

REVIEW OF 1962 PETROLEUM DEVELOPMENTS IN
SOUTH AMERICA AND CARIBBEAN AREA¹

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ABSTRACT

This review covers 24 reporting countries in South America and the Caribbean Area. During the review year, geological and geophysical field effort was expended in search of new petroleum reserves in 16 of the 24 countries and this effort totalled about 1,430 party-months—up a significant 10% from the preceding year. Wildcat drilling in 1962 was at about the same pace as last year. A total of 374 exploratory wells was drilled in 13 of the reporting countries and 80 of these wildcats were completed as oil or gas producers for a success ratio of 21%. Finally, oil production for the year from the subject area totalled 1,436,984,000 bbls., up 9% over the preceding year. About 80% of this total production came from Venezuela; 8 other countries—all of which have been on a producing basis for many years—provided the remainder. No new countries came on production during 1962. Substantial net acreage relinquishments of concession areas during the year by private companies are reported from Colombia, Bolivia, Venezuela, Peru, and Guatemala.

INTRODUCTION

Exploration and production operations of the oil industry in South America and the Caribbean Area continued to grow through 1962. The year's production from this important segment of the world was up 9% over that of 1961 and totalled 1,436,984,000 bbls.—about 19.5% of Free World oil production. The 8 oil-producing countries of the South American continent together with the Island of Trinidad have through 1962 accounted for 14% of total cumulative world oil production. The great bulk of the production from this part of the world comes, and has come, from one country—Venezuela. Table I shows the annual crude oil production of the 9 individual producing countries over each of the past 5 years, and their cumulative production through 1962.

Geological and geophysical effort expended in the search for new discoveries and new reserves totalled, for the area as a whole, 1,430 party-months in 1962. This total effort was expended in 16 countries (Table II) and, when compared with the preceding year, records an upswing in party-months of 10% for this type of work, thereby reversing a continuing downtrend which has persisted over the past several years. About half of the 1962 party-months of effort was in seismic work. Argentina and Brazil continue to account for almost 60% of the geological and geophysical field effort.

Over-all exploratory drilling was at the same pace as last year. During the year 374 exploratory wells were completed in this great area, exactly

¹ Manuscript received, April 25, 1963.

² Gulf Oil Corporation.

the same number as in 1961. Of the 1962 wildcats, 80 were completed as oil or gas producers, for a success ratio of 21%. Just over 71% of the 374 1962 exploratory wells were drilled in 3 countries—Argentina, Brazil, and Venezuela. Table III contains further drilling statistics.

Private companies again recorded substantial net acreage relinquishments in Colombia, Bolivia, Venezuela, Peru, and Guatemala.

The discovery of the year may have been Richmond's Rio Zulia-1 completion in Colombia on acreage south of the old Barco concession in the Maracaibo Basin. Y.P.F.'s Tonono wildcat in Salta Province, Argentina, and its Cerro Redondo wildcat in Santa Cruz Province also certainly hold promise.

ACKNOWLEDGMENTS

Grateful acknowledgment is made to the following companies and individuals for their part in supplying information toward, or in contributing whole sections to, this 1962 Review of Petroleum Developments in South America and the Caribbean Area. These sections, country by country, covering 24 countries and arranged in alphabetical order, comprise the remainder and the bulk of this Review. Wherever desirable and possible, pertinent maps and statistical tables accompany these sections on the individual countries. The reader is referred to these country-by-country reports for local highlights and details.

ARGENTINA	Juan J. Zunino, Yacimientos Petroliferos Fiscales, Buenos Aires
BAHAMAS	R. B. Mitchell, California Exploration Company, Coral Gables, Fla.
BOLIVIA	P. H. Baadsgaard, Bolivian Gulf Oil Company, Santa Cruz

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TABLE I. ANNUAL OIL PRODUCTION, 1958-1962
(Thousands of Barrels)

Country	1958	1959	1960	1961	1962	Total Cumulative Production
Venezuela	951,000	1,011,000	1,041,672	1,065,734	1,167,900	16,107,000
Argentina	35,709	44,578	63,846	84,257	98,208	962,698
Colombia	46,582	53,332	55,666	53,383	50,187	1,050,478
Trinidad	37,355	40,919	42,357	45,768	48,876	804,920
Brazil	18,923	24,506	29,613	34,807	33,415	160,861
Peru	18,732	17,733	19,255	19,371	21,134	619,196
Chile	5,568	6,423	7,243	9,278	11,708	56,076
Bolivia	5,436	3,170	3,574	2,990	2,914	34,453
Ecuador	3,187	2,823	2,800	3,022	2,642	86,317
Totals	1,120,492	1,204,484	1,266,026	1,318,610	1,436,984	19,881,999
Per cent change		+7.4%	+5.1%	+4.2%	+8.9%	

TABLE II. 1962 EXPLORATION ACTIVITY IN PARTY-MONTHS

	Surface	Seismic	Gravity	Magnetometer	Structure Drill	Other	Total
Argentina	11	363	13	13	—	—	400
Bahamas	—	2	—	—	—	—	2
Bolivia	56	15	12	—	—	—	83
Brazil	175	120	71	—	—	52	418
British Honduras	—	—	—	—	3	—	3
Chile	36	56	10	10	18	—	130
Colombia	43	58	20	—	—	—	121
Costa Rica	3	4	—	—	—	—	7
Cuba (est.)	36	36	12	—	—	—	84
Ecuador	4	—	—	—	—	—	4
Guatemala	4	—	—	—	—	—	4
Honduras	2	23	5	8	—	—	38
Panama	2	—	—	—	—	—	2
Peru	70	16	5	—	12	—	103
Surinam	4	7	—	1	—	—	8
Trinidad	4	7	—	—	—	2	13
Venezuela	11	3	—	—	—	—	14
Totals	453	710	148	32	33	54	1,430

TABLE III. 1962 DRILLING STATISTICS

	Total Wells Drilled	Total Footage Drilled	Explor. Wells Drilled
Argentina	1,286	7,031,000	130
Bolivia	49	328,000	13
Brazil	178	754,000	70
British Honduras	4	22,000	4
Chile	122	769,000	19
Colombia	87	622,000	20
Costa Rica	1	8,000	1
Cuba (est.)	36	144,000	4
Ecuador	22	77,000	0
Guatemala	1	9,000	1
Panama	3	18,000	3
Peru	145	659,000	25
Trinidad (est.)	280	1,506,000	20
Venezuela	504	3,344,000	64
Totals	2,708	15,291,000	374

BRAZIL Pedro de Moura, Petroleo Brasileira S.A., Rio de Janeiro
 BRITISH P. H. A. Martin-Kaye, Director, Geological Survey, Georgetown
 GUYANA O. D. Thomas & C. D. Davidson,
 BRITISH Phillips Petroleum Co., Bartlesville, Okla.
 HONDURAS
 CHILE Carlos Santa Maria, Empresa Nacional del Petroleo, Santiago

COLOMBIA W. Ernest Aitken, Colombia-Cities Service Petroleum Corp., Bogotá
 COSTA RICA J. Roger Heggblom, Caribbean Gulf Oil Co., San Jose
 CUBA Harry Wassall and Associates, Inc., Geneva, Switzerland
 DOMINICAN Harry Wassall and Associates, Inc., Geneva, Switzerland
 REPUBLIC
 ECUADOR Anglo-Ecuadorian Oilfields, Ltd., Guayaquil
 GUATEMALA D. L. Brehm, Esso Standard (Guatemala), Inc., Guatemala
 HAITI No activity reported
 HONDURAS William L. Carr, The Pure Oil Co., Houston, Tex.
 JAMAICA Harry Wassall and Associates, Inc., Geneva, Switzerland
 NICARAGUA No activity reported
 PANAMA J. Roger Heggblom, Caribbean Gulf Oil Co., San Jose, Costa Rica
 PARAGUAY No activity reported
 PERU Victor Benavides, International Petroleum Co., Lima
 PUERTO RICO No activity reported
 RICO
 SURINAM Han C. Swoffs, Colmar Surinam Oil Co., Paramaribo
 TRINIDAD The Petroleum Association of Trinidad, Port-of-Spain

DEVELOPMENTS IN SOUTH AMERICA AND CARIBBEAN AREA 1261

TABLE XXI. SUMMARY OF DEVELOPMENT
DRILLING, BY FIELDS, IN BRAZIL, 1962

Field	Total Compl. 1962	No. Prod. Compl. 1962	Dry Holes Compl. 1962	Wells Act. Drilg. or Test. 12-31-62	Footage Drilled
Agua Grande	12	11	1	—	37,687
Boa União	—	—	—	—	4,318
Brejinha/Canabrava	1	1	—	—	4,997
Buracica	5	3	2	—	10,358
Candeias	3	2	1	3	27,116
Cassarongongo	4	3	1	—	14,715
Cedro	1	—	1 ¹	—	7,185
Dom João	52	50	2	1	61,601
Fazenda Azevedo	—	—	—	—	—
Fazenda Caruacú	—	—	—	—	—
Fazenda Estivada	—	—	—	—	—
Fazenda Panelas	—	—	—	1	4,426
Gomo	—	—	—	—	—
Itaparica	2	1	1	—	5,469
Jacarandá	1	—	1	—	6,207
Jacuipe	2	2	—	—	10,164
Lobato	—	—	—	—	—
Mapele	1	1	—	2 ²	—
Mata de S. João	—	—	—	—	—
Morro do Barro	—	—	—	—	—
Paramirim	—	—	—	—	—
Pedras	—	—	—	—	—
Pitanga	—	—	—	—	—
Pojuca Central	1	—	1	—	4,980
Quererá	2	1	1	1	11,627
Roça Grande	—	—	—	—	—
Santana	—	—	—	1	3,589
São Pedro	—	—	—	—	—
Saulpe	—	—	—	—	—
Socorro	3	2	1	—	12,241
Taquipe	8	6	2	—	30,331
Tauá	—	—	—	—	—
Piaçabuçu	—	—	—	—	—
Tabuleiro dos Martins	10	10	—	—	44,442
All wildcats	—	—	—	33	452,063
Totals	108	93 ³	15	42	753,696

¹ The well discovered oil in "A" zone, but could not be completed as oil producer due to mechanical difficulties.
² Including the directional hole.
³ One water producer.

was drilled in the Recôncavo and Tucano Basins, including a stratigraphic test in the Jatobá Basin (State of Pernambuco). Total rig-months for the year was 137. Discoveries in 1962 in this area are listed—the most significant, perhaps, being those in the Tucano Basin.

