

## THE MINERAL INDUSTRY OF

# BOLIVIA

By Pablo Velasco<sup>1</sup>

During 1994, Bolivia's mining industry continued to play a dominant role in support of the economic life of the country, primarily because the Government-owned mining companies no longer account for much of the national output. The economy was sound in the sense that growth was continuing at a reasonable level, and inflation had declined to a low level. However, Bolivia needed more immediate investment, and the country continued to be greatly dependent on aid from world multilateral and bilateral organizations. The great expectations following the 1993 election of a new president had yet to materialize. The free market and the welcoming of foreign investment policies were expected to continue in the future, regardless of which political party leads the government.

The Bolivian government was gearing up to sell its State-owned mines, but first it must overcome the hurdle of its own people, who had a tradition of strongly objecting to private enterprise. The Denver, Colorado-based mining consulting firm of Behre Dolbear & Co. was tapped by the State-owned mining concern Corporacion Minera de Bolivia (COMIBOL) to help it sell a number of mining and smelting operations to private investors. Mining was and still is the mainstay of Bolivia's long-struggling economy. Bolivia has the largest silver mine in the world, and has ample antimony, gold, lead, tin, and zinc reserves to sell. Behre Dolbear had been contracted to evaluate the assets and improve the operations of 11 lead, silver, tin and zinc properties, 2 inactive mining operations and 4 smelters. There is a recognition that Bolivia's mines are not performing at world standards; to perform at that level, they would have to change the operating system of the mines, which means privatization, a word so politically charged in Bolivia that the official term for it is capitalization.

The contribution of the mineral sector to the national economy in 1994 remained at 8% of the gross domestic product (GDP) or about \$6.8 billion. More revealing was the contribution of minerals to Bolivia's exports: in 1994, it was 46%, or about \$504 million, well above their value in 1993 of \$452 million. Gold became the most valuable export, producing an income of about \$119.1 million, an increase of more than one-half of the 1993 figure (\$76.3 million). Hydrocarbons continued in third place in the Bolivian export balance sheet, after minerals and nontraditional goods. However, in 1994, the nontraditional export value increased more than 78% compared with that of 1993 and represented about 53% of the total exports earnings.

The medium mining sector—the privately owned commercial mines—was the dominant producer responsible for more than one-half (52%) of the value of mine production in 1994. COMIBOL, the state-owned company, in the same period declined in importance relative to the value in the national production from 51% in 1985 to 9% in 1994.

According to the National Statistical Institute (INE), the country's GDP grew by 4.2% in 1994, greater than the 3.2% growth registered in 1993. Inflation in the country and the public debt continued under control. The consumer price index rose by 8.2% in 1994, compared with 9.3% in the previous year. Exports increased by about 5.4% to \$748.4 million, owing to increases in nontraditional export products, while mineral exports and natural gas declined by 4.6% and 26.5%, respectively. The future of the hydrocarbon sector continued to depend upon the continuation of exports to Argentina; the implementation of the natural gas export project to Brazil, which was finally taking real shape, may also include Chile; and greater domestic use of gas.

### Government Policies and Programs

Government policies had been designed to increase private investment as well as capital and labor productivity. The National Secretary of Mining had the overall responsibility for the Government's mining policy as well as issuance of sectoral regulations and general supervisory duties for the Nation's mining industry.

In 1994, the Bolivian Government established a commission to study reform and modernization of the current Mining Code, simplifying and cleaning up concession registration, and probably removing current differences between exploration and exploitation concessions to result in a single mining concession. The Government intended to regulate this situation by giving holders of such concessions the opportunity to either bring their payments up to date or lose the concession. In 1994, the Bolivian Government enacted several Laws, Supreme Decrees (S.D.) and Supreme Resolutions (S.R.) regulating various activities of the mining industry. Four of the most important legal ordinances (Laws and Supreme Decrees) issued during the year were as follows:

- Law No. 1534, February 25, 1994—Beginning in 1994 and lasting for a period of 2 years, a compensation fund Decree was issued in favor of the mineral producer Departments giving them the equivalent of 2.5% of the net

sales export value.

- S.D. No. 23727, February 11, 1994—Approved that COMIBOL would be directed by a Board of Directors composed of seven members, which would be designated by the Bolivian President through a Supreme Resolution.

- S.D. No. 23809, June 24, 1994—Authorized the addition to article 209 of S.D. No. 21660, July 10, 1987, the service contracting of foreign consultants to carry on the process of capitalization (privatization) of companies and consortiums with a mixed economy.

- S.D. No. 23896, November 24, 1994—Designated a new Ministry of Economic Development, to be in charge of the National Secretaries of Mining, Energy and Hydrocarbons, Transportation, Industry and Commerce, Agriculture, and Tourism.

The new Government economic program, known as the "Plan for All," emphasized on two main programs related to the mineral sector:

(1) Capitalization and democratization of public enterprises, a new form of privatization in which companies were not sold to private investors, but investors were invited to subscribe additional capital, up to 50% of the shares, and granted management control, with the rest of the shares being distributed to all adult Bolivian citizens through pension funds. The six large public enterprises that were expected to be capitalized included Yacimientos Petroliferos Fiscales Bolivianos (YPFB), Empresa Nacional de Telecomunicaciones (ENTEL), Lloyd Aereo Boliviano (LAB), Empresa Nacional de Electricidad (ENDE), Empresa Nacional de Fundiciones (ENAF), and Empresa Nacional de Ferrocarriles (ENFE). It was expected that investment related to capitalization would be equivalent to 60% of Bolivia's GDP; that was, more than \$2.0 billion.

(2) Implementation of a project to export natural gas to Brazil, which was expected to produce annual revenues of about \$230 million and was expected to attract foreign investment in oil and gas development.

Bolivia began the process of privatizing mines in May 1994, when it invited bids for exploration and exploitation of all its undeveloped properties. According to Bolivia's 1993 privatization law, up to 50% of assets were to be sold in the international market, with the remainder to be given out to all Bolivians of legal age in the form of a pension, replacing an otherwise bankrupt national pension plan.

