

# ECUADOR

By Pablo Velasco

The Republic of Ecuador, which is in western South America, bordering the Pacific Ocean, between Colombia and Peru has an area of 283,560 square kilometers (km<sup>2</sup>). Land boundaries total 2,010 kilometers (km), bordering countries: Colombia, 590 km and Peru, 1,420 km. In July 2002, the population was 13,447,494 with a gross domestic product (GDP) per capita of \$3,000 and GDP of \$39.6 billion base on an estimated 2001 purchasing power parity. The Ecuadorian economy continued to be heavily dependent on petroleum production and exports of agricultural commodities and seafood. The economic indicators for 2001 have improved dramatically, with a real GDP growth rate of 4% and inflation at around 22% in a downward trend. A major contribution to growth is the investment in excess of \$1 billion by five multinationals from Argentina, Canada, Italy, Spain and the United States to build and operate a heavy crude oil pipeline in Ecuador. The pipeline will allow Ecuador to double its oil exports when it becomes operational, at the beginning of 2004 (U.S. Central Intelligence Agency, 2002§<sup>1</sup>).

The total exports of all commodities in 2001 was \$4.8 billion. In 2000, the major export markets were the United States, 38%; Peru, 6%; Chile, 5%; Colombia, 5%; and Italy, 3%. During 2001, the major export products by value were crude oil, bananas, shrimp, coffee, cocoa, cut flowers, and fish, the major import products were raw materials for the industry, consumer goods, machinery and equipment, chemicals, and fuels. In 2001, imports were valued at \$4.8 billion and came mainly from the United States (25%), Colombia (13%), Japan (8%), Venezuela (8%), and Brazil (4%). Ecuadorian products enjoy duty-free access to the U.S. market under the Andean Trade Preferences (ATPA) (U.S. Central Intelligence Agency, 2002§).

On January 9, 2000, the Government announced its intention to adopt the U.S. dollar as the official currency of Ecuador to address the ongoing economic crisis. Subsequent protest led to the removal of the President and the elevation of the Vice President to that position. The new President confirmed its commitment to dollarize as the centerpiece of its economic recovery strategy. The Government also entered into negotiations with the International Monetary Fund (IMF), culminating in a 12-month Standby Agreement with the Fund, which was extended through the end of 2001. Additional policy initiatives include efforts to reduce the Government's fiscal deficit, to implement structural reforms to strengthen the banking system, and to restructure Ecuador's external debt. In 2000, fiscal performance was better than expected, due largely to increasing oil prices and improved revenue collections. The overall deficit for 2001 was 0.1% of GDP.

The Ecuadorian Government has overhauled its mining code and created one of the best climates for mining investment in

Latin America. Ecuador's new set of mining regulations came into effect on April 17, 2001. They were based on major modifications to Ecuador's 1991 mining law in August 2000 (Northern Miner, 2001d).

In 1994, the National Government's Environment Consultancy Commission issued the country's first environmental policies, which promoted the goal of sustainable development in all economic activities, particularly in the petroleum and mining sectors. Two years later, this Commission had evolved to become Ecuador's Ministry of Environment, the authority responsible for administering the nation's protected areas and other reserved lands. Today, any mining operation in Ecuador must comply with the terms of sustainable development, environmental protection, and conservation as defined in three areas of law—the national constitution, which was adopted in August 1998; the Law of Environmental Administration, which was issued in July 1999; and the Law of Forestry and Conservation of Natural Areas and Wildlife. Most routine environmental matters concerning mining are handled by the Ministry of Energy and Mines (MEM) Under Secretariat of Environmental Protection.

For mineral industry programs in Ecuador, four levels of environmental impact studies (EIS) need to be submitted to MEM for approval before work can begin—a preliminary EIS for basic exploration, an EIS for advanced exploration, a comprehensive EIS required for exploitation, and an EIS for beneficiation, smelting, and refining (Northern Miner, 2001a).

