the collapse of the Soviet Union, starting in 1993 various western gold mining companies with proven track records conducted additional drilling and prepared major engineering feasibility studies but failed to find the project feasible according to their profitability criteria. Boroo Gold took over the project in 1999 and spent several million dollars on additional exploration and engineering studies, which then indicated a viable project. Therefore, it took almost ten years of work and considerable additional investment to prove the economic viability of the deposit.

50. *Ivanhoe Mines*[21] (see appendix D). The Oyu Tolgoi deposit in South Gobi aimag was previously explored down to a depth of 150 m in the mid-1990s by BMP. Although BMP found a deposit, it was judged to be insufficient to justify further investment. The rights were then acquired by Ivanhoe Mines, which undertook additional exploration by drilling deeper than 150 m and preparing engineering studies. This additional work resulted in Ivanhoe discovering a major "world-class" copper/gold deposit. While Ivanhoe is very pleased with the results, they have not yet made a formal public announcement that they intend to proceed with mine construction.

51. *Tsav.* While the above examples illustrate that additional work has resulted in proving up economically viable mineral deposits, it should not be presumed that it is always the case. The case of the Tsav deposit (previously described) illustrates exactly the opposite; specifically that additional work and large expenditures were unable to justify the investment in a commercial operation.

52. **Difficult Mining Conditions**. Difficult mining conditions result from both unforeseen geological problems such as faults as well as other conditions (such as high water levels, poor rock strength), which may have been anticipated. Difficult mining conditions result in higher operating costs.

53. **Metallurgical Problems**. Metallurgical problems may result from the unexpected chemical composition of the ore. Similar to difficult mining conditions, some of the problems (such as low metallurgical recovery) may have been anticipated but can be difficult to resolve in practice. Metallurgical problems will increase operating costs.

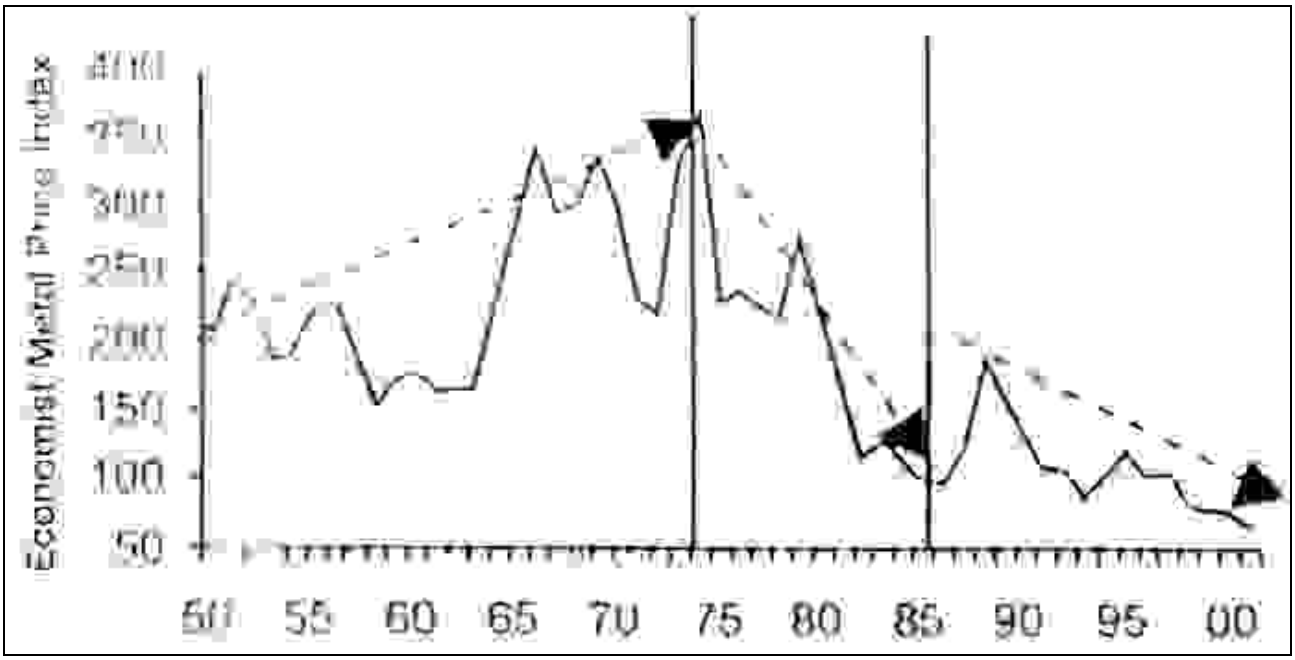
Fluctuating Commodity Prices

54. A mine whose economic justification is based on a certain commodity price will encounter economic hardship if the price drops to a lower level. The single greatest influence on commodity pricing is the imbalance between supply and demand. When supply lags demand, the price generally increases and vice versa. The possible exception to this is gold where other (emotional) factors also play a role.

55. Figure 2 illustrates the variability of commodity prices over the lasM050-year period from 1950 to 2000. Current prices are at a very low point in comparison to the previous periods and some commodities such as copper are near all-time record low prices.

56. Low commodity prices particularly penalize proposed mining projects, which must pay back high amounts of start up capital in addition to covering their operating costs. This is in contrast to existing mines where the capital requirements are generally much lower. Therefore, the threshold of commodity prices for new mining projects is higher than for existing mines unless the new projects have high grade ore bodies.

Figure 2: 50 - Year Trend in Price Base Metal Prices in Constant 2001 $



Source: Engineering 6. Mining Journal, April 2002

57. Low commodity prices require that operating mines produce at a lower cost in order to survive. Alternatively, operating rnines will mine from their higher grade ore bodies. In cases where they cannot sufficiently reduce costs, the mines will! Shut down, thereby reducing the supply.

58. Consider the impact of commodity prices on the economic viability of the polymetallic (gold, silver, lead, zinc) Tsav deposit located in northern Dornod aimag. A report prepared in 1996 by JICA concluded that the project was infeasible with rates of return ranging from -3% to +8%.

59. The prices used in calculations of the project's profitability are listed in Table 2 together with current prices. It should be noted that in every instance, the August 2002 price is lower than the JICA .Report's assumed price.

Table 2: Commodity Prices

	JICA Report Assumed Price (U.S.$)	Actual Price (U.S.$)
Gold, per troy ounce	390	309.40 (New York Mercantile Exchange; Average August 2002)
Silver, per troy	5.30	4.50 (New York Mercantile Exchange; Average August 2002)
Lead, per tone	650	415.74 (London Metal Exchange; Average August 2002)
Zinc, per tone	1,100	734.93 (London Metal Exchange; Average August 2002)

60. For the Tsav deposit to be feasible, metal prices would have to increase significantly over their current levels. Alternatively, more ore reserves need to be located in order to spread the capital costs.

Capital Requirements for Mining and Processing

61. Mining is highly capital intensive. Small metal mines with easy mining conditions and uncomplicated processing will range from U.S.$20 million to perhaps U.S.$50 million depending on their production rate and location (i.e. infrastructure requirements). In contrast, large copper mines can cost more than U.S.S1 billion- High capital cost mines typically require that financing be obtained from several sources {bank loans, equity and bond markets).

Additional Capital Costs Imposed by Lack of Infrastructure

62. The situation regarding capital investment in Mongolia is aggravated by the general lack of infrastructure in the form of good hard surface roads and electric power lines. In addition, the low population density means that a mining project will normally be required to fund the construction of a complete township for its employees, including apartments, schools, hospitals, etc. This places a huge additional economic burden on the project; the additional burden has been estimated to cost as much as the (presumably small-size) mining project itself. [22] (see appendix D)

63. It is beyond the scope of this study to resolve the issue of Mongolia's lack of infrastructure for mining projects. While it may be true that a mega-project such as Ivanhoe's Oyu Tolgoi may be capable of funding a railway, schools, power supply, etc, it is unrealistic to expect that all other projects can do the same. If this approach is adopted, it would stifle the future development of much of Mongolia's potential to develop its mining industry,

64. Generally speaking, based on U.S. experience of mining projects in remote areas, mining companies are willing to fund the construction of power lines and make annual contributions to the operating budgets of schools and even the local police. However, the construction of roads and railways are normally funded by others that will benefit from the existence of the mine. Government plays a large role in providing infrastructure and services through funds provided both by local taxes and the national/provincial governments. Local funding is derived from property taxes and mineral severance taxes, both of which are largely repatriated to the localities impacted by mining.

Operating Costs

65. As a general rule, the operating costs for production of any commodity must be proportional to the market value of the commodity for that operation to be profitable. For example, to be profitable the operating costs for coal, which sells for U.S. $ 5 per tone will have to be lower than the operating costs for coal, which sells for U.S.$ 20 per tone.