Recôncavo Basin	Reservoir	Discovery
1. FA-1-Ba (Fazenda Azevedo)	Sergí—Zona "A"	O&G
2. FE-1-Ba (Fazenda Estivada)	Candeias	Oil
3. FP-1-Ba (Fazenda Panelas)	Ilhas Sand & Zona "A"	O&G
4. GoX-3-Ba (Gomo Ext. No. 3)	Ilhas Sand	Oil
5. MB-1-Ba (Morro do Barro)	Sergí	Gas
6. MB-2-Ba (Morro do Barro)	Ilhas Sand	Gas
7. Sa-1-Ba (Santana)	Zona "A"	Oil
Tucano Basin		
8. Qe-1-Ba (Quererá)	Ilhas Sand	Oil
9. Qex-1-Ba (Quererá Extensão 1)	Candeias Sand	Gas

Ninety-nine proved field wells were drilled. Of these, 78 were oil, 4 were gas, 1 was completed as a water producer, and 16 were abandoned dry. Distribution of these 99 wells by fields is as follows.

1. Agua Grande	12	5. Candeias	3
2. Boa União	1	6. Cassarongongo	4
3. Brejinha/Canabrava	1	7. Cedro	1
4. Buracica	5	8. Dom João	52

9. Itaparica	2	13. Pojuca Central	1
10. Jacarandá	1	14. Quererá	2
11. Jacuipe	2	15. Socorro	3
12. Mapele	1	16. Taquipe	8

PARANÁ BASIN

Two surface geological parties, 1 seismic refraction crew, 1 gravity crew, and 1 electro-resistivity crew were active in the Paraná Basin. Electro-resistivity work has furnished good results and the use of this tool will be continued this year (1963) and will possibly be extended to the other Brazilian basins if usable results continue to be forthcoming.

In the Paraná Basin, 70,994 ft. of exploratory hole was drilled in 1962 as a result of 72 rig-months work. From the point of view of oil discoveries, the results were not encouraging. TV-3-SC, a wildcat in the State of Santa Catarina, did not find the Rio Bonito Sandstone (subcommercial gas reservoir discovered last year in the wildcat TV-1-SC), due to lateral facies change. However, more information has been developed on the area and a fourth test will be drilled this year.

Please turn the page for Table XXII.

BRITISH GUIANA

(By P. H. A. MARTIN-KAYE, director, Geological Survey, Georgetown)

There was no oil production or exploration in British Guiana in 1962. However, two companies (Gulf States Land & Industries, Inc., and Sinclair BP) filed applications for offshore exploration rights, and these applications are under consideration by the Government. In view of the heightening interest in the country's oil potential, the Government enlisted the assistance of United Nations technical advice. Early in the year, Robert McCall made recommendations to the Government of British Guiana on leasing policy and, later, two Russian geologists, V. V. Fedynsky and S. N. Simakov, visited the country to appraise the oil prospects on the basis of existing data. It is anticipated that their report will be published shortly.

PUERTO RICO

No 1962 oil development in Puerto Rico was brought to our attention.

SURINAM

(By HAN C. SWOLFS, Colmar Surinam Oil Company, Paramaribo)

The Colmar Surinam Oil Company continued its over-water seismic survey, which had been initiated in November, 1961, into mid-August of 1962. This work was carried out under contract with Marine Geophysical International, Inc. A total of 4,000 km. of profile was shot during the year and interpretation of this material is still in progress. In March, opportunity was taken to extend aeromagnetic coverage essentially all the way across the submerged shelf when Canadian Aero Mineral Surveys Limited flew 1,460 km. of profile out to a pivot-point some 550 km. from the coast. During the year, stratigraphic knowledge of the coastal area was materially increased by work on core samples from Government water wells, which work was carried out by several groups including van der Hammen of Leiden, the Netherlands. Encouraged by the outcome of the work completed to date, the Colmar Surinam Oil Company plans to continue its exploratory effort in 1963.

TRINIDAD (Tables LII-LVI)

(By THE PETROLEUM ASSOCIATION OF TRINIDAD, Port-of-Spain)

INTRODUCTION

Table LII summarizes the over-all drilling and producing activities in Trinidad. During the year an estimated 4 party-months of surface geological work, 2 party-months of auger work, and 7 party-months of seismic work were completed.

GEOLOGICAL AND EXPLORATORY DRILLING

BP (Trinidad) Limited drilled 5 exploration wells on land, and one exploration well, ACd-4, in the former Apex Cedros lease, was drilling at the year-end.

TABLE LII. SUMMARY OF DRILLING AND PRODUCTION IN TRINIDAD

	1962	1961
Total crude production (bbls.)	48,876,144	45,767,772
Average number of drilling strings	23	23
Wells completed	280	288
Producers (oil or gas)	255	245
Success ratio	91%	85%
Footage drilled	1,506,187	1,426,064

In the Apex Coora field, A.Co-1 was drilled to the Herrera sands in the underthrust unit of the Penal-Barrackpore structure, but was abandoned after testing these sands through stuck drill pipe. In the Moruga North field, MN-186 was abandoned after finding wet Herrera sands in the same thrust block as the Shell wells IN-1 and IN-20, and, in the Moruga South lease, MS-192 was completed as a small but uncommercial gas producer from lower Cruse sands on the south flank of the Southern Range anticline. In the Apex Palo Seco field, APS-2 was abandoned after encountering watered Lower Cruse sands and APS-3 was also abandoned when thin lower Cruse sands proved to be non-commercial.

TABLE LIII. SUMMARY OF WELL COMPLETIONS IN TRINIDAD FOR 1962

	Gas or Oil	Aband.	Sus.	Total	% Success.
Explor. wells	6	14	0	20	43%
Devel. wells	249	9	2	260	91%
Total wells	255	23	2	280	91%

Six semi-exploration wells were completed during the year and one was drilling at the year end in the Quarry field. In three instances, a pup-well was drilled to the main semi-exploration well in order to obtain an early evaluation of shallow sands. In the Palo Seco field, 4 main wells and 2 pup-wells were successful and in the Quarry field, 2 main wells were successful lower Cruse producers, but the pup-well was only a small gas producer from the Forest sands.

One field party was augering for two months, intermittently during the year.

Dominion Oil Limited spudded during December its only exploration well, Couva Marine-2, sited 5 mi. west of Couva Bay. In the same month, a marine sparker-geophysical survey and bottom sampling program was commenced off the East coast. Surface geological work was done in the Central Range, on the Icacos Peninsula and in southeastern Trinidad.

Premier Consolidated Oilfields Limited did no exploratory drilling during the year.

Shell Trinidad Limited drilled one exploration well (R-3) during the year, which was sited in their Rock Dome concession. The well was lost at a depth of 6,276 ft. while in the Cretaceous. A side-tracked hole to 5,150 ft. (Well R-3X) failed to find commercial prospects in this formation

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Coral Gables, Florida

ABSTRACT

This review covers 23 reporting countries—9 of which are established producers of petroleum. Oil production for 1963 totalled 1,468 million barrels—up a modest 2.2% over the preceding year. About 80% of this production came from Venezuela. Geological or geophysical work in 1963 was done in 14 reporting countries, and exploratory drilling was carried out in 12 countries. Tabulations reflect a moderate slowing of the tempo in 1963 in the over-all industry search for new reserves in the Caribbean area and South America when compared with 1962. Geological and geophysical field effort in 1963 totalled 1,334 party-months of work—down 7% from the preceding year. Exploratory drilling in 1963 was down 12%. 329 wildcats were drilled; 83 of these were completed as oil or gas producers for a success ratio of 25%. Development drilling was down 22%.

INTRODUCTION

1963 petroleum production from South America and the Caribbean area totalled 1,468 million bbls.—an increase of only 2.2% over the 1962 figure. This increase is in rather marked contrast to the annual increases recorded over the preceding 5 years which varied from a low of 4.2% to a high of 9.0% and averaged 6.3% per year for the 5-year period. Although oil is produced in 9 countries in this part of the world—and has been for many years—the great bulk of South American production comes from one country—Venezuela. Table I shows the annual crude oil production of each of the 9 producing countries each year for the past 6 years, as well as their cumulative totals through 1963. During the year, Argentina became the third country of this area whose cumulative production has passed the billion-barrel mark. Perhaps the most significant increase in production in 1963 that was recorded from any one country in the area was that of Colombia which posted 60,707,000 bbls. in 1963 against only 50,144,000 bbls. in 1962.

Geological and geophysical effort expended in 1963 in this part of the world in the search of new discoveries and new reserves totalled 1,334 party-months. This total effort was expended in 14 countries (see Table II) and, when compared with the preceding year, records a modest 7% decline in this type of work. Almost half of this work was seismic. In 1963, Argentina and Brazil alone accounted for 810 party-months of geological and

geophysical work, or 60% of the total field effort.

