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## REPORT ON THE MINING SECTOR

### BOLIVIA

Dept. of External Affairs  
Min. des Affaires extérieures

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## THE GEOGRAPHY OF MINING IN BOLIVIA

Encompassing spectacular mountain ranges, high plains and tropical lowlands, Bolivia presents a highly diverse and interesting geology. Within a national territory of about 1.1 million square kilometers, six distinct geographic regions display different metallogenic qualities.

Andean geography occupies roughly the southwestern quarter of Bolivia. Three geographic and geological regions can be identified here. Stretching in a relatively narrow band along the southwestern frontier with Chile, the Cordillera Occidental or Western Range presents recent volcanic structures along with Tertiary dacites and andesites. This region is believed to offer considerable precious metal potential in epithermal deposits well-suited to bulk mining techniques. Large, high grade sulfur deposits also occur here.

Just to the east, the Altiplano stretches in a band some 700 kilometers long and about 130 kilometers wide. This intermontane basin, at an altitude of about 4000 meters, runs from Lake Titicaca down to the border with Argentina. The Altiplano consists of Tertiary red-bed sediments and volcanics. One volcanic complex near the city of Oruro has been developed as a massive open pit heap leach gold operation by the Bolivian firm Inti Raymi S.A., a company in which Battle Mountain Gold of the U.S. now holds about one third capital interest. Inti Raymi's mine at Kori Kollo represents Bolivia's most important gold development and is one of the most modern operations in the country. Southward beyond the town of Uyuni, another important bulk mining operation produces silver at Toldos.

One of the most interesting mineral deposits on the Altiplano is the Salar de Uyuni, a large salt lake containing the world's largest lithium deposit together with other elements in suspension. The U.S. firm Lithco has for some time been negotiating proposals to develop this resource. Other small salt and borate deposits are also found in the region.

The third Andean region, the Cordillera Real, forms the eastern rim of the Altiplano. Mountains of the Cordillera Real rise to 7,000 meters, including Illimani, which looms dramatically over the La Paz skyline. From the Peruvian border northwest of La Paz this mountain range curves away south-southwestward to Argentina, gradually broadening to a width of some 100 kilometers. The geology of the mountain range is characterized by Tertiary intrusives and Devonian-Silurian phyllites.

The Cordillera Real is the traditional mining region of Bolivia, where for centuries rich lode deposits have been worked. In the 1500's, it was here that the Spanish discovered the fabulous silver deposit of Cerro Rico de Potosí. Some three billion ounces of silver are believed to have been extracted from this deposit over the last 400 years, and it is now believed that a similar amount still remains within the mountain in disseminated form. Other notable silver deposits have long been worked in Oruro, Colquechaca, and Pulacayo.

Tin mines in the Cordillera Real became gradually more important after the end of the colonial era in 1825, and from the turn of the present century tin became the leading export. From mid-century the state corporation COMIBOL dominated this resource. The most important tin deposits on the Cordillera Real are those at Catavi, Huanuni and Viloco.

It is only very recently that attention has shifted from narrow veins in sedimentary structures to the potential of disseminated metals in the Tertiary intrusives of the Cordillera Real.

The Sub-Andean zone is the fourth major geographic region exhibiting important geological potential. Here, in the eastern slopes of the Andes, Devonian shales host silver and base metals. Although hundreds of prospects have been identified, difficult terrain and lack of infrastructure have so far prevented development. Only one important mine has been established, working a zinc-silver deposit at Quioma.

Foothills north of La Paz and across the border in the Peruvian province of Madre de Dios are drained by a network of tributaries and rivers which run generally northward into the Amazon Basin. This drainage area comprises a fifth geological region of Bolivia, important for extensive alluvial gold deposits. Nuggets have been extracted for many years from the Tipuani fields to the north of La Paz. So far very little attention has been paid to the recovery of fine gold as extraction has been dominated by technically primitive, labour intensive cooperatives. Only one or two dredges have operated in this region of Bolivia. However, several dredges operate upstream in Peru on the Madre de Dios River and small suction dredges work on the Brazilian border to the north. It is estimated that there are 4 billion cubic meters of alluvial with gold potential in this region. The Madre de Dios and Beni rivers are considered promising, but infrastructure is rudimentary and very little exploration has taken place.

The sixth geological region of Bolivia is the least explored and is currently generating some of the greatest interest. Extending in from the Brazilian border, the Bolivian Precambrian occupies about 250,000 square kilometers in the tropical eastern lowlands. Although narrow gold veins and stream beds have been prospected in a small way since Colonial times, the Bolivian Precambrian did not attract serious attention until very recently.

From 1976 to 1986, the British Geological Service worked with its Bolivian counterpart GEOBOL to map the Precambrian region. This study established that the basic geological makeup of the region consists of proterozoic granitic gneisses and granulites, together with schist belts and mobile belts.

Among interesting occurrences found by the survey were gold bearing alluvials and greenstone belts extending over 380 kilometers. Intrusions bearing copper, nickel, chromium, and platinum group metals were identified. Niobium, tantalum, and precious metals were found in pegmatite fields. Tin-granites, iron and manganese formations and an alkaline carbonatite province were also encountered.

To date only one exploration program has followed the GEOBOL/BGS effort on the Precambrian. Rio Tinto Zinc, in a 50/50 partnership with the important Bolivian miner COMSUR, has undertaken a US\$20 million exploration program which has recently shown promising gold values on drilling in greenstones. In general, the Precambrian region is believed to present excellent potential.

## EVOLUTION OF THE BOLIVIAN MINING INDUSTRY

### Historical Prologue

While indigenous people had long known of and used metal deposits, exploitation of gold and silver on a massive, sustained basis began in the sixteenth century, early in the Colonial period. Until the end of the nineteenth century, Bolivia was a major world exporter of silver. However, when the abandonment of precious metal coinage together with the opening of large deposits elsewhere in the world led to declining prices, Bolivia was poorly equipped to compete. Primitive technology, difficult access and depleted reserves contributed to a general decline in the importance of silver exports.

