

## Oil and Gas Developments in South America, Central America, Caribbean Area, and Mexico in 1986<sup>1</sup>

W. DAVID WIMAN<sup>2</sup>

### ABSTRACT

Exploration activity in South America, Central America, the Caribbean area, and Mexico in 1986 was considerably reduced compared to 1985. Brazil, Colombia, Ecuador, Guatemala, and Venezuela had increased oil production, with Colombia showing a dramatic 71% increase attributed mainly to bringing on-stream the pipeline connecting Occidental-Shell-Ecopetrol's Cano Limon complex to the port of Covenas. Significant discoveries were reported from Argentina in the Olmedo, Oran, and San Jorge basins; Brazil in the offshore Campos and Amazon basins; Colombia in the Llanos basin; Ecuador in the Oriente basin; Mexico in the Bay of Campeche; Peru in the Ucayali basin; and Venezuela in the Eastern Venezuela basin. Eastern Venezuela's Furril discovery is reported to have recoverable reserves of more than 1 million bbl of oil, and Shell's Ucayali basin discovery is reported to hold more than 7 tcf of gas.

### INTRODUCTION

Petroleum developments in 27 countries are reported for 1986. Drilling activity for 16 countries is summarized in Table 1. Chile, Ecuador, Suriname, and Venezuela reported increased wildcat drilling and Bolivia, Brazil, Chile, Guatemala, Peru, Suriname, and Trinidad-Tobago reported increased development activity.

Oil and gas production data is listed in Table 2. Brazil, Colombia, Ecuador, Guatemala, and Venezuela reported increased oil production, and Argentina, Barbados, Bolivia, Colombia, Ecuador, Peru, and Trinidad-Tobago reported increased gas production.

Tables 3-10 list significant tests and exploration activities for which data are available.

### ARGENTINA (Figure 1; Table 5)

By M. Turic and E. Freytes, YPF, Buenos Aires,  
and M. R. Yrigoyen, Esso, Buenos Aires

In 1986, exploratory drilling in Argentina declined 43% in number of wells and 35% in meterage drilled (89 wildcats and 230,235 m) compared with 1985. The exploratory success rate was 29.3%, 2% higher than in 1985.

Seismic activity was conducted mainly on land, with a total of 10,273 line-km, 54% lower than in 1985. Geologic mapping doubled that of 1986 for a total of 11,262 km<sup>2</sup>. New techniques were extensively applied for detailed facies studies and depositional environment analyses involving thick stratigraphic sequences. The only offshore activity was acquisition of 1,302 line-km of seismic data on the Magallanes shelf.

Exploration activities in Argentina were drastically reduced in large part upon the enforcement of a new petroleum policy announced by the Argentine government during 1985. YPF (the national oil agency) had to cede part of its prospective areas, which were later opened for tender to private companies. YPF also suffered a reduction of its operation budget and was forced to assimilate the effects of an organizational remodeling. Activities in the old risk-contract areas were also diminished.

New oil reserves were discovered in Oran, Tarija, Neuquen, San Jorge, and onshore Magallanes basins. In the northern part of the country along the south flank of the Olmedo subbasin (Oran), Canada Rica X-1 was a significant discovery with an initial yield of 1,984 BOPD. Toward the northwest, Bidas discovered commercial pools in the Carboniferous section of the Macueta area. In the Neuquen basin, successful development of the Vega Grande and Atuel Norte oil prospects was achieved through outpost wells which yielded 679 and 333 BOPD, respectively. In the Loma de las Yeguas gas field, delimitation was also successful with Loma de las Yeguas E-4 well, which had an initial production of 12.8 MMCFGD and 535 BCPD. Cretaceous reservoirs on the western flank of the San Jorge basin were tested with the Mata Magallanes Este E-2 well, which initially yielded 2,189 BOPD. In the central onshore part of the Magallanes basin, a new lower Tertiary prospective zone with significant gas reserves was discovered by additional exploration drilling in Boleadoras field.

In 1985, the Argentine government, through YPF, launched an aggressive exploration program open to all oil companies both foreign and domestic. The program was begun because the continuous decline of oil reserves

© Copyright 1987. The American Association of Petroleum Geologists. All rights reserved.

<sup>1</sup>Manuscript received and accepted, July 15, 1987.

<sup>2</sup>Tenneco Oil Exploration and Production, P.O. Box 3249, Englewood, Colorado 80155.

This report was compiled from two main sources—data supplied by contributors resident in the various countries and the *Foreign Scouting Service Annual Reviews* published by Petroconsultants S.A., Geneva, Switzerland. I sincerely appreciate the time and effort spent by the various contributors and would welcome volunteers from the other countries. Roland Michel's authorization to use the Petroconsultants reports insured a more complete summary.

Tenneco Oil Exploration and Production supported the project, and I especially thank Jane Alexander for her help in preparing the 1986 summary.

South America, Central America, Caribbean Area, and Mexico / W. David Wiman

Indillana-Itaya-1 as a noncommercial discovery of heavy oil in June.

Oriente annual production rose to a new record of 106.1 million bbl of oil because CEPE tied in additional wells in Libertador, Tetete, and Bermejo fields. The record would have been considerably more but the CEPE-Texaco consortium was cut back in July in both Shushufindi and Cononaco fields, and all producing companies were further cut in September because of the OPEC decision to restrict production. The consortium production amounted to 85.3 million bbl, down about 0.35 million bbl from 1985. CEPE produced nearly 19 million bbl in 1986, and CEPE-CEPCO produced 1.8 million bbl. Production started to increase in early 1987, but 2 major earthquakes destroyed about 17 km of the Trans-Ecuadorian Pipeline and access road. It is estimated that the pipeline will be operational in August 1987.

FALKLAND ISLANDS

Data from Petroconsultants S.A., Geneva, Switzerland

Firstland Oil and Gas holds a 570-km<sup>2</sup> license on East Falkland Island. No exploration was conducted during 1986.

FRENCH GUIANA

Data from Petroconsultants S.A., Geneva, Switzerland

The 5,485-km<sup>2</sup> Permis de Guyane Grands Fonds held by SNEA (Elf-Aquitane) is the only license in effect. No exploration activity was conducted during 1986.

GUATEMALA

Data from Petroconsultants S.A., Geneva, Switzerland

Five onshore contracts totaling 8,383 km<sup>2</sup> are held by 4 groups comprised of 5 companies. Colburn Energy Corporation of Virginia reportedly applied for a contract covering the 1,984-km<sup>2</sup> Block L area last held by Texaco. Texaco and partners drilled 4 wells: 2 dry and 2 that tested noncommercial rates of oil.

Exploration activities resumed during 1986 with 269 line-km of seismic data acquired along with gravity, aeromagnetic, and field geology surveys. Esso and Amoco suspended geophysical programs mid-year 1986 due to guerilla activity, but plan to resume work in 1987.

Hispanoil completed Rubelsuj-1 as an oil well and abandoned as dry Jagueyes-1 in its Block I contract. Hispanoil also spudded 2 development wells in Caribe and Rubelsanto fields. Caribe 101 tested up to 3,330 BOPD after acidizing. Caribe 101 originally tested 2,000 BOPD of 20.5° crude from the Cretaceous Coban-C Formation.

Production reached an all-time record averaging 7,070 BOPD, an increase of 90% compared to 1985.

GUYANA

By Steve Lawrence, Exploration Consultants Ltd.,  
Henley-on-Thames, England

The Guyana government held promotional petroleum seminars in London and Houston in 1986. New petroleum legislation was enacted in July. Lasmo and BHP applied for a 13,000-km<sup>2</sup> area on the continental shelf, and the group was negotiating at year end.

The Ministry of Energy was dissolved and became the Guyana Natural Resources Agency, as of August 1986. Winston King, its executive chairman, is responsible for petroleum activity in Guyana.

HONDURAS

Data from Petroconsultants S.A., Geneva, Switzerland

Three companies held 3 onshore leases covering 6,122 km<sup>2</sup>. Bonavista Oil and Mining Company is reported to have completed geochemical, gravity, and aeromagnetic surveys over its acreage.

JAMAICA

Data from Petroconsultants S.A., Geneva, Switzerland

No petroleum rights exist. Petrojamaica (the state oil company) reported 6 months of field-geology surveys.

MEXICO

Data from Petroconsultants S.A., Geneva, Switzerland

Exploration activity, including geologic, gravity, magnetic, and geochemical, decreased 9% from 1985 levels to a total of 1,219 party-months.

Exploratory drilling was down 28% with 66 wells drilled; meterage, however, was only down 10% to 258,438 m. Sixty-eight wells were completed (13 oil, 9 gas, 34 dry or junked, and 12 stratigraphic or special project) compared to 69 in 1986. Four discoveries were made in the Chiapas-Tabasco region: Tepeyil-101 (1,500 BOPD), Cuatajapa-101A (500 BOPD), Chirimoyo-1 (3.1 MMCFGD), and Pijije-1A (1.7 MMCFGD). In the Sierra de Chipas, Nazareth-1 tested 4.1 MMCFGD and 403 BCPD. Gas was discovered in the Noralta-1A (4.6 MMCFGD) and Merced-1 (4.4 MMCFGD) in the Gulf of Sabinas and at Poleo-1 (2.0 MMCFGD) in the Cuenca de Burgos. Offshore, Uech-1 (20,000 BOPD) and Kay-1 (2,000 BOPD) were discoveries in the Bay of Campeche.

Development drilling was down 19% with 178 wells completed: 115 oil, 21 gas, 28 dry, and 14 injection. Meterage was down 40% to 437,816 m.

Oil production averaged 2,427,650 b/d, down 7.7%; gas output was 3,431.1 mmcf/day, down 4.8%; natural gas liquids were up 14% to 281,000 b/d; and condensate production was 72,721 b/d, down 0.1% from 1985.

South America, Central America, Caribbean Area, and Mexico / W. David Wiman

Proven reserves of hydrocarbon liquids declined 1.3% to 70 billion bbl at year end.

NICARAGUA

Data from Petroconsultants S.A., Geneva, Switzerland

Petronic (the state oil company) is the sole rightholder in the country. Gravity, magnetometry, and field geological surveys were conducted in the Carlos Fonseca area, south of Malagua. The team of Soviet geoscientists completed its assessment of Nicaragua's petroleum potential.

PANAMA

Data from Petroconsultants S.A., Geneva, Switzerland

Sossa Petroleum is the sole rightholder with 2,176 km<sup>2</sup> onshore and 750 km<sup>2</sup> offshore in the Gulf of Miguel. No exploration was conducted.

PARAGUAY

Data from Petroconsultants S.A., Geneva, Switzerland

Seven contracts totaling 126,132 km<sup>2</sup> were held at year end, down from 8 contracts and 158,650 km<sup>2</sup> (revised) in 1985. Pecten relinquished its block in eastern Paraguay. Primo Cano Martinez has held a 3,500-km<sup>2</sup> reconnaissance permit in northwestern Paraguay since 1983 and, in 1986, petitioned the government to convert its block along the Bolivian border to an exploration concession in order to carry out drilling. Servicios Petroleros Paraguayos (SPP) was issued a 20,250-km<sup>2</sup> reconnaissance permit in 1985 along the Argentina border. Both the Primo Cano Martinez and SPP blocks were omitted from the 1985 acreage total.

Two seismic crews were active for Occidental, acquiring approximately 2,300 line-km of data. Occidental abandoned Carmen-1 at 4,511 m in Silurian quartzites. Carmen-1 was drilled in the Pirity subbasin where YPF (the Argentine state oil company) discovered oil at Palmar Largo just south of the Paraguay border in 1984. YPF's discovery well, approximately 60 km west of Carmen-1, tested 3,150 BOPD.

PERU (Figure 5; Table 10)

By Oscar Moreno J., Petroleos del Peru, Lima,  
and Petroconsultants S.A., Geneva, Switzerland

PetroPeru and Petromar (both state oil companies), Occidental, and Shell hold surface rights to 192,259 km<sup>2</sup>. In addition, 2 service contracts with no surface rights were held by the Occidental-Bridas group and Perez Companac. Occidental renegotiated its Maranon basin producing Block 1-AB, relinquishing about 5,940 km<sup>2</sup>, and acquired the little explored Block 36 in the Ucayali basin. Petromar was assigned offshore Blocks Z-1A, Z-

2A, and Z-28 as a result of the nationalization of Belco and Union's 100% interest in Blocks Z-2A and Z-28, and 25% interest in Block Z-1A. PetroPeru was assigned Block S-2 (Lake Titicaca basin) and Block 7 (Maranon basin). Phillips assigned its interest to Shell in Blocks 38 and 42, and Texaco-Union Texas relinquished Block 6.