Exploratory drilling in South America and the Caribbean area declined from 374 exploratory wells in 1962 to only 329 such wells in 1963. About 65% of the 1963 exploratory wells were drilled in 3 countries—Argentina, Brazil, and Venezuela. Of the 1963 wildcats, 83 were completed as oil or gas producers, for a success ratio of 25%. In addition, 1,824 development wells were completed in 1963 compared with 2,334 such wells in 1962—a decline of 22%. Total footage drilled (exploratory plus development) also declined about 22% below the 1962 figure. A substantial reduction in drilling effort occurred in Argentina, but Argentina still accounted for 37% of the entire footage drilled, as well as for 37% of the total of all wells drilled during the year in the area under review. Table III presents a break-down of drilling statistics by countries.

The discovery of the year may be the Texpet-Gulf Orito-1 completion in the Putumayo area in the Amazon drainage basin just east of the Andean foothills in southern Colombia about 30 mi. north of the Ecuador border. Confirmation tests, Orito-2 and Orito-3, have been completed and Texpet-Gulf is currently drilling 4 new-field wildcats in this remote area to evaluate and qualify adjoining concessions blocks. YPF's 1963 discovery, Vi-3 in northern Mendoza, Argentina, which tested more than 1,200 BOD from the Conglomerado Rojo Superior at the base of the Tertiary is described herein as the most important discovery in that area in many years. Finally, Shell's deeper pool test VLE-400 in Lake Maracaibo created considerable excitement when it was

¹ Manuscript received, May 29, 1964.

² Gulf Oil Corporation, Coral Gables, Florida.

DEVELOPMENTS IN SOUTH AMERICA AND CARIBBEAN AREA

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TABLE I. ANNUAL OIL PRODUCTION, 1958-1963
(Thousands of Barrels)

Country	1958	1959	1960	1961	1962	1963	Total Cumulative Production
Venezuela	951,000	1,011,000	1,041,672	1,065,734	1,167,900	1,185,520	17,293,000
Argentina	35,709	44,378	63,846	84,390*	98,208	97,169	1,059,867
Colombia	46,582	53,332	55,666	53,383	50,144*	60,707	1,111,142
Trinidad	37,355	40,919	42,357	45,768	48,876	48,678	853,598
Brazil	18,923	24,506	29,613	34,807	33,401*	35,714	195,563
Peru	18,732	17,733	19,253	19,371	21,134	21,468	640,663
Chile	5,568	6,423	7,243	9,278	11,708	13,223	69,298
Bolivia	3,436	3,170	3,574	2,990	2,917*	3,401	37,902*
Ecuador	3,187	2,823	2,800	3,028*	2,642	2,547	88,573*
Totals	1,120,492	1,204,484	1,266,026	1,318,749*	1,436,930*	1,468,427	21,450,606
Per cent change	+7.4%	+5.1%	+4.2%	+9.0%	+2.2%		

* Includes small correction over figure presented last year.

reported to have tested the first Cretaceous oil in the lake. As of the year-end, this Shell well was reported as "suspended," and no final test results have yet been brought to our attention.

The remainder of this report consists of individual sections contributed by correspondents, each section covering one of the 23 reporting countries, with the countries arranged for convenience in alphabetical order. The reader in every case is referred to these country-by-country reports for local highlights and details. Wherever desirable and possible, pertinent maps and statistical tables accompany these sections on the individual countries. As a special feature this year, the reader's attention is directed to the wildcat location maps submitted for the Bahamas, British Honduras, SE. Costa Rica-NW. Panama, Ecuador, Guatemala, and Offshore Trinidad. These particular maps attempt to show all of the significant wildcats that have been *drilled to date* in the subject areas.

ACKNOWLEDGMENTS

Grateful acknowledgment is made to the following companies and individuals for their part in supplying information toward, or in contributing whole sections to, this 1963 Review of Petroleum Developments in South America and the Caribbean area:

ARGENTINA	Eduardo Padula, Yacimientos Petrolíferos Fiscales, Buenos Aires
BAHAMAS	R. B. Mitchell, California Exploration Company, Coral Gables, Florida
BARBADOS	Harry Wassall and Associates, Inc., Geneva, Switzerland
BOLIVIA	P. H. Baadsgaard, Bolivian Gulf Oil Company, Santa Cruz
BRAZIL	Pedro de Moura, Petróleo Brasileira S. A., Rio de Janeiro
BRITISH GUIANA	P. H. A. Martin-Kaye, Director, Geological Survey, Georgetown
BRITISH HONDURAS	C. D. Davidson, Phillips Petroleum Company, Bartlesville, Oklahoma
CHILE	Carlos Santa Maria, Empresa Nacional del Petróleo, Santiago
COLOMBIA	W. Ernest Aitken, Colombia-Cities Service Petroleum Corp., Bogotá

TABLE II. 1963 EXPLORATION ACTIVITY IN PARTY-MONTHS

Country	Surface	Seismic	Gravity	Magnetometer	Structure Drill	Other	Total
Argentina	31	271	12	0	0	0	314
Bahamas	0	4	0	0	0	0	4
Bolivia	43	154	114	0	0	0	70
Brazil	192	134	134	0	0	36	496
British Guiana	0	1	1	0	0	0	2
Chile	36	91	0	0	0	0	127
Colombia	55½	73	14	0	0	0	142½
Costa Rica	0	2	0	0	4	0	6
Cuba (estimated)	x	12	12	x	x	x	24
Ecuador	0	0	0	0	0	0	0
Honduras	0	1	6	2	0	0	9
Nicaragua	0	0	0	0	0	0	0
Panama	0	1	0	0	0	0	1
Peru	67	12	18	1	1	0	99
Puerto Rico	0	0	7	7	0	0	7
Trinidad	11	12	0	0	0	0	23
Venezuela	6	14	0	0	0	0	20
Totals	441½	640	208½	3	5	36	1,334

TABLE III. 1963 DRILLING STATISTICS

Country	Total Wells Drilled	Total Footage Drilled	Expl. Wells Drilled	Expl. Wells Success
Argentina	803	4,338,722	76	21
Bahamas	0	0	0	0
Bolivia	49	424,351	10	1
Brazil	202	802,000	89	14
British Guiana	0	0	0	0
British Honduras	1	3,453	1	0
Chile	95	633,000	14	2
Colombia	90	622,808	22	7
Costa Rica	2	14,945	2	0
Ecuador	31	84,990	0	0
Guatemala	0	0	0	0
Honduras	1	13,898	1	0
Panama	0	0	0	0
Peru	148	712,846	26	9
Trinidad	234	1,246,148	37	17
Venezuela	497	2,936,000	51	12
Totals	2,153	11,833,161	329	83

COSTA RICA	H. H. Fischborn, Caribbean Gulf Oil Company, San Jose
CUBA	Harry Wassall and Associates, Inc., Geneva, Switzerland
DOMINICAN REPUBLIC	Harry Wassall and Associates, Inc., Geneva, Switzerland
ECUADOR	Anglo-Ecuadorian Oilfields, Ltd., Guayaquil
GUATEMALA	L. C. Lamar, Standard Oil Company (New Jersey), New York, New York
HAITI	No activity reported
HONDURAS	Kenneth T. Smith, The Pure Oil Company, Houston, Texas
JAMAICA	Harry Wassall and Associates, Inc., Geneva, Switzerland
NICARAGUA	Harry Wassall and Associates, Inc., Geneva, Switzerland
PANAMA	H. H. Fischborn, Caribbean Gulf Oil Company, San Jose, Costa Rica
PERU	Victor Benavides, International Petroleum Company, Lima
PUERTO RICO	Harry Wassall and Associates, Inc., Geneva, Switzerland
EL SALVADOR	No activity reported
SURINAM	Han C. Swolfs, Gulf States Land & Industries, New York, New York
TRINIDAD	The Petroleum Association of Trinidad, Port-of-Spain American International Oil Company, New York, New York

TABLE IV. WELLS DRILLED IN ARGENTINA, 1963

Company	Wells Drilled			Total
	Wildcat	Outpost	Development	
Y.P.F.	57	108	89	254
Pan American	—	—	—	—
Union Oil	—	—	17	17
Tennessee	6	—	3	9
Cities Service	1	—	44	45
Shell Argentina	8	—	—	8
Astra Santa Cruz	—	—	56	56
Esso Inc.	1	—	—	1
Cadipca	—	—	9	9
Transworld (YPF contract)	—	—	125	125
Southeastern (YPF contract)	—	—	276	276
Continental	3	—	—	3
Total	76	108	619	803

Dominion Oil Limited, Port-of-Spain
Texaco Oil Company, Inc., Port-of-Spain
VENEZUELA Neal R. Van Middlesworth, Venezuelan Oil Scouting Agency, Caracas
Gordon Young, Mene Grande Oil Company, Caracas

ARGENTINA (Fig. 1; Tables IV-X)

(By Dr. EDUARDO L. PADULA, Yacimientos Petroliferos Fiscales, Buenos Aires)

During 1963 petroleum activity in Argentina continued at a high level. The total petroleum produced by YPF, the contracting companies, and by private companies from the old concessions was 15,448,393 cu. m. (97,169,509 bbls.). Gas production by YPF during the year was 5,510,102,000 cu. m. (194,586 million cu. ft.), an increase of 7.2% over last year's production of 5,137,275,000 cu. m. (181,421 million cu. ft.). The total number of wells drilled in Argentina was 803, classified as follows.

Wildcat wells	76
Outpost wells	108
Development wells	619
	803

This classification is shown broken down by companies in Table IV. A brief summary of well completion results for the year is presented in Table V.