One of the largest copper-porphyry districts discovered in the past decade is taking shape in the jungles of southeastern Ecuador. Exploration of the Corrientes copper belt, situated 70 km southeast of Cuenca in the Rio Zamora Valley, is so far indicating a potential for many billions of tons grading more than 0.5% copper in multiple deposits, which would launch the area to the status of a world-class copper province. Within a 3,200-km<sup>2</sup> area, the belt contains at least 10 porphyry bodies discovered during a \$12 million exploration campaign carried out by BHP Billiton Ltd. and its precursor Gencor Ltd. during the mid-1990s. Of these 10, 4 show indications of economic grades—Mirador, Panantza, San Carlos, and Warintza.

Soon after this discovery, however, BHP Billiton Ltd. decided at a corporate level to turn away from grassroots work and contracted exploration to Vancouver-based junior Corrientes Resources. The companies signed two joint-venture agreements in October 1999 and April 2000 that covered, respectively, a northern group of tenures (containing Panantza, San Carlos, and Warintza) and a southern group (Mirador). Corrientes is well on its way to earning a 70% interest in both tenures, but BHP Billiton has a back-in right to regain its 70% interest by providing project financing. BHP Billiton may also retain its 30% interest or exchange this stake for a 15% net-profits royalty. Owing to their central location, two of the most-

<sup>1</sup>References that include a section twist (§) are found in the Internet References Cited. section.

heavily drilled bodies in the Corriente copper belt are Panantza and San Carlos. Panantza has an indicated resource of 236 million tons grading 0.72% copper based on 28 drill holes and a 0.5% cutoff grade. The San Carlos deposit lies immediately across the Zamora River southeast of Panantza. Billiton drilled 25 widespread holes at San Carlos in 1997-98 and delineated an inferred resource of 508 million tons grading 0.68% copper, using a 0.5% cutoff grade. Warintza, on the eastern margin of the belt 10 km east of San Carlos, was discovered by Corrientes-Lowell in 1999. Warintza is at a higher level in the porphyry column and has an unusually high molybdenum byproduct credit. The Mirador discovery at the southern end of the Corriente copper belt is rapidly developing into a major copper-gold deposit with an unusually high gold grade of just below 3 grams per ton (g/t) gold, with minimal molybdenum (Northern Miner, 2001b).

On November 29, 2001, Zamora Gold Corp. continued working at the Campanillas 1 concession and maintained its exploration activities in adjacent areas. Ore obtained from different developments in Campanilla 1 was stored and milled, producing 21 kilograms (kg) (678 ounces) of gold in the third quarter. The total production for the three quarters was 34.3 kg (1,103 ounces). Based on the excellent results obtained in these developments, the Corporation has decided to restart the exploitation operations at the Campanilla 1 mine. The Campanilla 1 concession has been divided in six distinct areas with the purpose of achieving a more efficient future exploitation. Each area has a unique mineralized structure, and therefore, its exploitation was independent from that of other areas. The Corporation has entered into exploitation contracts with six different private mining groups in order to operate each of the six independent areas of the Campanilla 1 concession. Under the terms of these contracts, the miners will mine and transport the ore to the Corporation's mill plant at their own cost. The Corporation will charge a fee for the use of the mill and was entitled to 50% of the gold revenues (Zamora Gold Corp., 2001).

Zamora Gold Corp. was trying to get funds to solve some of the problems at its Campanillas gold mine in Ecuador. Major damages to the mill's power generator and a cone crusher in the second quarter of 2001 forced the mill to stop. The funds would be used to obtain ore to feed the mill on a continuous basis, and also to import replacement parts for the crusher and to repair the mill's power generator. Zamora maintained conversations with prospective joint-venture partners to fund the Mina Real. In the long term, the company planned to pursue the porphyry copper potential of the Mina Real concessions south of Nambija, where it was believed that a major discovery of a porphyry copper mineralization exist. Zamora also holds over 35,000 hectares in the Nambija region of Ecuador. Zamora was focusing on confirming gold reserves at the Campanillas Mine and Nambija 1 concession as well as exploration of Mina Real (Metals & Mineral Latin America, 2001).