66. To meet profitability requirements, as a "Rule of Thumb", the mine-site direct (i.e. controllable) costs should be no more than one-half the FOB mine selling price. Then, the difference between the sale price and operating costs would be sufficient to cover depreciation, interest, overhead, taxes, and other general administrative expenses and return a reasonable profit to the investor In commodities with low market prices, the amount available for operating costs is limited, hence making the project unprofitable.

Impact on Operating Costs Imposed by Transportation

67. The transportation cost of bulk mineral commodities is usually a major item and may even exceed the FOB mine cost of the commodity. Hence, the economics of mineral production are very sensitive to the cost of transportation.

68. Estimated cost of truck and rail transportation for Mongolian bulk mineral commodities are U.S.$0.30 and US$0.075 per tone-km respectively. The cost difference between the two estimates is U.S.$0.225 per tone-km; this difference must be "paid for" by mining at higher grade to offset the higher road transportation cost. This is illustrated in Table 3, which shows the additional revenue that must be generated to compensate for the increased cost of road transportation vs. rail transportation.

Table 3: Incremental Cost of Road Transportation

Haul distance (km)	400	500	600	700
Railway freight rate, per tone km (U.S.$)	0.075	0.075	0.075	0.075
Road freight rate, per tone km (U.S.S)	0.300	0.300	0.300	0.300
Difference, per tone km (U.S.S)	0.225	0.225	0.225	0.225
Difference, per delivered tone (U.S.$)	90.00	112.50	135.00	157.50

Source: Consultant

69. To avoid the higher transportation costs, most mines strive to transport by rail instead of road and the vast majority of mineral products are transported by rail.

70. The one exception to this general rule is the "road train" of Australia, which hauls minerals in high capacity (up to 270 tones) combinations of a tractor and several trailers. Road trains operate in remote regions with minimal infrastructure. According to recent reports, road trains of up to 500 tones are being considered on some mining projects. The Consultant also believes that, as an interim step on certain mineral projects, road trains would provide reduced transportation costs in comparison to the standard Mongolian trucks. However, they would need to operate on dedicated roads.

71. The implications of mining higher grades are very serious and should be avoided wherever possible. Ore reserves consist of both higher and lower grade ores and mining companies strive to blend the mining of each in order to extend the period of mining and recover the capital costs. Mines that operate in this fashion have a higher

Net Present Value (NPV) which is a key financial indicator of mine profitability. Mining higher grade ores increases the profit per tone but reduces the amount of ore that can be mined profitably[23] (see appendix D). This is a complicated issue and beyond the scope of this assignment to fully explain. However, it is very well illustrated by the following three mining scenarios[24] (see appendix D) developed by the Soviet studies undertaken before 1990 for the Ulaan deposit.

72. **Mining at the Average Grade**. This would require U.S.$30-40 million capital investment and result in a 30-year mine life.

73. **Mining at Higher than Average Grade**. This would require U.S.$10-20 million capital investment and result in a 10-year mine life. The payback period would be about three years.

74. **Mining at a Very High Grade**, this would require U.S.$10-15 million capital investment and result in a six-year mine life. The payback period would be about two years.

75. To relate the example of Ulaan to the issue of transportation, if road transportation was the only alternative due to the absence or railway, it would be necessary to mine at a higher grade in order to offset the high transport cost. This would reduce the mine life. The extent of the reduction depends on the additional revenue required to cover the higher cost for road transportation[25] (see appendix D).

Long Lead Times

76. The time taken from the initial discovery of the ore body until the subsequent mine is placed into production may be as long as 10 years for a large mine. Much of this time is consumed by gathering sufficient information to reduce the risk to manageable levels, thereby reassuring potential investors. As illustrated in Figure 3, the typical mining project proceeds in distinct stages with each stage being significantly more costly than the preceding stage.

77. The total time required to place a mid-size mine into production could be reduced to about five years. However, this shorter time period is predicated on rapid-decision making and presumes favorable drilling results, favorable commodity prices, favorable financial returns, etc.

78. In all likelihood, it will take longer than five years in Mongolia as indicated by the experience of Boroo Gold. This project, now under construction, was originally the subject of an East German/ Mongolian joint venture in 1969. Western mining companies took over the deposit in the early to mid-1990s and the mine will only be placed into production in 2003, almost 10 years later. It is expected that the total time to develop Ivanhoe's Oyu Tolgoi project will be at least 10 years.

Profitability Requirements

79. As a direct result of the previously-listed factors, mining investors demand higher than average rates of profitability with 20% Return on Investment (ROI) being generally regarded as the absolute minimum.

Minimum Criteria for Deposit Size fnd Mining Revenue

80. In order to account for all of the above-mentioned requirements, successful

international mining companies require that mining projects be based on certain minimum criteria.

81. In the 1990s one such international mining company[26] (see appendix D) conducted an evaluation of lead, zinc, silver deposits in PRO for the purpose of investment and examined over twenty deposits many of which were being operated by state-owned mining entities: The principal conclusion reached was that even the very best of the deposits examined (which had a combined lead and zinc grade of about 10%) would not have been economically viable under free market conditions. The reasons include:
    - Use of low cost labor, which receives additional (but unallocated) indirect remuneration in the form of housing, medical services, etc.
    - Direct and indirect subsidies through non-market prices for equipment, spare parts, chemicals, etc.
    - Government-sector mining entities were not being required to operate profitably. Instead, they are required to meet production targets regardless of the costs incurred.

Figure 3: Implementation Schedule for a Typical Mining Project



Source: Our Creation

82. The above factors resulted in severe cost distortions, which allowed the mines to continue to operate under conditions that would not be profitable for private sector (or free-market) mining companies.

83. As a result of the evaluations, the international mining company adopted a "Rule of Thumb" that was applied to all deposits of this type anywhere in the world. The Rule of Thumb specified that to ensure the economic viability of new projects, certain criteria applied to both the gross value of the ore and the size of the deposit. Specifically, the economic viability of a new lead, zinc, silver mine requires a minimum deposit size of 10 million tones of ore with grades sufficient to meet or exceed U.S.$150-175 per tone in the ground. This is roughly equivalent to 15% zinc content.

84. An inspection of the vast body of information provided to the Consultant relating to reserves and grades indicate that none of the projects presently meets the above-mentioned Rule of Thumb. For example: one of the deposits, which is rated highly by the local mining community, is the Ulaan deposit described earlier. The deposit is reported to contain 68 million tones of ore estimated to contain 2.0% zinc, 1.2% lead, 53 g/metric ton silver, and 0.21 g/metric ton gold. Compare these numbers against the Teck/Cominco Red Dog mine in northern Canada, which has proven reserves of 42 million tones at 19.2% zinc, 5.2% lead and 100g/t silver. While this is admittedly a very good deposit, it nevertheless required enormous infrastructure development. Similarly, Mount Isa Mines' McArthur River Mine in Australia has ore reserves of 40 million tones with grading of 12.6 % zinc, 5.5% lead and 57 g/t silver.

85. The smaller amount of proven reserves in deposits within the Project Area certainly provides one reason why they remain undeveloped at present. However, additional exploration similar to the comprehensive and costly programs conducted by Boroo Gold and Ivanhoe could result in proving up several of the deposits to the extent that they meet current profitability requirements.

TIMING OF SIGNIFICANT DEVELOPMENT OF MINERAL PROJECTS IN THE PROJECT AREA

86. Apart from those mining projects that have already been announced {Tumurtein Ovoo lead/zinc and Mardai uranium), it is the Consultant's opinion, based on discussions held with mining officials, that significant mineral development within the Project Area is unlikely to take place within the next 7-10 years. The reasons for this conclusion are discussed below.

Insufficient Exploration Performed To-Date

87. Although the Mongolian mining industry is growing rapidly and making a very valuable contribution to the national economy, mining in the Project Area is still in its infancy. The amount of exploration performed to-date is not great and much more needs to be done to confirm the previous findings and prove up commercial-size deposits[27] (see appendix D). Combined with this critically important factor is the current lack of infrastructure, which greatly contributes to the cost of doing business in the Project Area.

General Lack of Necessary Infrastructure Including Low Cost Transportation

88. While it is certainly true that the Boroo Gold project (located in Selenge aimag, outside the Project Area) is going ahead, its high value product (gold) does not need rail

transportation, a major expense. Contrast Boroo Gold with the Ivanhoe Oyu Tolgoi project (located in South Gobi aimag, outside the Project Area) which will require a railway, electric power lines and perhaps power plant in addition to infrastructure for its personnel in the form of apartments, schools, etc. However, Oyu Tolgoi is a "mega-project" and will likely generate sufficient revenue and profit to fund the infrastructure costs. Due to Oyu Tolgoi and other projects, this general Gobi area is likely to be the location of the first Mongolian "mining boom" that will take place within the next five to ten year period.