During 1963, 33 geophysical parties and 3 geological parties were active in Argentina. YPF itself carried out 31 party-months of geological field work, 271 party-months of seismic work, and 12 party-months of gravimeter work. Over-all exploratory activity by YPF in 1963 resulted in the discovery of 6 new oil or gas fields (Table VI). Some details concerning this work are given in the following paragraphs.

RÉSUMÉ OF WORK CARRIED OUT BY YPF, 1963

During the year YPF carried out exploration operations in the following provinces: Buenos Aires, Córdoba, Corrientes, Chaco, Chubut, Formosa, La Pampa, Mendoza, Neuquén, Rio Negro, Salta, Santa Cruz, San Luis, Santiago del Estero,

TABLE V. SUMMARY OF WELL COMPLETION RESULTS IN ARGENTINA, 1963

	Oil or Gas	Aban.	Total
Wildcat and outpost tests	104	80	184
Development wells	557	62	619
Totals	661	142	803

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PARANÁ BASIN

During the year 12 wildcats were completed and totalled 83,395 ft. of depth. No discoveries have been made to date in this great Paleozoic basin. The existence of a vast thickness of basaltic lava over a large part of the basin together with the existence of thick layers of diabase in the stratigraphic section make the mapping of subsurface structures by geophysical methods very difficult. The Exploration Department maintains sedimentology and paleontology laboratories in the area. During 1964 a comprehensive review of all available data and ideas will be made in an attempt to solve some of the special local geological problems. It is hoped that this review will afford new and valuable leads to follow in 1964-1965.

BRITISH GUIANA

(By P. H. A. MARTIN-KAYE, director, Geological Survey Department, Georgetown, British Guiana)

In March and April, two geophysicists of the Overseas Geological Surveys in London visited British Guiana in order to carry out some preliminary seismic and gravity surveys of the coastal sediments around Georgetown and a gravity survey in the northern savannas of the Rupununi District. The results of the seismic survey, which are tied in with previous oil-company work in offshore and other coastal areas, indicate that the sediments thin from 3,000 ft. to the immediate east of Georgetown to about 300 ft. in the region of the Essequibo River mouth. From the data obtained it appears that there is no appreciable large scale faulting in the area covered by the new work, and that the basement floor dips gently eastward. The presence of faults of less than a few hundred feet would not, however, be demonstrated by the methods used.

The gravity survey in the northern savannas of the Rupununi District in the south-central part of the country, more than 200 mi. inland from the coast, followed aeromagnetic data which suggested that a considerable thickness of sediments overlies the crystalline basement in this area. The gravity work confirmed the existence of a graben structure containing sediments up to 20,000 ft. thick in places.

No oil companies hold oil concessions in British Guiana at the present time.

A new colored Geological Map of British Gui-

ana on a scale of 1:1,000,000 was issued by the Geological Survey in 1963. Copies may be obtained from the Geological Survey Department, Georgetown, British Guiana. Price: 10 Shillings (\$2.40 BWD).

BRITISH HONDURAS (Fig. 9)

(By C. D. DAVIDSON, Phillips Petroleum Co., Bartlesville, Oklahoma)

Phillips Petroleum Company was the only company to carry out exploration activity in British Honduras during 1963. Phillips' activity was limited to the drilling, in the early part of the year, of the No. 1 San Jose wildcat which was located on the mainland 5 mi. north of the village of San Antonio in Southern British Honduras (Fig. 9). This new-field wildcat was drilled at Lat. 16° 17' N. and Long. 89° 03' W. The location was based on surface geological work. The No. 1 San Jose was spudded in Upper Cretaceous limestone and was drilled to total depth of 3,453 ft. to bottom in Macal Shale (Permian). No shows were encountered.

Near mid-year, British Honduras Gulf Oil Co. initiated actions to surrender back to the Government Gulf's 3 remaining Mining Leases and 2 remaining Prospecting Licenses (all 5 blocks were in the northern part of the country), and Gulf now holds no significant acreage in British Honduras. During the year Phillips reduced its holding in British Honduras by 874,000 acres. At year-end, Phillips still held 1,152,000 net acres in Oil Prospecting Licenses and Leases.

CHILE (Fig. 10; Tables XXV-XXX)

(By Ing. CARLOS SANTA MARIA, Empresa Nacional del Petróleo, Santiago)

LEGISLATION

During 1963 there were no changes in legislation affecting the oil industry except modifications in tax legislation which cover all lines of industry—both national and foreign.

EXPLORATION

Over-all petroleum exploration activity decreased slightly from 130 party-months in 1962 to 127 party-months in 1963 and, in the same period, wildcat well completions decreased from 19 to 14. Total footage drilled (both exploratory and development) decreased from 769,000 to 633,000. Breakdowns revealing further details of this over-

EL SALVADOR

No 1963 exploratory development in El Salvador was brought to our attention. However, during the year a new 12,750 barrel-a-day refinery in San Salvador was placed on stream by an affiliate of SONJ.

SURINAM (Fig. 19)

(By Dr. HAN C. SWOLFS, Gulf States Land & Industries, Inc., New York, N. Y.)

Exploration activities in Surinam by the Colmar group were continued into 1963 with the spudding of the first well on this group's offshore holdings on December 11. The well, Surinam Offshore No. 1, is located 55 mi. off the coast and north of the city of Paramaribo, in 146 ft. of water. Drilling was discontinued in February, 1964, at total depth of 4,428 ft. The operation was carried out by Global Marine Caribbean S. A. with its drilling vessel "The Western Explorer." The well cut an entirely marine section and bottomed in lowermost Miocene sediments. Gulf States Land and Industries, Inc., and a French Group headed by Petropar are partners in this venture and will continue their activities in the near future with a more detailed seismic survey preparatory to further drilling.

TRINIDAD (Fig. 20; Tables LIV-LIX)

(By the PETROLEUM ASSOCIATION OF TRINIDAD, Port-of-Spain)

Table LIV summarizes and compares over-all drilling and production activity in Trinidad for the years 1961, 1962, and 1963.

TABLE LIV. SUMMARY OF DRILLING AND PRODUCTION ACTIVITY IN TRINIDAD

	1961	1962	1963
Crude prod. (bbls.)	45,767,772	48,876,144	48,678,300
Av. drilling strings	23	23	19
Wells completed	288	280	234
Producers (oil or gas)	243	235	203
Success ratio	85%	91%	87%
Footage drilled	1,426,004	1,506,187	1,246,148

EXPLORATION ACTIVITY

Eleven party-months of geological field work, 10 party-months of land seismic work, and about 2 party-months of marine seismic work were reported for Trinidad for 1963. Eighteen appraisal wells and 19 semi-appraisal wells were completed during the year with results as presented in Table LV. On December 31, 5 rigs were active on appraisal drilling.



FIG. 19.—Surinam, location of 1963 wildcat well.

Some details of this exploration activity for the year by companies are presented here.

BP (Trinidad) Limited.—On the onshore leases, only one appraisal well was completed during 1963. This was Apex Cedros 4 which was abandoned at 15,128 ft. This well is located downdip at the western end of the north flank of the Southern Range anticline.

In the Palo Seco field, 3 semi-appraisal wells were drilled and all were successful. Palo Seco 537 proved marginally commercial eastward extensions of the Forest and Cruse reservoirs already being exploited in South Palo Seco. Palo Seco 541, located north of the Los Bajos fault, proved commercial production from the Forest sands and also proved a downdip limit of oil accumulation in the Lower Morne l'Enfer. Palo Seco 553, also north of the Los Bajos fault, is situated between Texaco's

TABLE LV. SUMMARY OF RESULTS OF EXPLORATORY DRILLING IN TRINIDAD IN 1963

	Gas or Oil	Aban.	Total	% Success
Appraisal wells	4	14	18	22
Semi-appraisal wells	13	6	19	70
Totals	17	20	37	46

REVIEW OF 1964 PETROLEUM DEVELOPMENTS IN SOUTH AMERICA AND CARIBBEAN AREA¹

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ABSTRACT

This review includes 26 reporting countries within the subject area—10 of which are established producers of petroleum and collectively account for 15% of total world production. The total production from these countries rose for the sixth successive year and for 1964 averaged 4,183,450 b/d—up 4.3% from 1963. Of this production, 81% comes from Venezuela, and Venezuela continues to be the world's largest exporter of petroleum. Geological and geophysical activity in the search for new reserves totalled 1,418 party-months—up 6% over 1963. More than 75% of this work was done in 3 countries—Argentina, Brazil, and Colombia. In the review area, 328 exploratory wells were drilled, 131 of which were successful. Development drilling continued to decline; there were 2,334 such wells drilled in 1962, 1,824 in 1963, and 1,652 in 1964. Much of this decline in development drilling was in Argentina. Accompanying the text are 26 maps, figures, and 73 tables.

INTRODUCTION

Increases in oil production were reported this year from 8 of the 10 producing countries in South America and the Caribbean area, and total 1964 production from this area averaged 4,183,450 b/d—an increase of almost 4.3% above the 1963 figure (Tables I, II). As a result, this segment of the world produced just over 15% of estimated 1964 total world production. Cumulative production at the end of 1964 was almost 22.9 billion bbls.—just over 14% of the world total. On the other hand, remaining reserves from this area have been reported to be just under 7% of the world total. The bulk of this production comes from Venezuela, and Venezuela continues to be the world's largest exporter of petroleum.

The over-all geological and geophysical effort

¹ Manuscript received, April 19, 1965.

² Gulf Oil Corporation.

