

THE MINERAL INDUSTRY OF

ECUADOR

By Pablo Velasco

The economy of Ecuador continued to be heavily dependent on petroleum production and exports of agricultural commodities and seafood in 1998. The state petroleum industry, which was represented by Petroecuador, made up 10% of gross domestic product (GDP), generated 37% of the country's total exports, and provided about 35% of Government revenue. The GDP reached \$19.5 billion¹ in real terms, which represented a growth of 0.4% from that of 1997. The growth was led by trade. However, in 1998, exports fell sharply as a result of low oil and commodity prices. The Government's decrease in the subsidies on cooking gas, diesel and electricity, resulted in the prices increasing by 410%, 104%, and 25% respectively. Consequently, the general labor strike that followed caused increased reduction in the economic productivity of the country. The inflation rate increased to about 50% compared with 30% in 1997. The unemployment rate was about 16% (U.S. Energy Information Administration, July 1999, Ecuador—Country analysis briefs, accessed November 18, 1999, at URL <http://www.eia.doe.gov/emeu/cabs/ecuador.html>).

According to Government officials, Ecuador was expecting to conclude an 18-month, \$400 million loan agreement with the International Monetary Fund and a \$500 million loan agreement with the World Bank, the Inter-American Development Bank, and Andean Development Corporation. These loan agreements would help improve the national economy, and if oil prices remained at the 1998 level and if the privatization process can be restarted, then Ecuador's economy could start a recovery in late 1999. The December 1998 signing of a peace treaty with Peru, which ended a long-standing border conflict that had existed between the two countries for more than 50 years, brightened the prospects for increased investment and trade between the two countries (U.S. Energy Information Administration, July 1999, Ecuador—Country analysis briefs, accessed November 18, 1999, at URL <http://www.eia.doe.gov/emeu/cabs/ecuador.html>).

Ecuador's mining exports have been affected by the decline in prices, the bankruptcies of companies that supplied the oil industry, flooding, high interest rates, the economic situation of Brazil, and the continuing Asian economic problems. Falling oil production has kept oil earnings down, which accounted for about half of Government revenues.

Ecuador exported about 60% of its oil production, used about 40% was used domestically. Petroecuador, oversees all the hydrocarbon operations and accounts for about 80% of the country's total production. In 1998, Ecuador produced about

387,000 barrels per day (bbl/d), of which 377,000 bbl/d was crude oil, Petroecuador produced about 300,000 bbl/d, and private companies produce an estimated 90,000 bbl/d. Ecuador's net oil exports were 236,000 bbl/d, most of which went to the United States (100,000 bbl/d), as well as to Asia, the Caribbean and Chile (U.S. Energy Information Administration, July 1999, Ecuador—Country analysis briefs, accessed November 18, 1999, at URL <http://www.eia.doe.gov/emeu/cabs/ecuador.html>).

The biggest problem that affects the development of the Ecuadorian oil industry has been its lack of transportation capability, which already operates at full or near full capacity. This problem has caused transportation bottlenecks throughout the country. Petroecuador officials estimated that up to 100,000 bbl/d of potential production was shut in because there was no way to export it. Meanwhile, analysts have indicated that the country's main export line—the Trans-Ecuadorian Oil Pipeline System—was on the verge of collapse owing to deferred maintenance. The pumping stations were in danger of breaking down. To take care of this problem, the Government was working with private oil companies to build a new heavy oil pipeline. This important project was expected to begin in late 1999. United States based Occidental Petroleum Inc., Arco Inc., and Oryx Inc.; Spain's Repsol Petróleo S.A.-Yacimientos Petrolíferos Fiscales S.A.; and Canada's Pacalta Resources Ltd. active in Ecuador have signed a letter of understanding to build and operate a pipeline to carry heavy oil from the Amazon region to the port of Balao. The construction of this new pipeline was estimated to take 18 to 20 months and to cost about \$400 million. The initial capacity would be more than 100,000 bbl/d and be expandable to 300,000 bbl/d of heavy oil between 16° and 22° API gravity. The new pipeline would run parallel to the Transecuadorian Pipeline. Petroecuador Officials have estimated that when completed, it could bring more than \$2 billion in additional foreign investments to the hydrocarbon industry sector and enable oil production to more than double by 2003 (U.S. Energy Information Administration, July 1999, Ecuador—Pipelines, Country Analysis Briefs, accessed January 27, 2000, at URL <http://www.eia.doe.gov/emeu/cabs/ecuador.html>).