89. Significant development of base metals within the Project Area will not take place without access to a rail network that will transport the products (most likely concentrates) to foreign markets, most likely PRC with its growing economy.

Long Lead-Times to Place Projects into Production

90. As discussed in the previous section, the total cycle time of placing mining projects into production can approach 710 years. This is particularly true in Mongolia where most of the deposits have been subject to limited exploration.

Current Levels of Low Commodity Prices

91. It is not possible to predict when the current cycle of unusually low commodity prices wilt end. The low prices act as a damper on exploration as mining companies have less money to invest in new projects and will prefer to wait until their profits improve.

Upside Potential

92. A sustained period of commodity pricing, which is measurably better than the present would very likely reduce the 7-10 year development period suggested in this Report.

93. Along with this reduction In time, there could be a cascading effect as smaller, less economic projects, could "springboard" off new infrastructure built by previous adjacent projects. This access to existing infrastructure would reduce the cost of subsequent projects. A likely area for this to occur is the northern section of the Dornod aimag, which has many potential projects. None, however, are big enough to support the cost of significant new infrastructure on their own.

ASSESSMENT OF THE DEMAND FOR MINERALS

94. Rather than being an overall assessment of global demand for all minerals, this Section focuses only on those minerals that:
    - Have the potential for future production in the Mongolian Project Area (lead/zinc, additional fluorspar, tungsten, molybdenum);
    - Are currently being produced in the Mongolian Project Area (coal, fluorspar);
    - Are currently being produced elsewhere in Mongolia but could be shipped through the Project Area (copper concentrates); and
    - Could be utilized in Xinganmeng Prefecture (coal, lead/zinc).

Fluorspar

95. PRC is the world's largest producer of fluorspar with about 54% of worldwide production in 2001. While mined production was unchanged from 2000 to 2001, the market for fluorspar is somewhat depressed, with increasingly stringent legislation covering the phase-out of CFCs (chlorofluorocarbons). Also, there is a continuing

reduction in the unit consumption of fluorspar in both steelmaking and primary aluminum smelting. Growth prospects depend principally on the acceptance of MFCs (another chemical compound) as a CFC substitute, which could yield modest increases in consumption in future years. It is reported that PRC has restricted exports of fluorspar in an effort to increase prices.

[28] (see appendix D)

Lead

96. Total worldwide mine production in 2001 was about 4% lower than 2000 while demand decreased by 1%. The decrease in demand was due principally to the market conditions in USA. Although producers cut production in response to the drop in demand, the average North American Producer and London Metal Exchange (LME) prices were down by 0.2% and 4.5% respectively.

97. Nevertheless, overall worldwide lead consumption is projected to increase through at least 2005; estimates range from 1-2% per year. PRC is a major lead producer (within the top five) with 2001 production at 560,000 tones. Mongolia does not at present produce lead.

Zinc[29] (see appendix D)

98. Total worldwide zinc mine production in 2001 was about 2% higher than 2000 despite a decrease in demand, principally in the USA. As a result of this demand/supply imbalance, the price of zinc fell to its lowest level in a decade.

99. Nevertheless, overall worldwide lead consumption is projected to increase through at least 2005; estimates range from 2-3% per year. PRC is the world's largest zinc producer with 2001 production at 1.7 million tones. PRC also exported an estimated 0.6 million tones in 2000. Mongolia does not at present produce zinc.

Iron Ore[30] (see appendix D)

100. Total world production of iron ore in 2001 was 931 million tones, a decrease by 3.1% compared to 2000, when production was the highest ever. North America experienced particularly sharp falls in production reflecting weak demand. However, PRC steel production increased by 15 per cent. World trade in iron ore decreased by about 2%, with Canada and Sweden experiencing large falls, while Indian and South African exports increased by large amounts. Imports by PRC and the Republic of Korea increased by large quantities. Iron ore prices increased by modest amounts in 2001 but decreased 2-5% in 2002. Based on available data, large price rises are not expected for the next several years despite increasing demand. This is due to large inventories of ore. However, in the long term, there may be room for several of the new mining projects now being considered to enter into production.

101. PRC is a major importer of iron ore with imports being 50, 88 and 105 million tones in 1995, 2000, and 2001, respectively. In contrast, Japanese imports over the same period were relatively stable at 120, 132, and 126 million tones.

Coal

102. Precise statistics on recent worldwide coal production are difficult to obtain. However, in 1999 about 4.7 billion tones of coal was produced with the biggest producer being PRC followed by USA and India. PRC is a major exporter of coal (78 million tones in 2000). There are two tiers of prices: the international export price and

the domestic price. While the international export prices vary with supply and demand and can generally be tracked and correlated worldwide, the domestic prices cannot be compared from country to country.

103. Coal consumption is expected to increase from about 104 quadrillion British Thermal Units (BTU) in 2002 to 135 quadrillion BTU in 2020. [31] (see appendix D) This represents an overall increase of 30%, equivalent to a straight-line increase of about 1.8% per year.

[32] (see appendix D)

Copper

104. Total worldwide mine copper production in 2001 was about 2% higher than 2000 despite a decrease in demand, principally in the USA. This resulted in an increase in inventories, which depressed prices throughout the year. The largest producer is Chile with 4.6 million tones, followed by the USA and Indonesia. PRC is about the sixth largest producer with 0.6 million tpy but also imports 0.7 million tpy. Mongolia is also a major copper exporter with shipments to Russia of about 0.5 million tpy since 1996.

105. Phelps Dodge Corp., a major US producer, has forecast global copper demand and prices to improve in 2002 as the world economy recovers. The company projects that global copper consumption will grow by about 2% in 2002. Present consumption in PRC is very strong (about 12% of the worldwide consumption) and this is projected to continue over the next two or three decades as the Chinese economy continues to expand and standards of living increase. Recent analyses of the global copper industry indicate that it is likely that prices will increase over the next decade.

[33] (see appendix D)

Tungsten

106. PRC is by far the world's largest producer of tungsten with an estimated 83% of the production. To increase export prices, beginning in 1999 PRC took steps to control release of tungsten for export. The increased prices following the control of exports by the PRC government led the importers to diversify their sources of supply. This resulted in decisions to develop new mines. However, in recent months prices have dropped sharply and are currently more than 30% below the levels of mid-2001.

[34] (see appendix D)

Molybdenum

107. Total worldwide mine molybdenum production in 2001 was about 3% higher than 2000 reflecting an increase in demand, principally in the USA. The USA is the largest producer of molybdenum followed by Chile and PRC. In Chile, molybdenum is produced as a by-product of copper mining. Although inventories decreased in 2000/2001, there is still a substantial inventory "overhang" on the market. But if demand continues to exceed supply, as seems likely in 2002, then the inventory will decrease further. This trend has so far not been reflected by prices, which bottomed out at the end of 1998 and have remained relatively flat.

108. Mongolia is also a molybdenum exporter with shipments of about ~~0.25 million tpy 4.5 thousand ton in 2000. However, exports have been declining in recent years.~~

ASSESSMENT OP MINERAL MARKETS IN XINGANMENG PREFECTURE

109. As part of this assignment an attempt was made to match the mineral potential of the three easternmost aimags of Mongolia to the mineral needs of Xinganrneng Prefecture. This was done by identifying those mining projects that (based on current

information) are most likely to go ahead and assessing, through interviews and questionnaires, the demand for mineral products in Xinganrneng Prefecture.

Minerals Produced in the Three Aimags

110. The following is a summary discussion of the present demand for mineral products, which could be sourced from the three aimags.

111. Zinc/Lead/Silver. The Mung En zinc/lead/silver mine near Ulanhot produces about 230,000 tpy of ore but is now more than 30 years old and production is expected to cease over the next several years. The mine has the capability to concentrate and refine the lead, but not the zinc and silver, which is shipped elsewhere for processing.

112. This could provide an opportunity for Mongolian zinc/lead/silver projects to have the lead portion of their product refined. However, the concentrator would not be useful as the Mongolian product would already be in the form of concentrate for economical transportation to PRC.

113. **Iron**. The Ulanhot steel mill consumes about 200,000 tpy of iron ore or concentrates (+66% Fe, SiO2<4%, S<0.1%) which is transported about 750 km from Benxi in Leaning Province. Hentii aimag has two iron deposits (Navchit and Bargilt) with reported reserves of 25 million and 50 million tones, respectively. However, these are considerably smaller than the Tumurtei and Bayangol deposits in Selenge aimag, which lie outside the Project Area and have reserves of 230 million and 260 million tones, respectively. These deposits are about 25 km apart but require about 150 km of railway to connect to the mainline to Russia and Ulaanbaatar. The Mongolian Mineral Authority does not at present rate the Hentii deposits high in comparison to the Selenge deposits. A significant disadvantage of the Selenge deposits is that they are further west of the Project Area and would incur additional transportation costs. Due to the proximity of well-developed alternative transport routes to Tumurtei and Bayangol, products from these deposits are not expected to be routed through any transport infrastructure which may be built in the Project Area. In nearby Darkhan City there exists a small steel plant, which uses scrap iron, but it is reported to be running at low capacity because of a shortage of scrap. This facility could perhaps be converted to use iron ore if the nearby iron deposits were developed. The Consultant recommends that additional studies be conducted to assess both the Hentii and Selenge deposits and their export potential to PRC.