TABLE II. 1964 OIL PRODUCTION

Country	Barrels Per Day
Venezuela	3,392,505
Argentina	274,235
Colombia	171,628
Trinidad	135,877
Brazil	91,014
Perú	63,167
Chile	37,445
Bolivia	8,989
Ecuador	7,877
Cuba	714
Total	4,183,451

expended in 1964 in the search for new discoveries and new reserves totalled 1,418 party-months (Table III) in 10 countries. Compared with the preceding year, it reflects a 6% increase in this type of work. Almost half of this total effort was seismic. In 1964, 3 countries, Argentina, Brazil, and Colombia, accounted for 1,073 party-months of geological and geophysical work—more than 75% of the total effort.

TABLE I. ANNUAL OIL PRODUCTION, 1959-1964
(Thousands of Barrels)

Country	1959	1960	1961	1962	1963	1964	Total Cumulative Production
Venezuela	1,011,000	1,041,672	1,065,734	1,167,900	1,185,520	1,241,657	18,535,000
Argentina	44,578	63,846	84,390	98,208	97,143 ^a	100,370	1,160,236
Colombia	53,332	55,666	53,383	50,144	60,720 ^a	62,816	1,173,937
Trinidad	40,919	42,357	45,768	48,876	48,678	49,731	903,238
Brazil	24,506	29,613	34,807	33,401	35,714	33,311	229,874
Perú	17,733	19,255	19,371	21,134	21,468	23,119	665,782
Chile	6,423	7,243	9,278	11,708	13,223	13,705	83,003
Bolivia	3,170	3,574	2,990	2,917	3,404 ^a	3,290	41,124
Ecuador	2,823	2,800	3,028	2,642	2,547	2,883	91,456
Cuba	b	b	b	b	216	261	b
Totals	1,204,484	1,266,026	1,318,749	1,436,930	1,468,633 ^a	1,531,143	22,881,650
Per cent change		+5.1%	+4.2%	+9.0%	+2.2%	+4.3%	

^a Includes small correction over figure presented last year.

^b Official figures not available. Estimated cumulative production is close to 6 million bbls.

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TABLE III. 1964 EXPLORATION ACTIVITY
IN PARTY-MONTHS

Country	Surf.	Seis.	Grav.	Mag.	Struc. Drill	Other	Total
Argentina	48	264	12	0	0	0	324
Bolivia	50	31	12	0	0	0	93
Brazil	180	144	117	0	0	52	493
Chile	32	84	0	0	0	0	116
Colombia	143	96	16	1	0	0	256
Cuba	0	24	19	0	0	0	43
Dominican Republic	?	0	0	0	0	0	?
Ecuador	6	0	0	0	0	0	6
Guatemala	0	0	0	0	0	0	0
Perú	47	4	6	0	6	0	63
Trinidad	14	0	0	0	0	1	15
Venezuela	6	3	0	0	0	0	9
Totals	526	650	182	1	6	53	1,418

Drilling during 1964 in South America and the Caribbean area totalled 328 exploratory wells compared with 329 in 1963. Of the 328 exploratory wells, 131 were completed as oil producers for a success percentage of 40. Eighty-six of these exploratory wells were drilled in Brazil alone. In 1964, 1,652 development wells were completed in this part of the world compared with 1,824 in 1963—a decline of 9%. Total footage drilled (exploratory plus development) declined about 8% below the 1963 figure. Drilling statistics by countries are presented in Table IV. A substantial reduction in drilling effort occurred in Argentina but this was, in part, offset by an increase in Venezuela.

The discoveries of the year could be 1 or more of the 4 completions in Cretaceous limestone that finally were achieved under Lake Maracaibo, but more information is needed before a firm evaluation can be made. Cerro de Pasco may have a gas-condensate discovery in the Oriente of Perú where the Oxapampa 19-1 was awaiting testing. Brazil's 1963 Carmópolis discovery in Sergipe Province developed, during 1964, into a potentially significant new producing area 150 mi. north of Brazil's established Bahia fields. Carmópolis may prove to be Brazil's largest single field yet discovered. It produces 20° API oil—mixed base—from Lower Cretaceous sandstones. Finally, 1964 step-out drilling in the Texpet-Gulf Orito field in the Putumayo area of southern Colombia near the Ecuadorian border gave 5 producers out of 5 wells drilled, and there were 7 wells in this field at year-end.

A new 12-10-inch pipeline across the Andes from the Santa Cruz area of Bolivia to join with the existing Sicasica-Arica line to the Pacific was under construction at year-end. Under discussion at year-end was a pipeline across the Andes from

TABLE IV. 1964 DRILLING STATISTICS

Country	Total Wells Drill.	Total Footage Drilled	Expl. Wells	Expl. Wells Success
Argentina	450	2,673,301	55	15
Bolivia	40	316,731	13	8
Brazil	233	863,336	86	24
Chile	107	700,350	14	4
Colombia	80	609,235	30	8
Cuba	36	113,723	7	3
Dominican Republic	0	?	?	0
Ecuador	50	138,361	6	3
Guatemala	0	320	0	0
Perú	142	793,462	8	3
Suriname	1	4,428	1	0
Trinidad	194	1,056,337	53	39
Venezuela	647	3,550,000	55	24
Totals	1,980	10,819,584	328	131

^a Two wells drilling at year-end.
^b One well drilling at year-end.

the Putumayo area of southern Colombia to the Pacific. These two significant lines will provide outlets to the world market for newly discovered reserves being developed east of the Andes.

The remainder of this report consists of individual sections contributed by correspondents, each section covering one of 26 reporting countries, with the countries arranged for convenience in alphabetical order. The reader in every case is referred to these country-by-country reports for local highlights and details. Wherever desirable and possible, pertinent maps and statistical tables accompany these sections on the individual countries. This year the report on Trinidad was prepared for the first time by the newly established Ministry of Petroleum and Mines for Trinidad and Tobago. Also, as a special feature this year, the reader's attention is directed to the wildcat location map (and related tables) submitted for the Santa Elena Peninsula area of Ecuador, and for the Magallanes area of Chile. These two maps and tables locate—and present some data on—all significant wildcats drilled to date in these interesting areas.

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BAHAMAS	R. B. Mitchell, California Exploration Company, Coral Gables, Florida

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BARBADOS	Harry Wassall & Associates, Inc., Geneva, Switzerland
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BRAZIL	Pedro de Moura, Petróleo Brasileiro S. A., Rio de Janeiro
BRITISH GUIANA	P. H. A. Martin-Kaye, Director, Geological Survey Department, Georgetown
BRITISH HONDURAS	C. D. Davidson, Phillips Petroleum Company, Bartlesville, Oklahoma
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JAMAICA	Harry Wassall & Associates, Inc., Geneva, Switzerland
NICARAGUA	Harry Wassall & Associates, Inc., Geneva, Switzerland
PANAMÁ	Harry Wassall & Associates, Inc., Geneva, Switzerland
PERÚ	Victor Benavides, International Petroleum Company, Ltd., Lima
PUERTO RICO	Harry Wassall & Associates, Inc., Geneva, Switzerland
EL SALVADOR	No activity reported
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VENEZUELA	Neal R. VanMiddlesworth, Venezuelan Oil Scouting Agency, Caracas John Garrett, Mene Grande Oil Company, Caracas

ARGENTINA (Fig. 1; Tables V-XII)

(By DR. EDUARDO L. PADULA, Yacimientos Petrolíferos Fiscales, Buenos Aires)

Note by Compiling Authors: Unfortunately, no text accompanied the material received this year from Argentina. We did receive the Statistical Tables V through XII. The map (Fig. 1) locates YPF's 9 most significant 1964 wildcats. These tables and the map are presented herein.

TABLE V. TOTAL OIL PRODUCTION IN ARGENTINA
(In Cubic Meters)

1963	1964	Cumulative through December, 1964
15,444,151 m ³ (97,142,827 bbls.)	15,957,178 m ³ (100,369,738 bbls.)	184,458,889 m ³ (1.160 billion bbls.)

TABLE VI. TOTAL GAS PRODUCTION IN ARGENTINA
(In Cubic Meters)

1963	1964
5,510,102,000 m ³	6,100,000,000 m ³

TABLE VII. PARTY-MONTHS OF GEOLOGICAL AND GEOPHYSICAL EXPLORATION IN ARGENTINA

Year	Surf. Geol.	Seis.	Grav.-Mag.	Total
1964	48	264	12	324
1963	31	271	12	314
1962	11	363	26	400

TABLE VIII. SUMMARY OF WELL COMPLETIONS IN ARGENTINA, 1964

	Oil	Gas	Aban.	Susp.	Total	% Success
Explor. tests	14	1	39	1	55	28
Devel. wells	318	25	47	5	395	88
Totals	332	26	86	6	450	81

TABLE IX. IMPORTANT DISCOVERIES IN ARGENTINA, 1964

Well Name	Province	Basis for Location	Logos Class.	Compl. Date	Total Depth (Feet)	Name and (or) Age Deepest Formation	Result
SLB-1	Santa Cruz	Seismic	NFW	July 8	8,136	Springhill, L. Cret.	Gas & Cond.
SCHB-1	Santa Cruz	Seismic	NFW	October 23	5,630	Springhill, L. Cret.	Oil
T-124	Chubut	Geol.-Seis.	EXT	April 13	3,898	Chubutiano, U. Cret.	Oil
ChCT-1	Chubut	Geol.-Seis.	NPW	August 10	5,807	Chubutiano, U. Cret.	Oil
ChVH-3	Chubut	Geol.-Seis.	NPW	October 5	5,663	Chubutiano, U. Cret.	Oil
ChVH-1	Chubut	Geol.-Seis.	EXT	October 12	6,201	Chubutiano, U. Cret.	Oil
ChVH-2	Chubut	Geol.-Seis.	EXT	November 20	5,951	Chubutiano, U. Cret.	Oil
ChVH-4	Chubut	Geol.-Seis.	EXT	December 18	5,935	Chubutiano, U. Cret.	Oil
RNA-1	Río Negro	Seismic	NPW	November 17	4,665	Neocomian	Gas

Note: The general location for each of the above wells is shown on Figure 1.