## **Environmental Issues**

In 1994, the Ministry of Sustainable Development (Secretaría de Desarrollo Sostenible) of Bolivia, through its National Environmental Secretariat (Secretaría Nacional del Medio Ambiente) developed four draft regulations applicable to the Bolivian Environmental Law No. 1333. The draft Environmental Impact Assessment and Environmental Quality regulations for air, water, and other activities applicable to new mining projects in Bolivia were similar to those in other developed countries. However, these

environmental regulations were more strict than other ones enforced at international levels. The Inter-American Development Bank (IDB) of Washington DC, recently approved a \$20 million environmental assistance Loan to the Ministry of Sustainable Development of Bolivia for various activities applicable to preserving the environment in new mining and processing projects, including abandoned mined lands projects. A Swedish Technical Mission in Bolivia prepared a preliminary report indicating a new criteria for establishment of levels and limits of permissible contamination in the mining and industrial sectors. The Government, concerned about environmental remediation of old mining sites in various parts of the country, prepared environmental audits of mining and smelting areas to follow through with backing by the IDB and in consultation with the U.S. Bureau of Mines.

## **Production**

Officially reported data for 1994 indicated that the value of Bolivia's nonfuel mineral production increased by about 13.9% to \$412.5 million compared with \$362 million in 1993. The tin industry showed an increase of 8.9% in value, even though primary tin output decreased by 14% to 16,329 metric tons (mt) in 1994.

During the past 5 years, the Bolivian mining industry has tried to diversify its mineral production away from tin by increasing production of gold, silver, and lead. Production of zinc reached a figure of almost 101,000 mt, but decreased 16% in value to about \$100 million compared with that of 1993.

Lead output decreased 7% to 19,678 mt but increased 5% in value to \$10.8 million. Silver production maintained almost the same level as that of the previous year, or about 350 mt of silver in concentrate, but increased 32% in value to \$60 million compared with previous year. Officially recorded gold production increased 96% from 10.4 mt of gold 1993 to about 12.8 mt of gold in 1994. This increase, according to the National Secretary of Mining, was due largely to the stable gold prices and higher production by the Empresa Minera Inti Raymi, the largest gold producer in the country. The best official record continued to be that of gold produced as precipitates in heap-leaching operations and exported as such. COMIBOL's efforts were concentrated on privatization programs to attract private firms to operate its mines under joint ventures or operating contracts. Crude oil and natural gas were produced by YPFB and its contractors. YPFB's production in 1994 represented 77% and the contractors 23% of the country's total production. Natural gas extraction increased 5.8% in 1994 compared with that of 1993.

## **Trade**

Nonfuel minerals and mineral fuels (oil and gas) continued to be Bolivia's leading exports; in combination, they contributed about 46% of Government revenues. Exports of

nonfuel minerals in 1994 increased 13.9% in value, compared with those of 1993, to \$412.5 million, amounting to less than one-half of total exports. In 1994, Bolivia's mining exports to the United States dropped by 10.5% to \$73.6 million. Mineral exports to European countries decreased by 7.3% to \$250 million. Gold, tin, and zinc continued in 1994 to lead nonfuel mineral exports by value, along with a strong performance by silver. Tin export earnings, historically Bolivia's most important mineral export, increased about 9% in value to \$90.7 million in 1994. Zinc exports, the rising star among Bolivia's mineral exports, likewise decreased 12% in value to about \$105 million. Gold exports increased by 47% in volume and 56% in value to \$119.1 million in 1994.

The medium-size mining sector was, for the fifth straight year, the largest exporter within the mining sector. This sector's exports went up 16% in value in 1994 compared with 1993, and represented about 52% of Bolivia's total mineral exports. The small-size mining sector and mining cooperatives accounted for 20% of the country's total mineral exports and 26% of the smelters. The nonfuel minerals sector surpassed the hydrocarbon sector as the leading foreign exchange earner for the seventh consecutive year.

Empresa Metalúrgica de Vinto, formerly Empresa Nacional de Fundiciones (ENAF), the previous foreign exchange leader in the mining sector, had another excellent year in 1994. Exports of metallic tin by Vinto increased in volume 7% to 15,380 mt, and increased in value 11% to \$83 million from \$74.5 million in 1993. Tin export value, including metallic tin, was down 23% to \$90.7 million.

In 1994, hydrocarbons (crude oil, natural gas and liquefied natural gas) dropped to third place in Bolivia's export sector, after minerals and the nontraditional goods. Nevertheless, through taxes on exports and domestic sales, they contributed 39.1% of the national treasury's consolidated revenues. In 1994, hydrocarbons decreased from 11.5% the previous year to 8.3% by value of Bolivia's total exports. The value of exports to Argentina decreased to \$91.6 million, compared with \$99.4 million in 1993. Petroleum and refined products exports in 1993 continued to be minimal.

### **Structure of the Mineral Industry**

The National Secretary of Mining and the Secretary of Energy and Hydrocarbons, respectively, were the principal policymaking regulatory agencies within the mining and petroleum sectors of the economy. The National Secretary of Mining controlled and participated in the mineral industry with the Servicio Geológico de Bolivia, the Instituto de Investigaciones Minero-Metalúrgico de Oruro, and COMIBOL as autonomous entities.

COMIBOL, formerly the largest mineral producer in the country, continued trying to attract private firms to operate its mines under joint-venture or other contracts, and reopened some mines to boost their mineral output in 1993. Producing only 14.2% of the value of Bolivian mine production in

1994, COMIBOL had been responsible for two-thirds of the country's total 10 years before. By November 1994, the COMIBOL's labor force was reduced to 1,500 compared with 4,400 in 1993; 6,000 in 1992; and 27,500 in 1985. Only three of COMIBOL's existing mines remained in operation in 1994, Huanuni tin mine (with 508 workers in May 1994), Colquiri tin-zinc mine (464), and Caracoles (140), not all of which were likely to attract private investors. Thirteen properties were rented to mining cooperatives, whose members scavenged what they could from old workings, and eight mines were abandoned. The president of COMIBOL anticipated that COMIBOL was expected to begin formal contacts with multinational firms to transfer its mines and smelters to private control. COMIBOL was seeking to contract with an international consultant to provide bankable reserve assessments of its four underground tin, zinc, lead, and silver mines. The state-owned corporation hoped to attract multinational companies committed to investing a total of \$300 million by 1995 to revamp its mines and smelters and in exploration concessions. Foreign investors would have to guarantee investments in equity shares in the smelters and in joint ventures to administer the mines, and would not have to pay a fixed price. Despite the scaling down of its operations, COMIBOL was still the major single producer of minerals in the country and could become more productive after reorganizing.