In 2001, Ecuador's official gold production was 2,297 kg. Gold production in Ecuador continued to be the important activity in the Nambija, the Ponce Enriquez, and the Portovelo-Zaruma gold districts. Production has been carried out by small-scale private companies and/or by miners' cooperatives. The sources of the gold have normally been alluvial and hard-

rock deposits in several gold districts throughout the country. These activities were reported unofficially to have an annual production of about 15 metric tons of gold. However, the most reliable gold production was by Minera Bira S.A. in the Portovelo Zaruma gold district, with 100 metric tons per day being fed to the mill. This company is considered the main formal gold producer in Ecuador. Minera Bira announced recently that it will expand its activities. In 2001, the company signed a joint-venture agreement with Minas de Buenaventura S.A. from Peru. They will be involved in mineral exploration in southern Ecuador and will expand Bira's current gold production operation.

Toronto-based IAMGOLD Corp. (IMG) has been redirecting some of the large profits generated from its Sadiola Gold Mine in Mali, West Africa, towards grassroots exploration of Ecuador's Western Cordillera. IMG is most active at Retazos project in the historic Zaruma-Portovelo gold district, where companies and artisanal miners have extracted more than 140,000 kg (4.5 million ounces) of gold during the past century. Currently, IAMGOLD is seeking joint-venture partners for gold and base-metal targets identified by the Hockey Stick and the Retazos projects and has been engaged in negotiations with various companies. Anglo Gold Ltd. withdrew from the Hockey Stick joint venture as of January 31, 2001, following a reassessment of their corporate exploration portfolio (IAMGOLD Corp, 2000).

The reconnaissance work required to identify favorable targets within the large area covered by the British Geological Survey (BGS) geochemical sampling has been completed. The work identified 11 gold and base-metal targets that are considered to warrant further work. These projects, together with the Quimsacocha (epithermal gold target) and the Filon (porphyry copper and gold target), which were previously not included in the Hockey Stick project, have been offered to other companies for joint venture. A number of companies have shown an interest. Exploration at the Retazos Project focused on the northern and central portions of the 15-km-long Zaruma-Portovelo vein system while acquisition of mineral rights in the old Portovelo mining camp at the southern end of the vein system continued (IAMGOLD Corp. 2000).

Ecuadorian Minerals Corp. (EMC) announced that the Toronto Stock Exchange has issued its approval of the EMC name change to International Minerals Corporation (IMZ), which was previously approved by EMC's shareholders on December 20, 2001, at its Annual and Special General Meeting. Commencing at the start of business as of January 24, 2002 (Ecuadorian Minerals Corp., 2002a). In 2001, EMC has signed a letter agreement with Rio Tinto Mining and Exploration Ltd. (Rio Tinto) to amend certain terms of the October 8, 1998, Option Agreement between EMC and Rio Tinto for the Beroen epithermal gold-silver prospect, southwest of Ecuador. Under the terms of the original agreement, EMC is acquiring a 100% interest in Rio Tinto's mineral concessions together with Rio Tinto's rights in the previously existing joint-venture agreement with EMC. Under the new letter agreement, the cash option payment of \$800,000 that was due to Rio Tinto on October 8, 2001, has been changed to a total of \$200,000 payable as \$45,000 in cash and \$155,000 in common shares of EMC, the latter being subject to regulatory approval. In November 2000,

EMC announced a revised in-house inferred resource estimate for the Beroen project of approximately 1.1 million ounces of gold and 7.6 million ounces of silver for the Alejandra and the Dorada Zones with significant potential for additional mineralization along strike and at depth. EMC also completed a 30-meter (m)-long exploration tunnel (adit) across the Alejandra Zone, which reported average uncut grades of 21.9 g/t gold and 216 g/t silver from 66 samples, including 4.5 m at 83 g/t gold and 1,060 g/t silver. Individual assay values range from 0.3 to 159 g/t gold and 9 to 1,450 g/t silver (Ecuadorian Mineral Corp., 2002b).