114. **Coal**. The total coal demand in the prefecture is estimated at 1.2 million tones per year. The sources of supply are:

- 300,000 tpy is produced in the local Mangniuhai mining district using underground methods. This is the maximum output of the region and no further increase is possible.
- The remaining 900,000 tpy is transported into the prefecture from elsewhere and used as follows:
    - the electricity generating station consumes about 400,000 tpy of coal (year-end 2002 estimate) with a quality of 3,500-4,000 Kcal/kg
    - the Ulanhot steel mill and adjacent cement plant use a total of about 80,000 - 100,000 tpy with a quality of +5,000 Kcal/kg
    - the remaining 400,000 tpy is used by a variety of local industrial customers.

115. The coal used by the electricity generating station and local industrial customers, totaling about 800,000 tpy, can be supplied from the adjacent Mongolian Project Area. There are two possible sources ranked in order of priority:

116. *Bulangiin Hooloi* Coal Deposit. However, this is subject to substantial additional work (exploration, coal quality testing, engineering feasibility studies, etc.) being performed on the deposit. The key issue is whether the coal quality is sufficiently high (at least 3,500 Kcal/kg.) to meet the requirements.

117. *Aduunchutuun Coal Mine* While this mine already exists and has an immediate spare capacity to supply 300.000 tpy, the biggest question relates to coal quality. The current coal quality is reported to be about 3.200 Kcal/kg versus 3,500 Kcal/kg required.

118. **Limestone**. There is substantial usage of limestone in the Ulanhot steel mill and adjacent cement plant, but the demand is met locally by two local mines. It is, therefore, very unlikely that Mongolian limestone could cost-effectively compete in this market unless it has special qualities that make it superior to the local product.

119. **Silica Sand**. There are no existing facilities in Xinganmeng Prefecture that could use silica sand.

120. **Fluorspar**. According to the information provided, there are no existing facilities in Xinganmeng Prefecture that use fluorspar. While fluorspar is used in basic steel making, the Ulanhot steel mill is reportedly not using the material.

Minerals Produced in Xinganmeng Prefecture

121. Figure 4 shows principal mining locations and mine-related centers in Xinganmeng Prefecture and surrounding areas. In addition to the above-mentioned zinc/lead/silver, limestone, and coal, the prefecture also produces copper from three mines:
- The Lianhuaxan Mine produces about 130,000 tpy of concentrate;
- The Naoniuxan Mine produces about 100,000 tpy of concentrate;
- The Budunhua Mine produces about 180,000 tpy of concentrate, but is presently shut down.

122. All of the concentrates are transported elsewhere for refining, There are no local facilities that consume copper.

ASSESSMENT OF FUTURE MINERAL MARKETS -XINGANMENG PREFECTURE AND BEYOND

123. With the progress of industrialization in PRC and economic globalization, PRC's demand for mineral resources is expected to grow by many times in the coming decades to make the country the largest mineral consumer in the world. [35] (see appendix D) Most of this growth is likely to occur outside Xinganmeng Prefecture.

124. It is logical to expect that neighboring Mongolia, which is regarded as having vast potential to become a major minerals producer, would become a key supplier to PRC. The following official statistics in Table 4 illustrate the rapid rate of growth of PRC's mineral imports.

Table 4: PRC Imports of Mineral Commodities

	1998 (1,000 tones)	1999 (1,000 tones)	2000 (1,000 tones)	3-year increase
Iron ore	51,770	55,270	69,970	35%
Manganese ore	1,180	1,070	1,200	2%
Copper ore	1,180	1,250	1,810	53%
Coal	1,580	1,670	2,120	34%
Copper and alloys	268	548	812	203%
Rolled copper	547	632	741	36%

Source: China Statistical Yearbook.

125. Some of Mongolia's mineral exports (copper and iron concentrates) would logically pass through the Project Area depending on the location of the customers and availability of transport infrastructure.

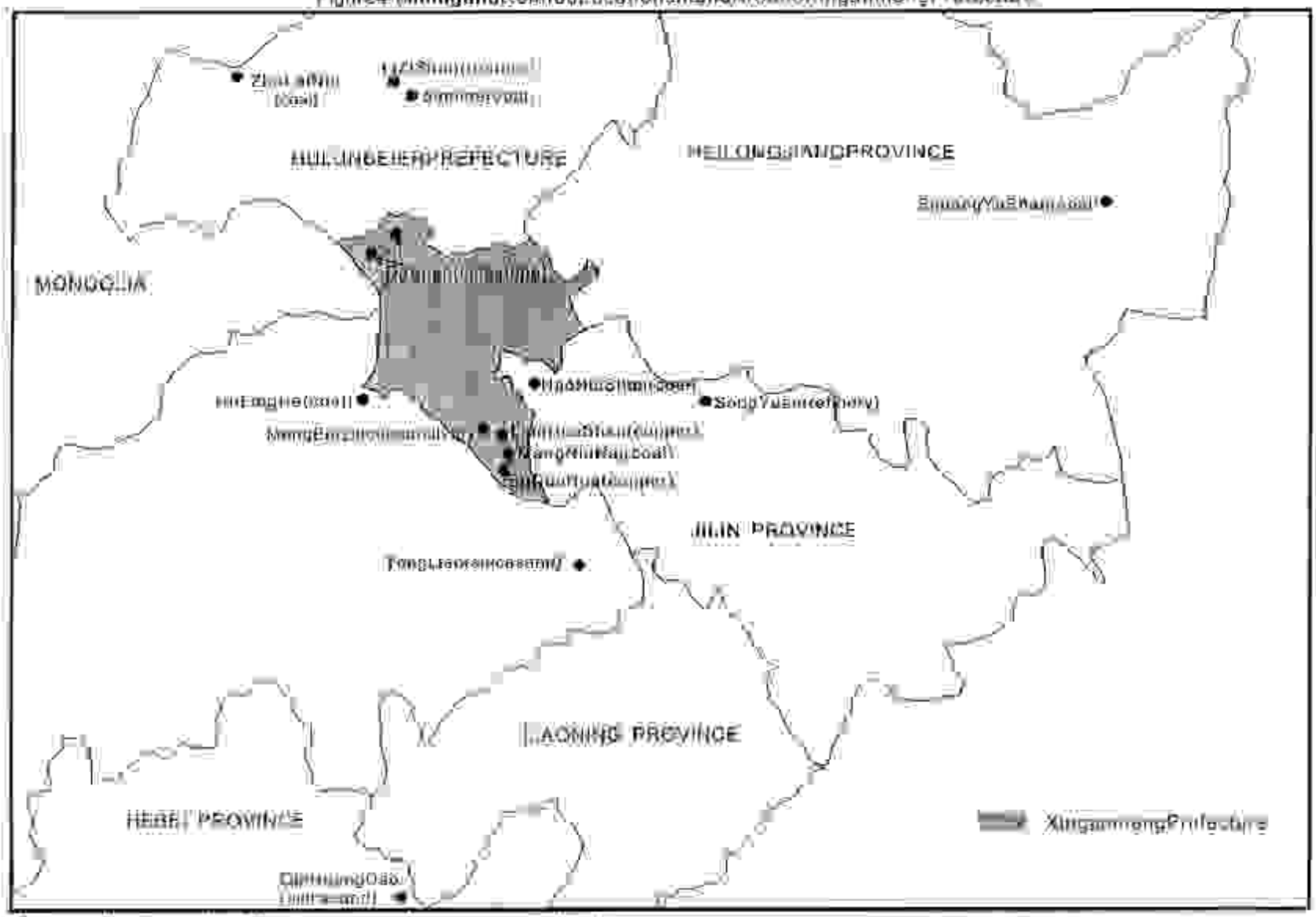
126. Fluorspar from Mongolia presents a special case. PRC is the largest fluorspar producer in the world (production 2.45 million t in 2000) [36] (see appendix D) and is therefore unlikely to use Mongolian fluorspar (production 0.199 million t in 2000) much of which is produced in the Project Area. However, it is possible that Mongolia could sell fluorspar directly to end-users such as Korea and Japan and transship it through the Project Area. This is a highly likely scenario as PRC's exports of fluorspar have been flat for the last three years

ESTIMATION OF RAILWAY FREIGHT VOLUMES

127. As stated in the Section, Timing of Significant Development of Mineral Projects, significant mineral development witting the Project Area is unlikely to take place within the next 7-10 years. Accordingly, the estimate of railway freight volumes is based on a timeframe lying beyond 2013. The estimate is made in increments of five years to 2023.