The private mining sector, comprising medium- and small-scale mining entities and cooperatives, maintained its position as the leading producer of antimony, gold, lead, tin, tungsten, and zinc in the country.

In the private sector, there were 11 affiliated mining companies in 1994 under the National Association of Medium-Size Miners: AUSPAC of Australia, Empresa Minera Avicaya Ltda., Empresa Minera Borrosquira Ltda., Empresa Minera Bernal Hnos., Cia. Minera La Barca S.A., Cia. Minera Salinas S.A. (COMISAL), Cia. Minera del Sur S.A., Cia. Minera Concepcion S.A. (COMCO), Empresa Minera Unificada S.A. (EMUSA), Empresa Minera Inti Raymi S.A., and Cia. Minera La Rosa S.A.

The Small Miners Association, grouped under the Cámara Nacional de Minería, included 600 small mines operating in the country in 1994, a decrease of 50 compared with 1993. Mining cooperatives were organized under the Federación Nacional de Cooperativas Mineras and included most of the gold mining cooperatives of Tipuani, Guanay, Mapirí, and Conzata. According to the National Institute of Cooperatives, there were more than 320 mining cooperatives in the country, grouped under the Federación Regional de Cooperativas, of which about 40% were mining gold in 1994, mainly in the Tipuani area in the Province of Larecaja, La Paz Department.

During 1994, COMIBOL continued to operate three concentrating plants and two smelting subsidiary companies. COMIBOL controlled smelting and refining of metals through Empresa Metalúrgica de Vinto (antimony and tin), and the Telamayu bismuth smelter. The Empresa Metalúrgica de Karachipampa (lead, silver, and zinc), remained shut

down since mid-1984 because of a shortage of ore feed and the lack of operating capital.

## Commodity Review

### Metals

**Antimony.**—Bolivia's antimony output increased 27% in weight and 68% in value in 1994, and its production was entirely in the hands of the private sector. Approximately 60% was produced by the medium-size group of mines, and 40% by the small-size group of mines and cooperatives. Empresa Minera Unificada S.A. (EMUSA), operating its Chilcobija and Caracota Mines, remained by far the largest Bolivian antimony producer, closely followed by Cia. Minera Salinas S.A. The Empresa Minera Hermanos Bernal no longer produced primary ore. In 1994, Bolivia exported 8,937 mt of antimony, a 52% increase in volume and 60% increase in value compared with that of 1993. Of the total amount of antimony exported, 35% was in concentrates and 58% was as antimony trioxide, with the remaining 7% as antimony alloys. Of the total antimony exported, 49% went to United States 42% to Europe; and the remaining 9% to Asia and Africa.

The private Palala antimony smelter of the Hermanos Bernal in Tupiza, Department of Potosí, produced 21% of the antimony trioxide in 1994 and 79% was produced by Empresa Metalurgica Vinto in a toll basis.

**Gold.**—Official gold production in Bolivia increased in weight and value 23% and 31%, respectively, to 12,837 kilograms (kg) and \$158.6 million. Private exporting of gold was legalized in August 1985 by S.D. No. 21060. Gold in Bolivia was produced mainly by application of modern heap leaching methods to extract gold from low-grade crushed ore from an epithermal subvolcanic gold-silver deposit at the Kori Kollo open pit mine, now Bolivia's most productive mining operation and one of the leading gold mines in Latin America. The success of Empresa Minera Inti Raymi, a subsidiary of the U.S. firm, Battle Mountain Gold Co., which owns 85%, has attracted attention to the possibility of comparable deposits and a number of other overseas companies have acquired concessions elsewhere. In September 1994, Orvana Minerals of Canada and MK Gold Company of Idaho began test drilling in the Challapata and Candelaria areas south of the city of Oruro; in December 1994, Orvana announced the discovery of a promising gold showing at Pueblo Viejo de Lipez. Da Capo Resources of Vancouver, Canada, drilled at Amayapampa and Capa Circa; American Barrick of Canada and Auspac of Australia were drilling at Escala in the Lipez area and Pan World Minerals International of Utah entered into a joint venture with the Bolivian Bartos Group to develop the small Vilarque, Charito, and San Silvestre gold mines, as well as from alluvial deposits. Bolivia produces around 18,662 kg of gold annually, most of it mined by small cooperatives that sell its production as contraband.

According to officials of Empresa Minera Auspac S.A. of Bolivia, a subsidiary of Australia's Auspac Gold NL in July 1994 signed a \$2.5 million joint venture with American Barrick Resources of Canada to take its Escala gold prospect to the feasibility stage. Drilling was expected to show in 1995 if Escala, at 4,000 meters (m) elevation in the Los Lizpez zone of the Bolivian Andes, had enough gold to be mined. The richest and most productive alluvial gold deposits were located on the Tipuani, Mapirí, Kaka, and Challana Rivers, all in the northern area of the Department of La Paz. The second most important alluvial mining was in the Araras area in the northeast part of the country on the border with Brazil, where gold has been recovered from the Madera and Madre de Dios Rivers.

Among other U.S. mining companies involved in Bolivia exploring the altiplano and alluvial gold deposits in the Tipuani-Guanay-Mapirí region are ASARCO Inc. and Specialty Metals of Denver, Colorado, through its wholly owned Bolivian subsidiary, COMINESA. The latter signed COMIBOL's first joint-venture contract in late 1992. However, Specialty Metals in late 1993 sold COMINESA to Corrientes Resources of Vancouver, Canada. Still other companies exploring were MINPROC Bolivia S.A., a U.S.-Australian company; and Tipuani Development Co., S.A., which purchased the gold dredge of South American Placers Inc., a subsidiary of COMSUR.

U.S. companies exploring or looking at possibilities in the altiplano and alluvial gold deposits in the Tipuani-Mapirí area included Arimetco International, Renison Goldfield, Inc., Canyon Resources Corp., Echo Bay Mines, Santa Fe Pacific Gold, Nevada Goldfields Inc., and Newmont Gold Company.