Since oil was discovered in Ecuador in the 1970s, it has become an increasingly important part of the Ecuadorian economy. The country has 2.1 billion barrels of proven oil reserves, with crude production of around 415,000 barrels per day (bbl/d) during 2001 (up from 395,000 bbl/d in 2000). Most of Ecuador's oil reserves are in the eastern Amazon region, known as the Oriente. Major oilfields include Auca, Cononaco, Cuyabeno, Lago Agrio, Libertador, Sacha, and Shushufindi; smaller oilfields include Anaconda. Significant new oil deposits are suspected to exist in the southern Oriente, and Empresa Estatal Petróleos del Ecuador (Petroecuador), the Government-owned oil company, reportedly is laying the groundwork for a ninth round of exploration and production tender offerings, possibly for April 2002. Ecuador consumes around 149,000 bbl/d domestically, with the remaining 276,000 bbl/d being exported. Petroecuador, which oversees all the hydrocarbon operations, was attempting to attract foreign investment in the country's largest oilfields and to boost its production from 230,000 bbl/d (around 55% of national production) today to 600,000 bbl/d by 2005. In early 2001, however, Ecuador's Congress rejected legislation to allow joint ventures, and in December 2000, Ecuador's Constitutional Tribunal rejected a Government reform plan which would have allowed private companies to take operational control (not ownership) of Petroecuador's top five oilfields. In August 2001, Petroecuador released details of a major new oil project. The \$2.5 billion program aims to develop the Ishpingo, the Tambococha, and the Tiputini oilfields, with estimated reserves of 700 million barrels of heavy oil and initial output of 130,000 bbl/d expected (U.S. Energy Information Administration, 2001§).

Ecuador's oil exports will more than double over the next 2 years with the completion of the new \$1.1 billion pipeline that will connect oilfields in the Oriente region to port facilities on the Pacific Ocean. Scheduled to come online in early 2003, the project will ease a chronic oil-transport bottleneck that has thwarted development of Ecuador's petroleum industry for more than a decade and cost the Government billions of dollars in lost revenue. Named the Oleoducto de Crudos Pesados Ltd. (OCP), the new pipeline will have a daily capacity of 450,000 bbl/d of heavy oil with an API gravity of 18° to 24°. It will be built and operated by OCP Ecuador, a private-sector consortium led by Calgary-based Alberta Energy Corporation (AEC) and the Argentine-Spanish oil giant Repsol-YPF. Other members of the consortium are Occidental Petroleum del Ecuador Inc. and Kerr McGee Ecuador Inc. from the United States, Agip Oil Ecuador BV. from Italy, and engineering firm Techint International Construction Corp. from Argentina.

The new pipeline will run 500 km from Nueva Loja in the Oriente to refining facilities at the port of Balao, near the city of Esmeraldas in the north of the country. It will be laid underground alongside the existing Trans-Ecuadorian pipeline, named SOTE, except for a deviation on the northern outskirts of Quito. In 2001, State-owned SOTE operated at a capacity of about 400,000 bbl/d following a series of expansions and upgrades carried out since the 1970s. In 2001, heavy and light crude from the Oriente were mixed and transported together through SOTE, thereby degrading the value of the lighter crude. However, when the OCP is completed, it will transport the heavy crude, and SOTE will transport the light (Northern Miner, 2001c).

The U.S.-based Energy Development Corporation (EDC) (a subsidiary of Samedan Oil Corporation) continues with its natural gas project at the Gulf of Guayaquil where the Amistad Field has been estimated to have reserves of 9.76 billion cubic meters (Puig, 2001a). Ongoing drilling to yearend 2001 at Amistad 5 to a depth of 3,325 m, and logging, has detected the presence of 105 m of sandstone saturated with natural gas. Should drilling continue to prove the estimated reserves, the southwest of Ecuador will benefit from an expected daily production of 905,600 cubic meters to generate 204 megawatt-hours per year of electricity.

Ecuador has an estimated 105 billion cubic meters (3.7 trillion cubic feet) of natural gas reserves, but the country currently lacks the necessary infrastructure to utilize these resources. Natural gas associated with oil production is flared. Consequently, there is no natural gas market of any significance in Ecuador. This could change, however, with the development of gas fields in the Gulf of Guayaquil and the eastern Oriente region. The U.S.-based Noble Affiliates Inc. and its subsidiary EDC Ecuador Ltd. have signed a 15-year agreement with Petroecuador to tap the estimated 5 billion cubic meters (177 billion cubic feet) of recoverable gas reserves of the Amistad field in block 3 of the Gulf of Guayaquil. As of November 2001, Noble reportedly was looking for a partner to help it develop Amistad. Ecuador also was attempting to increase recovery of associated natural gas from the Sacha and Shushufindi oilfields (U.S. Energy Information Administration, 2001§).