TABLE XXV. TOTAL FOOTAGE DRILLED
IN BRAZIL IN 1964

Field	Footage Drilled
Agua Grande	13,295
Buracica	47,139
Candeias	65,315
Dom João	93,691
Fazenda Azevedo	7,075
Fazenda Caruaçu	24,355
Santana	17,585
Taquipe	19,987
São Pedro	7,046
Quererá	16,445
All others	64,740
Subtotal	376,673
All wildcats	486,663
Grand total	863,336

6) was delimited during the year. Its oil-in-place is relatively small—about 0.8×10^6 cu. m. (5 million bbls.).

Neither of the above-mentioned new fields was on production by December 31, 1964; as of that date, commercial oil production in the Sergipe-Alagoas basin was confined to the Taboleiro do Martins field, near Maceió, with an average daily production of 800 bbls.

Laboratories of paleontology and sedimentology have been installed in Maceió, and began operations during May.

PARANÁ BASIN

(Fig. 7)

The Paleozoic basin of Paraná covers a great area of southern Brazil, including the States of São Paulo, Santa Catarina, Paraná, Mato Grosso, Rio Grande do Sul, and a part of Minas Gerais.

Exploration activity in this great area consisted of 36 party-months of surface geology, 8 crew-

months of gravimeter, and 12 crew-months of electro-resistivity. Furthermore, 2 rigs operated during the year and completed 3 wells for a total of 5,130 m. (16,831 ft.). One of the rigs was also occupied with the re-testing of wells TVst-1-SC and TV-2-SC (Taquara Verde, Santa Catarina) that formerly had shows of gas which needed re-evaluation. The TVst-1-SC was found to be a subcommercial gas well (21,600,000 cu. ft. of gas per day with 0.1% of helium). No oil discovery was made during the year.

A separate paleontological laboratory operated in the area during the whole year, and a sedimentological laboratory is in the process of being installed.

BRITISH GUIANA

(By Dr. P. H. A. MARTIN-KAYE, Director, Geological Survey Department, Georgetown)

Two applications for exploration rights over offshore areas of British Guiana remained outstanding throughout the year. In December, a further application was received. By the end of the year, no announcement had been made on the granting of exploration rights. At present there are indications that interest in British Guiana's offshore oil prospects will mount considerably during 1965, and some announcements are expected soon.

BRITISH HONDURAS (Fig. 8)

(By C. D. DAVIDSON, Phillips Petroleum Co., Bartlesville, Okla.)

Although no exploration work was carried out in British Honduras during 1964, it was a year of increased land activity. Phillips Petroleum Company increased its holdings by 153,000 acres and remained the principal acreage holder with

TABLE XXVI. OIL PRODUCTION (IN BARRELS) BY FIELDS, BRAZIL

Field	Discovery Year	Total Wells Drilled	Annual Production		Cumulative Production through December, 1964
			1963	1964	
Agua Grande	1951	226	16,584,000	15,150,000	119,750,000
Candeias	1941	175	4,137,000	3,810,000	39,771,000
Taquipe	1959	108	4,515,000	4,290,000	22,979,000
Dom João	1947	525	4,047,000	3,405,000	20,092,000
Buracica	1959	123	4,475,000	4,450,000	17,069,000
Mata São João	1951	53	288,000	308,000	4,245,000
Cassarongongo	1959	37	406,000	282,000	1,266,000
Santana	1962	15	433,000	620,000	1,053,000
Fazenda Pannels	1962	10	414,000	480,000	899,000
Pojuca	1953	14	102,000	76,000	321,000
Brejinho	1960	13	190,000	100,000	357,000
Taboleiro do Martins	1962	23	10,000	93,000	113,000
Carmópolis	1963	16	—	10,000	11,000
All others	—	94	108,000	236,100	1,948,000
Totals		1,430	35,714,000	33,311,000	229,874,000

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TABLE LVII. OIL PRODUCTION (IN BARRELS) BY AREAS, FIELDS, OR DISTRICTS IN PERU

Area, Field, or District	Company	Discovery Year	Total Wells Drilled	Producing Formation	Annual Production		Cumulative Production through December, 1964
					1963	1964	
CONTINENTAL SHELF							
Litoral	Belco	1960	34	Tertiary	386,177	555,624	1,691,600
Humboldt, Rincón ¹	Per. Pacific	1939	28	Tertiary	74,152	50,022	715,000
COASTAL							
Mirador ²	Belco	1955	39	Tertiary	181,952	180,181	1,820,000
Los Organos ³	E.P.F.	1943	889	Tertiary	2,048,192	2,654,771	18,351,100
La Brea-Paríñas	IPC	1869	5,052	Tertiary	8,603,843	8,114,793	456,232,200
Interlob ⁴	IPC	1905	2,326	Tertiary	8,893,016	10,292,890	173,820,600
Amotape	Pet. Amotape	1956	32	Tertiary	20,215	16,337	281,400
EASTERN							
Maquía	El Oriente	1937	12	Cretaceous	505,337	534,163	2,142,100
Aguas Calientes	Ganso Azul	1939	28	Cretaceous	734,533	720,271	8,441,300
SIERRA							
Pirín (Puno)	Peruvian Govt.	1906	—	Cretaceous	—	—	286,600
Totals			8,440		21,467,437	23,119,052	663,781,900

¹ Includes Douglas wells and production, and former Per. Pacific Tablazo concession production (195,426 bbls.) prior to its return to E.P.F. (February, 1960).

² Includes predecessor, Petrolera Peruana.

³ Includes production from other E.P.F. pools in northwest Perú, such as Sector Perú, Tunal, Hualtaacal, Cope, and the almost depleted Zorritos producing area, discovered in 1863. Also, well count includes 406 Zorritos wells drilled prior to E.P.F. ownership.

⁴ Concessions jointly held with Compañía Petrolera Lobitos, operated by IPC.

OTHER MATTERS

Note by Compiling Authors: Mention should be made that during the review year, Texas Gulf Producing Company's 76% interest in the Ganso Azul field of eastern Perú passed to Sinclair in a deal which involved producing properties in several countries. Also, Cabeen Exploration Company signed an agreement with Peruvian Pacific (Richfield and Cities Service) whereby Cabeen would become operator on—and earn an interest in—the Humboldt concession offshore from La Brea and Los Organos fields.

TABLE LVIII. TOTAL GAS PRODUCTION IN PERU (Million Cubic Feet)

1963	1964
44,833	53,788

TABLE LIX. PARTY-MONTHS OF GEOLOGICAL AND GEOPHYSICAL EXPLORATION IN PERU, 1964

Company	Surf. Geol.	Seis.	Grav.	Struc. Drig.	Total
Cerro de Pasco Petroleum	—	—	—	6	6
Empresa Petrolera Fiscal	19	—	6	—	25
Mobil Oil	24	—	—	—	24
Cía. Peruana "El Oriente"	—	4	—	—	4
Peruvian Gulf	4	—	—	—	4
Totals	47	4	6	6	63

PUERTO RICO

(By HARRY WASSALL & ASSOCIATES, INC., Geneva, Switzerland)

No oil rights were held in Puerto Rico at the beginning of 1964, and no reports were received during the year indicating that any concessions had been awarded in that period. There was no petroleum exploration *per se* in the country during 1964, but it may be noted that the U. S. Geological Survey, in cooperation with the Economic Development Administration of Puerto Rico, continued with a gravimetric study of the island's north coast. A similar study of the south coast had already been completed. Also during 1964, compilation and evaluation of an airborne radiation and magnetic survey was continued. This work was done by the U. S. Geological Survey and the Atomic Energy Commission.

EL SALVADOR

No 1964 development related to oil or gas exploration was brought to the attention of the compilers.

SURINAME

(By Dr. HAN C. SWOLFS, Gulf States Land & Industries, Inc., New York, N. Y.)

The first well drilled on the Suriname shelf, Suriname Offshore No. 1, was plugged and abandoned on February 27, 1964. The well, located 55 mi. offshore in the open Atlantic,

reached a total depth of 4,428 ft. in upper Oligocene sediments. An element of surprise in the well is a carbonate section from 1,600 ft. down. Operations were suspended during the remainder of the year pending completion of negotiations for amendments to the concession agreement. The new concession terms, effective early in 1965, reflect participation by a French consortium, led by Petropar, with the Gulf States Land & Industries, Inc., affiliates which initiated exploration efforts in Suriname in 1958. The 1965 program for Suriname will be coordinated with work in French Guiana, and will provide for establishing radio navigation stations and the conducting of conventional marine seismic work in the eastern sector of the 100-mi.-wide Suriname shelf.

TRINIDAD AND TOBAGO (Fig. 23; Tables LX-LXVIII)

(By the Ministry of Petroleum and Mines, Port-of-Spain)

Highlights of the Trinidad and Tobago Petroleum Industry during 1964 were:

1. A decrease in drilling activity from 19 to 15 rigs;
2. An increase in the number of pilot secondary-recovery projects, along with the introduction of thermal methods;
3. A significant expansion and modernization in the refining and petrochemical sectors; and
4. Publication of the Report of the Commission of Enquiry into the country's oil industry.

Table LX presents production and drilling statistics for 1964 and also presents 1962 and 1963 data for ready comparison.