Ecuador planned to tender the 46,000-bbl/d La Libertad refinery near Guayaquil via a 20-year concession to a private investor by the end of 1999. Petroecuador officials estimated that modernizing the facility and expanding the capacity to 60,000 bbl/d cost from about \$150 million to \$200 million. The concession was expected to bring in from about \$400 million to \$500 million. La Libertad refinery, which is located in the southern part of Guayas Province, produced about 60%

¹Where necessary, values have been converted from Ecuadorian sucres (S) at the rate of S/11,565=US\$1.00.

of the country's fuel demand; the remaining 40% was provided by the refinery in Esmeraldas in northwestern Ecuador (U.S. Energy Information Administration, July 1999, Ecuador—Country analysis briefs, accessed January 27, 2000, at URL <http://www.eia.doe.gov/emeu/cabs/ecuador.html>).

In 1998, Ecuador had an estimated 104.8 billion cubic meters of natural gas reserves, but the country lacked the necessary infrastructure to use these resources. For that reason, the gas market was of no significance. This could change, however, with the development of gasfields in the Gulf of Guayaquil and the Oriente Province.

United States-based Energy Development Corporation (EDC) invested \$170 million in a natural gas project in the Gulf of Guayaquil—the Amistad Gas Field—that would produce an estimated 2.0 million cubic meters per day of gas within 15 years. EDC was still deciding whether the gas pipeline would bring gas onshore to either Guayaquil or Machala (U.S. Energy Information Administration, July 1999, Ecuador—Country analysis briefs, accessed on January 27, 2000, at <http://www.eia.doe.gov/emeu/cabs/ecuador.html>). The downturn in metal prices slowed the rate of mineral exploration in Ecuador, particularly by junior companies that were unable to secure adequate funding.

Ecuador has extensive but underdeveloped gold resources, as well as other minerals. In 1998, recorded gold production was about 3,500 kilograms (kg), much of which was produced by the informal sector. The value of recorded mineral exports (mostly gold and silver sold to the United Kingdom dropped by 50% to about \$64 million, with much of the rest being sold on the black market. The mining sector shrank considerably because international mining companies left Ecuador and artisan miners were unable to reach their mines because of the flooding caused by El Niño. Legal reforms, improved protection for property rights, and consistent Government policies are required for Ecuador to attract large-scale foreign investment in its mining sector. The mining sector was open to foreign investment, with individual concession arrangements to be negotiated with the Ministry of Energy and Mines. Foreign investors were prohibited from obtaining mining rights in zones adjacent to international boundaries without permission of the President and approval of the Armed Forces (U.S. Embassy, Quito, Ecuador, 1999).

In 1998, the Under Secretary of Mines of Ecuador introduced an important new Government Agency, Dirección Nacional de Geología (DINAGE), which replaced Corporación de Desarrollo e Investigación Geológico-Minero-Metalúrgico. DINAGE will be responsible for basic geologic investigations for the national mining sector and other applied geologic activities under the Ministerio de Energía y Minas.

The current Ecuadorian Mining Law (law No. 126) which was published in the Official Registry No. 695 on May 31, 1991, and reforms to the General Regulations of the Mining Law, which were promulgated and published in the Official Registry No. 839 of December 11, 1995, for the specific legal context for mining activities in the country. This legal framework was designed to offer important incentives for foreign and national investments and technology transfer processes. The Environmental Protection Regulations, part of

law No. 126, established the following: environmental impact studies (EIS) and environmental management plans (PEM's).