**Lead, Silver, and Zinc.**—Production of lead ore and concentrate decreased 7%, silver increased 6%, and zinc dropped 18% compared with outputs in 1993. Production of metallic lead, including alloys, increased by 11% from the depressed level of previous years. Output of metallic silver decreased 16% below that of 1993. The medium-size mining sector was the dominant lead and zinc producer, with 76% of total lead and 58% of total zinc. In this sector, the major producers were Cía. Quioma, S.A., COMSUR S.A. and Caballo Blanco S.A. All of COMSUR's production came from the Porco zinc-lead-silver mine. In 1994, about 59% of the zinc produced was from the medium mining sector, 30% from the small mining group, and 11% from COMIBOL. Bolivia does not have a zinc smelter, and all past metallic production came from Vinto's tin refinery. Currently, Bolivia's zinc concentrates are smelted in Western Europe.

**Tin.**—Bolivia's relative position as a world tin producer remained in fourth place, in order of production, after China, Brazil, and Indonesia. In 1994, tin prices remained low, and consequently tin output decreased about 13% to 16,169 mt from 18,638 mt in 1993. Tin output amounted to 22% of the country's total 1994 minerals export value, compared with zinc exports that decreased to 26% of the total export mineral

value. The largest production increase in the private sector was by the small-size mines and cooperatives, which, for the eight consecutive year, replaced COMIBOL as the leading tin-producing sector, and in 1994 accounted for about 64% of Bolivia's tin production. The COMIBOL mines produced about 32% of the total mining sector's output.

COMIBOL was preparing to open up all of its land holdings, other than those immediately surrounding established deposits, to international bidding for exploration and possible exploitation under joint-venture agreements. The corporation possessed 2,326 properties covering more than 1 million hectares, plus considerable land holdings that have not been properly explored. These lands, located in the cordillera and in the east of the country, included alluvial gold potential along the Beni, Madera, Madre de Dios, and Mamore Rivers. During 1994, four new joint-venture contracts were signed with COMSUR (Bolivia) for the exploitation of the Bolivar mine; Downer Mining Ltd.-AUSTPAC Gold N.L. (Australia) to exploit COMIBOL's alluvial gold deposits in the northeast of Bolivia; AUSTPAC Gold, N.L. (Australia) for the Escala Mine, and SEBOL (BRGM-France) for the Asientos ore body. COMIBOL's Huanuni Mine became the largest and the richest tin mine in the country since its reopening in September 1988. The state-owned Vinto tin smelter (formerly operated by ENAF) increased its exports to 15,380 mt of metallic tin (99.95% average tin content) in 1994 and sold 143 mt (worth about \$871,697) of metallic tin to Bolivian customers. About 87% of Bolivia's metallic tin exports went to the United States and the rest to six Latin American countries, Holland, Great Britain and Spain. During 1994, Vinto smelted 4,155 mt of antimony-in-concentrates received from Laurel Industries to produce 3,289 mt of antimony trioxide. Vinto's labor force in December 1994 amounted to 463 workers (not including 110 part-time workers).

**Tungsten.**—Bolivia's production of tungsten concentrate ( $WO_3$ ), heavily dependent on international prices, increased to 583 mt in 1994 from 362 mt in 1993. The mines closed in previous years, owing to severe ore depletion and high operating costs, did not resume operations. Production came from the small miners and cooperatives that have small deposits with high ore grades and low labor costs. Output of the small-size mining sector increased about 61% to 583 mt ( $WO_3$  content).

### *Industrial Minerals*

**Cement.**—Cement in Bolivia was produced by four plants in different regions of the country having a total production capacity of about 601,000 metric tons per year (mt/a). Two plants, Fábrica Nacional de Cementos S.A. (FANCESA) and Fábrica de Cementos El Puente (EL PUENTE), were state-owned. Under the current Government's privatization policy, the two plants were offered for sale under an international bid. The Compañía Boliviana de Cementos S.A.M., in Irpa Irpa, Department of Cochabamba, had a production capacity

of 150,000 mt/a, and was a mixed-capital company (state and private shareholders). The FANCESA plant, a part of the Regional Development Corporation of Chuquisaca, was offered for sale. The third plant, EL PUENTE, in the Méndez Province of the Department of Tarija, with a 60,000-mt/a capacity, was owned by the Development Corporation of Tarija. The Sociedad Boliviana de Cementos S.A. in Viacha, Department of La Paz, with a capacity of 210,000 mt/a, was the only wholly privately owned cement plant in the country. During 1994, total cement sold in the country was about 600,000 mt, an increase of 18% compared with that of 1993.

**Lithium.**—Bolivia's recent attempts to attract private exploitation of mineral reserves were frustrated by the abandonment of a prospective agreement between the State agency, Complejo Industrial de los Recursos Evaporíticos del Salar de Uyuni (CIRESU), and a U.S. company, Lithium Corporation of America, one of the two major world producers of lithium and a subsidiary of Food Machinery Corp., to extract lithium from the Uyuni Salar in the western Altiplano.

The Bolivian Government, by Supreme Resolution dated May 2, 1994, authorized CIRESU to make a complete inventory and an internal audit of its installations and business from the beginning of its functions in 1985 to 1994, in accordance with its S. D. No. 21660 and its associated Regulatory Decree.

### *Mineral Fuels*

Bolivia's hydrocarbons sector continued to play an important role in the country's economy. In 1994, Bolivia's oil and gas industry continued in third place in the Bolivian export sector, after nonfuel minerals and nontraditional goods. In 1994, hydrocarbons decreased from 12.5% to 9.4% by value of Bolivia's total exports. The sector accounted for 4.3% of the GDP and it employed about 7,500 persons out of a total work force estimated at 2 million. The Ministry of Hydrocarbons and Energy was restructured to National Secretariat status under the Ministry of Economic Development and Finance.

YPFB conducted exploration, production, transportation, and marketing; it signed either "operational contracts" or "petroleum services contracts," and was authorized to form joint ventures with other parties. In September 1994, YPF S.A. of Argentina signed with YPFB two 30-year association contracts for the areas of Montero and Charagua, both in Santa Cruz. On December 5, 1994, YPFB signed a 30-year operational contract with the French company Elf Aquitaine-Elf Hydrocarbures Bolivie, the Spanish company Repsol Exploration Secure, the Australian BHP Petroleum (Bolivia), and the U.S. company Maxus Bolivia Inc. for the Secure Block in Cochabamba (Chapare) and Beni (Ballivian, Marana and Moxos). On September 24, 1994, a second 30-year operational contract was signed with the Bolivian company Compañía Boliviana de Petróleo S.A. to explore the Santa Cruz-1 Block, south of the city of Santa Cruz.