Surface exploration sharply decreased in 1986 with only 622 line-km of data acquired by Occidental and Shell. PetroPeru acquired 1,356 km of gravity data in the Talara area and conducted 6 party-months of field geological work. Occidental reported 2 party-months of geochemical sampling in its Ucayali block.

Exploratory drilling in 1986 was similar to 1985 with 11 wildcat wells spudded. Two significant new-field discoveries were Occidental's Carmen Central-5X, which tested 4,150 BOPD of 20.7° crude but with strong and increasing water cut, and Shell's Cashiriari 42-50-3X, which tested 56.730 MMCFGD and 1,553 BCPD. In February 1987, Shell reported that the well discovered reserves estimated at 4 tcf of gas, adding to the 3 tcf discovered in the nearby San Martin structure.

Development drilling activity in 1986 was down 13% compared to 1985, with 138 wells spudded and 262,028 m (down 2%) of hole drilled. The success rate is impossible to determine since 97 wells were suspended at year end; however, 26 oil wells were reported completed, 1 reported dry, and 8 reported as "other."

Production was down 5.8% in 1986, averaging 177,535 BOPD. Peru's yearly production for 1986 totaled approximately 64,800,300 bbl.

SURINAME

Data from Petroconsultants S.A., Geneva, Switzerland

Suriname Petroleum Company (Nomeco, 37.2%; Austra Tex, 18.68%; Base Resource Ltd., 18.6%; Suriname Aluminum, 18.6%; and private, 7%) holds a 8,500-km<sup>2</sup> offshore license, and Staatsolie (the state oil company) has a 80-km<sup>2</sup> production lease onshore, where it is developing the Tambaredjo heavy oil field.

No exploration activity was reported during 1986.

Exploration drilling was up 75%, with 14 wells drilled in 1986. All were abandoned, however.

Development drilling totaled 37 onshore wells, up from the 4 wells completed in 1985. Thirty were completed as oil producers for a success rate of 81%.

Production from Tambaredjo field averaged 1,938 BOPD, up 70.3% from 1985. Reserves remain estimated at 300 million bbl of oil, of which 45 million bbl are believed recoverable.

TRINIDAD AND TOBAGO

By Ministry of Energy, Port of Spain, and  
Petroconsultants S.A., Geneva, Switzerland

Total area under concessions in 1986 amounted to 10,498 km<sup>2</sup>, down 5.5% from 1985.

Exploration activity, as measured by seismic activity, was down 77% from 1985 with 2,378 line-km of seismic

South America, Central America, Caribbean Area, and Mexico / W. David Wiman

Table 3. South America, Central America, Caribbean Area, and Mexico Significant Exploratory Tests, 1986

BASIN Region Operator	Name	Location	Spud Date (Completion)	TD in Meters	Formation at TD	Producing Zone FM	Remarks IP/day
<u>ARGENTINA</u>							
<u>DRAN</u>							
<u>YPF</u>	La Tigra Norte X-1	23°08'30" 61°56'48"	(02-18-86)	4,356	Palmar Largo	Palmar Largo	NA, oil
	Canada Rica X-1	23°17'33" 62°14'45"	(06-06-86)	4,004	Palmar Largo	Palmar Largo	314.7 m <sup>3</sup> /d oil 25,500 m <sup>3</sup> /d gas
<u>TARIJA</u>							
<u>Bridas</u>	Macueta Sur. X-1001	22°14'12" 63°56'15"	(02-12-86)	1,932	Tarija	Las Penas	29 m <sup>3</sup> /d oil
	Macueta Sur. X-1002	22°13'33" 63°56'06"	(05-04-86)	1,397	Tarija	Las Penas	NA, oil
<u>NEUQUEN</u>							
<u>YPF</u>	Atuel Norte e-3	35°09'36" 69°27'08"	(02-27-86)	2,017	Vaca Muerta	Huifrin	53 m <sup>3</sup> /d oil
	Vega Grande e-2	34°40'40" 69°39'37"	11-05-86	2,720	Tordillo	Tertiary Andesite	108 m <sup>3</sup> /d oil 10,800 m <sup>3</sup> /d gas
<u>YPF</u>	Loma de las Espinas X-2	36°10'47" 69°41'56"	(11-20-86)	1,999	Cuyo Group	Neuquen Group	16.8 m <sup>3</sup> /d oil 98,000 m <sup>3</sup> /d gas
	Cerro Fortunoso Este X-1	36°12'04" 69°20'31"	(07-07-86)	2,168	Neuquen Group	Loncoche	32,000 m <sup>3</sup> /d gas
<u>ALIANZA</u>	Barreales Colorados X-1001	36°44'40" 69°29'58"	(06-26-86)	2,049	La Manga	Vaca Muerta	4 m <sup>3</sup> /d oil
<u>YPF</u>	Cerro Vagon X-7	39°21'09" 69°27'20"	(02-14-86)	1,556	Quebrada del Sapo	Quebrada del Sapo	8.1 m <sup>3</sup> /d oil
	Loma de las Yequas X-3	38°03'27" 68°50'47"	(02-11-86)	1,933	Quintuco	Quintuco	62 m <sup>3</sup> /d oil
	Veta Ecocondida XP-24 (Deeper pool test)	37°50'57" 68°31'58"	(03-07-86)	2,600	Lotena	Quintuco	80 m <sup>3</sup> /d oil
	Lomita X-2	37°18'16" 69°12'55"	(09-05-86)	1,860	Quintuco	Agrio	9.5 m <sup>3</sup> /d oil
	Aqua Salada X-1	38°14'31" 67°54'56"	(10-13-86)	2,750	Planicie Morada	Catriel	72 m <sup>3</sup> /d oil
	Semillosa Centro X-1	38°55'36" 67°51'09"	(12-14-86)	1,547	Cuyo Group	Quintuco	30 m <sup>3</sup> /d oil
	Loma de las Yequas e-4	38°03'36" 68°52'29"	(09-29-86)	2,300	Quintuco	Quintuco	85 m <sup>3</sup> /d condens. 362,688 m <sup>3</sup> /d gas
<u>YPF</u>	Bartolo Norte X-1	38°00'38" 68°01'59"	(11-17-86)	1,750	Cholvoi	La Manga	NA gas
<u>SAN JORGE</u>							
<u>YPF</u>	Mata Magallenes Oeste XP-7 (Deeper pool test)	45°55'49" 70°00'17"	(02-28-86)	2,700	Lago La Plata	Bajo Barreal	19.2 m <sup>3</sup> /d oil
	Canadon Yatel e-9	46°33'13" 69°35'18"	(07-21-86)	2,202	Pozo D-129	Mata Siete	9 m <sup>3</sup> /d oil
	Estancia Los Cerros	46°50'38" 68°02'45"	(08-25-86)	1,600	Basamento	Canadon Seco	9.6 m <sup>3</sup> /d oil 35,680 m <sup>3</sup> /d gas
	Estancia Bahia Langara X-1	46°39'12" 67°25'26"	(09-14-86)	2,202	Pozo D-129	Canadon Seco	9.5 m <sup>3</sup> /d oil
	Cerro Negro X-1	51°13'19" 69°56'23"	(11-24-86)	2,200	Pozo D-129	Bajo Barreal	28.3 m <sup>3</sup> /d oil
	Mata Magallenes Este e-2	46°01'37" 69°55'55"	(12-29-86)	2,200	Pozo D-129	Castillo-Matasiete	348 m <sup>3</sup> /d oil 37,104 m <sup>3</sup> /d gas

(continued)

South America, Central America, Caribbean Area, and Mexico / W. David Wiman

Table 3. Continued.

BASIN Region Operator	Name	Location	Spud Date (Completion)	TD in Meters	Formation at TD	Producing Zone FM	Remarks IP/day
<b>ONSHORE</b>							
<b>Chiapas-Tabasco</b>							
<u>Pemex</u>	Chirimoyo-1	18°02' 93°35'				Middle Cretaceous	Gas and cond. 3,100 MCFGD
	Cuatajapa-101A	18°02' 93°35'				Kimmeridgian	500 BOPD
	Pijlje-1A	18°26'20" 92°51'30"				Middle Cretaceous	1,700 MCFGD
	Tepeyil-101	17°56' 93°26'30"				Kimmeridgian	1,500 BOPD
<b>Sierra de Chiapas (SE)</b>							
<u>Pemex</u>	Nazareth-1	N.A.		4,100			4,100 MCFGD, 403 BCPD, 60°
<b>Gulf os Sabinas (NE)</b>							
<u>Pemex</u>	Merced-1	27°32' 101°02'				Lower Cretaceous	4,400 MCFGD
	Noralta-1A					Jurassic	4,600 MCFGD
<b>Cuenca de Burgos</b>							
<u>Pemex</u>	Poleo-1					Tertiary	2,000 MCFGD
<b>PARAGUAY</b>							
<b>Occidental</b>							
	Carmen-1	23°04'29"S 61°28'43"W	10-05-85 (02-18-86)	4,511	Silurian		Abd.
<b>PERU</b>							
<b>Occidental</b>							
	Carmen Central-5X	02°25'37.3"S 76°21'24.5"W	09-14-86 (12-02-86)	3,255	Chonta	Vivian	4,158 BOPD, 20°
	Shiviyucu-20	02°28'43.2"S 26°08'22.1"W	07-27-86 (09-02-86)	3,112	Chonta		5,000 BOPD
<b>UCAYALI</b>							
<b>PetroPeru</b>							
	Aguaytia-3X	08°22'44.4"S 75°13'31.9"W	06-24-86 (09-157-86)	2,718	Cushabatay	Cushabatay	Gas and condensate discovery
	Aguaytia Sur-4X0	08°28'34.5"S 75°16'35.2"W	09-29-86				Drig. year end
<b>MADRE DE DIOS</b>							
<b>Shell</b>							
	Cashirari-3X	11°52'16.4"S 72°43'52.2"W	08-07-86 (12-09-86)	2,684	Copacabana	Vivian Agua Caliente, Chonta, Cushabatay, and Ene	Susp. 56.7 MMCFGD, 1553 BCPD
	Segaklato	11°46'04.6"S 72°46'45.3"W	05-26-86 (07-26-86)	2,567	Copacabana Gp.	Cushabatay	Abd. gas shows
<b>SURINAME</b>							
<b>OFFSHORE</b>							
<b>Aust Tex</b>							
	K/6-2	06°02'2.6"N 55°31'04"W	06-20-86 (06-23-86)	612			Abd., oil shows
	L/1-3	06°02'23.5"N 55°29'05.6"W	05-10-86 (05-28-86)	614			Abd., tested oil

(continued)

South America, Central America, Caribbean Area, and Mexico / W. David Wiman

Table 3. Continued.