The holders of mining, beneficiation, smelting, and refining concessions must prepare EIS's and PEM's to prevent, mitigate, control, rehabilitate, and compensate the environmental and social impacts that resulted from their operations. EIS's and PEM's must be approved by the Environmental Secretariat of the Ministry of Energy and Mines.

As shown in table 1, production levels of Ecuador's main mineral commodities were as follows in 1998: gold increased by 14%, and silver declined by 6.3%. Total crude production for 1998 increased by 2% to 144 million barrels, an increase of 2% compared with that of 1997.

The United States continued to be Ecuador's principal trading partner. During 1998, the value of exports to the United States increased by 9% to \$5.8 billion. Crude oil and processed petroleum exports to the United States were valued at \$416 million. Imports from the United States, primarily machinery, increased slightly to \$1.3 billion. Most Ecuadorian products enjoy duty-free access to the U.S. market under the Andean Trade Preferences Act (U.S. Embassy, Quito, Ecuador, 1998).

The Government had almost completed a geologic and geochemical survey that was of the western Ecuadorean Andes Cordillera funded by the World Bank and led by staff from the British Geological Survey.

A number of major mining companies continued various regional exploration of potential porphyry-type mineralization targets. The most active mining companies were Newmont Overseas Explorations Ltd. of the United States and Billiton International Metals B.V. of the United Kingdom, and Noranda Inc. of Canada, Placer Dome Inc. of Canada, and Gold Fields of South Africa Ltd. have all shown interest in exploration.

IAMGOLD Corp. of Canada, which has expanded its operation during the past 2 years, reported that a reconnaissance stream sediment sampling program over an area of some 890 square kilometers has identified gold anomalies within six separate areas (Puig, 1998).

Among the junior companies operating in Ecuador, Ecuator ASA of Norway, was carrying out gold and copper exploration at nine separate projects. Most promising has been the Nambija Norte property, where 6,400 meters (m) of drilling in 41 holes has identified a 570-million-metric-ton low-grade copper porphyry deposit that contains 771,106 metric tons of copper and about 10,000 kg of gold to a depth of 100 m (Puig, 1998).

Vancouver-based Balaclava Mines Inc. began exploration work at its El Corazon property, which is 60 kilometers (km) north of Quito. Balaclava has thus far established a geological resource of some 11,000 kg of gold. El Corazon is a highly prospective precious metals district with a geologic setting similar to Battle Mountain Gold Company's Kori Kollo gold, and silver deposit in Bolivia (140 kg) and Minorco Société Anonyme (Minorco)'s Cerro Vanguardia deposit (121 kg) in Argentina.

Perhaps the most active mining company in Ecuador was Mineral Australia S.A., which explored for primary and secondary mineral targets over a 1,200-km area of the country.

The most notable target was El Encanto, which lies in a gold district on the eastern flanks of the Cordillera Real in northeast. Trenching has returned values of up to 17.9 grams per metric ton (g/t) gold in a 35-m channel, and an exploration adit has identified a 3-m-wide zone that averaged 10.7 g/t gold and 27.9 g/t silver (Mining Journal, 1998). Ecuadorian Minerals Corp. outlined a 68-kg minable gold reserve within the 124-kg resource at its Gaby property (Puig, 1998). Ecuadorian Minerals Corp. realized the results of what the company called “Bonanza grade intercepts” from the first phase diamond-drilling program on their Beroen epithermal gold/silver project in Ecuador. Twenty-one angled drill holes were completed on the Alejandra, Dorada Zones, and San Luis for a total of 2,029 m. According to the company press release, three drill holes intersected a “well developed” northeast-southwest striking, southerly dipping breccia zone that covered an estimated true width of 20 to 30 m in the Alejandra zone. Within the breccia zone, a drill hole intercepted uncut values of 24.9 g/t gold and 189 g/t silver in a width of 16 m at a depth ranging from 8 to 24 m (Weekly Mining News, 1999).