128. The key item driving exports of mineral commodities to PRC is GDP growth. This was recently estimated to be about 7% per year over the next 10-15 years. [37] (see appendix D)

129. Tables 5 and 6 show the Consultant's estimates of railway freight shipments.



Source: The Consultant, Borders and prefectures are approximate

Table 5: Railway Shipments from Mongolia

Commodity, Minerals and Mine Products (1,000 tones)	2013	2018	2023
Coal	4,000	5,600	7,800
Zinc/lead/silver concentrates	140	200	270
Iron ore concentrates (trans-shipment)	500	700	1,000
Copper ore concentrates (trans-shipment)	300	420	600
Fluorspar concentrates (trans-shipment)	240	240	240
Tungsten concentrates	100	140	200
Molybdenum concentrates	100	140	200
Estimates of other commodities (See note below)			
Grain	250	350	500
Fertilizer	200	280	400
Oil	235	300	380
Iron, steel	150	210	300
Containers	200	280	400
Fodder	180	250	360
Cattle, meat, food cargo	40	60	80
Other cargo	440	620	880
Transit cargo	750	1,050	1,500
Total Shipments	7,825	10,840	15,110

Note: Estimates for other commodities (except oil) are based on the Pre-Feasibility Study of the Mongolia China Railway Project. UNDP/Tumen Secretariat, Sept 1998. Volumes proportioned for Year 2013 (midway between 2010 and 2015) and then escalated at 7% per year.

Table 6: Railway Shipments to Mongolia (See note below)

Commodity (1,000 tones)	2013	2018	2023
Cement	100	140	200
Containers	230	320	450
Machinery, equipment	220	310	430
Food and consumer goods	140	200	270
Metal, steel	110	120	130
Other cargo	190	270	370
Transit	250	350	450
Total Shipments	1,240	1,710	2,300

Source: Pre-Feasibility Study of (he Mongolia China Railway Project. UNDP/Tumen Secretariat, Sept 1998. Volumes proportioned for Year 2013 (midway between 2010 and 2015) and escalated at 7% per year.

General Assumptions

130. Mineral transport projections summarized in Tables 5 and 6 are based on the following assumptions:

131. Exports/imports between Mongolia and PRC will be exclusively driven by supply and demand considerations between the two countries. In other words, neither country

will artificially protect its industries in a manner that adversely affects the exports of the other.

132. A railway will be built extending from Choibalsan to the easternmost part of Mongolia and then on to Arxan.

133. With an efficient transportation network in place and with the infrastructure issue resolved, Mongolia will produce mineral commodities at competitive costs FOB mine {i.e. excluding freight). The relatively short shipping distances to PRC compared to other mineral exporting countries such as Brazil, South Africa, Australia, etc. will then allow Mongolia to become a major exporter.

134. While there are several commodities of which PRC is a major exporter (such as zinc and tungsten), Mongolia will be able to produce these at a cost that is sufficiently low to allow transshipment through PRC to nearby third countries such as Japan and Korea.

135. Commodity prices are highly cyclical and are currently in a severe down-cycle. As long as this period of low prices continues, it will generally reduce investor interest in opening new mines other than those, which are highly profitable.

136. However, a combination of improved commodity prices and the low transportation costs will make Mongolia an attractive place for mining investments. This optimism will result in mining companies making considerable expenditures in additional exploration and technical feasibility studies to prove up the various mineral deposits, which are described below.

Coal

137. While PRC is reported to be the world's largest coal producer, selective exports from the Mongolian Project Area to Xinganmeng Prefecture are possible. Current demand in Xinganmeng and nearby destinations for non-metallurgical coal with a quality of 3,500 Kcal/kg is about 2.8 million tpy. For the purposes of this study, it is assumed that this demand will escalate to 4 million tpy by 2013 and then escalate at 7% per year beyond that.

138. The Bulangiin Hooloi Coal Deposit in Dornod aimag appears at this time to be a good fit to displace some of the coal, which is used in the Prefecture but sourced from outside. However, this is subject to substantial additional work being performed and assumes that the coal quality will be at least 3,500 Kcal/kg. The time frame of 10 years in the future is sufficient to bring the mine into production.

139. Alternatively, the existing Aduuchuulun Coal Mine near Choibalsan in Dornod aimag could supply coal. However, the question of whether its coal quality can be increased from its current level of 3,200 Kcal/kg to the required level of 3,500 Kcal/kg must be resolved.

Zinc/lead/silver concentrates

140. The announced plans of the Tumurtein Ovoo zinc project in Dornod aimag are based on shipping 70,000 tpy of concentrates to PRC. The Consultant's projections assume the existence of two such projects with exported production (perhaps including new projects) escalating at 7% per year. Although PRC is the world's biggest zinc producer, it is reasonable to expect that PRC will import zinc from Mongolia, if

Mongolian zinc is competitively priced. Alternatively, it is assumed that Mongolia will sell directly to third party countries such as Japan or Korea and transship the product through PRC.

Iron Ore

141. According to official statistics PRC imports large amounts of iron ore. As described previously, Hentii aimag has two iron deposits. However, they are considerably smaller than two other iron deposits in Selenge aimag, which are about 400 km further to the west. Additional feasibility studies should be conducted to assess both the Hentii and Selenge deposits and their export potential to PRC. Regardless of the outcome of the feasibility studies, there is considerable potential to export Mongolian iron ore due to the shorter shipping distance compared to other iron ore exporting countries (Brazil, South Africa, Australia). Accordingly, projections assume that the opening up of an east-west rail link will allow economical transshipment of Mongolian iron ore or concentrates to the existing Ulanhot Steel Mill located in Xinganmeng Prefecture. It is further assumed that the demand will increase[38] (see appendix D) from its present level of 300,000 tpy to 500,000 tpy by 2013 after which it will further escalate at 7% per year.

Copper Concentrates

142. According to official statistics, PRC is a major importer of copper ore concentrates. Copper ore concentrates are being produced at Erdenet Copper Mine in Bulgan aimag and shipped to Russia. According to the Armada Gold Corporation's 1997 Annual Report, Erdenet has sufficient reserves for another 90 years of production. Therefore, exporting to PRC in the 2013-2023 timeframe should not pose a problem. Projections assume that the opening up of an east-west rail link will allow economical transshipment from Erdenet to points beyond the Project Area. Demand is assumed to escalate at 7% per year.

Fluorspar Concentrates

143. While PRC is the largest fluorspar producer in the world and is unlikely to use Mongolian fluorspar, it is possible that Mongolia could sell fluorspar directly to end-users in Korea and Japan and transship it through the Project Area. It is assumed that two projects such as MongolRostvetment in Hentii aimag would each export 120,000 tpy of concentrates for the period 2013-2023. No escalation is projected. This is consistent with PRC's experience, which has seen exports being flat for the last three years.

Tungsten and Molybdenum Concentrates

144. There are three separate deposits in the Project Area that have the potential to produce tungsten and/or molybdenum, these are Undur-Tsagaan, Yuguzer and Ariin Nuur.

While the Mongolian Mineral Authority does not at this time consider these deposits as being particularly attractive, additional work performed prior to 2013 will prove up the economic viability of these and/or other deposits. Demand is assumed to escalate at 7% per year.

145. Although PRC is by far the world's largest producer of tungsten with an estimated 83% of the production, it is anticipated that Mongolia will sell directly to third party countries such as Japan or Korea and transship the product through PRC.

Silica Sand

146. While the Altan Gol silica sand deposit is of high quality, based on interviews conducted with officials in Ulanhot, there does not appear to be a present market for the product as there are no glass manufacturing facilities in Xinganmeng Prefecture. While the possibility exists that a dedicated facility could be established in the Prefecture to use the Altan Gol silica sand, for the purpose of this Report this is considered to be somewhat unrealistic. Accordingly, no projections of silica sand exports have been made. However, after the decision has been made to proceed with the railway construction, this possibility should be further explored.

Oil

147. This commodity was previously estimated in the Pre-Feasibility Study of the Mongolia China Railway Project and exports via railway were projected at 5 million tones per year in 2015.

148. At present, total oil production is 30,000 tpy[39] (see appendix D) from two production sharing contracts at the Tamsagt Basin in Dornod airnag, all of which is exported to PRC, The oil is initially transported by truck through the Bichigt border post and then for another 70 km to a pipeline, which moves it to a refinery at Hohhot, the capital of Inner Mongolia. Total production from the Tamsagt Basin in Mongolia is officially projected to increase to 1.26 million barrels (175 thousand tpy) by 2007. [40] (see appendix D) Production is assumed to escalate at 5% per year.