TABLE LX. TRINIDAD SUMMARY DATA

	1962	1963	1964
Crude oil prod. (bbls.)	48,876,144	48,478,270	49,730,998
Nat. gas prod. (mcf.)	99,948,968	99,385,888	110,731,592
Aver. GOR (scf./bbl.)	2,045	2,042	2,227
CHPS (nat. gasoline prod., bbls.)	193,807	170,399	199,725
Total wells compl.	280	232	194*
Aver. depth compl. wells (ft.)	5,274	5,601	5,313
Total footage	1,506,187	1,246,251	1,056,337*
Prod. (oil and gas)	255	199	168
Success ratio %	91.1	85.8	89.4
Aver. rigs running	23	19	15

* Includes 4 service wells (injection and observation).

CONCESSIONS

There were no major changes in concession holdings during the year 1964.

SURFACE EXPLORATION

No geophysical work was carried out in Trinidad and Tobago during 1964. Surface geological effort during the year amounted to 13½ party-months. An additional 1½ party-months was devoted to geological map checking and stratigraphic familiarization.

EXPLORATION DRILLING

All 1964 exploratory wells are listed in Table LXI and are located on the map (Fig. 23). Exploratory drilling effort (Lahee type A-3 and A-2C) in Trinidad in 1964 totalled 15 completed wells. Eight of these were marine wells, of which the 2 drilled off the east coast, as well as the exploratory well off the south coast, were dry holes and have been abandoned. Marine operations were more successful in the Gulf of Paria where all 5 exploratory wells were producers.

On land, 7 wildcats were completed with 2 successes, 1 in the Ortoire basin and 1 in the Guayaquayare area.

Perhaps the most important well being drilled at year-end was S-189 (G/6),* a deep test for Cretaceous objectives located in the Soldado area (Gulf of Paria).

Field extension drilling was on the increase and of the 38 step-out wells drilled, 32 resulted in small but important additional reserves. The over-all exploratory drilling effort in Trinidad in 1964 totalled 358,074 ft. of hole. Results are summarized in Table LXII.

TABLE LXII. SUMMARY OF WELL COMPLETIONS IN TRINIDAD AND TOBAGO, 1964

	Oil or Gas	Aban. or Susp.	Total	% Success
Exploratory wells (Lahee A-3 and A-2c)	7	8	15	46.7
Semi-appraisal wells (Other Lahee types)	32	6	38	84.2
Sub-totals	39	14	53	75.6
Development wells	131	6	137	95.6
Totals	170	20	190*	89.5

* In addition, there were 4 service wells completed as observation and injection wells.

* The letter-number combination given in parentheses after the well name refers to the well's approximate grid coordinates on map (Fig. 23).

BULLETIN OF THE AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS
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REVIEW OF 1965 PETROLEUM DEVELOPMENTS IN
SOUTH AMERICA AND CARIBBEAN AREA¹

LOUIS C. SASS² AND C. H. NEFF³
Coral Gables, Florida

ABSTRACT

This review includes 25 reporting countries from South America and the Caribbean area—9 of which have long been established producers of petroleum and collectively accounted for 14% of the world's total oil production in 1965. Total production from these 9 countries within the coverage of this review rose for the seventh successive year, and for 1965 averaged almost 4.3 million b/d—up 105,000 b/d from 1964 figures. Of this production, 81% came from Venezuela, which continues to be the world's largest exporter of petroleum. Perhaps the most significant single development of the year in the area under review was the revival of exploration interest in Central America—this time, the offshore—witnessed principally by leasing activity, including activity by majors. Geological and geophysical surface work throughout the whole of South America and the Caribbean area in the search for new reserves appears to have increased, but only slightly, from 1964 figures. Of 364 exploratory wells completed, 127 proved successful. Brazil's Miranga field may be the year's outstanding single discovery. Accompanying the text are 23 map-figures and 69 tables.

INTRODUCTION

The 9 oil-producing countries of South America and the Caribbean area for the year 1965 had a combined average production rate of 4,288,817 b/d, or about 14% of estimated worldwide production. Production details from the area under review are summarized in Tables I and II. Cumulative production from the same 9 countries at the end of 1965 was almost 24.5 billion bbls.—just over 14% of the world's estimated cumulative total. The bulk of South American and Caribbean area production comes, as in past years, from Venezuela. Venezuela continues to be the world's largest exporter of petroleum. Comparing the 1965 production of individual countries with their 1964 performance, Colombia's registered increase of 17% from the 1964 figure is outstanding. This increase is largely the result of the full year of production from Chevron's new Río Zulia field in the Maracaibo basin near the Venezuelan border.

Surface-exploration activity in South America and the Caribbean area in 1965 totaled 1,459 party-months, a slight increase from 1964. Details by countries for 1965 are given in Table III. Drilling activity for the year tallied 364 completed exploratory wells with 127 successes (Table IV). The total of all wells drilled was 2,083, up slightly from 1964, but total footage in 1965 was just under 10.5 million ft., down from 10.8 million in 1964.

¹ Manuscript received and accepted, May 9, 1966.

² Latin American Gulf Oil Company.

From an exploration standpoint, perhaps the most significant single development of the year was a revival of interest in Central America—this time, the offshore. This interest was shown by the leasing activity, principally by majors, in British Honduras, Guatemala, and Nicaragua. These extensive preliminary 1965 leasing actions will most certainly be followed by marine seismic studies and offshore drilling. Interest in offshore continental South America also revived in 1965, evidenced by offshore leasing and (or) other offshore activities reported from Perú, Colombia, Venezuela, British Guiana, Surinam, French Guiana, Brazil, and Argentina. An important development during the year was the successful installation of Belco's fixed drilling platform in 65 ft. of water, 2.5 km. offshore from Talara, Perú. This platform went into service in May and was the first such platform to be erected on the west coast of South America.

Two significant onshore actions reported for the year were (1) the geological and geophysical program carried out by Texpet-Gulf in the headwaters of the Amazon in northern Ecuador, which could lead to a drilling recommendation next year, and (2) the decision by Chevron to conduct its own investigation of the petroleum prospects of northern British Honduras.

The oil discovery of the year may prove to be Petrobrás' Miranga field, which is not far from Agua Grande in the Recôncavo basin, Bahia. Partly because of its strategic location, development at Miranga was rapid; 6 rigs were drilling

DEVELOPMENTS IN SOUTH AMERICA AND CARIBBEAN AREA

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TABLE I. ANNUAL OIL PRODUCTION, 1960-1965
(Thousands of Bbls.)

Country	1960	1961	1962	1963	1964	1965	Total Cumulative Production
Venezuela	1,041,672	1,065,734	1,167,900	1,185,520	1,241,657	1,267,709	19,803,000
Argentina	63,846	84,390	98,208	97,143	100,370	98,797	1,259,031*
Colombia	55,666	53,383	50,144	60,720	62,857*	73,659	1,249,589*
Trinidad	42,357	45,768	48,876	48,678	49,731	48,859	952,097
Brazil	29,613	34,807	33,401	35,714	33,313*	34,345	264,271*
Perú	19,255	19,371	21,134	21,468	23,119	23,068	686,850
Chile	7,243	9,278	11,708	13,223	13,687*	12,704	95,584*
Bolivia	3,574	2,990	2,917	3,404	3,290	3,357	44,481
Ecuador	2,800	3,028	2,642	2,547	2,883	2,919	94,375
Totals	1,266,026	1,318,749	1,436,930	1,468,417*	1,530,907*	1,565,417	24,449,278*
Per cent change	+4.2%	+9.0%	+2.2%	+4.3%	+2.2%		

* Includes small adjustments made since last year's report.

actively in the new field at year's end, 14 wells already had been completed, and credited cumulative production was approaching 250,000 bbls. This appears to be a major discovery. The reservoir is within the Cretaceous Ilhas Formation.

Laying of pipe on Bolivian Gulf Oil Company's 389-mi., 12-10-in. oil pipeline, which extends from the low-lying Santa Cruz area of eastern Bolivia to Sicasica on the high Altiplano, was completed during the year. At Sicasica, this line joins with YPF's already-existing Sicasica-Arica pipeline that continues to the Pacific coast. Installations of pumping and storage facilities are now in progress, and this entire system—from Santa Cruz across the Andes to Arica—is expected to go into operation in July, 1966.

The remainder of this report consists of individual sections contributed by correspondents, each section covering one of 25 reporting countries, with the countries arranged for convenience in alphabetical order. The reader is referred to these country-by-country reports for local highlights and details. Wherever desirable and possible, pertinent maps and statistical tables accompany the sections on the individual countries.

TABLE II. 1965 OIL PRODUCTION

Country	Bbls. Per Day
Venezuela	3,473,176
Argentina	270,678
Colombia	201,806
Trinidad	133,860
Brazil	94,097
Perú	63,200
Chile	34,806
Bolivia	9,196
Ecuador	7,998
Total	4,288,817

ACKNOWLEDGMENTS

A report such as this is impossible without real cooperation and help from many people. The compiling authors make grateful acknowledgment to the following companies and individuals for

TABLE III. 1965 EXPLORATION ACTIVITY IN PARTY-MONTHS

Country	Surf. Geol.	Seis.	Grav.	Struc. Drig.	Other	Total
Argentina	55	256	24	—	103	438
Bolivia	34	24	12	—	—	70
Brazil	186	128	130	10	36	490
British Honduras	—	5	—	—	—	5
Chile	7	68	—	—	—	75
Colombia	151	58	19	1	8	237
Ecuador	21	8	—	—	—	29*
French Guiana	—	3	—	—	—	3
Guatemala	—	2	—	—	—	2
Nicaragua	—	3	—	—	—	3
Perú	42	15	2	—	—	59
Surinam	—	2	—	—	—	2
Trinidad	21	2	—	—	—	23
Venezuela	20	3	—	—	—	23
Total	537	577	187	11	147	1,459

* In addition, there was some air-magnetometer activity and aerial photography; see text.