BASIN Region Operator	Name	Location	Spud Date (Completion)	TD in Meters	Formation at TD	Producing Zone FM	Remarks IP/day
	L/5-1	06°02'48.6"N 55°07'21.4"W	06-06-86 (06-19-86)	1,374			Abd., oil shows
	L/7-3	06°06'00.5"N 55°28'44.8"W	04-25-86 (05-05-86)	1,025			Abd., oil shows
	L/8-1	06°06'06.2"N 55°20'53.8"W	05-29-86 (06-03-86)	818			Abd., oil shows
<u>ONSHORE</u>		<u>TRINIDAD AND TOBAGO</u>					
<u>Trintopec</u>	Erin-80		01-28-86 (05-26-86)	3,553	Cruse		Completed oil
<u>Trintec</u>	Morne Diablo-57		02-09-86 (05-7-86)	1,971	Lower Cretaceous		Assumed completed oil
<u>OFFSHORE EAST COAST MARINE AREA</u>							
<u>Amoco</u>	Galeota Ridge-4	10°11'20"N 60°51'30"W	11-08-85 (01-06-86)	2,813			Suspended, oil
	Galeota Ridge-5	10°09'44.4"N 60°53'17.7"W	01-24-86 (04-06-86)	3,962			Abd., oil shows
	Galeota Ridge-6	10°11'27.5"N 60°51'29.2"W	04-06-86 (05-22-86)	1,918			Abd.
	W. East Queens Beach	10°02'23.9"N 60°24'46.6"W	11-04-86	4,181			Susp., gas and cond.
		<u>URUGUAY</u>					
<u>CHACO-PARANA Ancap/YPF</u>							
							3 wells in Artigas prov. All believed abd.
<u>ONSHORE</u>		<u>VENEZUELA</u>					
<u>APURE</u>							
<u>Corpoven</u>	Guafita-X13	06°59'30.4"N 71°02'24.4"W	02-13-86 (03-14-86)	2,496			Susp., probable oil
	Guafita-X18	06°15'31.3"N 71°01'34.2"W	04-15-86 (05-28-86)	2,985			Susp., probable oil
<u>MONAGAS</u>							
<u>Corpoven</u>	Carisito AGH-2E	09°22'03.4"N 63°51'28.1"W	07-23-86 (10-13-86)	4,938			Susp., oil
	La Florida ONH-201AK	09°25'17.7"N 63°40'35.2"W	07-21-86				Drig. at 4,900 m
<u>Lagoven</u>	Furrial-1	09°41'00"N 63°27'00"W	03-17-85 (02-11-86)	4,240	Tertiary	Carapita Fm.	Susp., 7,300 80PD
	Furrial-2	09°40'27"N 63°28'10"W	02-22-86 (11-28-86)	4,523	Cretaceous		Oil
	Furrial-3	09°40'00"N 63°28'00"W	12-20-86				Drig at 1,524 m
<u>Meneven</u>	Aragua de Haturin-1X	09°21'30.9"N 63°56'35.5"W	10-19-85 (06-26-86)	4,881			1,659 80PD
<u>Corpoven</u>	Onado-105E	09°19'06.8"N 63°38'07"W	04-21-86 (11-20-86)	4,620			Oil

(continued)

## Oil and Gas Developments in South America, Central America, Caribbean Area, and Mexico in 1987<sup>1</sup>

W. DAVID WIMAN<sup>2</sup>

### ABSTRACT

Exploration activity in South America, Central America, the Caribbean area, and Mexico in 1987 showed significant increases in seismic acquisition in Belize, Bolivia, Brazil, Costa Rica, Guatemala, Mexico, Paraguay, and Peru, and a decrease in Chile and Venezuela. Exploratory drilling increased in most major producing countries but was accompanied by a decline in development drilling. Most of the increase could be attributed to private companies fulfilling obligations under risk contracts; however, state oil companies in Bolivia, Chile, and Colombia showed significant increased activity, with only Mexico showing a decrease. Colombia again had a dramatic increase in production (29% from 1986). Noteworthy discoveries were made in Bolivia (Villamontes-1); Brazil, in the Solimoes basin (1-RUC-1-AM); Chile (Rio Honda-1); Colombia, in the Llanos basin (Austral-1, La Reforma-1, Libertad Norte-1, Cravo Este-1, and Cano Yarumal-1), in the Upper Magdalena basin (Toldado-1 and Los Mangos-1); Ecuador (Frontera-1, a joint-exploration venture with Colombia); Mexico, in the Chiapas-Tabasco region (Guacho-1 and Iridi-1), in the Frontera Norte area (Huatempo-1); Peru, in the Madre de Dios basin (Armihuari-4X); Trinidad (West East Queen's Beach-1); and Venezuela (Musipan-1X).

Brazil's upper Amazon (Solimoes basin) discovery, Colombia's Upper Magdalena basin discoveries Toldado-1 and Los Mangos-1, Mexico's Chiapas-Tabasco discoveries, Peru's confirmation of the giant Cashiriari discovery of 1986, and Venezuela's success in Monagas state were the highlights of 1987.

### INTRODUCTION

Petroleum developments in 24 countries are reported for 1987. Drilling activity for 15 countries is summarized

© Copyright 1988. The American Association of Petroleum Geologists. All rights reserved.

<sup>1</sup>Manuscript received and accepted, July 14, 1988.

<sup>2</sup>Tenneco Oil Exploration and Production, P.O. Box 3249, Englewood, Colorado 80155.

This report was compiled from two main sources: data supplied by contributors resident in the various countries and the *Foreign Scouting Service Annual Reviews* published by Petroconsultants S.A., Geneva, Switzerland. I sincerely appreciate the time and effort spent by the various contributors and would welcome volunteers from the other countries. Roland Michel's authorization to use the Petroconsultants reports and Keith Murray's (Petroconsultants' Denver representative) help in securing copies of the reports insured a more complete summary.

Tenneco Oil Exploration and Production supported the project. I especially thank Jane Alexander, Karen Chase, and Sheryl Lloveris for their help in preparing the 1987 report.

in Table 1. Oil and gas production data is listed in Table 2. Bolivia, Colombia, Mexico, and Venezuela reported increased oil production, and Brazil, Mexico, and Venezuela reported increased gas production. Tables 3-8 list significant tests and exploration activities for which data are available.

### ARGENTINA

Data from Petroconsultants S.A., Geneva, Switzerland

Information on Argentina was available only for the first half of 1987.

Exploration activity was down compared to the first half of 1986; however, it is believed that YPF (the national oil agency) continued work with its own 11 seismic and 7 field-geology crews that were active in the last half of 1986. A seismic crew and a field-geology survey were working for private contractors.

Forty-one exploratory wells drilled 102,158 m during the first half of 1987 compared to 56 wells and 153,000 m for the same period of 1986. No drilling occurred in the contract areas.

Production of oil and condensate in the first half of 1987 averaged 417,000 b/d, down 7% from the corresponding period of 1986. YPF produced about 64% of the total. Natural gas production averaged 1.7 bcf/day, down 17% from 1986.

### BARBADOS

By J. M. Gordon and L. H. Barker, Energy Division,  
Ministry of Finance, Christ Church

Exploration and development activity in 1987 remained at a standstill as world oil prices continued to be low. The Barbados National Oil Company maintained its production cutback instituted in 1986; its average production in 1987 was 1,361 BOPD. It is expected that during 1988 there will be some drilling activity with the beginning of an exploration program.

### BELIZE

By R. Prasad Rao, Ministry of National Resources,  
Belmopan, and Petroconsultants S.A., Geneva, Switzerland

Eight companies have leased 3,994 million ac. Pecten completed 1,880 line-km of seismic offshore. Teistar

South America, Central America, Caribbean Area, and Mexico / W. David Wiman

Empresa de Perforacion y Extraccion de Petroleo (EPEP). There are no other rightholders. Petroleum activities are secret, and accurate information is scarce.

Information about exploration activities and their results is strictly classified; however, USSR, Mexican, and Cuban newspapers occasionally publish some general information. EPEP was estimated to have had 2-3 land-seismic parties and several geologic parties working more or less continuously in 1987. It is thought that at least one-third of this activity was near known oil accumulations, that is, east and west of Havana (Varadero, Boca de Jaruco, Martin Meia) as well as near Ciego de Avila (Jatibonico). The other two-thirds of the seismic effort was in the extreme west, where objectives are deep (below 15,000 ft), and in the Tertiary basins of central and southeastern Cuba.

No press releases about exploratory drilling were published in 1987. Up to 10 rigs are active in developing in the known fields, mainly on the north coast in Habana and Matanzas provinces. The main effort has been applied in Boca de Jaruco and Varadero, the 2 best fields in the country. Additional drilling was carried out in Jatibonico and Cristales, 2 fields in Camaguey province.

The 40,000-BOPD production target set for 1990 was reset for the year 2000. This is probably a consequence of the disappointing results of the wildcats of the last few years. Despite a 24,000-BOPD average (a new record) reported in January 1987, the rest of 1987's production did not rise as fast as planned. More than 20,000 BOPD is estimated for 1987, up 6.9% compared to the revised figure for 1986 of 18,700 BOPD.

**ECUADOR (Figure 3; Tables 7, 8)**

By R. W. Canfield, Texaco, Quito

Two major earthquakes destroyed the Trans-Ecuadorian pipeline and access road on March 5, 1987, causing a sharp decline in production from the record 1986 figures. A lateral pipeline of 25 km was completed by CEPE in May to tie into the Colombian Transandean system; this allowed a temporary production of about 50,000 BOPD. The pipeline was repaired, and normal production resumed in August.

During 1987, Ecuadorian production was 63.5 million bbl of oil, about 40% less than that of 1986 (Table 2). Exploration activity continued at a fairly high rate because of the requirements of the risk-service contracts. There were 16 party-months recording 2,863 line-km of digital seismic in the Oriente, and a total of 8 party-months of surface geology (Table 7). Nine exploratory wells drilled 28,116 m during 1987, resulting in 3 discoveries and 4 dry holes. Two wells were preparing to test at year end. Two of the discoveries were drilled by Conoco in Block 16, and one was completed by CEPE at Paraiso-1 north of and on trend with BP's 1986 discovery at Payamino (see Figure 3; Table 3). CEPE, in a joint exploratory drilling program with Ecopetrol (the Colombian state oil company), spudded Frontera-1, which was

completed in January 1988 for 4,499 BOPD from the "U" and "T" sandstones. Twenty development wells were completed during 1987, and 8 were suspended at year end awaiting completion. Development drilling totaled 71,188 m (Table 1).

The Ecuadorian government signed risk-service contracts in 1987 with the Elf group (Block 14), Braspetro group (Block 17), Tenneco group (Block 12), and Petro-Canada (Block 9). The government also held a fifth licitation and contract negotiations for Oriente Blocks 10 (Arco group) and 13 (Unocal group) as well as coastal Block 5 (YPF). Contract negotiations for offshore Block 3 with Fred Parks Inc. (from an earlier licitation) were still in progress at year end. Figure 3 shows contract areas.

Field production was down considerably because of the pipeline break and averaged only 173,938 BOPD (Table 2). At year end, however, production was back to normal at about 313,000 BOPD.

**FALKLAND ISLANDS**

Data from Petroconsultants S.A., Geneva, Switzerland

Firstland Oil and Gas holds a 546-km<sup>2</sup> (revised from 1986) license on East Falkland Island. No exploration activity was conducted during 1987.

**GUATEMALA**

Data from Petroconsultants S.A., Geneva, Switzerland

Area held under contracts (8,387 km<sup>2</sup>, all in the Peten basin) remained the same as 1986. Two land-seismic crews acquired more than 600 line-km of data, up 121% from 1986. No other geophysical or geological surveys were reported.

Exploratory drilling resumed in December with the spudding of the Atzam new-field wildcat. Two wildcats were spudded in 1986. One rig drilled a development well in Rublejanto field compared to 2 in 1986.

Production declined 49% to an average of 3,600 BOPD during 1987.

**GUYANA**

Data from Petroconsultants S.A., Geneva, Switzerland

Petro-Marine Engineering (US) and Petrolam Trinidad were awarded a 977-km<sup>2</sup> permit in the Takutu basin around the 1982 Karanambo oil discovery. The permit is valid for 4 years, from February 6, 1988. Lasmo and BHP were reported to be negotiating for an offshore area. No exploration activity or drilling was reported.

**HONDURAS**

Data from Petroconsultants S.A., Geneva, Switzerland

Three companies held 3 onshore leases covering 6,122 km<sup>2</sup>. Bonavista invited tenders for 600-700 line-km of



South America, Central America, Caribbean Area, and Mexico / W. David Wiman

onshore seismic data; it plans to drill 3 deep wells. It was reported that during November Bonavista farmed out an interest in its concession to an unidentified company.

JAMAICA

Data from Petroconsultants S.A., Geneva, Switzerland

No petroleum rights exist. Petrojamaica (the state oil company) reported 6 months of field-geology surveys.

MEXICO

Data from Petroconsultants S.A., Geneva, Switzerland

No private rightholders exist in Mexico. All exploration and development activity is conducted by Pemex, the state oil company.