THE NEEDS OF THE MINING INVESTOR

149. What does the mining investor look for in evaluating an investment project? What drives his investment decisions? What items does he consider to be more important than others? Why is he prepared to invest in Country A but not Country B? How important to him are royalties compared to income taxes?

150. These are all key questions to be answered by the investor before he makes the substantial capital investment in a mining project.

151. Whether apparent or not, all countries and mining projects are in competition with each other to attract new investment capital. This applies to both foreign investors and domestic investors. Foreign investors will place their money in those countries that yield the highest return. On the other hand, domestic investor? will invest abroad if they can get a better return on their capital elsewhere. In effect, a global economy exists in mining and to achieve sustainable economic growth, national governments should ensure that their policies are reasonably competitive within this global environment.

152. Therefore, all investors carefully examine several factors before committing large

amounts of capital. In the particular case of mining, investors take a long term view of the world. Due to the capital-intensive nature of mining and the typically low commodity prices, long pay-back periods are common. Many mining projects are planned for 20 to 30 years of production and the capital investment is frequently not recovered until well into the economic life of the project. This contrasts to the oil industry, which is- characterized by higher rates of return allowing the development of deposits with shorter lives, sometimes less than 5 years. To protect his interest, the miner must feel Confident that throughout the life of the project he will obtain a return on his investment that warrants the initial investment.

153. The criteria that mining companies apply to capital investments are very much company-specific but will generally fall into three broad categories:
- Geologic risk;
- Political risk, and
- Investment climate.

154. All of these factors are interrelated. For example the most politically stable country in the world with bad geology will be of no interest to a miner. Similarly, a great geologic prospect in a stable country where the government takes away any potential for a reasonable financial return through royalties and taxation will not be attractive to the investor. In other words, all the factors must be in the proper mix to attract investment. The three factors are discussed below.

GEOLOGICAL RISK

155. All mining companies must believe that there is a reasonable geologic risk (i.e. the ability to find an economic ore body) before they invest in a new country. A higher perceived geological risk will necessarily mean that other risk factors should be correspondingly lower in order to attract new investment. A high quality ore body will always attract the most attention. There is no substitute for grade. [41] (see appendix D)

Political Risk;

156. Political risk is not just a mechanical processing of objective facts, but is very much a matter of subjective perception and, therefore, has much to do with a country's recent history. Decision makers in companies ate senior people and have usually been around for a long time. Their personal experience and the experience of their peers in one country forms the basis for long lasting impressions, both positive and negative.

157. Political risk is obviously an important factor in investment decisions of any kind, but particularly so in an industry that has such a high up-front capital investment as the minerals industry. If minerals development can occur in a country that is resource rich but has significant political risk, some cost penalties can be worth considering. Clearly, however, there are limits to this and the outcome may be that a resource remains undeveloped until a more opportune time.

158. A paper by D. Ritchie[42] (see appendix D) identified some of the key factors used in assessing political risk. While the political system in place does not necessarily affect the attractiveness of an investment, a number of conditions internal to the country certainly do have an effect. These are listed below.

Political Stability

159. A stable continuous regime, free of turmoil and dramatic change is an important consideration for foreign investors. This does not mean that one particular political party should be favored to retain control of government over another. Rather, it means that the investor seeks a host country, which provides a setting where successive governments of perhaps different political persuasion have an established record of encouraging foreign investment and in particular, encouraging the development of the country's minerals sector.

Law and Order

160. A potential foreign investor will favor a country where its staff, its investment and its plant are unlikely to be placed at risk of physical attack. Particularly due to globally increased terrorism in recent years, this factor has gained considerable weight in investment decisions.

Attitude to Foreign Investors

161. A key consideration to a potential foreign investor is that he will be treated in the same manner as the domestic investors are treated. A regime, which maintains open and non-discriminatory attitudes and policies towards foreign investors is important to an investor's perception of the potential for successful operations.

Bureaucratic Efficiency

162. A government bureaucracy that is efficient and free of corruption is instrumental in creating the flexibility and freedom necessary for productive exploration work.

INVESTMENT CLIMATE

163. The investment climate of a particular country is the overall rating of the country based on a compilation of a number of factors. There have been several surveys and studies done to assess the relative importance of each of these factors. One of the most often quoted is a study done by Charles Johnson of the East-West Center in 1990. [43] (see appendix D) that survey asked companies to identify the most critical issues for investing and where they expected to invest in the 1990s. The results of his survey are presented in Figure 5.

164. Of the eight principal issues identified there is one central theme that is consistent throughout, namely the rights of an investor. The government must not discriminate against either a foreign or local investor and both should be treated equally in all aspects of the law. The eight factors are discussed below.

Right to Mine

165. The foreign investor must have the right to mine throughout the project's life provided he meets certain criteria, which are clearly defined at the beginning and can be monitored objectively. Companies will not invest where the right to mine can be arbitrarily revoked, nor will they invest where the fruits of their exploration are likely to be offered out for bid by others. The host country must protect the right to mine through all means possible.

Right to Repatriate Proceeds

166. An investor will be in the best position to obtain a payback on its investment if it can

export a mineral product on a steady basis and sell it in world markets for convertible currencies. However, where host governments require sales of product to the central bank (as is the case for gold in Mongolia) then the company must be assured that:

1. Payment will be made in a timely manner at world market prices;
2. The local currency will remain convertible or payments are made in convertible currency; and
3. If payments are made in domestic currency, there will be no foreign exchange restrictions on convertibility and an adequate supply of foreign currency is available at all times during the life of the project.

167. The rate of exchange will also be important as well as the company's right to maintain its investment records in a stable currency, such as U.S.$. Finally, the investor must be assured that the system imposed by the government will remain basically unchanged for the life of the project.

Management Control/Equity Control

168. With respect to management and equity control, mining companies must have assurance that they control the project and, therefore, have the flexibility to deal with changes as they occur. However, as noted by Thomas L. Reiner[44] (see appendix D) "Governments have no real incentive or need to accept the economic risks associated with equity investments. When equity participation is undertaken, it is sometimes contrary to the best financial advice available to the host country and is often undertaken for political and not financial or economic reasons".

169. From a company's perspective, an equity position by the government is acceptable where the goals of the company and the government coincide and they operate as true joint venture partners. However, this is rarely the case and perhaps at no time will this be more apparent than when the mineral commodity price has dropped and the project is in a break-even or loss position. During these types of hard times, the company's interest to reduce costs (through such measures as layoffs) would be in conflict with the government's social objectives.

Fixed Tax Terms

170. Because of the long term nature of mining investments, some degree of assurance is required that the taxation rules will not change in the middle of the project life. The investor needs this assurance so that the economic evaluation to justify opening a mine will remain valid throughout the life of the mine.

Modern Minerals Legislation

171. Mining and minerals legislation that clearly contain all the rules relevant to investment will make a country appear more attractive to a potential investor. He will be able to understand the rules and not need to expend the time and expense in developing an understanding of a multitude of different codes. Similarly a modern system of administration, such as efficient administration of land titles, increase the confidence in a country.

Fixed Rules for Life of Mine

172. Similar to taxation, the mining investor needs some assurance that the rules will not change in the middle of the project life.

Guaranteed Arbitration

173. Foreign investors prefer some form of protection for their investment through arbitration outside the country of dispute. This provides a mechanism for fair treatment or compensation for any losses of property due to governmental intervention.

174. In summary, the mining investor intends to make a long term commitment to the host country and plans for the long haul through the inevitable price fluctuations of the commodity to be produced. In return for this commitment, the mining investor requires that he gets fair treatment under laws that are understandable and that he will not be subject to extreme regulatory change over the life of the project.

Page 175-182 not here

INVESTMENT CLIMATE

Right to Mine

183 This critically important requirement is addressed effectively under the 1997 Mineral Law of Mongolia, which was drafted with assistance from experts from the World Bank. The parts of the law that are most important to investors are summarized below.

184 The mineral resources in Mongolia are the properly of the State, which has the right to grant exploration and mining licenses. Any Mongolian citizen or foreign citizen is entitled to hold an exploration license covering not more than 400,000 hectares. Certain restrictions on exploration apply to protected or restricted areas. An exploration license shall be granted on a "first come first served" basis to the first qualified applicant. The exploration license is issued for a period of three years and the holder has the right to obtain two extensions for two years each. In accordance with the terms and conditions of this law, an exploration license holder has the following rights;

- To exclusively explore for minerals within the boundaries of an exploration claim;
- To obtain a mining license for any part of an exploration area;
- To transfer all or part of an exploration license;
- To obtain two extensions of the term of an exploration license for two years each;
- To have access to, entry on, and transit through, the exploration area;
- To construct temporary structures necessary for conducting exploration activities;
- To use the land adjacent to the exploration area for the purpose of gaining access; and
- To enter and transit through land owned or used by other persons. This right shall be determined by a contract between the license holder and the landowner or land-user.