Instead, attention shifted to tin in response to increasing prices and high world demand after the turn of the twentieth century. In fairly short order, tin became the dominant export and Bolivia joined the ranks of leading producers.

Ownership of tin production was quite concentrated, and conditions of extraction were notoriously arduous. Nearly 80% of output was controlled by three groups, Patiño, Hochschild and Aramayo, the "tin barons". These groups came to control not only tin deposits but also other important metal deposits and prospects.

With the Revolution of 1952, the interests of the former controlling groups were nationalized by the government of Hugo Paz Estenssoro to form COMIBOL, Corporación Minera de Bolivia. In the process some 163 mines and properties passed into state hands, including 24 operating mines, 20 small mines with limited artesanal workings, 29 partially explored but undeveloped properties, and many prospects and concessions.

While COMIBOL maintained existing operations, it is instructive to note that the state corporation was unable to develop even one of its exploration prospects into a productive operation. It has been suggested that this reflected not just limited economic capacity but also an inherent orientation toward maximization of production in the short term. Exploration and development capabilities were never fostered in any coherent way.

By the mid 1980's, it was possible for the Bolivian government itself to characterize COMIBOL as "inefficient, corrupt and unprofitable". The leading mine producer had become addicted to fiscal-based financing, helping to contribute to inflation which reached the astonishing level of 26,000 percent early in 1985. Populism and years of patronage had

played an important role. Of 30,000 COMIBOL employees, it is said that only some 7,000 were directly involved in mine work. The collapse of tin prices in 1985 following the failure of the International Tin Agreement merely constituted the coup de grace.

In the first half of the 1980's, COMIBOL's accumulated losses on mining and smelting activities approached one billion dollars. Losses in 1983-1984 alone had exceeded US\$300 million. The state itself contributed to decapitalization through the imposition of highly unrealistic official exchange rates that sold US currency (earned predominantly on COMIBOL exports) at little more than 10 percent of street rates.

Bolivia's experiment in state-led economics thus came to an inglorious end in 1985 in a mire of hyperinflation, corruption and disarray which capped five years of declining GNP. Value of mining production had peaked in 1980 at over US\$ 641 million in a climate of strong prices. By 1984, even before the collapse of tin prices, production value had fallen by nearly half to US\$364 million, and it would fall again by nearly another half to US\$197 million in 1986 with the near paralysis of COMIBOL:

#### 1985 to 1990: From Stabilization to Recovery

In 1985, Hugo Paz Estenssoro was elected to the Presidency. Ironically, he had been the principal architect of nationalization when he had ruled some thirty years before. In 1985, he was presented the daunting task of stabilizing a shattered state-led economy with one of the highest hyperinflations ever experienced. His response was the New Economic Policy (NEP) of 1985, and it represented the undoing of much which his party had previously engendered.

The principal elements of the NEP were fiscal austerity and free play of market forces. The budgetary deficit has been held to near zero since 1986. Controls on prices of goods, services, wages and foreign exchange have been eliminated. US dollars are now sold under open auction by the Central Bank. The tax system was greatly simplified and efforts were made to cut bureaucracy. Inflation has been wrestled down from astronomical heights to levels which have been maintained in the 10 to 20 percent range.

COMIBOL was a special target for attention. The workforce was slashed from 30,000 to under 7,000, with several mines formed into cooperatives, including the tin operations at Catavi, Coquechaca, Morococala and Colavi. The new government chose effectively to paralyze COMIBOL during a period of readjustment. The effects in terms of output may be gauged from mid-1980's figures given in the Appendix to the present report. COMIBOL'S financial losses were cut to US\$8.3 million in 1988. The intention is to convert COMIBOL into a holding corporation, operating a few profitable mines on its own account while seeking partners to explore, develop and operate other properties. (As minerals are the inalienable property of the state according to Bolivian law, COMIBOL, as the state's mining arm, evidently cannot divest itself of resource ownership. For this reason, joint venture arrangements are sought, rather than outright sale.)

A system of "fiscal reserve" had held major portions of Bolivian territory in state hands, thereby excluding entrepreneurial exploration and development. Most of the territory involved has since been freed up. The legal monopoly of state sector foundries has been eliminated, allowing private producers to freely sell concentrate to private foundries, including those abroad. One result of this has been to force state-sector processors to adjust to competitive conditions. The state-run Vinto metallurgical complex has since been described by private sector spokesmen as "well managed", a singular accolade under the circumstances.

The government of President Paz Estenssoro explicitly recognized that private foreign and domestic investment would be indispensable for the recovery and expansion of mining. Efforts were therefore made to render the climate as welcoming as necessary.

Among the factors which should be attractive to foreign investors (in addition to highly interesting geology) are equal treatment of national and foreign capital, Latin America's lowest income tax rates, tax exemption for reinvested profits, free currency convertibility and repatriation, and Bolivian subscription to international investment guarantee agreements.

### Recovery and diversification of mining production

Stable economic circumstances and a liberalized policy environment permitted overall output volume to recover to near 1980 levels by the end of the decade, although lower prices resulted in lower overall value of production. The process of recovery was not simple, but involved fundamental shifts in the output mix and in the distribution of control in the industry.

Value of output grew from some US\$196 million in 1986 to US\$423 million in 1990. And whereas the state produced 63 percent of output value in 1980, the state share had fallen to 21 percent by 1989. Correspondingly, the private sector share in value of production rose from 37 to 79 percent. Reflecting the shift in emphasis away from traditional production, the combination of tin, tungsten and antimony which had accounted for 71 percent of output value in 1980 represented only 30 percent of value by 1990. Zinc had become the leading product in 1990, contributing 36 percent of output value. The share of gold production in the total value of production rose steadily to 15 percent in 1990 and silver to 13 percent.