Exploration activity, including geologic, gravity, magnetic and geochemical surveys, increased 24% to 1,509 party-months in 1987.

Exploratory drilling was down 51% in 1987 with 27 wells drilled compared to 56 wells in 1986. Meterage decreased 30% to 179,937 m. Twenty-seven wells were completed (6 oil, 2 gas, 17 dry, and 2 other) compared to 68 wells completed in 1986. Two oil discoveries made in the Chiapas-Tabasco region, Gaucho-1 (1,050 BOPD) and Iridi-140 (2,447 BOPD), were significant, along with a gas discovery, Huatempo-1 (3.9 MMCFGD), in the Frontera Norte district. No offshore discoveries were reported.

Development drilling was down 57% with 76 wells completed (60 oil, 13 dry, and 3 injection). Meterage was down 30% to 305,019 m in 1987.

Oil production averaged 2,540,639 BOPD, up 4.6%; gas output was 3,498.4 MMCFGD, up 2%; natural gas liquids were up 5% to 337,000 b/d; and condensate production was 75,772 b/d, up 4.2% from 1986.

Proven reserves decreased 1.4% to 69.2 billion bbl of oil and 74.8 tcf of gas at year end. Reserves are broken down as follows: oil—47,176 million bbl, condensate—6,934 million bbl, and natural gas liquids—15,120 million bbl.

NICARAGUA

Data from Petroconsultants S.A., Geneva, Switzerland

No private or foreign rightholders exist. Geophysical activity consisted of 8 months of geo-electric surveying and 5 months of gravity and magnetic surveys. Five months of field geology were reported in 1987. A wildcat in the Carlos Fonseca region was to be spudded in early 1988.

PANAMA

Data from Petroconsultants S.A., Geneva, Switzerland

New hydrocarbon legislation was signed by the president of the republic on June 16, 1987. In November, Idria Oil and Gas and Isthmian Oil and Gas Company were each awarded 2 blocks, both onshore and offshore, on the Pacific side. A marine seismic survey was started for both blocks during December. No drilling occurred in 1987.

PARAGUAY

Data from Petroconsultants S.A., Geneva, Switzerland

Eleven contracts totaling 221,344 km<sup>2</sup> were held at year end, up from the 7 contracts and 138,882 km<sup>2</sup> (revised) in 1986.

Exploration activity was up markedly from 1986, with 5 seismic crews acquiring 3,150 line-km of data along with gravity and field geology surveys. Exploratory drilling continued with Occidental abandoning Teniente Acosta-1X and spudding Nazaret-1, both in the Pirity subbasin.

PERU

Data from Petroconsultants S.A., Geneva, Switzerland

At the end of 1987, 200,419 km<sup>2</sup> were held by PetroPeru and Petromar (both state oil companies), Occidental, and Shell. In addition, 2 service contracts with no surface rights were held by the Occidental-Bridas group and by Cia. Naviera Perez Companac. PetroPeru relinquished Block 7 (Maranon basin), retaining only 2 areas surrounding the small Pastacocha and Samiria discoveries. PetroPeru received Block 53 (26,301 km<sup>2</sup>) in the undrilled Huallaga basin and was granted a small area surrounding the Bretana oil discovery in the Maranon basin.

Seismic activity was up sharply in 1987 with 1,274.5 line-km acquired.

Exploratory drilling was similar to 1986, with 13 wells drilled. Shell's Armihuari-4X outpost confirmed the 1986 Cashiriari-3X gas and condensate discovery. Two of the 3 offshore wells found oil. Development drilling decreased 13% to 139 wells drilling 228,322 m of hole with a success rate of 94%.

Production decreased 7.6% in 1987 to 165,593 BOPD. Peru's total production for 1987 was 60 million bbl of oil.

SURINAME

Data from Petroconsultants S.A., Geneva, Switzerland

No private rightholders existed at year end after the Austra-Tex group relinquished its 8,500-km<sup>2</sup> offshore

South America, Central America, Caribbean Area. and Mexico / W. David Wiman

block. Staatsolie (the state oil company) has an 80-km<sup>2</sup> production lease onshore, where it continued developing and extending the Tambaredjo heavy oil field.

No exploration activity was reported during 1987.

Exploration drilling was down 36% with 9 wells drilled in 1987, 4 of which were stratigraphic tests. Development drilling was down 30% to 26 wells in 1987 with a success rate of 77%.

Production from Tambaredjo field averaged 2,175 BOPD, up 12% from 1986. Staatsolie reported proven reserves of 26-33 million bbl.

TRINIDAD AND TOBAGO

Data from Petroconsultants S.A., Geneva, Switzerland

Total area under concessions in 1987 amounted to 12,561 km<sup>2</sup>, up 2% from the 12,352 km<sup>2</sup> (revised) held at the end of 1986.

No exploration activity was reported during 1987.

Exploratory drilling remained at a level similar to 1986 with 8 wells completed resulting in 4 discoveries: 3 onshore oil wells and Amoco's offshore West East Queen's Beach-1, which tested up to 29 MMCFGD and 600 BCPD. Development drilling was down 18% to 134 completions. Trintol and Trintopec (both state oil companies) accounted for all but 1 of the onshore wells. Offshore, Amoco and TNA completed 4 and 9 wells, respectively.

Production was down 8% to 155,180 BOPD in 1987. Amoco was the leading producer with 73,978 BOPD (48%), TNA produced 37,936 BOPD (24%), Trintopec produced 22,755 BOPD (15%), and Trintol produced 19,869 BOPD (13%). Data were not available on gas production.

URUGUAY

Data from Petroconsultants S.A., Geneva, Switzerland

No private companies held licenses and no exploration activity was reported in 1987.

ANCAP (Administracion Nacional de Combustibles, Alcohol y Portland), with the technical assistance of YPF (the Argentine national oil agency), completed a 4-well program (3 wells in 1986 and 1 in 1987), details of which are in Table 3.

VENEZUELA (Figures 4, 5)

By Eugene Van Middleworth, VOSA S.R.L., Caracas

No foreign rightholders exist in Venezuela. The state oil company, Petroleos de Venezuela S.A. (PDVSA), controls 3 operating companies: Corpoven, Lagoven, and Maraven.

Exploration activity continued to fall during 1987 with a total of 5,908 line-km of seismic acquired, down 40% from 1986. Corpoven acquired 3,958 km of the total, Lagoven acquired 1,231 km, and Maraven acquired 719 km. Only 585 line-km (10%) was in Lake Maracaibo, the remainder being on land, with Apure having 2,347 line-km (8%), Monagas having 2,520 line-km (43%), and Zulia having 457 line-km (8%).

Drilling activity, based on rig-months, also continued to drop from an average of 28 in 1986 to 19 in 1987. Of the total, exploratory drilling had 79 rig-months (25 in western Venezuela and 54 in eastern Venezuela) and development drilling had 148 rig-months (94 in western Venezuela and 54 in eastern Venezuela). Corpoven accounted for 86 rig-months (38%), Lagoven for 101 (44%), and Maraven for 40 (18%). Exploratory wells spudded during the year totaled 9 (Corpoven, 5; Lagoven and Maraven, 2 each). Six wells were rank wildcats, 2 were deeper pool tests, and 1 a new-pool test. Almost all the drilling in eastern Venezuela was in Monagas and centered around the area of the 1986 El Furrial discovery. In Lake Maracaibo, Maraven concentrated its efforts on its newly assigned area in Ceuta-Tomoporo in the southeastern section of the lake. An interesting point about the new discoveries in the El Furrial and Musipan areas in Monagas and the Guafita and La Victoria discoveries in Apure is that each well can produce from 3,500 b/d of medium-gravity crude, whereas the overall average per well for the country has been around 110 b/d. Also, old fields in the same areas in Monagas had averages between 3 and 400 b/d. There were only 138 wells spudded in 1987, down 55% from 1986. Of these, 9 were wildcats, 12 were outposts, 89 development, and 28 injection. Completions dropped 45% from 357 in 1986 to 194 in 1987. Twelve were wildcats, 26 outposts, 100 development, and 56 injection. Corpoven drilled 342,469 ft (25%), Lagoven 805,715 ft (59%), and Maraven 213,418 ft (16%).

Production for 1987, including crudes and condensates, totaled 655,872,764 bbl (1,796,912 b/d), of which very heavy crude was 12,469 b/d (0.7%), heavy crude was 433,694 b/d (24.1%), medium crude was 665,652 b/d (37.1%), light crude was 521,496 b/d (29.0%), and condensate was 163,601 b/d (9.1%). Of these amounts, Corpoven produced 18.7%, Lagoven, 42.5%, and Maraven 38.8%. Total natural gas production was 36,614 million m<sup>3</sup> (1,293 tcf). Oil reserves increased by 745 million bbl to 58,084 million bbl with a daily production potential of 2,568,000 b/d. Natural gas reserves were up to 2.8 tcf.

An important development, which should increase Venezuela's petroleum product exports, was a method of stabilizing a mixture of heavy crude (70%), water, and chemical additives to form what is called "orimulsion" (Orinoco-emulsion) since the heavy crudes come from the Orinoco tar belt. This product is being tested in Japan and Europe as a possible substitute for coal in factories.

Petrochemical activity was up with designs for a new polypropylene plant and an ethylene oxide plant, both in Zulia, and a MTBE plant in Anzoategui.

South America, Central America, Caribbean Area, and Mexico / W. David Wiman

Table 1. South America, Central America, Caribbean Area, and Mexico Exploratory and Development Drilling, 1987

COUNTRY Operator	EXPLORATORY						DEVELOPMENT					
	Oil	Gas	Dry	% Success	Totals		Oil	Gas	Dry	% Success	Totals	
					Drilled	Meters					Drilled	Meters
ARGENTINA <sup>1</sup> YPF	9	1	25	29	45	102,158	--	--	--		371	525,000
BOLIVIA YPFB	2	--	3	20	10	23,066	5	9	1	93	15	42,240
BRAZIL Petrobras	43	7	92	31	158	418,464	621	23	60	84	771	973,424
Private	7	--	11	39	18	37,213	3	--	--	100	3	2,872
CHILE (ENAP)	5	4	26	26	35	80,442	45	5	19	72	69	124,511
COLOMBIA Ecopetrol	8	0	9	47	17	56,721	35	0	2	95	44	65,757
Private	18	1	30	37	52	104,579	46	0	3	94	49	108,176
COSTA RICA	--	--	3 <sup>2</sup>	0	3	6,678	--	--	--	--	--	--
ECUADOR CEPE	1	--	--	100	2	5,816	10	--	--	100	10	1,327,125
Private	2	--	4	33	7	22,300	10	--	--	100	11	27,629
GUATEMALA	--	--	--	--	--	550	1	--	--	100	1	33,459
MEXICO	6	2	17	32	27	179,937	60	0	13	82	76	2,077
PARAGUAY	--	--	1	0	2	7,704	--	--	--	--	--	305,019
PERU	7	1	5	54	13	36,299	130	--	7	94	139	228,322
SURINAME	3	--	6	33	9	2,862	20	--	6	77	26	7,993
TRINIDAD-TOBAGO	3	1	3	43	8	12,000	73	2	6	93	134	182,000
URUGUAY	1	--	1	0	1	2,301	--	--	--	--	--	--
VENEZUELA	--	--	--	--	21	103,289	--	--	--	--	156+	311,834

<sup>1</sup>First half of 1987 only.

<sup>2</sup>Stratigraphic tests.