During 1994, YPFB continued to negotiate several exploration contracts with different companies. YPFB approved the association contract to be signed by Diamond Shamrock for the Nupuco Block in Tarija. On December 1993, Mobil formally applied to YPFB for the Bella Flor Block in the Madre de Dios Basin. Mobil also formally applied to YPFB for the Cobija Block in the Madre de Dios basin. Oceanic Exploration and Development Corp. applied to explore the Ustarez Block in the Department of Santa Cruz. Phillips Petroleum Co. gained rights to the areas of Robore and Tucavaca in the Suarez Arana Block. Braspetro of Brazil was to continue with its application for association contracts for the San Alberto and San Antonio fields.

**Natural Gas.**—Production of natural gas increased 5.8% from that of 1993 to 5,400 million cubic meters (Mm<sup>3</sup>). Of the total production of natural gas, 75% was produced from YPFB Gasfields and 25% by private contractors. YPFB's Vuelta Grande Gasfield continued to be Bolivia's largest natural gas producer; its production decreased 6% compared with that of 1993. Rio Grande's output was YPFB's second-largest natural gas producer, decreasing 14.2% in 1994. Production from the new fields of Sirari and Vibora increased 20% and 63%, respectively. YPFB's total natural gas production increased 8.4%, while its contractors' production, on the other hand, dropped 1.5%. Occidental Boliviana's Porvenir Gasfield and Tesoro Bolivia's La Vertiente Gasfield decreased 39.8% (continuing the downtrend started 7 years ago) and 2.4%, respectively.

Of the total natural gas produced in Bolivia, 36.3% was exported to Argentina; 13.1% was consumed domestically; 28.7% was reinjected into the gasfields; 16.6% was vented, flared, or lost; 3.0% was consumed as fuel by YPFB; and the remaining 2.2% was converted into liquefied petroleum gas (LPG). As a result of YPFB's program of substituting gas products for liquids, domestic consumption of LPG increased 28.3% from 1,718,200 bbl in 1993 to 2,518,760 bbl in 1994. In 1993 and 1994, several natural gas pipelines were installed and a larger volume of natural gas was consumed domestically, mostly in the city of Santa Cruz. YPFB operated four LPG plants at Rio Grande, Colpa, Camiri, and Vuelta Grande in the Department of Santa Cruz, all of which also produced natural gasoline.

On August 17, 1994, in Brasilia, Brazil, the Bolivian President and his Brazilian counterpart renegotiated the 1993 contract, just before the project financing deadline. As a result of this renegotiation, an addendum to the contract was signed by YPFB and Petroleo Brasileiro, S.A. (PETROBRAS). The financial engineering was postponed for a year, with a timetable set for meetings to discuss its progress.

The sale of natural gas to Northern Chile was a project that has been on the table for more than 4 years. The urgent need for electrical energy to run the gigantic copper mining projects in Northern Chile makes that market ideal for Bolivian natural gas. Trans-Andean Partners, Inc., a consortium of U.S. firms, Broken Hill Proprietary Co. Ltd.,

(BHP), and others, presented to the Bolivian Government a proposal for the construction and operation of a natural gas pipeline from Tarija, Bolivia, to Tocopilla, Chile. In June 1994, YPFB (with 45% of the consortium) signed a Memorandum of Understanding to form a consortium with BHP of Australia (45%) and the Chilean oil company Empresa Nacional de Petroleo (ENAP) (10%) to study and develop the natural gas export project to Northern Chile. The proposed project was to build an 800-kilometer (km), 51-centimeter (cm)-diameter gas pipeline that would transport 4.25 million cubic meters per day (Mm<sup>3</sup>/d) of natural gas purchased from YPFB. The proposed pipeline would feed a projected Trans-Andean Partners 500-megawatt (MW) thermoelectric plant in the city of Tocopilla, on the northern coast of Chile. The cost of the pipeline was estimated at about \$250 million, and the cost of the thermoelectric plant would be about \$350 million.

In February 1994, Bolivia and Paraguay signed a Memorandum of Understanding by which Bolivia agreed to sell about 1.7 Mm<sup>3</sup>/d. At the same time, both countries agreed to build a 846-km, 51-cm pipeline to deliver the gas.

**Petroleum, Crude.**—Crude oil plus lease condensates are produced by YPFB and its contractors. YPFB's production represented 77.3% and the contractors 22.7% of the country's total production, in 1994. Bolivia's total liquids production increased 15.6% to 9.4 million barrels (Mbbbl) or 25,700 barrels per day (bbl/d) compared with 8.1 Mbbbl (22,200 bbl/d) produced in 1993. The country's total liquids production, including the production of LPG and natural gasoline, reached 30,000 bbl/d for 1994 compared with 29,600 bbl/d for 1993. YPFB made two new oil discoveries, the Patujusal and Yuquis. A third new find was made at the Bulo Bulo X-3, which discovered a new deeper natural gas/condensate-bearing formation in the old Bulo Bulo Oilfield.

Patujusal was financed by the IDB, and it was estimated that this oilfield could produce about 1,500 bbl/d of crude oil and natural gas from the upper Oligocene Petaca Formation after development is completed and the Yuquis X-1 wildcat, spaded on April 27, 1993, went to a depth of 3,125 meters (m).

The contractor's crude oil production was up 31.2% higher than in 1993. The Surubi Oilfield operated by Maxus Energy Corp. of the U.S. started production in August 1992 and has already tripled its production to almost 980,000 bbl (up 284.4%) in 1994.

### **Reserves**

COMIBOL's mine reserves for tin, zinc, lead, and silver at the main mines were revised in 1989 for its 5-year plan. Mineral reserve estimates for lead, silver, tin, tungsten, and zinc were recalculated and revised to improve accuracy, not only for the large mines but also for the medium- and small-size mining sectors. In view of the widespread occurrence of both lode and placer gold in Bolivia, gold reserves have not

yet been projected. However, the Kori Kollo open pit at Inti Raymi is mining an epithermal deposit of gold and silver, with production presently reported at about 10,588 kilograms per year (kg/a) and reserves exceeding 60 million metric tons (Mmt) and averaging 2.33 grams per metric tons (g/mt) of gold. YPFB estimated that the total Bolivian proven crude oil reserves, plus lease condensate as of yearend 1994, were 128 Mbbl. YPFB's proven reserves total 93 Mbbl or about 72.9% of the total crude oil proven reserves.