The rate of growth in output began to slow as the decade of the 1990's drew to a close. In part, this reflected the fact that the limitations of previously established capacity were being approached. Although there remains considerable potential for improvement in the traditional vein-oriented mines, a qualitative transformation of productive processes will be required if Bolivian mineral output is to expand efficiently. Inti Raymi's successful and expanding open pit carbonic leach gold operation offers some suggestion of the way ahead. The fact that Battle Mountain Gold holds approximately a 50 percent stake in Inti Raymi is hardly coincidental (Westworld holds about another 25 percent). The Bolivian government wishes to use the mining industry to prime national growth and development. The necessity of attracting outside capital resources, technology and expertise is obvious if this goal is to be realized.

The government of President Paz Zamora, which succeeded the Paz Estenssoro regime in 1989, committed itself to maintaining the general economic course established in the New Economic Policy. Overall, President Paz Zamora's government has kept its word, despite popular pressures and the complications of running a coalition regime .

By the end of 1990, however, a feeling of growing frustration was apparent in the Bolivian mining community. There was a sense that momentum had been lost. A project for a new mining code, which enjoyed the blessing of the private sector, was tied up in a series of challenges and delays, and there was fear that the code would either be delayed indefinitely or suffer birth in monster form. Critics pointed to lack of coordination and poor timing in the calling of joint venture development proposals by COMIBOL at this time. There was fear that such tender calls would only serve to draw attention at a vulnerable moment, leaving potential investors with an impression of incompetence. There was, in short, fear that a bad reputation would be confirmed and opportunities compromised.

Indeed, when the call was issued for joint venture proposals to operate a range of COMIBOL mines and installations, the volume of solid responses was far from overwhelming. (The mines included both tin and polymetallic operations at Huanuni, San Jose, Chocaya, Tasna, Tatasi, Catavi and Caracoles.). However, in response to a separate call, five companies presented proposals to operate the Bolivar mine. The five companies were Consolidated Goldfields (South Africa), Carnon (U.K.), Metall Mining Corporation (Toronto), Comsur (a Bolivian company in which RTZ holds a stake), and Tiwanacu S.A. (a Bolivian company with major participation by Jordex Resources). Tenders were opened in June 1991.

#### New Mining Code becomes Law, April 1991

Early in April 1991, the new Bolivian Mining Code became law, taking many observers somewhat by surprise. Passage came rather dramatically during a late night session of the legislature. Issued in the form of a series of amendments to the old 1965 Code, the new legislation has been well received by the industry. While the former Code had generally been viewed as an adequate framework for traditional vein mining, it was felt that modifications were overdue.

The two most significant elements in the new code concern taxation and access to previously restricted territories.

Under the old system, mining companies were assessed taxes on the basis of presumed production costs and "presumed" profits, according to a somewhat complex formula. As production costs were based on average assumptions, the system was rather perverse, tending to the greatest benefit of firms whose costs of production were lowest. Nonetheless, (or perhaps consequently) many traditional producers were happy enough with the arrangements.



The current system applies to all new mining ventures, while allowing established operations to continue to use the former approach until 1999, if desired. A tax of 30 percent is levied on profits, as determined by standard accounting procedures. In addition, a 2.5 percent "anticipo" (advance payment) is levied on the value of all onward sales of mineral product. The total of "anticipos" paid is applied against the tax owing on profits. If the balance of (tax owing on profits) minus (anticipo paid) is positive, the difference must be paid to the revenue collecting authority. If the total value of anticipo payments exceeds profit tax liability, the difference may be brought forward as a credit in succeeding fiscal years. (Unprofitable operations will thus go out of business a little sooner, perhaps.)

In addition to the above taxes, a 10 percent V.A.T. applies to transactions involving mineral commodities. V.A.T. is refundable in the form of a fiscal credit at the point of export. A secondary market in V.A.T. paper exists, and processors are authorized to "purchase" credits in advance from suppliers. (In the case of state foundries this seems not to be so; state agencies are not at liberty to engage in these secondary transactions.)

Under the new rules, reinvested profits are exempt from taxation as an incentive to productive expansion. It has been suggested, however, that the use of "standard accounting norms" to calculate profit may ultimately rule out the possibility of accelerated depreciation allowances or similar measures.

Formerly, foreign investors were prohibited from participating in mining activity within 50 kilometres of international borders. The new code lifts this restriction (except in the case of investors from the immediately neighbouring state or states involved). Foreigners must, however, operate in partnership with Bolivian principals in these zones. (This liberalization could be of particular interest to Rio Tinto Zinc, currently exploring toward the Brazilian border on the Precambrian.)

### The Way Ahead

The response of foreign firms to the signal given by passage of the new mining code has been swift and impressive. Whereas pessimism had been in vogue just three months previously, by June 1991 it was possible to identify some thirty foreign companies either actively involved or demonstrating solid interest in Bolivia.

These firms include some of the largest names in mining from the United States, Australia, South Africa, the United Kingdom and Brazil, as well as Ireland, Hong Kong and Spain. (Japanese firms are for the moment notable for their absence.) Several well-known Canadian names are also in evidence.

Some firms, such as Rio Tinto Zinc, Battle Mountain Gold and Jordex Resources have bought into established Bolivian operations. Others are operating small mines, developing tailings reprocessing operations, bidding on COMIBOL offerings, operating exploration consortia.

or otherwise seeking opportunities. The Association of Medium Miners of Bolivia has estimated that inflows of foreign investment could exceed US\$100 million in 1991.

The U.S. firm Lithco is again engaged in negotiations with the Bolivian government (and the responsible official agency CIRESU) to develop the the Salar de Uyuni lithium resource. Many in the industry will continue to follow this process with great interest, as problems arose here in the past. Positive results from the Lithco negotiations would be most encouraging.

