THE MINERAL INDUSTRY OF

ECUADOR

By Pablo Velasco[1]

The mineral industry of Ecuador in 1994 continued to be dominated by the petroleum sector, which contributed 35% of the country's export revenues and accounted for nearly 11% of gross domestic product (GDP). Mining contributed less than 1% of the country's GDP and export revenues and employed less than 1% of the active labor force. In 1994, the gross value of mineral production—mainly industrial minerals—was about $135 million.

To date, mining in Ecuador was small in scale and largely informal and unregulated, with about 40,000 workers involved in artisanal gold operations using primitive mining and processing techniques that waste about 30% to 50% of the gold. This created additional health hazards in the mining communities near the Zaruma-Portovello, Nambija, and Ponce Enriquez districts and polluted nearby rivers in southern Ecuador. Collectively, these small freelance miners produced the greatest value of Ecuador's gold production, smuggling most of it out of the country.

There was just one small-scale underground gold and silver mine in operation and only one significant placer gold operation in Ecuador. According to statistics released by the Ecuadorian Central Bank in 1994, the value of crude oil and refined products was about $1,305 million.[2]

The Ecuadorian economy grew by 3.4% in real terms during 1994, led by trade, manufacturing, foodstuffs, and mineral production. The inflation rate dropped to 25.4%, compared with 31% in 1993.

Government Policies and Programs

The Government continued efforts to create a favorable climate for domestic and foreign investment in natural resources exploration and development and has initiated a process of modernization and privatization of several governmental institutions and industries. Economic reforms have met stiff opposition in the legislature. Debt-restructuring agreements with private banks were made by the Government in an effort to solve the $12.5 billion foreign debt. Ecuador was expected to pay about $225 million in interest in 1995 under the agreement, and Ecuador was to receive a 45% discount on capital debt, which was expected to reduce the Nation's debt from $4.5 billion to $2.5 billion for a 30-year period. By raising fuel prices, the Government attempted to expand the aging Transecuadorean pipeline's capacity through foreign investment. The World Bank has approved a $24 million loan to support the restructuring of the mining sector including the modernization of the Government's mining agencies, the development of the private mining sector, and the implementation of enviromental regulation programs for the mining industry.

Mining activity was regulated by the Mining Law, Decree No. 126 of May 22, 1991, and by regulations of Decree No. 2831 of October 24, 1991. This legislation established the relationship between the State and persons or entities engaged in all mining activities, excluding exploitation of hydrocarbons, radioactive minerals, and medicinal waters.

The greatest weakness of the Mining Law from the point of view of potential investors was the imposition of a 3% royalty on gross production. This tax, which was enacted at the insistance of Congress, had the effect of raising the ore grade that a deposit must have to be profitable. The Chamber of Mines, the chief industry lobbying group, hoped that legislation could be passed to lower this royalty to 1.5%. Ecuador had a 25% corporate income tax and profits remitted abroad were subject to an additional 11% tax.

Environmental Issues

Petroecuador's has signed a 2-year contract with a U.S. company to clean up massive hydrocarbon pollution in Ecuador. Officials said environmental damage caused by the pollution was of crisis proportions. Environmental studies commissioned by World Bank indicated more than 4.4 million barrels (Mbbl) of hydrocarbons have been spilled across Ecuador in hundreds of minor mishaps. Recovery was planned at 483 eastern pits, ponds, and lagoons. American Fluids International Inc, of Midland, Tex., expected to start moving employees, equipment, and material to Ecuador by yearend. This recovery project in Ecuador was one of the first nationwide cleanups reported in Latin America. On December 29, 1994, the press reported that a lawsuit had been filed against Texaco in U.S. Federal District Court in New York by a group of indigenous Ecuadorean plaintiffs. According to the reports, the lawsuit alleged that Texaco contaminated the Amazonian Oriente region of Ecuador while operating there from 1967-90, and that this subsequently contaminated the River Napo, used by the Ecuadorean plaintiffs downstream as a source of food and for travel. The Government had turned its attention to informal gold mining in districts in El Oro, Azuay, and Zamora-Chinchipe Provinces, including Portovelo-Zaruma, Nambija, and Ponce Enriquez. Local miners had deforested the area, and a number of remote mining district operations processed ore using mercury, which subsequently was released into the environment. Besides mercury, arsenic, cadmium, copper, lead, and zinc tended to be lost in the rudimentary gold recovery operations. Contaminated process water discharged directly into streams was blamed partially for pollution problems in the coastal regions where aquaculture-raised shrimp had become a significant industry, as well as large banana plantations. The influx of people into the "gold rush" shanty towns also caused serious sanitary, social, health, and safety problems.