Table 2. South America, Central America, Caribbean Area, and Mexico Production Summary, 1987

COUNTRY	OIL (million bbl)					Cumulative bbls. (X 10 <sup>6</sup> )	BOPD (1,000 bbl)	GAS (bcf)					Cumulative (tcf)	Avg. Daily (bcf)
	1983	1984	1985	1986	1987			1983	1984	1985	1986	1987		
ARGENTINA	175.3	170.8	167.8	158.5	--	--	417 <sup>a,f</sup>	596.8	658.5	674.8	677.4	--	--	1.7 <sup>f</sup>
BARBADOS	0.38	0.63	0.68	0.56	0.50	--	1.361	0.75	0.84	1.17	1.21	1.06	--	.003
BOLIVIA	8.1	7.6	7.2	6.4	6.9	297.9	18.88	178.1	173.2	164.1	160.8	161.1	2.74	.441
BRAZIL	124.2 <sup>b</sup>	173.4	205.5	216.3	215.0	2,297.4	590	144.5 <sup>b</sup>	173.1 <sup>b</sup>	192.4 <sup>b</sup>	201.7 <sup>b</sup>	207.9	2.047 <sup>b</sup>	.570
CHILE	14.3	14.0	13.0	12.2	10.9	352.5	29.9	169.5	172.9	163.7	153.9	153.6	6.02	.42
COLOMBIA	55.5	61.1	64.4 <sup>a</sup>	110.3 <sup>a</sup>	142.1 <sup>a</sup>	2,703.4	389.1	174.4	183.1	183.1	184.0 <sup>a</sup>	180.8	4.261	.495
CUBA(a)	--	--	--	--	--	--	20.0 <sup>c</sup>	--	--	--	--	--	--	.014 <sup>a,c</sup>
ECUADOR	86.5	93.8	102.0	106.5	63.5	1,301.5	173.9	14.8	14.5	21.5	25.9	16.3	--	.045
GUATEMALA	--	1.78 <sup>b</sup>	1.37 <sup>a</sup>	2.6 <sup>a</sup>	1.31 <sup>a</sup>	--	3.6	--	--	--	--	--	--	--
MEXICO	972.9 <sup>a</sup>	982.5 <sup>d</sup>	960.1 <sup>a</sup>	886.1 <sup>a</sup>	1,077.9 <sup>h</sup>	19,558 <sup>h</sup>	2,943.2 <sup>h</sup>	1,479 <sup>d</sup>	1,373.5 <sup>a</sup>	1,252.4 <sup>a</sup>	1,276.9 <sup>a</sup>	--	--	3.498
PERU	62.5	67.4	69.3 <sup>b</sup>	64.8	60.4	1,690.4	165.6	42.1	45.5	39.3 <sup>e</sup>	50.0	33.2 <sup>g</sup>	--	.136 <sup>g</sup>
SURINAME	--	0.2	0.42	0.71 <sup>b</sup>	0.79	--	2.175	--	--	--	--	--	--	--
TRINIDAD-TOBAGO	58.3	62.0	64.3	61.6	56.64	2,389.9	155.2	220.6	252.1	261.7	267.9	--	--	--
VENEZUELA	654.7	657.0	611.4	650.2	655.9	40,751.9	1,796.9	--	--	--	--	1,293	--	3.5

<sup>a</sup>Data from Petroconsultants.

<sup>b</sup>Corrected.

<sup>c</sup>Estimated.

<sup>d</sup>Data from Morse & Company.

<sup>e</sup>Through October 1986.

<sup>f</sup>First half of 1987 only.

<sup>g</sup>Through August 1987.

<sup>h</sup>Includes condensate and natural gas liquids.

## Oil and Gas Developments in South America, Central America, Caribbean Area, and Mexico in 1988<sup>1</sup>

W. DAVID WIMAN<sup>2</sup>

### ABSTRACT

Exploration activity in South America, Central America, the Caribbean area, and Mexico in 1988 showed an increase from the low levels reported in 1987. Increases in seismic acquisition occurred in Brazil, Chile, Colombia, Costa Rica, Ecuador, Honduras, Mexico, and Trinidad. Exploratory drilling increased in most major producing countries and, in contrast to 1987, so did development drilling activity. Ecuador had the largest increases in production of both oil and gas, resulting from operating the Trans-Ecuadorian pipeline for 12 months in 1988 compared to 7 months in 1987, when 2 major earthquakes destroyed the line. Suriname increased its oil production by 55%, and Argentina had a 16% increase in gas production. Noteworthy discoveries were made in Argentina (Estancia Vieja X-1, La Reina X-1, and La Maggie X-1), Bolivia (Sirari X-2 and Vibora X-1), Brazil (1-PRS-4 and 1-RJS-409), Chile (Skua XE-4 and Kimiri Aike Sur-2), Colombia (Quilili-1, Quillacinga-1, Pompeya-1, Chaparrito-1, Palmarito-1, Tierrablanca-1, Guarilaque-1, Santiago Este-1, Jiba-1, Guahibos-1, Guarimena-1, Quimbaya-1, and Balcon-1), Ecuador (Mono-1, Frontera-1, Cantagallo-1, Daima-1, Ginta-1, and Indillana-1), Mexico (Chipilin-1), Peru (Jibaro-IX), and Venezuela (Pato Este, El Carito, Carito Norte-1, Tejero-IX, Furrrial Norte-1, Cueta-3728, Cueta-3729, and Cueta-3732).

The highlights of 1988 were in Argentina (Estancia Vieja X-1 and La Reina X-1), Bolivia (Vibora X-1), Colombia's Llanos basin (Chaparrito-1, Palmarito-1, Jiba-1, Pompeya-1, Tierra Blanca-1, and Guahibos-1), and Upper Magdalena basin (Quimbaya-1 and Toldado-2), Ecuador (Frontera-1, Cantagallo-1, Daima-1, and Indillana-1), and Venezuela's Monagas state (El Carito, Carito Norte-1, Tejero-IX, and Furrrial Norte-1).

### INTRODUCTION

Petroleum development in 20 countries are reported for 1988. Drilling activity for 15 countries is summarized in Table 1. Oil and gas production is listed in Tables 2, 7, and 12. Argentina, Bolivia, Ecuador, Guatemala, and Suriname reported increased oil production; Argentina, Barbados, Bolivia, Brazil, Ecuador, and Trinidad-Tobago showed increased gas production. Tables 3-12 list significant tests and exploration activities for which data are available.

#### ARGENTINA (Figure 1; Tables 5-7)

By Edward E. Miller, Triton Argentina Inc., Buenos Aires

Since the implementation in mid 1985 of Argentina's new exploration policy (commonly called the Houston Plan), 24 contract areas totaling 150,545 km<sup>2</sup> have been awarded to private industry. Twelve contract areas were accepted by YPF (the national oil company) and approved by the Argentine government during 1988. The 12 blocks signed in 1988 were offered in the third round of the Houston Plan along with 18 blocks in October 1987. Offers were submitted on 24 blocks of which 11 were pending at year end.

In 1988, 102 exploration wells were drilled in Argentina with a meterage of 218,153 m. These figures are slightly higher than 1987 levels; however, when compared to Argentina's 1984 all-time high of 126 wells and 360,049 m, they are considerably lower.

New oil and gas fields were discovered by YPF, Occidental, Bidas, Cadipsa, and Total. The most significant discoveries were made in the Neuquen, Noroeste, and Austral (Magallanes) basins.

Occidental's Estancia Vieja X-1 well in the Rio Negro Norte block of the Neuquen basin tested a combined flow rate of 501 m<sup>3</sup>/day (3,151 b/d) of oil predominantly from the Punta Rosada and Catriel Formations. The discovery was significant in that it established the Punta Rosada as a new productive interval and additionally established production on the extreme eastern limit of the Neuquen basin previously believed nonproductive.

YPF had two significant discoveries in 1988: the La Reina X-1 well in the Noroeste basin tested 368 m<sup>3</sup>/day (2,315 b/d) of oil from the Palmar Largo Formation (Cretaceous weathered volcanics), and the Estancia La Maggie X-1 in the Austral basin tested 187.2 m<sup>3</sup>/day (1,177 b/d) of oil, indicating that the Springhill Formation continues to be the significant oil and gas reservoir in the basin.

© Copyright 1989. The American Association of Petroleum Geologists. All rights reserved.

<sup>1</sup>Manuscript received and accepted, July 18, 1989.

<sup>2</sup>BG Ecuador, S. A., 1100 Louisiana, Houston, Texas 77002.

This report was compiled from two main sources: data supplied by contributors residing in the various countries, and the *Foreign Scouting Service Annual Reviews* published by Petroconsultants S.A., Geneva, Switzerland. I sincerely appreciate the time and effort spent by the various contributors and would welcome volunteers from the other countries. Bogdan Popescu's authorization to use the Petroconsultants reports is acknowledged.

British Gas supported the project. I especially thank Maria del Carmen and Patricia Vasconez for their help in preparation of the 1988 report.

South America, Central America, Caribbean Area, and Mexico / W. David Wiman

Eight months of surface geologic mapping was conducted in the Limon basin (5 party-months) and in the Pacific Zone (3 party-months).

Land seismic acquisition totaled 600 line-km with 426 line-km in the Limon basin and 174 line-km in the Northern Pacific Zone. Three months of gravity surveys were also conducted.

CUBA

Date from Petroconsultants S.A., Geneva, Switzerland

Since the 1959 revolution, all exploration and production activities have been carried out by the state agency, Empresa de Perforacion y Extraccion de Petroleo (EPEP). Activities are secret, and accurate information is scarce.

No activity was reported from offshore in 1988; 2 land seismic parties were reported to be operating. The west coast play was reported abandoned, and exploratory activity, with up to 6 rigs involved, shifted to the northern, central, and eastern areas. Twelve rigs were reported drilling development wells.

Oil production was estimated to have leveled at 21,000 BOPD and gas production was quoted as having passed the 1 bcf/year mark for the first time in 1987. This would amount to only 2.740 MMCFGD, not the 14.0 MMCFGD given as an estimate since 1986. Much of the gas is sour, particularly the associated gas from Varadero which contains as much as 18% H<sub>2</sub>S.

ECUADOR (Figure 5, Tables 11, 12)  
By R. W. Canfield, Texaco, Quito

Ecuadorian production reached a record high in 1988 with 110.3 million bbl of oil, about 3.8 million bbl above the previous record set in 1986 (Table 2). The CEPE-Texaco consortium accounted for 86,726,890 bbl or 78.65%, with CEPE's 100% operations producing 21,154,683 bbl or nearly 19.2% of the total (Table 12).

The Ecuadorian government signed risk-service contracts for Oriente blocks 10 (Arco group) and 13 (Unocal group) during 1988. Contract negotiations for the offshore Block 3 (Fred Parks Inc.) and coastal Block 5 (YPF) were still in progress at year end.

In September, the government announced that CEPE will assume the Trans-Ecuadorian Pipeline operations on October 1, 1989, the producing and exploration operations of the CEPE-Texaco consortium on July 1, 1990, and the refinery operations of Repetrol on November 1, 1989, and of Anglo in December 1989.

Exploration activity continued at a fairly high rate because of the risk-service contract requirements. More than 22 party-months of geophysical activity recorded 3,615 line-km of digital seismic in the Oriente area during 1988. In the coastal Santa Elena Peninsula area, 125 line-km were recorded (Table 11). Fourteen exploratory wells drilled 44,179 m during 1988. There were 8 successful completions (2 of which were drilled in 1987) and 8 dry holes. One important discovery, Cantagallo-1, drilled by

CEPE northeast of the producing areas, tested over 11,600 b/d of mostly 31° API oil from 5 Cretaceous Napo sands. Other important discoveries of 15-17° API oil were made by Conoco in Block 16, and of 18-25.5° API oil by British Petroleum in Block 7.

Twenty-one development or extension wells were completed during 1988 and 7 were suspended at year end awaiting completion. One extension well was abandoned due to mechanical reasons. Development drilling totaled 59,300 m during 1988.

FALKLAND ISLANDS

Data from Petroconsultants S.A., Geneva, Switzerland

Firstland Oil and Gas hold a 546-km<sup>2</sup> license on East Falkland Island that expired in July 1988. An application to renew the license was submitted in May; at year end, it was still pending.

No exploration work was conducted in 1988.

GUATEMALA

Data from Petroconsultants S.A., Geneva, Switzerland

Area held under contracts (8,387 km<sup>2</sup>, all in the Peten basin) remained the same in 1988 as in 1987. Land seismic acquisition totaled 206 line-km of data, down 65% from 1987.

Exploratory drilling resulted in 3 wells spudded with 1 active at year end. No development occurred in 1988.

Production averaged 3,700 BOPD, up 3% from 1987.

GUYANA

Data from Petroconsultants S.A., Geneva, Switzerland

The Guyana Exploration/Petrel Group conducted a 1,020 line-km marine seismic survey. No exploratory drilling was reported.