Zappa Resources Ltd. was selling its interest in the Gaby gold deposit in southern Ecuador to Ecuadorian Minerals. In the deal, which was valued at \$1.6 million, Ecuadorian would acquire sole interest in the deposit by issuing to Zappa 2.5 million shares within 2 years to purchase Zappas’s interest in three concessions—Guadalupe, Mollopongo, and Papa Grande. The 112-hectare Guadalupe concession incorporates most of the Gaby deposit; the remainder of the deposit was already owned by Ecuadorian. Mollopongo and Papa Grande are higher grade gold deposits in the vicinity of Gaby that were expected to make an operation centered on the latter deposit more economic (Northern Miner, 1998).

Some companies have had to pull out of the country within the past months. United Kingdom-based Rio Tinto Zinc Corp. Plc. announced in September 1998 that it would terminate exploration in Ecuador and sell off its Llano Largo project. In January, Canadian junior Odin Mining and Exploration Ltd. abandoned its alluvial gold mine Estero Hondo and various gold exploration properties in the region; the market conditions were not favorable for juniors.

Yacimientos Petrolíferos Fiscales (YPF) of Argentina was planning to invest \$787,000 to expand the oil pipeline, thus allowing the company to increase its own pipeline shipments and production by 10,000 bbl/d (Petroleum Economist, 1998a).

In March 1998, Petroecuador and Ecopetrol of Colombia signed an agreement to increase the pipeline flow capacity by 25,000 bbl/d via its pipeline over the Andes Mountains to Colombia. As of 1999, 45,000 bbl/d flowed through the duct under agreement. The new accord may include the participation of YPF and City Investing Co. Ltd. from the United States. That line carries 330,000 bbl/d of the 390,000 bbl/d produced by Ecuador (Reuters, April 27, 1998, Ecuador to pump more oil via pipeline to Colombia, accessed May 1, 1998, at URL http://biz.yahoo.com/finance/980427/ecuador_to_1.html).

In October 1998, the Ecuadoran Government announced plans to increase private sector involvement throughout the country’s oil sector. “This is a revolution in the hydrocarbons

sector,” said the finance minister. “The philosophy of the project is liberalism and deregulation of the market but with a regulatory body guaranteeing constitutional interests, free competition, and efficiency.” Ecuador’s oil sector has been plagued by such problems as the low international price of crude and inadequate transport capacity that have left private investors wary. Consequently, crude oil exports, which earned \$1.4 billion in 1997, slipped into second place in 1998. Crude oil and derivatives contributed more than one-third to the Government’s income last year, but falling prices have contributed to this year’s fiscal deficit, which has been forecast to be 4.5% to 5% of the GDP. In attempt to double oil production to about 800,000 bbl/d, the Government began to provide greater legal security and fresh investment opportunities to private oil companies. Petroecuador, which produced about three-quarters of Ecuador’s oil in 1998, will be given financial and administrative autonomy (Financial Times, 1998).

Petroecuador will offer 10 Amazonian oilfields to foreign investors in an effort to secure the \$171 million required for their development. Production was expected to be increased by 12,000 bbl/d from 8,420 bbl/d (Petroleum Economist, 1998b).

For the mining sector, especially gold, silver, and base metals, to supplement petroleum as an important source of revenue, significant foreign investment will be needed to create adequate infrastructure, and the Government will need to maintain investors’ confidence by improving the fiscal and legal environments for mineral exploration and development.

Ecuador’s infrastructure was indicated by Government officials as being a restricting factor in mineral development. Mine production was transported by truck on the nation’s 43,709 km of highways or on the 965 km of state-operated rail to processing plants and shipping ports.

Despite the problems that plague Ecuador’s mining industry, Government officials were confident that revenue generated by mining will rise in coming years, provided that Ecuador remains committed to attracting foreign investment. Gold has already become a significant second-level export and ranks with such products as cocoa, fish, and cut flowers. Gold production could increase by titling concessions to the informal miners who were responsible for 85% of Ecuador’s gold production, and gold recovery could be improved from 40% in 1998 to 90% by using modern technology. Ecuadorean mining officials envisioned that revenue generated by gold production could represent 3% of Ecuador’s GDP and that minerals export could generate \$1 billion in revenues by 2006. Foreign investment, Government policies and strategies, and the support of the World Bank will encourage and accelerate the development of modern mining projects in Ecuador.