185 A mining license is issued for a term of sixty years and the holder shall have the following rights, in accordance with the law:

- To exclusively engage in mining of minerals within the mining claim;
- To manage its operations and market its products;
- To sell mineral products from the mining claim at market prices;
- To conduct exploration for minerals within the mining claim;
- To transfer all or part of the mining license;
- To extend the term of the mining license once for a period of 40 years;
- To enter and transit through the mining area, use the mining area, construct necessary structures, and conduct other activities related to mining and

exploration;
- To enter and transit through the land adjacent to the mining area;
- To enter and transit through land owned or used by other persons in order to exercise the mining rights. This right shall be determined by a contract between the license holder and the landowner or land-user; and
- To use water.

186 The 1997 Minerals Law of Mongolia fully addresses the investor's "right to mine". Furthermore, an international mining company which requested anonymity described it as "the best in Asia".

Right to Repatriate Proceeds

187 Under the Foreign Investment Law, investors have the right to transfer abroad: [45] (see appendix D)
- Shares of profits and dividends;
- Proceeds from the sales of their assets and securities; and
- Proceeds from the transfer of their property rights to other persons, as well as from their withdrawal from or the dissolution of the business entity.

188. Bilateral and international agreements executed by Mongolia generally stipulate that monetary transfers can be made in a freely usable currency at the prevailing rate of exchange on the date of transfer. The right to repatriate proceeds is sufficiently assured in Mongolia.

Management Control

189. The 1997 Minerals Law of Mongolia grants the holder of a mining license the right to manage its operations and market its products. The holders of Exploration and Mining Licenses have full control over management.

Equity Control

190 In Mongolia there is no requirement[46] (see appendix D) that:
- Mongolian nationals own shares in a foreign investment;
- The share of foreign equity be reduced over time; or
- Technology must be transferred on certain terms.

191 The holders of Exploration and Mining Licenses have full control over their equity.

Fixed Tax Terms

192 The 1997 Minerals Law of Mongolia describes the availability of a "stability agreement" with the following provisions. The stability agreement must be negotiated with the Ministry of Finance.

193 If a mining license holder undertakes to invest in its mining project in Mongolia at least U.S.$2 million during the first five years of the project, a stability agreement may be entered with the Government. The stability agreement provides guarantees for a stable fiscal environment for the mining license holder.

194 The specific stability agreement must be approved by the Government and contain provisions regarding the stability of tax rates for a definite time period, the right of the license holder to export and sell its products at international market prices; a

guarantee that the license holder may receive and dispose of hard currency income derived from such sales; and provisions with respect to the purpose, amount, and term of the license holder's investment.

195 The term of the stability agreement is 10 years if the amount of the initial investment in the mining project is at least U.S.$2 million. If the investment is at least U.S.$20 million, the term of the stability agreement is 15 years.

196 Furthermore, there is complete tax exemption for 10 years with a 50% deduction for the following five years for oil, coal, and mineral mining and processing (except precious metals).

197 The legislated royalty rate of 2.5% of sales profit is reasonable and comparable to that of other mineral-rich countries, which have royalties ranging from 2% to 5%. The legislated royalty rate is 7.5% for only gold placer deposit whereas it is 2.5% for gold deposit but VAT is not included.

198 Amendments were made to "Excise Tax Law", "Customs Tariff Law" and "Value Addition Law", effective February 2000, for exemptions of the following taxes associated with the mining industry and oil production sharing contracts with the Government;

- Excise Tax on gasoline and diesel fuel;
- Customs Duties Tax on imported equipment, machinery, spare parts, materials, gasoline, diesel fuel; and
- Value Added Tax (VAT) on imported equipment, machinery, spare parts, materials, gasoline, diesel fuel.

~~199~~ Article 63 of the 1997 Minerals Tax Law of Mongolia allows for a loss incurred in any tax year to be deducted from taxable income during the three tax years following the year in which the loss was incurred (i.e. "loss carry forwards"). In the view of private sector investors interviewed during the course of the study, this period is considered insufficient and should be extended to seven years, allowing fuller recovery of losses. The same Article 63 allows for depreciation write-offs on a straight line basis. Instead, accelerated depreciation should be allowed for faster recovery of invested capital. The financial provisions of the 1997 Minerals Law of Mongolia have not been incorporated into the Mongolian Tax Code and must be negotiated by the investors as part of the Stability Agreement. This is universally regarded by the mining companies to be a major drawback. Also, the standard 40% tax rate on income appears to be high in comparison with other countries against which Mongolia competes for mining investments. ~~The available information and documentation does not appear to specifically address the following taxation issues which are very important to the mining industry;~~

- Exemptions of Excise Tax; customs Duties; and VAT (similar to the oil industry);
- Accelerated depreciation;
- Loss carry forwards and
- Reductions to the standard 40% Tax rate on income, which appears to be high

200. In general Mongolia has been able to establish an attractive environment from the point of view of taxes. However, it is recommended that the entire process be made more specific and transparent. While certain investors may enjoy having to "bargain" on every financial issue during the Stability Agreement negotiations, it can become a complicated and time consuming process. In addition, it can be costly to the mining investor. A significant disadvantage is that investors may have difficulty constructing credible "financial models" (used to determine the economic viability of the project)

without knowing in advance important details such as tax rates, depreciation schedules, etc., which may be considered later during Stability Agreement negotiations.

Modern Minerals Legislation

201 The 1997 Minerals Law of Mongolia, drafted with assistance from experts from the World Bank, provides a very good framework for the licensing of exploration and mining. In addition, sections are included pertaining to environmental protection; royalties and methods of calculation; relations with local administrative bodies; reporting requirements; transfers, termination and revocation of licenses; resolution of boundary disputes; and sanctions for breaches of the Mineral Laws. The 1997 Minerals Law of Mongolia provides a secure framework regarding the licensing and other legal issues of exploration and mining.

Fixed Rules for Life of Mine

202 The 1997 Minerals Law of Mongolia was enacted after making certain amendments to the previous version. Further amendments are possible. However, having developed what is regarded as a good Minerals Law, it is net expected that the State Ikh Hural will make changes that are adverse to the mining industry.

Guaranteed Arbitration

203. The Foreign Investment Law states that disputes will be settled in the courts of Mongolia unless provided otherwise by a treaty to which Mongolia is a signatory. [47] (see appendix D) While there is no reason to believe that the judiciary is unduly influenced either by the government or by any individual or entity in Mongolia, it is important to note that there is a countrywide lack of expertise in modern business practices that certainly extends to judges. In addition, many of the laws governing business activity and foreign investment have not been thoroughly tested.

204. There is general concern that there could be problems with the implementation of this untested dispute settlement method. Investors want recourse through some independent method of dispute resolution that is fair and transparent, such as an international court in a neutral country. Until the Mongolian arbitration procedure is thoroughly proven, new companies will be concerned about fair treatment.

RECOMMENDATIONS

205. The Consultant makes the following recommendations:

Coal

206. A feasibility study on the undeveloped Bulungiin Holooi coal deposit in eastern Dornod aimag should be performed. The feasibility study should determine the capital and operating costs of the mine and estimate the time required to place it into production. If necessary, additional exploration should be conducted to firm up estimates of expected coal quality.

207. Using the feasibility study as a base, a comparative assessment should be made of the existing Aduuchuun Mine vs. a new mine established on the Bulungiin Holooi deposit. The purpose of the comparative assessment is to determine which coal is better suited and more cost-effective to serve the needs of the identified customers in

Xinganmeng Prefecture.

Iron Ore

208 Similarly, feasibility studies and a comparative assessment should be prepared on the four iron ore deposits: Navchit Gol and Bargilt in Hentii aimag and Tumurtei and Bayangol in Selenge aimag. The purpose of the comparative assessment is to determine which iron ore is better suited and more cost-effective to serve the needs of the identified customers in Xinganmeng Prefecture.

Road Trains

209. Road trains should be further studied as an interim step before the construction of a railway. If judged to be cost-effective and commercially viable under Mongolian conditions, they should be promoted to mining investors as a means of "kick-starting" mineral development in the Project Area. In addition, they may prove to be cost-effective for the existing fluorspar mines as well as for soon-to-be-implemented projects such as Tumurtein Ovoo and Mardai.

Improved Environmental Enforcement

210 Based on Consultant's observations, existing environmental rules and regulations are frequently not enforced by the responsible agencies. This results in unnecessary harm to the environment.