The Ministry of Energy and Mines' (MEM) Direccion Nacional de Medio Ambiente (DINAMA) administered and enforced the new Environmental Law and Regulations for the mineral industry.

Production

Under the constitution, all subsurface resources are the property of the State. Petroleum was the basis for Ecuador's external economy, with average production of 378,395 barrels per day (bbl/d) in 1994 accounting for 10.2% of GDP, 35.1% of export earnings, and 30% of public sector revenues. Total crude production for 1994 was 138.1 million barrels per year, up 10.1% since 1993. Ecuador has extensive, but underdeveloped, gold and other minerals. In 1994, gold production increased to some 10 metric tons (mt) valued at more than $100 million, of which 90% was produced by the informal sector. The mining sector's primary output was industrial minerals which, with the exception of some pumice exports, were consumed by the domestic construction industry.

Trade

Export of 86.4 million barrels Mbbl of crude oil and 10.5 Mbbl of refined products earned $1.305 billion, up only 4.1% from 1993. The price of Ecuadorian light crude oil improved from less than $10 per barrel (bbl) in late 1993 to an average of $13.68 in 1994. In 1994, the Government introduced a market-related pricing system for domestic fuel sales and opened up wholesale marketing to private sector competition. Total imports reached $3.27 billion. Increased sales to members countries of the Andean Pact and other countries worldwide accounted for much of the increase in nonpetroleum exports. The value of recorded gold and silver exports increased 8.4% to $66.3 million in 1994, with the remainder being sold on the black market. The mining sector grew by only 1% in 1994, accounting for 0.6% of GDP.

The United States continued as Ecuador's principal trading partner. During 1994, the value of exports to the United States reached $1.4 billion. Crude oil and processed petroleum exports to the United States were valued at $416.1 million. Gold exports to the United States increased from $9.6 million in 1993 to $24.4 million in 1994. Imports from the United States, primarily machinery, increased slightly to $1.1 billion in 1994.

Structure of the Mineral Industry

The Ecuadorian Government regulated the mineral industry through the MEM's Subsecretaria de Minas, which administered the mineral industry through its three agencies: Corporación de Desarrollo e Inversión Geológico-Minero Metalúrgica (CODIGEM), DINAMA, and Direccion Nacional de Mineria (DINAMI).

CODIGEM, the Corporation for Geological, Mining and Metallurgical Research and Development, was responsible for development and maintenance of geologic, mapping, and mining databases. CODIGEM also provided technical assistance to miners, in addition to supporting mining, geological, metallurgical, and seismic research. DINAMA, the National Environmental Directorate, was concerned with environmental aspects of resource development. DINAMI, the National Mining Directorate, granted mineral concessions and appropriate exploration and exploitation permits. Petroecuador, the state-owned petroleum holding corporation reorganized in 1992, and its subsidiaries produced, refined, stored, transported, and sold crude oil and petroleum products. Petroecuador's operating subsidiaries, Petroamazonas and Petroproducción, were combined to form Petroproducción.

International petroleum companies produced crude oil and natural gas under contract with the Government and were involved in downstream trade.

According to the 1994 membership list of the Ecuadorian Chamber of Mines, more than 150 small mining companies operated in the country. Additionally, more than 40,000 small-scale and informal artisanal miners were active, primarily in the gold sector.

Much of the Nation's gold output was being produced by these small, often illegal, operations. Informal miners either worked individually or in small groups. Cooperatives were formed, principally because they could obtain legal rights to the mining operation. Cooperatives were concentrated in the south in the El Oro, Azuay, and Zamora-Chinchipe Provinces, particularly around the areas of Portovelo-Zaruma, Nambija, and Ponce Enríquez.

Several major multinational mining companies, including Newmont Overseas Explorations Ltd. (Newmont), of the United States; Gold Fields of South Africa Ltd.; RTZ Corp. PLC, of the United Kingdom; and Noranda Exploration Co., Ltd., and Placer Dome, Inc., both of Canada, were pursuing exploration programs. A substantial number of highly speculative ventures also were being actively promoted.