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### Major Sources of Information

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### Major Publication

Banco Central del Ecuador-Division Tecnica; Boletin Anuario.  
U.S. Embassy, Quito, Ecuador.

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

(Metric tons unless otherwise specified)

Commodity	1997	1998 e/	1999	2000	2001
<b>METALS</b>					
Cadmium, mine output, Cd content e/ kilograms	200	200	200	200	200
Copper, mine output, Cu content e/	100	100	100	100	100
Gold, mine output, Au content kilograms	3,070	3,500	2,026	2,871 r/	2,297
Iron and steel:					
Steel, crude	43,700	45,784 3/	53,000	58,483 r/	60,979
Semimanufactures	43,700	45,784 3/	53,000	58,483 r/	60,979
Lead concentrate, Pb content e/	200	200	200	200	200
Silver, mine output, Ag content e/	2,135 3/	2,000	2,000	2,000	2,000
Zinc, mine output, Zn content e/	100	100	100	100	100
<b>INDUSTRIAL MINERALS</b>					
Barite	--	--	--	1,476	1,181
Cement, hydraulic thousand tons	2,900	2,600 3/	2,300	2,800 e/	2,850 e/
Clays:					
Bentonite	205,445	200,000	--	41	33
Common:					
For cement e/ thousand tons	2,000	2,000	2,000	2,000	2,000
Other	485,234	450,000	450,000 e/	324,626 r/	259,701
Kaolin	7,345	7,000	20,652	11,022	8,818
Feldspar	60,328	60,000	33,142	47,041	37,633
Gypsum, crude	1,510	1,500	1,456	1,043 r/	834
Sand:					
Silica (glass sand)	43,240	40,000	21,978	27,522	22,018
Ferruginous e/	10,000	10,000	9,950	9,950	9,900
Stone, sand and gravel:					
Limestone (for cement manufacture) thousand tons	4,261	4,200	2,865	3,147	2,518
Marble	1,089	1,000	2,508	1,680 r/	1,344
Pozzolan	85,000 e/	80,000	70,000 e/	27,687 r/	22,200
Pumice	368,269	320,000	275,274	344,850 r/	275,880
Sand and gravel thousand tons	2,135	2,100	6,148	6,489	5,191
Salt (common) e/	100,000	100,000	95,000	90,000	90,000
Sulfur: e/					
Native	4,000	4,000	4,000	4,000	4,000
Byproduct:					
From petroleum	5,000	5,000	8,243 3/	11,778 3/	11,700
From natural gas	5,000	5,000	5,000	5,000	5,000
Total	14,000	14,000	17,200	20,800	20,700
Zeolites	--	--	--	1,291	1,033
<b>MINERAL FUELS AND RELATED MATERIALS</b>					
Gas, natural:					
Gross million cubic meters	189	190	964	1,057	1,050 e/
Marketed do.	118 e/	119	113	113	115 e/
Liquefied natural gasoline thousand 42-gallon barrels	1,830 e/	1,830	2,014	2,818	2,820 e/
Petroleum:					
Crude do.	141,620	136,875 3/	136,291	146,180	147,468
Refinery products:					
Liquefied petroleum gas do.	2,555	3,000	3,000	2,600	2,800 e/
Gasoline do.	10,950	10,800	9,783	9,272	9,300 e/
Jet fuel do.	1,460	1,700	1,554	1,976	2,000 e/
Kerosene do.	365	720	716	575	600 e/
Distillate fuel oil do.	9,490	10,700 3/	8,361	12,161	12,000 e/
Residual fuel oil do.	19,710	20,300 3/	20,833	16,327	16,300 e/
Unspecified do.	8,030	8,430	7,856	9,173	9,100 e/
Total do.	52,560	55,700	52,103	52,084	52,100 e/

e/ Estimated. r/ Revised. -- Zero.

1/ Includes data available through August 2002.

2/ Estimated data are rounded to no more than three significant digits; may not add to totals shown.

3/ Reported figure.