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Major Sources of Information

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Major Publications

Banco Central del Ecuador-Division Tecnica; Boletin Anuario.
U.S. Embassy, Quito, Ecuador: Country Commercial Guide, annual.

TABLE 1
ECUADOR: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity	1994	1995	1996	1997	1998 e/
METALS					
Cadmium, mine output, Cd content e/ kilograms	250	200	200	200	200
Copper, mine output, Cu content e/	100	100	100	100	100
Gold, mine output, Au content kilograms	13,000	7,410	7,208	3,070 e/	3,500
Iron and steel:					
Steel, crude	32,451	34,641	34,800	43,700 r/	40,000
Semimanufactures	32,451	26,566	20,477 r/	43,700 r/	40,000
Lead concentrate, Pb content e/	200	200	200	200	200
Silver, mine output, Ag content	60 e/	-- e/	1,325 r/	2,135 r/	2,000
Zinc, mine output, Zn content e/	100	100	100	100	100
INDUSTRIAL MINERALS					
Cement, hydraulic thousand tons	2,164	2,616	2,677	2,688	2,690
Clays:					
Bentonite	420 e/	511	431,758	205,445 r/	200,000
Common:					
For cement e/ thousand tons	2,000	2,000	2,000	2,000	2,000
Other	42,099	53,822	835,867 r/	485,234 r/	450,000
Kaolin	6,883	45,054	86,541	7,345 r/	7,000
Feldspar	5,692	10,297	10,321	60,328	60,000
Gypsum, crude	108,000 e/	2,430	2,038	1,510	1,500
Sand:					
Silica (glass sand)	33,535	26,486	24,070	43,240	40,000
Ferruginous e/	10,000	10,000	10,000	10,000	10,000
Stone, sand and gravel:					
Limestone (for cement manufacture) thousand tons	6,229	4,089	3,491	4,261	4,200
Marble	9,500	10,948	17,225	1,089	1,000
Pozzolan e/	86,560 2/	88,000	88,000	85,000	80,000
Pumice	8,665	9,000 e/	231,875	368,269	320,000
Sand and gravel thousand tons	170	170 e/	1,325 r/	2,135 r/	2,100
Salt (common)	70,000	224,309	110,000 e/	100,000 e/	100,000
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					
Gas, natural:					
Gross million cubic meters	209 r/	189 r/	187 r/	189 r/	190
Marketed e/ do.	110 r/	119 r/	115 r/	118 r/	119
Liquefied natural gasoline e/ thousand 42-gallon barrels	3,285 r/	3,285 r/	3,285 r/	1,825 r/	1,825
Petroleum:					
Crude do.	133,225 r/	143,091 r/	144,463 r/	141,708 r/	144,000
Refinery products:					
Liquefied petroleum gas do.	2,964 r/	4,774 r/	3,040 r/	3,050 r/	3,000
Gasoline do.	11,143 r/	10,497	10,789 r/	10,790 r/	10,800
Jet fuel do.	1,405	1,602	1,690 r/	1,690 r/	1,700
Kerosene do.	624 r/	595 r/	730 r/	730 r/	720
Distillate fuel oil do.	21,619 r/	20,725 r/	12,700 r/	12,720 r/	12,700
Residual fuel oil do.	9,975 r/	10,906 r/	22,239 r/	22,200 r/	22,250
Unspecified do.	2,884 r/	2,573 r/	8,369 r/	8,400 r/	8,430
Total do.	50,614 r/	51,672 r/	59,557 r/	59,580 r/	59,600

e/ Estimated. r/ Revised.

1/ Includes data available through September 1999.

2/ Reported figure.