The contractors' crude oil proven reserves amounted to 35 Mbbl or 27.1% of the total. Bolivia's crude oil reserves at current production and consumption could last for another 11 to 12 years. YPFB estimated that, of its total crude oil reserves, about 45% are crude oil and 55% lease condensate stored in natural gasfields. Bolivia's original reserves in 1984 were about 468 Mbbl.

According to YPFB, Bolivia's natural gas reserves, as of December 1994, were 178 billion m<sup>3</sup>, of which 108 billion m<sup>3</sup> were proven reserves, and 70 billion m<sup>3</sup> were probable reserves. YPFB's proven natural gas reserves are 84% of the total proven reserves, while the contractor's total amounted to 16%.

## Infrastructure

The development of communication and transportation systems in Bolivia was impeded by the rugged topography of the Andean Range, a very difficult barrier separating the western and eastern regions of the country. Alignments of railroad lines and highways are curvy, and during the rainy season, mud avalanches may block them temporarily. In the eastern plains, river flooding is a serious problem, preventing deliveries of supplies and food to consumers. Nevertheless, Bolivia had a reasonably well-developed infrastructure.

Minerals produced in La Paz Department were transported by rail and truck to Arica, Chile, and to Matarani, Peru, for export. Minerals from Oruro, Potosí, Cochabamba, and Santa Cruz Departments were transported by railway to Antofagasta, Chile, as well as to Argentina and Brazilian consumers.

The transportation network was composed of a total of 38,836 km of highways. The Pan-American Highway linking Argentina and Peru crossed Bolivia from south to northwest. The 3,684-km Government-owned railroad system was controlled by Empresa Nacional de Ferrocarriles. Bolivia's 10,000 km of commercially navigable waterways connected the eastern region of the country with the Amazon basin. As a landlocked country, Bolivia had no ocean ports but had access to ports in Chile through Arica and Antofagasta and Peru via Matarani.

About 13.5 Mbbl of crude oil and condensates, 5.6 Mbbl of refined oil products, and 1,251 Mm<sup>3</sup> of natural gas were transported between major distribution centers in Bolivia through 5,980 km of pipelines owned and operated by YPFB. All the pipelines were reversible, with the exception of an export pipeline to Arica, Chile. Several other pipeline construction projects were underway. The generation,

transmission, and distribution of electrical power in Bolivia was carried out by both state and private companies. An estimated 2,826 gigawatt hours of electricity was produced in 1994, an increase of 6.6% from that of 1983. The average consumption was 260 kilowatt hours per capita. Bolivia had an installed electrical generating capacity of 756 MW, of which 308 MW, or about 55%, was generated by hydroelectric plants and the remainder by thermoelectric plants, operated by ENDE, which had an installed generating capacity of 468.2 MW or 62% of Bolivia's total. The privately owned Bolivian Electric Power Co. (COBEE-BPC), originally Canadian-owned, has 142.2 MW of installed capacity or 19% of the country's total. COBEE-BPC supplied electricity to the cities of La Paz, El Alto, and Oruro.

## Outlook

The Bolivian Andean mineral belts and the eastern Precambrian shield hold substantial mineral resources and are largely untapped. Despite the current pause in political momentum, the economy was progressing reasonably well and the overall investment climate was favorable. The legislative base was established for advances in the next 2 years, and whatever the outcome of the elections in 1997, the welcome mat for foreign investors in a market economy was thought unlikely to change. The further opening up of large tracts of land for bids held by COMIBOL should offer investment opportunities. In addition, COMIBOL expected to offer its existing mining operations for joint ventures. Moreover, very promising discoveries were already being evaluated, with the likelihood of a second Kori Kollo coming on-stream in a few years. The proposed simplification and modernization of the Mining Code, with its tightening of the rules concerning the holding of concessions, was also likely to result in the release of additional land.

Mining companies, both large and small, were involved in an increasing level of exploration activity, with some promising projects underway. Mineral targets were related more to the new technologies of large tonnage-lower grade open pit mining operations than to the narrow, high-grade veins historically characterizing mining. Exploration in Bolivia was increasing and is currently estimated at \$25 million. The bulk of this expenditure was by large companies, such as Bardic Gold, RTZ, Battle Mountain, EMUSA (with Orvana and Echo Bay Mines), and Tack Corp. Exploration was taking place in each of the four principal regions—Altiplano, Cordillera, Brazilian Shield, and the Northeast. The most promising prospects were the gold properties of Escala, Cashi Laguna, and Don Mario, each with a good possibility of becoming open pit mines. COMSUR's Puquio Norte project also had considerable potential. Nonfuel minerals and hydrocarbons continued to lead Bolivia's exports. Natural gas was considered to have the greatest potential for sustained long-term growth.

The Government capitalization plan was an audacious program designed to bring Bolivia the benefits of

privatization without turning the companies involved completely over to private investors. The government hoped to attract foreign investors interested in becoming partners in owning the six public corporations up for sale: YPFB; ENDE; ENTEL, the international telecommunications company; LAB; ENFE, the National railroad; and ENAF-Vinto, the tin/antimony and lead/silver smelters. The best three opportunities in the capitalization process were ENDE, ENTEL, and YPFB. ENDE and ENTEL were in advanced stages of the pre-capitalization process and were expected to be in private hands by July 1995. Other moderately good prospects were ENAF-Vinto smelters, LAB (because of its international routes); and ENFE, which may be the hardest one to sell.

Foreign private investors viewed Inti Raymi's success as an example to emulate. For example, the Australian company AUSTPAC Gold, N.L., in a joint venture with COMIBOL, is exploring the Escala ore body, in the southern Altiplano, which shows great potential as a heap-leaching gold target. Billiton of United Kingdom signed a joint-venture contract with EMUSA to quantify reserves at the copper-gold Don Mario deposit in Santa Cruz. The COMSUR-RTZ joint venture continued with their exploration program in the Altiplano and the Pre-Cambrian. EMUSA has a joint venture with ORVANA Minerals Corp. of Vancouver, Canada, to explore a disseminated gold prospect of San Bernardino in Challapata, near Oruro.

Future resource development is likely to focus on continued expansion of the hydrocarbon sector, as well as the development Bolivia's gold industry and the iron ore-steel prospects at the Mutún deposit, near the Brazilian border.

The lithium and potassium projects from the Uyuni salt flats, the expansion of sulfur production and gold from alluvial deposits in Laz Paz and at the Brazilian border.