HONDURAS

Data from Petroconsultants S.A., Geneva, Switzerland

Three companies held 3 onshore leases covering 6,122 km<sup>2</sup>. The president signed Texaco's seismic option contract on 2 blocks totaling 4,000 km<sup>2</sup> over the offshore Mosquitia platform. Congress, however, has not ratified the award. Ernest Oil applied for rights in 3 offshore blocks covering 5,865 km<sup>2</sup>.

Bonavista initiated a 560 line-km land seismic survey, acquiring an estimated 150 line-km by year end.

No exploratory drilling occurred during 1988, and no production exists in Honduras.

South America, Central America, Caribbean Area, and Mexico / W. David Wiman

**MEXICO**

Data from Petroconsultants S.A., Geneva, Switzerland

No private rights exist in Mexico. All exploration and development activity is conducted by Pemex, the state oil company.

Exploration activity, including geologic, gravity, magnetic, geochemical, and VSP surveys, decreased 25% to 1,132 party-months in 1988.

Exploratory drilling was up 22% in 1988 with 33 wells drilled; however, meterage decreased 28% to 131,000 m.

Significant discoveries were Chipilin-1, in the Mesozoic area of Chiapas-Tabasco, which produced 4,510 BOPD from the upper Jurassic, and Reynosa-1145, in the Frontera Norte district, which tested 2,155 MCFGD.

Development drilling was up 46% with 111 wells completed in 1988. Meterage was up 9% to 333,305 m in 1988.

Oil production averaged 2,506,642 BOPD, down 1.3% from 1987; gas output was 3,478.3 MMCFGD, down 0.6%; natural gas liquids were up 8% to 364,000 b/d; and condensate production was 76,299 b/d, up 0.7% from 1987.

Proven reserves decreased 2% to 67.6 billion bbl of oil equivalent. Reserves are broken down as follows: oil, 46,191 million bbl; condensate, 6,821 million bbl; and natural gas liquids, 14,588 million bbl. Gas reserves were reported to be 73.4 tcf, with 85% being associated gas.

**PANAMA**

Data from Petroconsultants S.A., Geneva, Switzerland

Four license blocks (1 onshore and 3 offshore) totaling 10,968 km<sup>2</sup> were in force at year end.

In 1988, approximately 900 line-km of marine seismic data were recorded, adding to the 1400 line-km recorded in late 1987 in the Gulf of Panama. No drilling occurred in 1988.

**PARAGUAY**

Data from Petroconsultants S.A., Geneva, Switzerland

Nine contracts totaling 221,601 km<sup>2</sup> were held by 7 companies at year end compared to 10 contracts covering 211,929 km<sup>2</sup> (revised) in 1987.

Exploration activity was down from 1987, with 2 groups recording 1,015 line-km of seismic data along with gravity recording. This compares to the 2,750 line-km of seismic data acquired in 1987. The Nazareth-1 wildcat was abandoned in January by Occidental in the Pirity subbasin.

**PERU**

Data from Petroconsultants S.A., Geneva, Switzerland

At year end, 187,616 km<sup>2</sup> were held by PetroPeru and Petromar (both state oil companies), and Occidental. Shell relinquished its blocks in the Madre de Dios basin

and in the Ucayali basin, where it discovered the giant San Martin and Cashiriari gas and condensate fields.

Exploration activity decreased in 1988 with the acquisition of 981 line-km of seismic data and 376.5 line-km of gravity.

Exploratory drilling was also down with 7 wells spudded drilling 21,062 m, down 42% from 1987. Occidental's outpost, Jibaro-IX, tested 1,008 b/d of heavy crude from the Vivian Formation and was completed. Occidental also spudded its first wildcat in the Ucayali basin: La Copa-1. Development drilling also decreased 21% to 110 wells drilling 186,425 m (down 28% from 1987).

Production decreased 14% in 1988 to 143,114 BOPD. Peru's total production for 1988 was 52,379,830 bbl of oil and 49.9 mmcf of gas.

**SURINAME**

Data from Petroconsultants S.A., Geneva, Switzerland

A 12,000-km<sup>2</sup> offshore exploration option was held by International Petroleum Exploration, which had until April 30, 1989, to form a group and negotiate a production-sharing contract with Stratsolie (the state oil company). Stratsolie has an 80-km<sup>2</sup> production lease onshore, where it continued developing and extending the Tambaredjo heavy oil field.

No exploration activity was reported during 1988.

Exploration drilling was up 22% with 11 wells drilled in 1988. Development drilling was up 77% to 46 wells drilled resulting in 27 oil completions.

Production from Tambaredjo field averaged 3,390 BOPD, up 56% from 1987.

**TRINIDAD AND TOBAGO**

Data from Petroconsultants S.A., Geneva, Switzerland

Total area under concessions in 1988 was 13,657 km<sup>2</sup>, up 8.7% from 1987.

Exploration activity resumed in 1988 after a lull in 1987, with 3,820 line-km of marine seismic and 83 line-km of land seismic acquired.

Exploratory drilling remained at a similar level to 1987 with 6 wells completed resulting in 3 oil discoveries. Trintoc and Trintopec (both state oil companies) were active onshore, and Amoco and TNA were active offshore. Exploration meterage was 12,193 m, up 8% from 1987. Development drilling was down 1% to 136 wells completed; however, meterage was up 9% to 193,900 m.

Production was up 4% to 55,180,000 bbl from the 1987 revised figure of 53,255,000 bbl. Amoco contributed 46.5%, TNA 25.4%, Trintopec 14.4%, Trintoc 13.2%, and Premier 0.5%. Natural gas production averaged 763.07 MMCFGD, up 2.9% from 1987.

**VENEZUELA**

Data from Petroconsultants S.A., Geneva, Switzerland

No foreign rightholders exist in Venezuela. The state oil company, Petroleos de Venezuela S.A. (PDVSA), controls 3 operating companies: Corpoven, Lagoven,

South America, Central America, Caribbean Area, and Mexico / W. David Wiman

Table 1. South America, Central America, Caribbean Area, and Mexico Exploratory and Development Wells, 1988

COUNTRY Operator	EXPLORATORY						DEVELOPMENT					
	OIL	GAS	DRY	% SUCCESS	TOTALS		OIL	GAS	DRY	% SUCCESS	TOTALS	
					DRILLED	METERS					DRILLED	METERS
ARGENTINA	17	5	79	22	102	218,153	-	-	-	-	679 <sup>1</sup>	1,617,370 <sup>1</sup>
BOLIVIA												
YPFB	1	2	3	25	12	24,628	9	9	1	95	19	64,367
BRAZIL												
Petrobras	43	4	91	31	158	333,858	476	5	65	76	633	746,158
Private	3	-	7	38	18	31,895	-	-	-	-	-	-
CHILE (ENAP)	5	2	19	27	26	61,264	48	2	18	81	52	188,882
COLOMBIA												
Ecopetrol	14	1	9	63	24	58,581	188	-	4	96	184	358,888
Private	19	4	38	37	61	118,426	92	-	3	97	95	588,788
COSTA RICA	-	-	2	0	2	7,728	-	-	-	-	-	-
ECUADOR												
CEPE	2	-	-	100	1	2,530	11	-	-	100	18	38,262
Private	6	-	8	43	13	41,640	18	-	1	91	10	29,838
GUATEMALA	-	-	2	-	4	8,898	-	-	-	-	-	-
MEXICO	5	1	25	19	33	131,888	85	2	21	81	99	333,385
PARAGUAY	-	-	1	-	1	589	-	-	-	-	-	-
PERU	7	-	1	89	8	21,862	74	-	2	97	118	186,425
SURINAME	3	-	8	27	11	3,656	27	-	19	59	46	14,735
TRINIDAD-TOBAGO	3	-	3	58	6	12,193	183	1	11	77	136	193,988
URUGUAY												
VENEZUELA	13	-	-	100	17	79,988	147	-	1	99	218	582,595

<sup>1</sup>YPFB wells only.

Table 2. South America, Central America, Caribbean Area, and Mexico Production Summary, 1984-1988

COUNTRY	OIL (million bbl)					Cumulative 1984-1988 (million bbl)	GAS (bcf)					Cumulative 1984-1988 (tcf)	Avg. Daily (bcf)	
	1984	1985	1986	1987	1988		1984	1985	1986	1987	1988			
ARGENTINA	178.8	167.8	158.5	156.4	164.3	458.8	658.5	674.8	677.4	675.4	801.3	-	2,195	
BARBADOS	1.63	8.68	8.56	8.58	8.43	-	1.17	8.81	1.17	1.21	1.86	-	8.883	
BOLIVIA	7.68	7.28	6.48	6.98	7.88	384.98	19.18	173.28	164.18	168.88	161.18	169.98	2.91	8.454
BRAZIL	173.48	285.58	216.38	215.88	282.58 <sup>a</sup>	2,439.48 <sup>b</sup>	555.88	173.18	192.48	281.78	287.98	212.48	2,265 <sup>b</sup>	1,585
Offshore	111.98	148.88	146.18	143.88	135.38 <sup>a</sup>	916.48	371.88	97.48	116.68	126.18	133.38	138.98	8.98	8.383
CHILE	14.88	13.88	12.28	18.98	8.98	351.48	24.48	172.98	163.78 <sup>b</sup>	153.98	151.88	6,142	8,472	
COLOMBIA	61.18	64.48 <sup>a</sup>	181.38 <sup>a</sup>	142.18 <sup>a</sup>	137.28	2,849.88 <sup>b</sup>	374.78	183.18	182.18	184.88 <sup>a</sup>	188.88	172.68	4,432.18 <sup>b</sup>	8,473
CUBA	-	-	-	-	-	-	21.88 <sup>c,d</sup>	-	-	-	-	-	-	8,885 <sup>c</sup>
ECUADOR	93.88	182.88	186.58	63.58	118.88	1,411.7	381.38	14.58	21.58	25.98	16.38	29.48	-	8.88
GUATEMALA	1.78 <sup>b</sup>	1.37 <sup>a</sup>	2.88 <sup>a</sup>	1.31 <sup>a</sup>	1.35 <sup>a,c</sup>	-	3.78 <sup>a,c</sup>	-	-	-	-	-	-	-
MEXICO	982.58 <sup>d</sup>	988.18 <sup>a</sup>	886.18 <sup>a</sup>	1,877.98 <sup>b</sup>	1,858.98 <sup>b</sup>	28,688.98 <sup>b</sup>	2,874.68 <sup>a</sup>	1,373.58 <sup>a</sup>	1,252.48 <sup>a</sup>	1,276.98 <sup>a</sup>	1,278.18	-	3.48	
PERU	67.48	69.38 <sup>b</sup>	64.88	68.48	52.38	1,742.88	143.18	45.58	39.38 <sup>e</sup>	58.88	49.98 <sup>b</sup>	N.R.	-	8,127 <sup>e</sup>
SURINAME	8.28	8.42	8.71 <sup>b</sup>	8.88 <sup>b</sup>	1.24	-	3.38 <sup>a</sup>	-	-	-	-	-	-	-
TRINIDAD-TOBAGO	82.8	66.3	61.6	56.68	55.28 <sup>a,c</sup>	2,485.1	151 <sup>a,c</sup>	252.1	261.7	267.9	270.7 <sup>a,b</sup>	279.3 <sup>a</sup>	-	8,763 <sup>a</sup>
VENEZUELA	657.8	611.8	658.2	655.9	N.R.	N.R.	1,793.8	-	-	-	1,293	-	3,55 <sup>a,d</sup>	

<sup>a</sup>Data from Petroconsultants.

<sup>b</sup>Corrected.

<sup>c</sup>Estimated.

<sup>d</sup>Data from Morse & Company.

<sup>e</sup>Through October 1988.

<sup>f</sup>First quarter of 1988.

<sup>g</sup>Through October 1988.

<sup>h</sup>Includes condensate and natural gas liquids.

<sup>i</sup>Exclusive of condensate and natural gas liquids.