Commodity Review

Metals

Copper—. Toronto, Canada-based Junior Ecuadorian Minerals (EM) could acquire a 65% interest in the Chaucha property in southern Ecuador. The 5,100-hectare property, held by Ag Armeno Mines and Minerals Inc. and Ecuadorean Copperfields, 30 kilometers (km) northeast of Ecuadorian

Minerals' wholly owned Gaby gold deposit, hosted a known porphyry copper system. In 1970's and 1980's, Japanese and Belgian interests drilled out 130 million to 140 million mt of geologic resources grading 0.39% to 0.41% copper. About 12,290 meters (m) of core were drilled, but to date, none has been analyzed for gold. For an initial 55% interest in this exploration venture, EM would pay Armeno $505,000 and 200,000 shares of stock during the next 4 years. EM was required to spend $3 million in exploration expenses in that time, in addition to $200,000 shares of EM stock and payment of another $1.5 million within 180 days after earning the first 55%.

Newmont Overseas Exploration Ltd. reported earning a 60% interest in the Fierro Urco copper-gold property jointly owned by Ag Armeno and Trans Atlantic Enterprises Inc. of Canada. Ag Armeno operated the underground San Bartolome silver mine. Ag Armeno also owned the large Peggy copper-gold property, optioned to Curlew Lake Resources Inc. of Canada, which could acquire 50% interest of the property, and the Chaucha copper-molybdenum property. RTZ suspended work at the San José de Salinas prospect and has focused on two other prospects: El Pueblo and La Victoria, both in the Western Cordillera.

Gold—. Small-scale, intermittently producing gold mining operations were spread throughout the country. Unofficial reports indicated that Ecuadorian gold production totaled approximately 10 to 12 metric tons per year (mt/a). Ore was extracted from diggings and processed in small cyanidation plants. The primitive ore treatment plants only recovered between 50% to 70% of contained gold. Some gold also was obtained by amalgamation methods.

Alluvial gold operations also were numerous. The Australian company, Odin Mining & Investing Co., Ltd., reportedly was the largest formal gold producer in the country, recovering more than 600 kilograms of gold from its placer operations, the Biron Mine and the Río Chico Mine.

Startigan Corp. of Vancouver, British Columbia, Canada, acquired Square Valley A.V.V., an Aruba-based company in Ecuador, and its two gold prospects. A 10,000-m drilling program was initiated in October on the Gaby property. During the year, mapping and sampling operations were undertaken on the Tres Chorreras deposit. Zappa Resources Ltd. of Vancouver, Canada, assumed 100% ownership of the Ecuadorian company, Prominex S.A., and its 14 gold concessions during July. Zappa evaluated samples recovered during an evaluation of the Ponce Enriquez prospect. Teck Corp. of Vancouver initiated an environmental management plan for Zappa's placer concession along the Río Aguarico as a preliminary move to acquire a 75% interest in the property.

Since its rediscovery in 1980, Nambija, an ancient Inca mine site, has been Ecuador's principal gold mining center. Approximately 2,000 to 3,000 informal miners worked the area, widely considered to be an ecological disaster. Although this unstructured, unregulated, and untaxed mining activity relieved unemployment, it had serious environmental and social drawbacks. The denuded mountainside was honeycombed by a profusion of ditches and tunnels (some to a depth of 300 m), which severely undermined the ground beneath the mining areas and the town. Government safety intervention would put thousands of informal miners out of work. In 1993, another landslide destroyed part of Nambija and buried an estimated 300 people. Concerned that the rest of the town would cave in, the Government requested that all mining activity cease. The Government also recommended that the miners move 8 km away to a safer area. The miners rejected the request, remained on location, and continued to mine, claiming the need to defend continuously their small pits and shallow tunnels from claim jumpers. Miners also accused the Government of selling out their interest to foreign mining companies.

Gold Fields of South Africa Ltd. entered a joint venture on a cooperative's concession in the Nambija area. With the cooperative's consent, Gold Fields started exploration, but their access to the area was blocked by local citizens afraid that the international firm would swallow all of the region's operations, instead of working only on its concession area.

Industrial Minerals

The most significant industrial mineral operations were the cement and cement-related industries involving limestone and clays. Other industrial mineral operations included the marble quarries of Industria Marmolera Ecuatoriana S.A., Mármoles Andinos Cía. Ltda., Mármoles Santa Rosa Cía Ltda., and Marmolera Chimborazo; the calcium carbonate operations of Cecal. S.A.; Mineral M.D.K.'s and Mineral Bentonite Charasol's bentonite mines; and the barite pit of Mineral Bomboiza.