As Bolivia enters a year of municipal elections, with national elections not far beyond, government restraint may be sorely tested. The austerity required by the New Economic Policy has involved considerable pain and sacrifice over five years. The temptation to resort to populism may be strong; many voters will hunger for things more tangible than balanced budgets, rationalization and liberalization. If the government continues to hold the line, rejecting the quick and easy story that says progress and material well-being come from the state, then it will have honoured its side of the bargain. If the private sector also honours its side of the deal, the future of Bolivian mining will be secured.

### OPPORTUNITIES FOR CANADIAN SUPPLIERS OF MINING EQUIPMENT AND SERVICES

Potential opportunities coming out of the recovery and expansion of mining in Bolivia may be considered in three fields: exploration; rehabilitation, refurbishment and maintenance of old or established mines; and larger new projects.

For forty years, Bolivia saw virtually no serious exploration effort, a situation which is now changing quickly. This kind of neglect generates serious interest; precisely due to years of inattention, it is likely that exploration efforts will generate considerable level of excitement in Bolivia. Bolivia may thus offer a promising territory for suppliers of modern prospecting and exploration services and technology. It may safely be speculated that foreign companies active in Bolivia will meet much of the demand for such goods and services by using their own in-house resources. However, while multinationals will be seeking large targets, many of their local counterparts will be looking for smaller, more easily manageable potential projects, and they will be applying more modest resources to the search.

Investment in exploration and prospecting by the medium scale private mining companies of Bolivia totalled some US\$13 million in 1990. Thus was about double 1989 expenditure levels. Exploration was self-financed, and generally undertaken in partnership with foreign interests.

The rehabilitation, maintenance and consolidation of established mining operations generates demand for a range of equipment. Medium scale private mining firms invested US\$4 million in mining equipment in 1990, and another US\$4.2 million for installation, expansion and remodelling of concentrator plants for complex minerals. While few firms generate much

demand for larger items, companies such as Comsur and Inti Raymi operate larger scale drill equipment. There is some ongoing demand for smaller jack leg drills and stopers as well as consumables; qualified local agents and distributors serve this market. As the market is relatively small, it may be rather difficult to break in with small volume sales, given realities of after sales service and inventory.

An aspect of the Bolivian market for heavier mining and ore processing equipment which must be underlined is a marked preference on the part of many operators for reconditioned equipment. The price of new machinery often simply cannot be justified in smaller operations, which can however derive great utility from the right reconditioned gear. Those suppliers who are willing to dedicate a reasonable amount of effort to the logistics of moving "special" orders for recycled equipment can make sales. Demand for rebuilt gear runs the gamut from mills and thickeners to large winches.

The definitive large new project is the Kori Kollo gold expansion being undertaken by Inti Raymi. Production from high grade sulfides was initiated in 1983 at around 1,000 metric tons per day. (True to traditional form, another company had previously worked high-grade veins in the overcap without investing in bulk operations). By 1990, production was running at 4,000 to 4,500 metric tons per day, 25 days per month. Plans call for a US\$100 million expansion project to begin in July 1992, increasing processing to 14,000 metric tons per day.

This project will entail demand for hoists, drill machines, loaders, an ingot foundry and a range of related equipment. It is probable that trucks in the 65 to 80 ton range will be purchased; current stock are 35 ton units.

While no other projects of this scale are immediately in view, several international firms, including ASARCO are searching for other massive epithermal gold deposits.

If all continues to go well, Bolivia in coming years will represent an increasingly significant market for mining equipment and services. Competitive, competently represented Canadian companies willing to invest the necessary commitment and creativity will certainly have a role to play.

Bolivia has an open trading economy with low import duties and a convertible currency. These factors, plus a small industrial base, mean that mining firms can freely import their equipment requirements, and direct sales, rather than joint ventures or technology transfers for local manufacture, will be the norm. A competent local agent is an indispensable factor in selling into the Bolivian market; moreover as described in the section below on selling to public entities, local representation, whether an agent or a subsidiary office, is a legal requirement to sell to state-owned entities. The Embassy in Lima can provide you with the particulars of well-known agents.

## Financing

International Financial Institutions - International Monetary Fund (IMF), Inter American Development Bank (IADB), and International Bank for Reconstruction and Development (IBRD) or more commonly the World Bank, are active in Bolivia and maintain offices in La Paz. The World Bank approved a rehabilitation project effective June 14, 1990 for the mining sector for US\$ 35 million. The private sector credit component has not begun to disburse pending restructuring of the Banco Minero. Disbursement of the COMIBOL component has been halted until the economic recovery plan for COMIBOL has been completed.

While the Export Development Corporation (EDC), as of the date of drafting this report, is not providing direct loans to Bolivia, it does have a US\$ 10 million line of credit placed with the Corporación Andina de Fomento (CAF), a regional development agency, headquartered in Caracas and with offices in Andean capitals. The CAF is a possible source of financing.

The Industrial Cooperation Program (INC) of CIDA provides incentives for Canadian companies interested in long-term cooperation agreements including joint ventures and technology transfers, with businesses in eligible countries (which includes Bolivia), to conduct preliminary or in-depth studies related to this investment. Assistance is also available from CIDA INC for specialized studies relating to preparation of capital projects. For more information, contact the Industrial Cooperation Division, Canadian International Development Agency, 200 Promenade du Portage, Hull, Québec K1A 0G4. Telex 053-4140 CIDA HULL. Fax (819) 953-5024, telephone (819) 997-7906.

Another source of project preparation funding results from an agreement between the Government of Canada and the Inter American Development Bank for the provision of funds for a "Special Program for Financing the Preparation of Development Projects".