## Oil and Gas Developments in South America, Central America, Caribbean Area, and Mexico in 1989<sup>1</sup>

W. David Wiman<sup>2</sup>

### ABSTRACT

Exploration activity in South America, Central America, the Caribbean area, and Mexico in 1989 continued to rebound from the low levels reported in 1987. Exploratory drilling increased in most major producing countries and, for the first time, wildcatting began in Aruba and stratigraphic drilling was done in Puerto Rico. Noteworthy discoveries were made in Argentina (Selva Maria-1, Estancia Vieja-1, and Lago Fuego-1), Bolivia (Patuju X-1, San Roque X-10, and Vibora X-2), Brazil (1-RJS-414 and 1-RJS-409 offshore, and 1-CUP-1-AM and 1-CRP-1-AM onshore), Chile (Terramar XE-1, Fresia-1, Mata Negra-1, Municion Oeste-1, and Gaviota Norte-6), Colombia (Cohembi-1, Mansoya-1, Mecaya-1, Toroyaco-1, Camoa-1, Chaparrito Norte-1, Los Toros-1, Sirenas-1, Bucaro-1, Guacamayo-1, Valdivia-1, El Deseo-1, Doña María-1, Pacande-1, Olini-1, and Chenche-1), Ecuador (Danta-1, Lobo-1, Iro-1, Sunka-1, and Yanpuna-1), Peru (Chambria Este-123), and Venezuela (Boqueron Norte-1, Corozo-1, Carito-Este-1, and Tejero-1).

The highlights of 1989 were again in the eastern Venezuela deep basin, the Llanos basin of Colombia, the sub-Andean Amazon basins of Colombia, Ecuador, and Peru, and in the Neuquen basin of Argentina.

### INTRODUCTION

Petroleum developments in 24 countries are reported for 1989. Drilling activity for 19 countries is summarized in Table 1. Oil and gas production is listed in Tables 2 and 11. Argentina, Bolivia, Brazil, Colombia, Ecuador, Guatemala, Mexico, Suriname, and Venezuela reported increased oil production; Argentina, Bolivia, Brazil, Colombia, and Mexico showed increased gas production.

Tables 3–10 list significant tests and exploration activities for which data are available.

### ARGENTINA (Table 5)

Data from Petroconsultants S.A., Geneva, Switzerland

In 1989, 597,653 km<sup>2</sup> were held under petroleum rights, up 67% from 1988. Private companies were awarded 28 onshore blocks and YPF, the state oil company, was given 2 small areas. Two offshore blocks were awarded to private companies. Three exploitation licenses were granted to Occidental, and Perez returned to YPF 2 small gas fields in the Austral basin. The fifth round of the Houston Plan had 5 block applied for out of the 70 offered.

Seismic activity was up 29% to 17,752 line-km with YPF acquiring 60% of the total. Offshore activity was 996 line-km versus none in 1988. Gravity and magnetic acquisition was 826 and 509 km, respectively.

In 1989, 120 exploration wells drilled approximately 269,800 m, up 16% from 1988. Occidental (Citico) confirmed its major discovery in the Neuquen basin (Estancia Vieja-1, 3144 BOPD) with 4 successful outpost wells. Occidental had another discovery at Puesto Prado-1 (289 BOPD). YPF had 3 significant discoveries in the Neuquen: Portezuelo del Choique-1 (362 BOPD), Rincon de Aranda Oeste-1 (201 BOPD), and Punta Barda-1 (333 BOPD). In the San Jorge basin, YPF had success at Estancia dos Lagunas-1 (1.5 MMCFGD) and Meseta Sirven-1 (566 BOPD). In the Austral basin, Occidental's (CPOA) Lago Fuero-1 tested 2.9 MMCFGD and 44 BCPD. In the Cretaceous basin, YPF tested 2327 BOPD and 7.95 MMCFGD in its Selva Maria-1 wildcat.

Crude production increased 2.5% from 1988 to approximately 460,000 b/d. Natural gas production increased 6.8% to about 2.4 bcf/day.

### ARUBA

Data from Petroconsultants S.A., Geneva, Switzerland

The government of Aruba ratified 3 production-sharing agreements covering 1880 km<sup>2</sup> on its Caribbean shelf. These were the first licenses offered in Aruba.

In 1989, 1621 line-km of seismic were acquired offshore, the first activity since 1982. One wildcat was abandoned and a second spudded during the year.

©Copyright 1990. The American Association of Petroleum Geologists. All rights reserved.

<sup>1</sup>Manuscript received and accepted, July 20, 1990.

<sup>2</sup>BG Ecuador, S.A., 1100 Louisiana, Houston, Texas 77002.

This report was compiled from 2 main sources: data supplied by contributors residing in the various countries, and the *Foreign Scouting Service Annual Reviews* published by Petroconsultants S. A., Geneva, Switzerland. I sincerely appreciate the time and effort spent by the various contributors. Bogdan Popescu's authorization to use the Petroconsultants reports is acknowledged.

British Gas supported the project. I thank Cecilia Ayala, Patricia Vasconez, and María del Carmen Larsen for their help in preparation of the 1989 report.



Petroecuador drilled 18 development wells with 16 successful completions.

Ecuador's production in 1989 was 101,937,351 bbl of oil, about 8.4 million bbl less than the record set in 1988. The Petroecuador-Texaco consortium accounted for 79,804, 054 bbl or 80%, with the remainder produced by Petroecuador and Cepeco.

#### FALKLAND ISLANDS

Data from Petroconsultants S.A., Geneva, Switzerland

The only license, held by Firstland Oil and Gas, expired in 1988. The application to renew is still pending.

#### FRENCH GUIANA

Data from Petroconsultants S.A., Geneva, Switzerland

Elf has held the "Permis de Guyane Grands Fonds" since 1985; however, no exploration work was done in 1989.

#### GUATEMALA

Data from Petroconsultants S.A., Geneva, Switzerland

Five companies held 4840 km<sup>2</sup> in central Guatemala at year end compared to 6 companies with 7823 km<sup>2</sup> in 1988.

No exploration was conducted in 1989.

Drilling activity, mainly re-entry work, decreased 40% with approximately 5100 m drilled in completing 4 wells. Esso abandoned its first wildcat in Block L-7, Machaquila-1, and when archaeological problems prevented it from spudding El Ceibal-1, Esso relinquished the block.

Production averaged 4200 BOPD, up 14% from 1988. Basic's Tierra Blanca field was declared commercial in July and went on-stream.

Basic signed a contract with the Ministry of Mines for the construction of a minirefinery in the Xan area in the northwest part of the country. Texaco drilled the Xan heavy oil discovery but later relinquished the block. Later in the year, in response to pressure from environmental organizations, the government asked Basic to shift the location of the planned refinery to another, less sensitive area. At year end, no information was available on a new site.

#### GUYANA

Data from Petroconsultants S.A., Geneva, Switzerland

One onshore and 2 offshore licenses were held totaling 34,162 km<sup>2</sup>, up 37% from 1988.

A 3285 line-km marine seismic survey was acquired by the Lasmob-BHP group. No exploratory drilling was reported.

#### HONDURAS

Data from Petroconsultants S.A., Geneva, Switzerland

Three licenses covering 6271 km<sup>2</sup> were in effect at year end. Awarding of 5 offshore blocks, which were applied for in 1988, was pending at year end.

Cambria Resources, which took over operatorship of the Brus Laguna permit from Bonavista, completed the 560 line-km survey initiated in 1988.

A 2-well commitment exists for the Brus Laguna permit with drilling to start in 1990.

#### MEXICO

Data from Petroconsultants S.A., Geneva, Switzerland

No private rights exist in Mexico. All exploration and development activity is conducted by Pemex, the state oil company.

Exploration activity decreased 24% to 865 party-months. This includes seismic, gravity, and magnetometry acquisition along with geological and geochemical field parties.

Exploratory drilling was down 34% to 552 rig-months. Twenty-four wells were drilled compared to 33 in 1988; however, meterage increased 9% to 143,393 m.

Significant discoveries were Yagual-1 (4568 BOPD), Cardo 101B (3858 BOPD), Palapa 201-A (701 BOPD), and Palapa 101-A (1560 BOPD) in the Chiapas-Tabasco Mesozoic trend, and Pipila-1 (6.3 MMCFGD), Reynosa-1035 (12 MMCFGD)—a deeper pool discovery—, and Pita-1 (1.3 MMCFGD) in the Frontera Noroeste area. Offshore Och-1B (5994 BOPD), and Taratunich-201 (2086 BOPD) were significant discoveries in the Bay of Campeche.

Development drilling was down 38% to 636 rig-months. Eighty-one wells were completed with 200,677 m drilled.

Oil production averaged 2,513,305 b/d, up 0.3% from 1988; gas output was up 2.7% to 3471.7 mmcf/day; and natural gas liquids (including condensate) averaged 381,200 b/d, up 4.8% from 1988.

Published reserves were 45.25 billion bbl of oil, 6.7 million bbl of condensate, 14.6 million bbl of natural gas liquids, and 72.7 tcf of gas.

#### NETHERLANDS ANTILLES

Data from Petroconsultants S.A., Geneva, Switzerland

Aladdin Petroleum remained the sole rightholder with its 1280-km<sup>2</sup> Saba Bank offshore production-sharing contract. No exploration was performed in 1989 compared to 348 line-km of seismic acquisition in 1988. A well commitment is required in 1990.

#### PANAMA

Data from Petroconsultants S.A., Geneva, Switzerland

Four license blocks covering 10,976 km<sup>2</sup> were in effect at year end, the same as in 1988.

A 360 line-km, shallow water seismic survey was acquired in the Golfo de San Miguel (Panama Gulf).

IDRIA drilled 3 wildcat wells offshore for a total of 5678 m. All 3 were abandoned but reported oil and gas shows.

#### PARAGUAY

Data from Petroconsultants S.A., Geneva, Switzerland

Eight permits covering 165,447 km<sup>2</sup> were held by 6 companies at year end, down 25% in coverage from the 9 permits at the end of 1988.

Texaco acquired 250 line-km of seismic data in 1989, completing its 1200 line-km program started in 1987. This is down 75% from 1988.

Primo Cano Martinez spud Mendoza-1, but junked the test after drilling 100 m.

#### PERU

By O. Miró Quesada and Julio Talledo S., Petroperu, Lima

Exploration activities conducted by Petroperu S.A. (the state oil company) included geological and geophysical surveys and exploratory drilling. On land, 1347 line-km of conventional seismic was recorded in Block 8 (Maranon basin) and 7744 line-km of pre-existing seismic in Blocks 8 (Maranon basin), 31, and 35 (Ucayali basin) were reprocessed.

Mobil Exploration and Producing Peru initiated operations under a contract with Petroperu for Blocks 28, 29, 30, and 53 in the Huallaga basin totaling 36,500 km<sup>2</sup>. As part of the contract, 2400 km of airborne magnetometry was performed by year end.

The Maranon basin in northeast Amazon is the most prolific producing area, with 16 fields having produced 483 million bbl of 10-45° API oil from depths ranging from 7300 ft to 13,900 ft. Production in 1989 averaged 79,885 BOPD, 5985 BOPD (6.9%) below 1988, from 123 active wells from both Petroperu and Occidental Petroleum.

Natural gas production in Block 8 was 688 mmcf from Petroperu and 1583 mmcf from Occidental Petroleum.

A new oil field, Chambira East, discovered by Petroperu, which drilled 2 exploratory wells, is considered a major addition to the nation's energy supply. Initial tests indicate a potential production of 2179 BOPD of 26.5° API oil.

Occidental Petroleum drilled 6 successful development wells in its Block 1-AB.

In the Ucayali basin, Petroperu has 3 productive fields: Agua Caliente, Maquia, and Pacaya, which have a total of 3320 productive ac and a cumulative production of 26.4 million bbl of crude oil with API gravities ranging from 29 to 43.9. Daily production of 36 active wells averaged 2633 BOPD from between 1500 and 3300 ft. Petroperu drilled 1 development well in Maquia field. It produced 204 BOPD. Occidental Petroleum drilled 2 exploratory wells in Block 36: La Colpa 1X and Platanal 1X. Both were abandoned.

The Camisea gas project, involving the giant San Martin and Cashiriari gas and condensate fields discovered in 1988, is under evaluation. A significant volume of natural gas liquids (NGL) could be extracted. Current estimates are 10.8 tcf of gas and 725 million bbl of NGL.