The Bolivia-Brazil energy integration agreement included the selling of electricity generated by a natural gas-fired thermoelectric plant; urea and high-density polyethylene from a proposed plant to be installed in Puerto Suárez, Department of Santa Cruz; and the construction of the 563-km gas pipeline between the Santa Cruz Gasfields and Puerto Suárez, near the Brazilian border.

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<sup>1</sup>Text prepared June 1995.

<sup>2</sup>Where necessary, values have been converted from bolivianos (\$b) to U.S. dollars at the rate of \$b4.6=US\$1.00.

### **Major Source of Information**

Secretaria Nacional de Minas  
Ave. 16 de Julio 1769, Casilla 8686  
La Paz, Bolivia

### **Major Publications**

Secretaria Nacional de Minas y Metalurgia, La Paz City:  
Boletín Estadístico Minero Metalúrgico, monthly.  
Asociación Nacional de Mineros Medianos, La Paz City:  
Minería Mediana-Memoria 1994, annual.  
U.S.G.S. Report on the "Geology and Mineral Resources of  
the Altiplano and Cordillera Occidental."



TABLE I  
BOLIVIA: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity 3/ METALS 4/	1990	1991	1992	1993	1994	e/
<b>Antimony:</b>						
Mine output, Sb content	8,450	7,290	6,020	5,560 r/	7,050	5/
Metal including Sb content of trioxide	1,050	3,550	5,670	4,470	5,880	5/
Arsenic: Mine output, arsenic trioxide, arsenic sulfide	300	463	633	663	341	5/
<b>Bismuth:</b>						
Mine output, Bi content	68	--	--	--	--	
Metal, smelter	137	--	30	7	--	
Cadmium: Mine output, Cd content 6/	102	115	71	4	--	
Copper: Mine output, Cu content	157	30	101	94	79	5/
Gold: Mine output, Au content 7/ kilograms	5,200 8/	3,500 8/	4,690	10,400 r/	12,800	5/
<b>Iron ore: 9/</b>						
Gross weight	125,000	102,000	55,500	51,000 e/	--	
Fe content	78,900	72,100	35,000	32,100 r/	--	
<b>Lead :</b>						
Mine output, Pb content	19,900	20,800	20,000	21,200	19,700	5/
Metal, smelter	117	213	261	537	597	5/
Manganese: Mine output, Mn content	3,780	215	100	--	--	
Silver: Mine output, Ag content 10/ kilograms	311,000	376,000	282,000	332,768	352,000	5/
Tantalum, tantalite do.	583	3,740	2,720	3,535	1,820	5/
<b>Tin:</b>						
Mine output, Sn content	17,200	16,800	16,500	18,600	16,200	5/
Metal, smelter	12,600	14,700	14,400	14,500 r/	15,300	5/
Alloys	832	261	75	94	100	
Tungsten: Mine output, W content	1,010	1,070	851	287 r/	462	5/
Zinc: Mine output, Zn content	104,000	130,000	144,000	123,000 r/	101,000	5/
<b>INDUSTRIAL MINERALS</b>						
Barite	300	1,280	368	--	3,310	5/
Bentonite	--	825	454	368	364	5/
Calcite	300 e/	480	500 e/	37	100 e/	
Cement, hydraulic	560,000	592,000	600,000	480,000 r/	500,000	e/
<b>Gemstone, amethyst:</b>						
Polished kilograms	50	254	3	15	33	5/
Rough do.	--	32,100	47,200	248	220	5/
Gypsum, crude e/	100	4,000	6,000	4,000	532	5/
Marble	81	37	67	37	318	5/
Onyx kilograms	--	10,800	104	133	56	5/
Pumice e/	100	100	100	80	50	
Quartz kilograms	--	--	100	816	400	
Salt	155	255	260 e/	200 e/	200	
Sandstone (arenisca)	--	--	119	--	--	
Slate (pizarra)	104	14,800	5,000 e/	163	268	5/
Sodalite kilograms	--	4,170	3,000 e/	--	--	
Sulfur, native	2,100	2,780	15	1,050	252	5/
Ulexite	3,080	14,200	23,200	12,000 r/	10,400	5/
<b>MINERAL FUELS AND RELATED MATERIALS</b>						
<b>Gas, natural:</b>						
Gross million cubic meters	5,280	5,430	5,520	5,590	5,400	
Marketed do.	2,200	2,180	2,130	2,090 r/	2,050	
<b>Natural gas liquids:</b>						
Natural gasoline thousand 42-gallon barrels	732	814	775	880 r/	850	
Other (consumption) do.	1,850	1,900	1,820	1,810 r/	1,800	
<b>Petroleum:</b>						
Crude including condensate do.	7,640	8,090	7,752	8,116 r/	8,000	
<b>Refinery products:</b>						
Liquefied petroleum gas do.	1,200 e/	570	511	513	510	
Gasoline do.	3,400 e/	3,300	3,224	3,235	3,200	
Jet fuel do.	600 e/	683	669	741	750	
Kerosene do.	300 e/	269	262	231	235	
Distillate fuel oil do.	2,560 e/	2,830	2,848	2,635	2,600	
Lubricants do.	100 e/	90	70	31	30	
Residual fuel oil do.	90 e/	816	202	330	330	
Unspecified do.	200 e/	1,220	1,933	2,000 e/	2,000	
Refinery fuel and losses do.	50 e/	--	--	96	100	
Total do.	8,500 e/	9,770	9,719	9,812	9,760	

e/ Estimated. r/ Revised.

1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.

2/ Table includes data available through May 1995.

3/ In addition to the commodities listed, a variety of crude construction materials (clays, crushed and broken stone, dimension stone, and sand and gravel) are produced, but available information is inadequate to make reliable estimates of output levels.

4/ Unless otherwise specified, data represent actual production by COMIBOL and small- and medium-size mines.

5/ Reported figure.

6/ Cadmium contained in zinc concentrates produced by COMIBOL. (Cadmium is not recovered in elemental form in Bolivia.)

7/ Includes production of metallic gold.

8/ Small- and medium-size mines output sales to BAMIN, and COMIBOL exports (small- and medium-size mines cannot legally export gold).

9/ Data represent exports and are regarded as being equal to production.

10/ Includes production of metallic silver.