The Ministry of Agriculture, the National Development Bank, and the National Finance Corp. offered their 91.74% interest in FERTISA, the Ecuadorian fertilizer company, on the national stock exchanges during 1993.

Mineral Fuels

Oil production had been increasing sharply since Ecuador left Organization of Petroleum Exporting Countries in January 1993 by 6% to 365,000 bbl/d in the first year, and then by another 7%, to 380,000 bbl/d, by May 1994. The country also had continued to increase its reserves. By yearend 1993, reserves were 2 billion bbl, or about 30% more than in 1990. Despite the environmental damage suit brought against Texaco by Ecuadorean Indian organizations, and the threat of another suit by the Government, a fairly good response was received to the seventh bidding round concluded in June 1994—a key piece in the Government's effort to increase reserves to 4.2 billion bbl by the end of this decade. Bids were received from 21 companies for 8 of the 13 blocks being offered. The first awards were announced in June. Still pending in mid-1994 was a decision on another key factor, the $600 million expansion of pipeline capacity, offered to private investors under a 15-year contract. The Trans-Ecuadorean pipeline was a main bottleneck, transporting 325,000 bbl/d of the country's 380,000 bbl/d output. Another 30,000 bbl/d flowed through the Trans-Andean pipeline via Colombia. The Government planned to expand the main crude oil duct of 463 km and add another section totaling 172 km, increasing total capacity to 400,000 bbl/d. Some 20 foreign companies were reportedly interested in the venture. Estimated crude oil production in 1994 totaled 138,000 Mbbl, or 380,000 bbl/d, an increase of 9.5% from that of the previous year.

Reserves

Ore reserves of metallic minerals and industrial minerals were small in world terms, but considered significant in Latin America. Ecuador was believed to have significant undelineated gold resources, as gold mining essentially stopped during the colonial era (16th and 17th centuries).

Ecuador produced crude oil, mostly from fields in the Amazon basin operated by Petroecuador, the State oil company. Of the remaining proven reserves of 21 billion bbl, 3.5 billion bbl could be extracted using current methods and 11.8 billion bbl could be extracted using advanced technology. The country's proven crude oil reserves should last well into the next century at the present rate of production.

Infrastructure

Ecuador's infrastructure was cited as a factor in restricting mineral sector development. Mine production was transported by truck on the Nation's 28,000 km of highways or on the 965 km of state-operated rail to processing plants and shipping ports.

Petrocommercial, a subsidiary of Petroecuador, was responsible for the transportation of oil. Crude oil was transported from the oilfields in the Oriente region through the Ecuadorian Transandean oil pipeline system via Quito to Esmeraldas or Guayaquil for export or processing and domestic distribution. This pipeline repeatedly exceeded design capacity during the year. Additional production was shunted through the Trans-Andean pipeline in southern Colombia to the export terminal at Tumaco. A new 150,000-bbl/d capacity pipeline parallel to the existing Ecuadorian pipeline from Lago Agrio to Esmeraldas was proposed. Maxus Energy Corporation of Dallas, Texas, also had 352 km of product pipeline line under construction in the east.

Outlook

The mining sector, especially gold, silver, and base metals, could supplement petroleum as important sources of national income. However, significant foreign investment would be needed to create adequate infrastructure and the Government would need to boost investor confidence by maintaining and improving the fiscal and legal environment of mineral exploration and development.

Ecuador, which has long ignored its potential as a minerals producer, could be the site of important investments in the medium term. However, interest in gold projects, with their associated quicker return on investment, should dominate the short-term horizon. Junior and major multinational companies already have begun intensive exploration programs.

The Government eventually will have to deal with the social and political problems associated with claim jumping by small-scale miners. These invasions of prospective mineral concessions assigned to others have delayed programs and frightened off domestic and foreign investment. Upgrading the recovery rate and discharge and emissions from primitive gold recovery operations also must be addressed. Environmental awareness and activism should become more entwined with natural resources development in Ecuador.

Petroecuador was expected to expand its production and transport capacity, most notably the construction of a liquified petroleum gas terminal and petroleum product pipelines. However, Petroecuador's mandated domestic sale of refined products at steeply subsidized prices was expected to continue to encourage product smuggling and eventually enervate Petroecuador's competitive stance.

Observers believed that Ecuador has additional petroleum potential, although possibly of smaller volume and of lower quality than currently producing oilfields.

---

[1]Text prepared Oct. 1995.
[2]Where necessary, values have been converted from Ecuadorian sucres (S/) to U.S. dollars at the rate of S/2,196=US$1.00.