The Talara area (northwestern Peru), producing since the mid 19th century, is the oldest producing area in Peru. Its cumulative output is 1218 million bbl. Production in 1989 was 47,800 BOPD, 4600 BOPD (9.1%) below 1988, from 3378 producing wells (2142 Petroperu onshore, 479 Petromar offshore, and 757 Oxy onshore) with an average depth of 6264.9 ft for wells drilled in 1989. The average API gravity of the crude oil is 33.4. Natural gas production in northwest Peru was 36,434 mmcf from both Petroperu and Petromar. The Oxy-Bridas consortium produced 1.1 mmcf of natural gas.

Petroperu and Petromar drilled 77 wells totaling 501,192 ft in 1989 in their northwest fields. Of these wells, Petroperu drilled 2 exploratory and 41 development wells, of which 33 were productive and 10 are under evaluation, and Petromar drilled 1 exploratory and 33 development wells (25 productive, 3 under evaluation, 4 abandoned during drilling, and 2 temporarily abandoned). The Oxy-Bridas consortium drilled 7 development wells (1 productive, 1 abandoned, and 5 under evaluation) in northwest Peru.

During 1989, additional contracts with national companies V.G.S.A. for Block S2 in the Lake Titicaca basin and CMP for exploration in the Carpitaz-Zorritos fields in northwestern Peru were under negotiation.

#### PUERTO RICO

Data from Petroconsultants S.A., Geneva, Switzerland

No private rights exist in Puerto Rico. The state-run Corporacion de Desarrollos de Recursos Mineros is in charge of exploration and exploitation.

A 2740-m stratigraphic test was drilled in the northern coastal plain, the first drilling since 1960. Traces of methane were reported.

#### SURINAME

Data from Petroconsultants S.A., Geneva, Switzerland

No rights were held by private companies at year end. International Petroleum Exploration failed to conclude an agreement with the government for a 12,000-km<sup>2</sup> offshore license, and the preliminary agreement expired on April 30, 1989. Pecten and Amoco were reported to be negotiating for offshore areas.

No exploration activity was reported.

Staatsolie, the state oil company, drilled 8 onshore exploration wells, down 28% from 1988. Three were in Tambaredjo field area, and 5 were 40 km east of Paramaribo, 4 of which reported oil shows.

Staatsolie drilled 51 development wells in Tambaredjo field, up 16% from 1988. Thirty-one were productive.

Production from Tambaredjo field averaged 3800 BOPD, up 12% from 1988.

#### TRINIDAD AND TOBAGO

Data from Petroconsultants S.A., Geneva, Switzerland

Total area under concessions was 13,332 km<sup>2</sup>, approximately the same as 1988. This figure does not include the 2920-km<sup>2</sup> deep-drilling-right permit awarded to Southern Basin Consortium, Exxon (operator), Chevron, and Total, which covers nearly the entire southern half of the island. Shallower rights are held by numerous other companies. Trintoc and Trintipac (both state oil companies) are carried in The Southern Basin Consortium. The permit allows the consortium to explore for oil between 8000 and 17,000 ft, looking for an extension of the prolific Furrial trend being developed in Venezuela. Mobil was awarded a blocks in the Columbus Channel and East Coast Marine area.

Seismic acquisition was up 80% to 7200 line-km. Amoco shot 2-D and 3-D surveys, and Geco acquired a speculative program.

Six exploratory wells drilled 21,705 m, up 78% from 1988. Trinmar's deeper pool wildcat, SouthWest Soldado 670, reported promising oil shows and was suspended at year end.

Development drilling decreased 57% with 77 wells drilling 125,274 m.

Production was similar to 1988 with oil output averaging 150,000 b/d and gas production at 764.3 mmcf/day.

#### VENEZUELA

Data from Petroconsultants S.A., Geneva, Switzerland

No foreign rightholders exist in Venezuela. The state oil company, Petroleos de Venezuela S.A. (PDVSA) controls 3 operating companies: Corpoven, Lagoven, and Naraven. Total area under license is 46,666 km<sup>2</sup>, of which 1939 km<sup>2</sup> is offshore. At year end, Venezuela was considering inviting multinationals to participate in specific projects in hydrocarbon exploration and production.

Seismic activity was down 76% to 1895 line-km acquired, of which 1722 line-km was onshore. Gravity acquisition was also down with 1942 line-km recorded compared to 23,546 line-km of airborne gravity and magnetics recorded in 1988.

Exploration drilling was down 24% to 75,160 m. Of the 18 wells which encountered oil, Two-Boqueron Norte-1 (4842 BOPD) and Carito Oeste-1 (3540 BOPD) were significant discoveries. Activity was concentrated in the Greater Furrial trend and Greater Oficina areas in eastern Venezuela, and in the Ceuta-Tomoporo area in the south-eastern part of Lake Maracaibo. Exploratory drilling, however, was carried out in poorly explored areas, such as the Guarumen graben and the Norandino front.

Development drilling was similar to 1988 with 498,910 m, down 12%. Most of the activity was in the Maracaibo area, but the progressive shift to eastern Venezuela, as seen in previous years, was confirmed.

Production averaged 1,881,889 BOPD (including 158,612 BCPD), up 3.85% from the average of 1,813,772 BOPD in 1988. Noteworthy is the progressive decrease of condensate and increase of light oil from the Greater Furrial trend. Natural gas output averaged 3669 mmcf/day.

346 South America, Central America, Caribbean Area, and Mexico / W. David Wiman

Table 1. South America, Central America, Caribbean Area, and Mexico Exploratory and Development Drilling, 1989

COUNTRY Operator	EXPLORATORY						DEVELOPMENT					
	OIL	GAS	DRY	% SUCCESS	TOTALS		OIL	GAS	DRY	% SUCCESS	TOTALS	
					DRILLED	METERS					DRILLED	METERS
ARGENTINA	27	5	69	35	120	269,800 <sup>a</sup>	559	32	21	97	681	1,203,800 <sup>a</sup>
ARUBA	--	--	1	--	2	6,227	--	--	--	--	--	--
BARBADOS	--	--	2	--	2	3,841	7	--	--	100	7	9,306
BOLIVIA												
YPFB	2	1	5	37	12	21,174	6	9	2	88	18	45,120
Private	--	4	2	80	1	18,943	--	--	--	--	--	--
BRAZIL												
Petrobras	25	8	79	32	111	276,281	342	8	45	89	488	529,333
Private	--	--	4	0	4	27,348	8	--	2	80	10	15,973
CHILE (ENAP)	5	--	12	29	17	41,808	25	--	11	98	98	82,607
COLOMBIA												
Ecopetrol	7	--	7	50	14	34,896	13	--	--	100	13	81,561
Private	17	4	37	--	58	107,081	121	1	1	99	123	115,373
COSTA RICA	--	--	1	--	1	4,200	--	--	--	--	--	--
CUBA	1	--	1	50	2	5,434 <sup>a</sup>	--	--	--	--	--	--
ECUADOR												
Cepco-Petroecuador	--	--	--	--	--	--	16	--	2	89	18	46,523
Private	10	--	1	91	11	37,428	--	--	--	--	--	--
GUATEMALA	1	--	2	33	4	8,100	--	--	--	--	--	--
MEXICO	9	5	24	58	24	143,393	51	6	18	76	59	200,877
PANAMA	--	--	3	--	3	5,678	--	--	--	--	--	--
PANAGUAY	--	--	1	--	1	100 <sup>b</sup>	--	--	--	--	--	--
PERU	4	--	1	69	7	20,456	70	--	6	92	79	150,860 <sup>a</sup>
PUERTO RICO	--	--	1	--	1	2,704 <sup>c</sup>	--	--	--	--	--	--
SURINAME	0	--	5	--	8	2,843	31	--	20	61	51	10,058
TRINIDAD TOBAGO	2	--	4	33	8	21,688	85	2	7	91	77	125,300 <sup>a</sup>
VENEZUELA	18	--	2	90	23	75,180 <sup>a</sup>	108	--	2	98	158	496,910 <sup>a</sup>

<sup>a</sup>Estimated.  
<sup>b</sup>Junked.  
<sup>c</sup>Stratigraphic tests.

Table 2. South America, Central America, Caribbean Area, and Mexico Production Summary, 1985-1989

COUNTRY	OIL (THOUSAND BBL)					CUMULATIVE (MILLION BBL)	BOPI (1,000 BBL)	GAS (bcf)			CUMULATIVE (Tcf)	AVERAGE DAILY (bcf)		
	1985	1986	1987	1988	1989			1985	1986	1987				
ARGENTINA	167.00	154.50	156.00	164.20	167.80 <sup>c</sup>	--	458.00	614.00	677.00	575.00	853.50	--	2.383	
BARBADOS	0.66	0.66	0.50	0.12	0.39	--	1.07	1.17	1.21	1.06	1.25	1.11	--	0.003
BOLIVIA	7.20	6.40	6.30 <sup>b</sup>	7.00	7.30	312.20	18.33 <sup>k</sup>	166.10	174.90	181.10	169.30	185.80	3.10	0.512
BRAZIL	205.50	218.30	215.00	202.50 <sup>i</sup>	217.40 <sup>i</sup>	2,656.10	595.60	152.40	201.70	287.80	313.40	215.20	2,476.00	0.590
Offshore	140.30	146.10	143.90	135.50 <sup>i</sup>	145.00 <sup>i</sup>	1,051.50	397.30	116.60	166.10	131.30	159.80	136.50	1,076.00	0.374
CHILE	18.00	19.20	10.30	8.98 <sup>t,c</sup>	8.05	369.46	28.99	143.70	153.90	183.50	181.60	149.60 <sup>j</sup>	6,398.00	0.410
COLOMBIA	64.40 <sup>a</sup>	101.30 <sup>a</sup>	142.10 <sup>a</sup>	137.20	147.50	2,909.30	181.10	183.10	184.90 <sup>a</sup>	186.10	173.60	178.30	4,507.00	0.458
CUBA	--	--	--	--	--	--	16.88 <sup>t,k</sup>	--	--	--	--	--	--	0.003 <sup>t,k</sup>
ECUADOR	182.00	104.50	63.50	119.20	101.39	1,813.60	279.28	21.50	16.30	16.30	23.40	28.84	--	0.079
GUATEMALA	1.37 <sup>a</sup>	2.80 <sup>a</sup>	1.31 <sup>a</sup>	1.35 <sup>t,c</sup>	1.33 <sup>a</sup>	--	4.20 <sup>t,c</sup>	--	--	--	--	--	--	--
MEXICO	950.10 <sup>a</sup>	806.10 <sup>a</sup>	1,077.90 <sup>k</sup>	1,090.00 <sup>k</sup>	1,056.91 <sup>k,a</sup>	21,655.41 <sup>k,a</sup>	2,836.34 <sup>k,c</sup>	1,242.40 <sup>a</sup>	1,816.50 <sup>a</sup>	1,275.20	1,279.10	1,383.67 <sup>a</sup>	--	3.911 <sup>b</sup>
PERU	89.30	64.30	60.40	52.36	67.97	1,799.38	130.32	25.30 <sup>o</sup>	30.00	49.30	--	38.71	--	0.186
SURINAME	6.42	6.75	0.60	1.24	1.39 <sup>a</sup>	--	3.80 <sup>a</sup>	--	--	--	--	--	--	--
TRINIDAD TOBAGO	84.30	51.10	36.64	65.29 <sup>t,c</sup>	54.40 <sup>t,c</sup>	2,429.39 <sup>t,c</sup>	149.00 <sup>t,c</sup>	241.70	367.90	278.70 <sup>k</sup>	179.30 <sup>k</sup>	218.96 <sup>a</sup>	--	0.161 <sup>t</sup>
VENEZUELA	611.48	636.20	635.50	683.84	886.89 <sup>k</sup>	--	1,861.20 <sup>k</sup>	--	--	1,291.69	--	--	--	1.420 <sup>k</sup>

<sup>a</sup>Data from Petroconsultants.  
<sup>b</sup>Corrected.  
<sup>c</sup>Estimated.  
<sup>i</sup>Includes condensate and natural gas liquids.  
<sup>j</sup>Exclusive of condensate and natural gas liquids.  
<sup>k</sup>54% recycled.