## PURCHASING PROCEDURES FOR PUBLIC ENTITIES IN BOLIVIA

Under Bolivian legislation, all acquisitions exceeding the sum of B/. 100,000 (about US\$ 30,000) by state-owned companies and government bodies must be made through one of the three independent procurement agencies officially appointed by the Bolivian government for that specific purpose. The agencies are:

1. U.N.D.P./O.S.P.(Office of Services For Projects-United Nations Development Program)  
Av. Arce # 2579 - Bloque C  
2o. Mezanine  
La Paz, Bolivia  
Phone: (591-2) 362174; Fax: (591-2) 357447
  
2. CROWN AGENTS  
Av. 6 de agosto # 2508, Esq. Pedro Salazar  
Casilla # 11393  
La Paz, Bolivia  
Phone: (591-2) 373425; Fax: (591-2) 372765
  
3. C3D (CAISSE DES DEPOTS DEVELOPPEMENT)  
Calle Pinilla # 262  
La Paz, Bolivia  
Phone: (591-2) 379452; Fax: (591-2) 391614

Once a specific agency is appointed by the Bolivian state organization to purchase on their behalf, the agency carries out all the procedures of a public tender, including:

- a) Publication of the Call for Tender in all major newspapers in Bolivia. In the case of large international tenders the publication is made also in major newspapers in New York and Washington. (Direct invitations are sent to some foreign Embassies in some cases).
- b) Reception and evaluation of proposals.
- c) Final report to the end user with the agency's recommendations. (Normally the end user follows that recommendation).

Tenders for which services are required normally go through a prequalification stage. A public invitation is called, following the procedure outlined in (a) above. The interested companies send only their background information (credentials) and are not required to have a local counterpart or agent at that stage. Those companies that are prequalified are then invited to submit their proposals for the final tender.

In order to submit a tender, it is a legal requirement that the company have either a local office or a local agent, otherwise their bid cannot be accepted.

## BOLIVIAN MINING PRODUCTION: REVIEW OF 1990 RESULTS

(Please to refer to tables contained in Appendix.)

The year 1990 saw continuing productive expansion. Output tonnages of zinc, gold and silver reached record levels, reflecting a continued diversification away from traditional base metal dependence and marking increased emphasis on production of precious metals. While tin production had increased to the point where output had doubled compared to the mid-1980's, tonnages were still only half those produced a decade before. Medium-sized private mining companies continued to be the driving force behind both recovery and diversification.

Total value of mining output in 1990 reached some US\$423 million, led by zinc at US\$153 million (36 percent of value), tin at US\$111 million (26 percent of value), gold at US\$64 million (15 percent of value), and silver at US\$56 million (13 percent of value). Lead, antimony, tungsten and other products accounted for the remainder (9 percent of value).

### Zinc:

Record production of 103,849 metric tons in 1990 represented a 40 percent increase of 1989 output and was double the quantity produced in 1980. Medium mining firms produced 61 percent of output, led by Comsur S.A. with 28 percent of the total. Quioma S.A., Caballo Blanco S.A. and Tiwaacu S.A. were responsible for 12, 10 and 8 percent of production respectively. COMIBOL's production of zinc was up 55 percent from 1989, and at nearly 25,000 metric tons represented just under one quarter of national output. All producers reported important tonnage growth in 1990, responding to prices which rose to a peak in May.

One hundred percent of zinc production is exported in concentrate form, mostly to Chile, as no refining facilities exist in Bolivia. Nonetheless, with production levels beyond 100,000 metric tons, a private zinc smelting operation could become economically viable.

### Tin:

Production of 17,884 metric tons represented an increase of 5 percent from 1989. Total value was US\$110 million, 34 percent of which corresponded to COMIBOL output. Output from medium private mining companies was limited, totalling not more than 8 percent of total production. Quioma S.A. was the leading private producer with 506 metric tons. Cooperatives based on mines such as Catavi, formerly operated by COMIBOL were responsible for a considerable share of the remainder. The value of tin production, US\$111 million, accounted for 26 percent of total mining value.

Some 77 percent of tin production was exported in refined form in 1990, up from 65 percent the previous year. The state sector Vinto refinery contributed 93 percent of this total, while the private operator Hormet S.A. produced the balance. Chile received some US\$61 million in exports, while US\$11 million went to the United States.

### Gold:

Gold output, a record at 5,810 kilograms, was up by 50 percent in 1990, reflecting the increased attention being given to the metal (and possibly reflecting a higher rate of reporting). Total value was US\$64 million. Over one third of production came from medium enterprises, led by Int Raymi S.A. with 1,504 kilograms. Production by this company was up by 22 percent. Small mines and cooperatives produced the balance, a large proportion of which was purchased and exported by intermediary traders, the so-called "big shots". COMIBOL participation in gold production was minimal.

Exports of bars accounted for 60 percent of production, up from 47 percent in 1989. Native(?) gold accounted for 11 percent of total exports, while concentrates contributed 29 percent of exports by value. Approximately half total exports were destined for the United States, with the remainder shared by Switzerland and countries of the European Community.

### Silver:

Representing 13 percent of production value, silver production was up 21 percent from 1989, at a record 357 metric tons. Private medium miners accounted for nearly one half of total production, led by Comsur (129 metric tons), Caballo Blanco (41 metric tons), Tiwanacu (24 metric tons), Quioma (18 metric tons), Inti Raymi (9 metric tons) and Reminsa (3 metric tons). Output increases were recorded by all producers, led by Tiwanacu, reporting a 117 percent increase over 1989 production. COMIBOL production represented 36 percent of the total, at 129 metric tons. The shift to dominance by private producers is illustrated by the fact that COMIBOL's share of silver output had been 84 percent in 1980.

Of total exports valued at US\$56 million, 14 percent was shipped as refined metal. the balance in concentrate form. Private refiners, Comco S.A. and Yana Mallcu S.A. accounted for 90 percent of refined output, COMIBOL for 5 percent. Western European destinations absorbed most refined and concentrate exports. The United States and Chile imported over US\$1 million each, mostly as refined metal. East block destinations received concentrate shipments valued at nearly US\$3 million.