Major Sources of Information

Ministerio de Energia y Minas
  Subsecretaria de Minas
  Santa Prisca 223 y Manuel Larrea
  Quito, Ecuador
  Telephone: 593-2-570-376
  Facimile: 593-2-570-350
Corporación de Desarrollo e Inversión Geológico-Minero
  Metalúrgica (CODIGEM)
  Casilla 17-03-23, Av. 10 de Agosto 5540 y Villalengua
  Quito, Ecuador
  Telephone: 593-2-240-209
  Facimile: 593-2-463-861
Cámara de Minería del Ecuador
  Ave. Rep. del Salvador #525
  Edif. Rosanía, Ofic. 14
  Quito, Ecuador

Major Publications

Banco Central del Ecuador—Division Técnica; Boletín Anuario.
U.S Embassy—Quito: Country Commercial Guide, annual.

TABLE 1
ECUADOR: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity		1990	1991	1992	1993	1994 e/
METALS						
Cadimum: Mine output, Cd content e/	kilograms	250	200	260	260	250
Copper: Mine output, Cu content e/		100	100	100	100	100
Gold: Mine output, Au content	kilograms	10,700	12,200	6,700 e/	6,600 r/	7,000
Iron and steel:						
Steel, crude		19,800	20,500	20,000 e/	26,600 r/	21,800
Semimanufactures		173,000	202,000	190,000 e/	189,000 r/	214,000
Lead concentrate, Pb content e/		200	200	200	200	200
Silver: Mine output, Ag content e/	kilograms	60	60	60	60	60
Zinc: Mine output, Zn content e/		100 e/	50 r/ e/	35	33 r/	100
INDUSTRIAL MINERALS						
Cement, hydraulic e/	thousand tons	2,250	2,300	2,250	3,240 r/ 3/	3,000
Clays:						
Bentonite		760	135	393	350 r/	300
Common:						
For cement	thousand tons	3,890	3,660 r/	3,160 r/	1,820 r/	2,000
Other		372,000	283,000 r/	278,000	113,000 r/	135,000
Kaolin		7,880	12,000 r/	6,380 r/	508 r/	1,000
Feldspar		8,130	5,010	3,250	3,300 e/	8,200
Gypsum (for cement)		24,200	-- r/	-- r/	-- r/	--
Sand:						
Silica (glass sand)		42,400	23,200	35,500	18,800 r/	20,000
Ferruginous e/		10,000	10,000	15,000	10,000	10,000
Stone, sand and gravel:						
Limestone (for cement manufacture)	thousand tons	3,890	3,660 r/	3,160 r/	1,820 r/	1,900
Marble		2,170	1,740 r/	1,960	8,620 r/	8,500
Pumice		34,000 e/	33,300 r/	20,600 r/	12,200 r/	13,000
Sand and gravel	thousand tons	--	--	363	164	170
Sulfur: e/						
Native		4,000	4,000	4,000	4,000	4,000
Byproduct:						
From petroleum		5,000	5,000	5,000	5,000	5,000
From natural gas		5,000	5,000	5,000	5,000	5,000
Total		14,000	14,000	14,000	14,000	14,000
MINERAL FUELS AND RELATED MATERIALS						
Coal, lignite e/		-- r/	-- r/	-- r/	-- r/	--
Gas, natural:						
Gross	million cubic meters	214	239	195	200 e/	200
Marketed e/	do.	100	90	90	90	90
Liquefied natural gasoline	thousand 42-gallon barrels	289	364	397	400 e/	400
Petroleum						
Crude	do.	104,000	109,000	117,000	126,000 e/	138,000
Refinery products:						
Liquefied petroleum gas	do.	1,710	2,230	2,550	2,550 e/	2,550
Gasoline	do.	10,000	11,200	11,500	11,500 e/	11,500
Jet fuel	do.	1,370	1,420	1,530	1,500 e/	1,530
Kerosene	do.	1,400	1,140	786	800 e/	787
Distillate fuel oil	do.	9,220	10,300	10,500	10,500 e/	10,600
Lubricants	do.	151	208	256	260 e/	260
Residual fuel oil	do.	17,400	18,000	16,600	16,650 e/	16,600
Unspecified	do.	534	458	374	400 e/	374
Total	do.	41,800	44,900	44,200	44,200 e/	44,200

e/ Estimated. r/ Revised.
1/ Previously published and 1994 data rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.
2/ Includes data available through Oct. 1995.
3/ Reported figure.