TABLE 2  
BOLIVIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1994

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Antimony		Empresa Minera Unificada S.A. (EMUSA) (private, 100%)	Caracota, Chilcobija, and Espiritu Santo Mines, Potosi Department	5.2.
Do.		Empresa Minera San Juan Ltda. (private, 100%)	Candelaria Mine, Potosi Department	2.1.
Antimony trioxide		Empresa Minera Hermanos Bernal S.A. (private, 100%)	Palala smelter, Tupiza, Potosi Department	1.0.
Gas	cubic meters	Yacimientos Petroliferos Fiscales Bolivianos (YPFB) (Government, 100%)	Rio Grande, Vuelta Grande, and Sirari Gasfields, Santa Cruz Department	2,472.
Do.	do.	do.	San Roque, Vibora, and Yapacani Gasfields, Southern District	683.
Do.	do.	do.	Cascabel, Naranjillos, Carrasco, Camiri, Monteagudo, Santa Cruz Gasfield Central, and Southern Districts	441.
Do.	do.	Occidental Boliviana Inc., Tesoro Bolivia Petroleum CO. (U.S.) and Empresa Naviera Pwew-Compac-Sacfic (Argentina) contractors (private, 100%)	El Porvenir, La Vertiente, Gasfields, Santa Cruz Department	66,100.
Gold	kilograms	Cooperatives (some with U.S. equity) (private, 100%)	Tipuani, Guanay, Mapiiri, Huayta, Kaka and Teaspon te Rivers, La Paz Department	2.2.
Do.	do.	Empresa Inti-Raymi S.A. (private, 100%) (Battle Mountain Gold Mining Co., 85%; EMUSA, 15%)	Gold Leaching, open pit operation at La Joya, near Oruro, Oruro Department	1.5.
Do.	do.	Bolivian Army's Development Corp.; 200 dredges operating in the Araras region (without legal concession)	Araras, Cachueta Esperanza gold dredging, Pando and Beni Departments	6.0.
Lead		Empresa Minera Quioma S.A. (COMSUR S.A.) (private, 100%) (Formerly owned by ASARCO Incorporated of the U.S.)	Asientos, lead-silver-zinc mine at Mizque, Cochabamba Department	6.5.
Do.		Corporacion Minera de Bolivia (Comibol)	Santa Fe, Tatasi Animas-Inocente, and San Jose Mines, Potosi Department	3.2.
Do.		Empresa Metalurgica de Karachipampa (Government, 100%) (Autonomous subsidiary company of COMIBOL) Lead/silver smelter (continued shutdown for lack of operating capital and shortage of ore-feed)	Karachipampa, Potosi Department	24.0.
Petroleum	thousand barrels	Yacimientos Petroliferos Fiscales Bolivianos Bolivianos (YPFB) (Government, 100%)	La Pen, Vuelta Grande, Rio Grande, San Roque, and Vivbora Oilfield, Santa Cruz Department	4,500.
Do.	do.	Occidental Boliviana Inc. and Tesoro Bolivia Petroleum Co., both U.S. companies and other contractors (Private, 100%)	Porvenir, La Vertiente, Bermejo, Caigua, and Colpa Oilfields	1,200.
Silver	kilograms	Corporacion Minera de Bolivia (COMIBOL) Cia. Minera de Oruro, Cia. Minera Quechisla, and Cia. Minera Potosi subsidiaries (Government, 100%)	San Jose, Bolivar, Poopo, Santa Fe, San Vicente, Tatasi, Animas-Inocente, and Unificada Mines at Oruro, and Potosi Departments	99,000.
Do.	do.	Cia. Minera del Sur, S.A. (COMSUR) (Private, 100%) (RTZ of the United Kingdom, shareholder)	Martha, Huari, Porco, and Milluni Mines La Paz Department	97,000.
Tin		COMIBOL: Cia. Minera de Oruro, Cia. Minera Quechisla, Cia. Minera de Potosi and Cia. Minera La Paz (Government, 100%)	Huanuni, Colquiri, Caracoles, Viloco, and Chorolque Mines, at Oruro, Potosi, and La Paz Departments	5.7.
Do.		COMSUR, Barrosqira, International Mining Co., Yana Mallcu and Avicaya companies (private, 100%)	Martha, Cerro Grande, Milluni, and Berengueta tin mines	0.8.
Do.		Small miners and cooperatives (private, 100%)	Catavi-Siglo XX, Caracoles, Bolivar Viloco, Colquiri, and Colquechaca Mines	10.0.
Tin, refined		Empresa Metalurgica de Vinto (COMIBOL's subsidiary) (Government, 100%)	Vinto, Oruro Department	14.3.
Do.		Fundestano de Oruro S.A. (private, 100)	City of Oruro, Oruro Department	0.05.
Do.		Cia. Metalurgica Industrial y Commercial-Hormet S.A. (private, 100%)	City of La Paz, La Paz Department	0.25.
Tungsten		COMIBOL-Cia. Minera La Paz (Government, 100%)	Kami, Tasna, and Bolsa, Negra Mines, La Paz Department	Closed since 1987.
Do.		International Mining Co. (IMCO) (private, 100%)	Chojilla Mine, La Paz Department	0.5.
Do.		Empresa Minera San Jose Berque (private, 100%)	Esmoraca, Pueblo Viejo, Espanola, and La Argentina Mine, Sudchichas Province, Potosi Department	0.2.
Zinc		COMIBOL, Cia. Minera de Oruro, Cia Minera Quechisla, Cia. Minera de Potosi (Government, 100%)	Santa Fe, Colquiri, San Vicente, Tatasi, Animas-Inocente and Unificada Mines at Oruro, Potosi, and La Paz Departments	27.8.
Do.		COMSUR S.A., Maragua Ltda., Caballo Blanco S.A. (private, 100%)	Porco, Asientos, Maragua, Huari-Huari Monserrate, and Monte Blanco Mines at Cochabamba, Oruro, and Potosi Departments	83.5.

TABLE 3  
BOLIVIA: RESERVES OF MAJOR MINERAL  
COMMODITIES FOR 1994

Metric tons unless otherwise specified)

Commodity	Reserves
Antimony, metal content	350,000
Lead, metal content	25,965
Lithium carbonate	5,500
thousand metric tons	
Natural gas	166
billion cubic meters	
Petroleum	20
million 42-gallon barrels	
Silver, metal content	1,378
Tin, metal content	274,774
Tungsten, metal content	533,000
Zinc, metal content	935,497