### Lead:

Production was up 26 percent at 20,030 metric tons, valued at some US\$15 million. Private medium scale mining companies produced 57 percent of output by value, led by Quioma S.A. with 9,286 metric tons, 46 percent of national production. Lesser quantities were produced by Comsur S.A. (7 percent), Maragua Ltda. (1 percent), and Tiwanacu S.A. (1 percent). COMIBOL produced 18 percent of the national total.

Western European export destinations accounted for over half of total exports. while East European states accounted for a third. Refined lead, produced by Hormet S.A. and exported to Brazil for battery production, represented only 1 percent of total lead exports.

### Antimony:

Antimony output remained steady at 8,548 metric tons, though a value of US\$14 million was down 15 percent on soft prices. Production represented only about half of 1980 volume. Medium scale private producers led by EMUSA and San Juan Ltda. accounted for 71 percent of output, small mines for 18 percent, and COMIBOL for 7 percent of the total.

Concentrates accounted for 86 percent of antimony exports by value, alloys for 5 percent and antimony trioxide for 9 percent. The U.S. firm Laurent (a company active in China), has been working with the Vinto refinery, operating a crude antimony trioxide circuit. The private company Bernal Hnos produced over 600,000 kilograms of antimony trioxide in 1990. With South Africa, Bolivia is one of only two high grade antimony producers. The United States was the leading importer of Bolivian antimony in 1990, followed by the European Community and neighbouring Latin American countries.

### Tungsten:

With production of 1,250 metric tons of tungsten valued at US\$5 million, this metal represented about 1 percent of total mining value. Two private companies, International Mining Co. and San Jose de Berque, accounted for nearly half of output. COMIBOL, dominant at a time of high prices ten years before, did not participate significantly in 1990 production.

### Other Products:

A range of products accounted for the remaining 2 percent of production value, including copper, salt, sulfur, cadmium, iron, manganese, borate, marble, amethyst and others.



ANNEX 1

COMPOSITION OF BOLIVIAN MINING OUTPUT, 1990

PRODUCT	OUTPUT (mt)	VALUE (US\$'000)	PERCENT OF TOTAL VALUE
ZINC	103,849	153,097	36
TIN	17,884	110,789	26
GOLD	5.18	63,937	15
SILVER	357	55,516	13
LEAD	20,030	15,676	4
ANTIMONY	8,548	13,661	3
TUNGSTEN	1,250	4,892	1
BISMUTH	68	482	-
COPPER	157	407	-
OTHERS		5,026	1
<u>TOTAL</u>		<u>423,483</u>	<u>100</u>

VALUE OF MINING PRODUCTION, 1975 TO 1990 (US\$ '000, current)

1975	304,493
1976	366,927
1977	492,688
1978	515,625
1979	591,864
1980	641,127
1981	556,046
1982	419,349
1983	347,316
1984	364,040
1985	263,758
1986	196,820
1987	207,167
1988	273,058
1989	407,125
1990	423,483

EVOLUTION OF BOLIVIAN MINING OUTPUT, 1952 TO 1990

	YEAR	PRODUCTION (mt)	VALUE (US\$'000)	% OF TOTAL MINING VALUE
<b>ZINC</b>	1952	35,619		
	1960	4,027		
	1970	46,547	38,117	6
	1980	50,260	25,237	13
	1986	33,472	121,118	30
	1989	74,241	153,097	36
	1990	103,989		
<b>TIN</b>	1952	32,470		
	1960	19,718		
	1970	29,384		
	1980	27,310	458,131	71
	1986	10,740	61,138	31
	1989	17,052	148,117	36
	1990	17,884	110,788	26
<b>GOLD</b>	1952	0.07		
	1960	1.61		
	1970	0.86		
	1980	1.62	31,768	5
	1986	0.76	8,987	5
	1989	3.46	42,928	11
	1990	5.18	63,938	15
<b>SILVER</b>	1952	220		
	1960	152		
	1970	185		
	1980	190	132,292	21
	1986	95	16,607	8
	1989	295	52,151	13
	1990	357	55,516	13

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PRODUCTION (mt)

VALUE (US\$'000)

% OF TOTAL MINING VALUE

YEAR

**LEAD**

1952	30,014	15,646	2
1960	21,419	1,333	1
1970	25,757	10,542	3
1980	17,225	15,676	4
1986	3,303		
1989	15,939		
1990	20,030		

**ANTIMONY**

1952	9,805	38,287	6
1960	5,327	20,403	10
1970	11,576	16,043	3
1980	16,052	13,661	3
1986	10,243		
1989	8,533		
1990	8,548		

**TUNGSTEN**

1952	2,225	48,525	8
1960	1,290	6,090	3
1970	2,410	7,426	2
1980	3,359	4,892	1
1986	1,380		
1989	1,410		
1990	1,250		

**BISMUTH**

1952	16	56	-
1960	183	253	-
1970	623	2,862	1
1980	11	482	-
1986	43		
1989	240		
1990	68		

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	YEAR	PRODUCTION (mt)	VALUE (US\$'000)	% OF TOTAL MINING VALUE
COPPER	1952	4,541		
	1960	2,271		
	1970	8,823		
	1980	1,884	4,117	1
	1986	297	407	-
	1989	298	840	-
	1990	157	405	-
CADMIUM	1990	30	217	-
IRON	1990	125,264	1,578	-
MANGANESE	1990	3,778	149	-

Other mineral products include salt, marble and other structural/ornamental stone, amethyst, sulfur, arsenic, barium sulfate and others.