Greater Transparency and Specificity on Financial Taxation Issues

1. The overall issue of taxation should be made more specific and transparent so that potential investors know in advance what the tax regime will be. It is unreasonable to expect investors to wait until the Stability Agreement negotiations, which is one of the final steps in the project cycle. In particular, the following items are very important to the mining industry:
   - The financial provisions of the 1997 Minerals Law of Mongolia should be incorporated into the Mongolian Tax Code. This will eliminate the present situation whereby financial issues must be negotiated by the mining investors as part of the Stability Agreement. Exemptions of Excise Tax Customs Duties and VAT
   - Accelerated depreciation should be allowed, rather than straight line depreciation, permitting the recovery of capital costs at a faster rate. 7
   - The loss carry forward period of three years should be extended to seven years, allowing fuller recovery of losses. ~~Losses carry forwards and clarify this from Tax Authority. There should be principle changes~~
   - The standard 40% tax rate on income should be reduced to levels equivalent to other countries against which Mongolia competes for mining in vestments. ~~Reductions to the standard 40% tax rate on income~~

1. Rather than leaving these items to be resolved during the Stability Agreement negotiations, Consultant recommends that they be made part of the overall (written) incentive package for mining investments.

Education of the Local Holders of Exploration and Mining Licenses

213. It is the Consultant's overall perception that the local holders of exploration and mining licenses are generally unaware of the stringent requirements for additional exploration and engineering feasibility studies necessary to prove up the economic

viability of their deposits. They tend to think that the exploration and feasibility work (if any) which was principally done during the pre-1990 socialist times is perfectly acceptable for the investment of large amounts of capital in mining ventures which are inherently high risk. In Consultant's opinion this tack of knowledge acts as a deterrent to the further development of the mining industry in Mongolia.

214. Accordingly, Consultant recommends that a series of seminars or workshops be held for the local holders of exploration and mining licenses, which would be organized by the local mining university and the respective government departments, This would provide an opportunity for them to learn more about the mining industry, particularly the perspectives and expectations of foreign investors. Following is a summary list of topics that should be covered in the seminars:

- How to judge the adequacy and sufficiency of past exploration;
- Determination of mining reserves and their various categories (measured; indicated; inferred),
- Mining feasibility studies and their function in determining the economics of mining;
- The expectations of banks regarding technical supporting data and projections of life-of-mine capital requirements, cash flow and profitability;
- How to obtain bank financing; and
- How to negotiate joint venture agreements with investors.

[1] Information provided by the Mineral Resources Authority of Mongolia

[2] With the exception of precious metals (such as gold and silver) the volumes of mined products require access to efficient low cost transportation, preferably a railway.

[3] The "bottom line" of the multiplier effect is illustrated by the results of research by the Western Economic Analysis Center in the US which shows that mine output valued at US$60 billion in 1995 made a direct and indirect contribution to the economy of US$524 billion. This was comprised of US$296 billion in business income; US$144 billion in personal income and US$84 billion in federal, state and local taxes. Similarly, according to a confidential study by Norwest Mine Services, the economic benefits of a medium-size copper mine in Argentina were estimated as follows: (i) Direct and indirect employment: US $ 53.4 million per year; (ii) Consumption of local goods and services: U.S.$ 37 million per year; and (iii) Royalties U S $ 3.5 million per year.

[4] Exploration Licenses or Mining Licenses are granted to individuals over designated mineral properties and grant the license holders the exclusive right to further develop the properties.

[5] USA, Argentina and Chile

[6] Separate interviews with Mr. Tsend EnkhboM, Deputy Director, Mineral Policy and Regulation Department and Mr. Bazaryn Magvanjav. Quieter, Head of Minerals Department, Reserves- Minerals Authority.

[7] Information provided by Mr. Ganbat. President & CEO

[8] The Consultant believes that the schedule provided is likely to slip. The proposed mine-site was visited and showed no signs of any imminent construction activity.

[9] Information provided by Mr. Wallace Mays, U.S. investor

[10] Ibid.

[11] The Consultant visited Mardai on August 9 2002 and noted evidence of past removals of infrastructure. In addition, it was observed that power poles were being loaded onto specialty vehicles. The removal operation appears to be well organized and not the work of the few impoverished families remaining in the town.

[12] Information providers! By Mr Badamdamdin. President, Aza Dalai Far East.

[13] Information provided by Mr Badamdamdin. These feasibility studies were not reviewed by the Consultant. Accordingly, the reliability of the figures included in the report has not been established.

[14] Information provided by Mr. Kh. Bayaraa, General Director, and Shine Eh Gobi Co

[15] Information provided by Mr. Demberel Erdenebat, Deputy Head of Trade and Dr. G. Tsogt, Director of Mining, MAK

[16] It is generally agreed that international mining projects should only be considered if they generate rates of return in excess of 20%.

[17] Interview with Mr. Gantumur. Deputy Director of Mon Jap International, holder of an Exploration License on the Ulziit deposit in Sukhbaatar aimag Mon Jap's existing placer gold operation, also in Sukhbaatar aimag, produces less than 5 kg t?7 of gold per year.

[18] Information provided by Mr. Pinvf?, MongolRostsvetrriRnt Mining & Trade Corporation

[19] Information provided by Mr. Lu'bayar. Chief Engineer; Mr. Enkhbayar, Mining Engineer; and Mr. Tsagan, Finance Department

[20] Information provided by Mr. Terry Moylan, General Manager

[21] Information provided by Mr Douglas Mc Gay, Manager, Government & Community Affairs

[22] Mr. Purvee, MongolRostsvetmRnt Mining 8, Trade Corporation.

[23] There is an analogous situation with coal mining whereby the mining of only the lowest stripping ratio (i.e. lowest mining cost) coal could, under certain circumstances, reduce the life of the mine by making the remaining reserves unprofitable

[24] The Consultant is not able to confirm the accuracy of these estimates provided by Mr. Badamdamdin of Aza Dalai Far East, the license holder over the Ulaan deposit. However, the numbers can be considered as indicative or illustrating a trend

[25] An actual experience of grade versus NPV is from South Africa. The period of high gold prices in the late 1970s and we'll 1980s was unusually profitable for the South African gold mining industry. However, lo extend the life of the mines; the national government (which owns the minerals) issued a directive to all gold mining companies that they should only mine at the average grade of the remaining reserves. While this reduced the short term profitability of the mines, it increased the NPV.

[26] Confidential correspondences from Norwest Corp dated August 20, 2002

[27] A generally accepted 'Rule of Thumb" is that the total amount expended on exploration to determine the amount of measured reserves (which is required to secure project financing) is equal to about should not be more than 2% of the gross value of the metal in the reserve. The overall validity of this "Rule of Thumb" is proven by the Mongolian experience of the license holders of Boroo Gold and Ivanhoe, who spent significantly more on additional exploration after acquiring their deposits.

[28] Natural Resources Canada 1997; US Geological Survey. January 2002

[29] Natural Resources Canada 1997; US Geological Survey, January 2002

[30] US Geological Survey, January 2002; UNCTAD Iron Ore Trust Fund Report for 2001.

[31] Extrapolated from National Energy Information Agency, January 1999.

[32] US Geological Survey. January 2002; Engineering & Mining Journal, June 2002

[33] US Geological Survey. January 2002

[34] US Geological Survey. January 2002; Mongolian National Statistical Yearbook

[35] News release from Asia Pulse dated June 28, 2002

[36] United States Geological Survey, 2002 Mineral Commodity Summaries

[37] Mr. Qui XiaoHua. Deputy Director of Chinese Bureau of Statistics, article published in Asia Link Media dated December 2001

[38] Information provided by Ulanhot Steel Mill. Steel production under the 1u'h Five-Year Plan (2001-2005) is scheduled to increase above its current level of 600,000 tpy.

[39] Information provided by Mr. Ps Humur Chimiddorj, Vice Chairman, Petroleum Authority of Mongolia.

[40] Information provided by Mr, Davaasarnbuu, Chairman, Petroleum Authority of Mongolia.

[41] Gцdel, Ralph W. (1992) "Prospective of Mining Companies Making International Investments".

[42] Ritchie. Douglas. (199?). "Exploration and Mining Conditions in the Asia/Pacific Region - An Industry Perspective".

[43] Johnson, Charles J. (1990) "Ranking Countries for Minerals Exploration", Natural Resources Forum. (August issue) pp. 178-186.

[44] Rainer, Thomas L (1991) " Government Take in Pacific Rim Mining and Petroleum Developments: The Papua New Guinea Experience," International Resources Law: A Blueprint for Mineral Development^ Paper no. 10-10 (Rocky Mountain Mineral Law Foundation). Mr. Rainer goes on to point out that the government of Papua New Guinea at one time had its equity interest in the OK Ted project diluted for failure to meet a call for a contribution. The equity lost by the dilution was later recouped to the full 20%.

[45] "1999 Investment Climate Statement" dated July 6. 1999, prepared by the U.S. & Foreign Commercial Service and the U.S. Department of State.

[46] Ibid.

[47] Ibid.