PARTICIPATION IN PRODUCTION BY SUBSECTOR (VOLUME BASIS)

	COMIBOL	MEDIUM MINES	SMALL MINES	COOPERATIVES	OTHERS
<b>ZINC</b>					
1980	60%	33%	7%	-	-
1990	25%	85%	3%	-	-
<b>TIN</b>					
1980	68%	22%	10%	-	-
1990	34%	11%	7%	5%	43%
<b>GOLD</b>					
1980	-	21%	-	79%	-
1990	-	29%	15%	5%	51%
<b>SILVER</b>					
1980	84%	11%	5%	-	-
1990	36%	48%	11%	2%	3%
<b>LEAD</b>					
1980	59%	23%	18%	-	-
1990	18%	57%	22%	2%	1%
<b>ANTIMONY</b>					
1980	-	72%	28%	-	-
1990	7%	71%	18%	-	4%
<b>TUNGSTEN</b>					
1980	47%	46%	7%	-	-
1990	-	51%	12%	37%	-
<b>BISMUTH</b>					
1980	100%	-	-	-	-
1990	99%	-	1%	-	-
<b>COPPER</b>					
1980	95%	-	5%	-	-
1990	-	-	69%	23%	8%

PRINCIPAL BOLIVIAN ZINC PRODUCERS, 1990

COMPANY	OUTPUT (mt)	PERCENT CHANGE FROM 1989	PERCENT OF TOTAL NATIONAL OUTPUT
COMSUR S.A.	28,786	+10%	28%
COMIBOL	24,773	+55%	24%
QUIOMA S.A.	12,044	+45%	12%
CABALLO BLANCO S.A.	10,290	+38%	10%
TIWANACU S.A.	8,523	+56%	8%
REMINSA S.A.	2,734	+24%	3%
BOLIVIAN MINERAL TRADERS	718	*	1%
MARAGUA LTDA.	462	+14%	-
SAN JOSE DE BERQUE	116	+49%	-
BERNAL HNOS.	23	*	-

PRINCIPAL BOLIVIAN TIN PRODUCERS, 1990

COMPANY	OUTPUT (mt)	PERCENT CHANGE FROM 1989	PERCENT OF TOTAL NATIONAL OUTPUT
COMIBOL	6,068	+52%	34%
QUIOMA S.A.	506	+37%	2%
BARROQUIRA S.A.	376	-8%	2%
INTERNATIONAL MINING CO.	324	-25%	2%
AVICAYA LTDA	205	-6%	1%
COPROMIN S.A.	198	-61%	1%
YANA MALLCU S.A.	150	-37%	1%
TIWANACU S.A.	65	+23%	-
COMSUR S.A.	46	+32%	-
BOLIVIAN MINERAL TRADERS	16	*	-
REMINSA S.A.	4	+37%	-

PRINCIPAL BOLIVIAN GOLD PRODUCERS, 1990

COMPANY	OUTPUT (kg)	PERCENT CHANGE FROM 1989	PERCENT OF TOTAL NATIONAL OUTPUT
INTI RAYMI S.A.	1,504	+22%	29%
COMIBOL	20	*	-
EMUSA	6	-52%	-
SAN JUAN LTDA.	4	*	-

PRINCIPAL BOLIVIAN SILVER PRODUCERS, 1990

COMPANY	OUTPUT (mt)	PERCENT CHANGE FROM 1989	PERCENT OF TOTAL NATIONAL OUTPUT
COMIBOL	129	+3%	36%
COMSUR S.A.	41	+6%	12%
CABALLO BLANCO S.A.	24	+39%	7%
TIWANACU S.A.	22	+117%	6%
QUIOMA S.A.	18	+74%	5%
INTI RAYMI S.A.	9	+29%	3%
REMinsa S.A.	6	+15%	2%
MARAGUA LTDA.	3	+24%	1%



PRINCIPAL BOLIVIAN LEAD PRODUCERS, 1990

COMPANY	OUTPUT (mt)	PERCENT CHANGE FROM 1989	PERCENT OF TOTAL NATIONAL OUTPUT
QUIOMA S.A.	9,286	+43%	46%
COMIBOL	3,547	+10%	18%
COMSUR S.A.	1,375	-6%	7%
MARAGUA LTDA.	295	+43%	1%
TIWANACU S.A.	277	+90%	1%
SAN JOSE DE BERQUE	8	-31%	-

PRINCIPAL BOLIVIAN ANTIMONY PRODUCERS, 1990

COMPANY	OUTPUT (mt)	PERCENT CHANGE FROM 1989	PERCENT OF TOTAL NATIONAL OUTPUT
EMUSA	2,729	+1%	32%
SAN JUAN LTDA.	2,237	+6%	26%
COMIBOL	625	*	7%
CHURQUINI ENTERPRISES	326	*	4%
COMSUR S.A.	128	-9%	1%

PRINCIPAL BOLIVIAN TUNGSTEN PRODUCERS, 1990

COMPANY	OUTPUT (mt)	PERCENT CHANGE FROM 1989	PERCENT OF TOTAL NATIONAL OUTPUT
INTERNATIONAL MINING CO.	376	-28%	30%
SAN JOSE DE BERQUE	241	+3%	19%
CHURQUINI ENTERPRISES	12	*	1%

## ANNEX 2

### MINISTERIO DE MINERIA Y METALURGICA

Dirección : Av. 16 de Julio No. 1769  
Casilla : No. 8686 y Cajón Postal  
Telex : No. 2625 - BV  
Fax : No. 359998 - 19

Ministro de Minería y Metalúrgica	
Ing. Walter Soriano Lea Plaza	371184 - 374124
Subsecretario Técnico	
Ing. Carlos Zamora Piñeiro	374125
Subsecretario de Coordinación e Inversión Mineras	
Ing. Rafael Delgadillo Arauco	362810
Director Nacional de Minería	
Ing. Rubén Martínez	378051
Director de Planificación	
Ing. Raúl Laguna Zambrana	371165
Director de Documentación e Informática	
Lic. Ana María Aranibar Lafuente	371174

### CORTE NACIONAL DE MINERIA

Dirección : Av. Villazón No. 1966  
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Presidente  
Dr. Ramón Salinas Mariaca 362793

### SUPERINTENDENCIA DE MINAS

Dirección : Av. Villazón No. 1966  
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Superintendente  
Dr. Waldo Tapia Zárate

## CORPORACION MINERA DE BOLIVIA (COMIBOL)

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367693 al 95

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Sr. Benigno Leño Vidaurre 353659  
Director  
Ing. José del Solar Melgarejo 320247  
Director  
Dr. Ismael Castro Montaña 367492  
Gerente General  
Ing. Alberto Oño Villegas 356547  
Asistente Técnico  
Ing. José Cespedes Ayaviri 378172  
Sub-Gerente Empresas Subsidiarias  
Ing. Antonio Cortez Silva 354044  
Sub-Gerente de Propiedades Mineras  
Ing. Marcelo Velásquez Martínez 355313

## EMPRESA METALURGICA KARACHIPAMPA

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Fax : No. 23818

Presidente  
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Director  
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### EMPRESA METALURGICA VINTO (EX-ENAF)

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#### Presidente

Ing. Gonzalo Martínez Alvarez 359270

#### Director

Ing. Gonzalo Gutiérrez Moscoso 369546

#### Gerente General

52857 (Oruro)

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Dirección : Calle Abarca No. 95  
Casilla : No. 3079 - 1315  
Telex : No. 4612  
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Fax : No. 03-327037

#### Presidente

Ing. Armando Arce Gómez 27037

#### Director

Ing. Rolando Ibañez Gómez 26888

#### Gerente General

Ing. Guillermo Salamanca A. 27037

### INSTITUTO DE INVESTIGACIONES MINERO METALURGICAS (I.I.M.M.)

Dirección : Oruro - Calle Junin, entre Petad y  
Camacho (Comibo Socavón)  
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358877 (La Paz)  
25085 (Potosí)  
Código Telef. : No. 052

#### Director Ejecutivo

Ing. Carlos Garrón Ugarte 52740

## BANCO MINERO DE BOLIVIA

Dirección : Calle Comercio Esq. Calón No. 1290  
Casilla : No. 4606  
Telex : No. 2568 BV  
Fax : No. 368870  
Central Piloto : No. 352162 al 68

### Presidente

Ing. Jaime Ascarrunz Eduardo 376218

### Gerente General

Ing. René Sanz Molina 350927

### Gerente Comercial

Dr. Jaime Vargas Palomo 352276

### Gerente del Fomento y Crédito

Ing. José Antonio Suárez Muñoz 355058

## FONDO NACIONAL DE EXPLORACION MINERA (FONEM)

Dirección : Av. Sanchez Lima, esq. Ecuador  
No. 125 Edif. Orion P.B  
Casilla : No. 5796  
Telex : No. Min. Minería Bx. 5564  
Central Telef. : Nos. 355258 - 361228 - 355642

### Gerente General

Ing. Juan Koch Mejía 355684

### Gerente de Proyectos

Ing. Mario Barrientos Siles Int. 45

## SERVICIO GEOLOGICO DE BOLIVIA (GEOBOL)

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Zuazo No. 1673  
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### Dirección Ejecutivo

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### Jefe de Prospección y Explotación Minera

Ing. Edgar Ruiz Bonilla 358243

### Jefe Dpto. Planeamiento

Ing. Oscar Siles Arce

## CAMARA NACIONAL DE MINERIA

Dirección : Pasaje Bernardo Trigo No. 429  
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Central Telef. : Nos. 350623 - 379651 al 54

Presidente

Ing. Luis Prado Barrientos

350623

## ASOCIACION NACIONAL DE MINEROS MEDIANOS

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Fax : No. 354124  
Central Telef. : 354124 - 371112 - 352223

Presidente

Lic. Alfredo Rojas Osinaga

352223

Secretario General

Lic. Rolando Jordán Pozo

354124

## CENTRO DE ESTUDIOS MINERIA Y DESARROLLO (CEMYD)

Dirección : Av. Sanchez Lima No. Dpto. H.  
Casilla : No. 6172  
Central Telef. : 390249

Director

Rolando Jordán Pozo

390249

Sub-Director

Ing. Juan C. de la Puente Fernández

390249

## CORPORACION ANDINA DE FOMENTO (address in Bolivia)

Dirección : Av. Arce Psje. Esmeralda No. 4 -  
La Paz, Bolivia  
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Casilla : 550  
Telex : 2287 CAF BV  
Fax : 391032

Representante: Sr. Arturo Castaños

**CORPORACION ANDINA DE FOMENTO**  
(address of Headquarters in Caracas)

Dirección : Av. Luis Roche - Altamira  
Edif. Torre Central  
Caracas, Venezuela  
Telef. : 285.5555  
Telex : 27418 CAFCS VC  
Fax : 2842880

Presidente Ejecutivo  
Galo Montaña

Vicepresidente Ejecutivo  
Pedro Sorensen

**CANADIAN REPRESENTATION IN BOLIVIA**

The Canadian Embassy in Lima is accredited to the Government of Bolivia, and John McNeish, First Secretary (Development) is resident in La Paz. The Canadian Government is represented in Bolivia by an Honorary Consul. There is also a Canadian Cooperation Office (CCO) responsible for Canadian aid programs in Bolivia. Both the Consulate and the CCO are located at 20 de Octubre 2475, La Paz. Consulate tel: (591-2) 375224; Fax: (591-2) 329435. CCO tel: 392060; Fax: 391488.

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Ambassador : James D. Leach  
Commercial Counsellor : Wayne A. McKenzie  
Commercial Officer : Romeo Cubas  
Commercial Officer : Oscar G. Vásquez  
(responsible for mining sector)

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