TABLE IV. 1965 DRILLING STATISTICS

Country	Total Wells Dril.	Total Footage Drilled	Explor. Wells Compl.	Explor. Wells Success
Argentina	557	2,834,663	78	20
Bolivia	58	323,384	16	2
Brazil	226	964,721	98	30
Chile	47	330,975	8	—
Colombia	80	432,877	20	6
Dominican Republic	2 ^a	3,887	—	—
Ecuador	49	154,019	21	10
Guatemala	1 ^b	1,407	—	—
Perú	159	895,081	30	12
Trinidad	224	1,058,736	37	24
Venezuela	680	3,483,000	56	23
Totals	2,083	10,482,950	364	127

^a Both wells suspended under *force majeure*.

^b Suspended.

their part in supplying information toward, or in contributing whole sections to, this 1965 Review of Petroleum Developments in South America and the Caribbean Area.

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ARGENTINA (Fig. 1; Tables V-X)

By DR. EDUARDO L. PADULA, Yacimientos Petroliferos Fiscales, Buenos Aires

In 1965, Yacimientos Petroliferos Fiscales (YPF) operated 22 seismic crews, 2 gravimeter crews, 5 geological field parties, and 8 topographic parties. In addition, a reflection-seismic study was made of the submarine platform in front of the Gulf of San Jorge (Chubut-Santa Cruz).

A total of 7,330 km. of seismic-reflection profile was shot; seismic-refraction work consisted of 41 set-ups. An area of 94,300 sq. km. was covered by gravimeter, and a combined gravimeter-magnetometer survey covered 8,654 sq. km. In addition, geological field parties mapped 17,520 sq. km. and detailed 240 km. of stratigraphic section. The above-mentioned activities were conducted in all of the proved petroliferous basins of the country, with some work in other basins of possible petroleum interest (Chaco-Paranense, Río Salado, and the Mesozoic basin in Salta).

During the year, 78 exploratory wells were completed totaling 213,600 m. (700,786 ft.) of drilling. Twenty of these 78 wells proved to be commercial oil and gas producers. Of 477 de-

TABLE V. PARTY-MONTHS OF GEOLOGICAL AND GEOPHYSICAL EXPLORATION IN ARGENTINA, 1965

Basin	Surf. Geol.	Seis.	Grav.	Topography	Total
Salteña	—	43	—	33	76
Chaco-Paranense	—	23	—	12	35
Cuyana	24	60	12	24	120
Neuquina	24	60	—	12	96
Golfo S. Jorge	—	2*	—	—	2
Austral	7	68	—	22	97
Río Salado	—	—	12	—	12
Total	55	256	24	103	438

* Marine shooting.

were in the Carmópolis field and were completed as oil producers. In Recôncavo, 90,775 m. was drilled in 91 wells, 79 of which were oil or gas, and 12 were dry. Whereas development drilling in Sergipe was limited to the Carmópolis field, for the purpose of quick development, such drilling in Recôncavo took place in 14 different fields, principally Dom João, Taquipe, and Miranga (a 1965 discovery).

PRODUCTION

Oil production in 1965 reached 5,460,354 cu. m. (34,345,314 bbls.), compared with 5,296,229 cu. m. (33,312,978 bbls.) in 1964—a 3.4% increase on a per-day basis. Twenty-four fields contributed to this production. All but 30,562 cu. m. (192,233 bbls.) of the total came from the Recôncavo fields.

Gas production for the year was 683,133,370 cu. m. (24.1 Bcf.), approximately 28% more than in 1964. This increase can be attributed not only to the increased oil production, but also to higher gas-oil ratios in some fields.

Two important events took place during 1965 regarding production activities. The first was the discovery of the Miranga field, whose import is comparable to that of Carmópolis. Miranga raised the perspectives in Petrobrás' anticipated rate of production growth. The second important event of 1965 was the slight increase in Petrobrás' total production in the last months of the year, which reversed a declining trend since 1961. This increase came from several sources: production from new areas; better use of producing wells; and increasing use of secondary-recovery techniques. Improvements in completion techniques and the greater efficiency of contractor services were additional contributing factors.

BRITISH GUIANA (Fig. 7)

By DR. P. H. A. MARTIN-KAYE, Chief Geological Survey Officer, Georgetown

The increasing interest of recent years in British Guiana's oil possibilities culminated in 1965 with the granting of exploration licenses for the offshore and adjacent land areas to the Continental Oil Company and to Shell Oil Company. The areas acquired are shown on the map (Fig. 7). Both companies have completed preliminary offshore seismic programs, and stratigraphic drilling is anticipated in 1966.

Interest in the inland Takutu basin continued, and the granting of an exploration license was being considered at year's end. Subsequently, notice of intention to grant a license to the Phoenix Oil Company of Canada has been published in the Official Gazette of the Government.

Appraisal of airborne-magnetic and ground-gravity data on the Takutu basin, considered to contain several thousand feet of sediments, suggests the possibility that evaporite deposits are present in that basin.

During the year, the Geological Survey Department concluded a program of shallow drill holes across the Takutu basin for stratigraphic information. Palynological examination of the cores is being undertaken by Th. van der Hammen at Leiden University. Van der Hammen's recent publications (1963, 1964) on the palynology of British Guiana have provided material stimuli to the current interest in oil exploration.

Bulletin 36 of the Geological Survey issued in 1965 is a report on prospecting for oil in British Guiana by V. V. Fedynsky and S. N. Simakov,



FIG. 7.—British Guiana, 1965-1966 concession map.

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whose services were obtained under the auspices of the United Nations Technical Assistance Board. The study was made in 1962, covers the history of oil exploration in the country up to that time, and presents recommendations for future work. The experts concluded that there was ample justification for further prospecting, a view with which companies have subsequently shown themselves to be in agreement.

PUBLICATIONS

- van der Hammen, Th., 1963, A palynological study on the Quaternary of British Guiana: *Overdruk uit Leidse Geol. Mededel.*, Deel 29, p. 125-180.
 ——— and T. A. Wijmstra, 1964, A palynological study on the Tertiary and Upper Cretaceous of British Guiana: *Overdruk uit Leidse Geol. Mededel.*, Deel 30, p. 183-241.
 Simakov, S. N., and V. V. Fedynsky, 1965, United Nations Technical Assistance Board, Report on the prospecting for oil in British Guiana: *Geol. Survey Br. Guiana Bull.* 36, 48 p.

BRITISH HONDURAS (Fig. 8)

By T. L. SANDRIDGE, Phillips Petroleum Co., Bartlesville, Okla.

Exploration activity in British Honduras was resumed during 1965 after being suspended for nearly 2 years. British Honduras Shell Petroleum Development Company Limited and Esso Belize, Inc., separately conducted marine seismic surveys. Shell did 4 crew-months of offshore seismic work east and southeast of Belize City, partly on its own acreage and partly on acreage held by Phillips Petroleum Company. Shell will earn an interest in approximately 382,000 acres of Phillips' holdings by carrying out a specific work program. Esso Belize conducted 1 month of marine seismic work on Phillips' acreage under an option agreement.

Concession activity was highlighted by the awarding of exploration rights over approximately 4,125 sq. mi. in northern British Honduras to Belize Chevron Oil Company. The award, granted October 18, 1965, covers practically the entire northern half of the country. At year's end, Chevron was preparing to begin an electrical survey in early 1966.

Phillips made minor acreage acquisitions and relinquishments during the year, and now holds 1,303,000 acres under Oil Prospecting License or Lease. Shell's holdings total approximately 1,240,000 acres offshore.

CHILE (Fig. 9; Tables XXV-XXX)

By OSVALDO WENZEL G. and MARIO MARINO P., Empresa Nacional del Petróleo (ENAP), Santiago

EXPLORATION

During 1965, 8 exploratory tests were drilled in Chile, all of which proved to be dry. At year's end, 3 rigs were actively drilling wildcat hole. Exploratory details by zones follow.

MAGALLANES ZONE

In the Magallanes zone, ENAP continued its exploratory effort both on Tierra del Fuego and on the mainland. For the most part, surface studies were seismic, with 4 crews working all year. Also, in the Tertiary district on the mainland, important paleontologic and stratigraphic studies were completed to help explore some of the complex sedimentary problems encountered.

During 1965, 4 exploratory wells were completed in Magallanes, and 2 additional exploratory tests were actively drilling ahead at year's end. An important part of this drilling effort was in the Tertiary district on the mainland north of Punta Arenas where deep drilling (11,500-14,000 ft.) was being done. This drilling established the existence of high-pressure gas zones at depth, but the commercial importance of these zones has not yet been determined.

SOUTH-CENTRAL ZONE

In the south-central zone, exploration activities included (1) seismic work, (2) reconnaissance surface geological studies to complete earlier efforts, and (3) drilling. The seismic and geological studies were concentrated principally in the Provinces of Ñuble, Arauco, Cautín, and Llanquihue. Four exploratory tests were drilled: Puerto Montt-1 and Colegual-1 were in Llanquihue, and the other 2, Huilma-1 and 2, were in Osorno, (Fig. 9). All 4 wildcats were dry. Nevertheless, in Colegual-1, some streaks of fluorescence were observed in shaly sandstone units, and provided sufficient encouragement to consider the drilling of a second test. The future work program for the south-central zone includes the drilling of additional wildcat wells in the Provinces of Cautín, Arauco, and Ñuble.

DEVELOPMENT DRILLING

During 1965, 39 development wells totaling 247,596 ft. were drilled, 22 of which were pro-

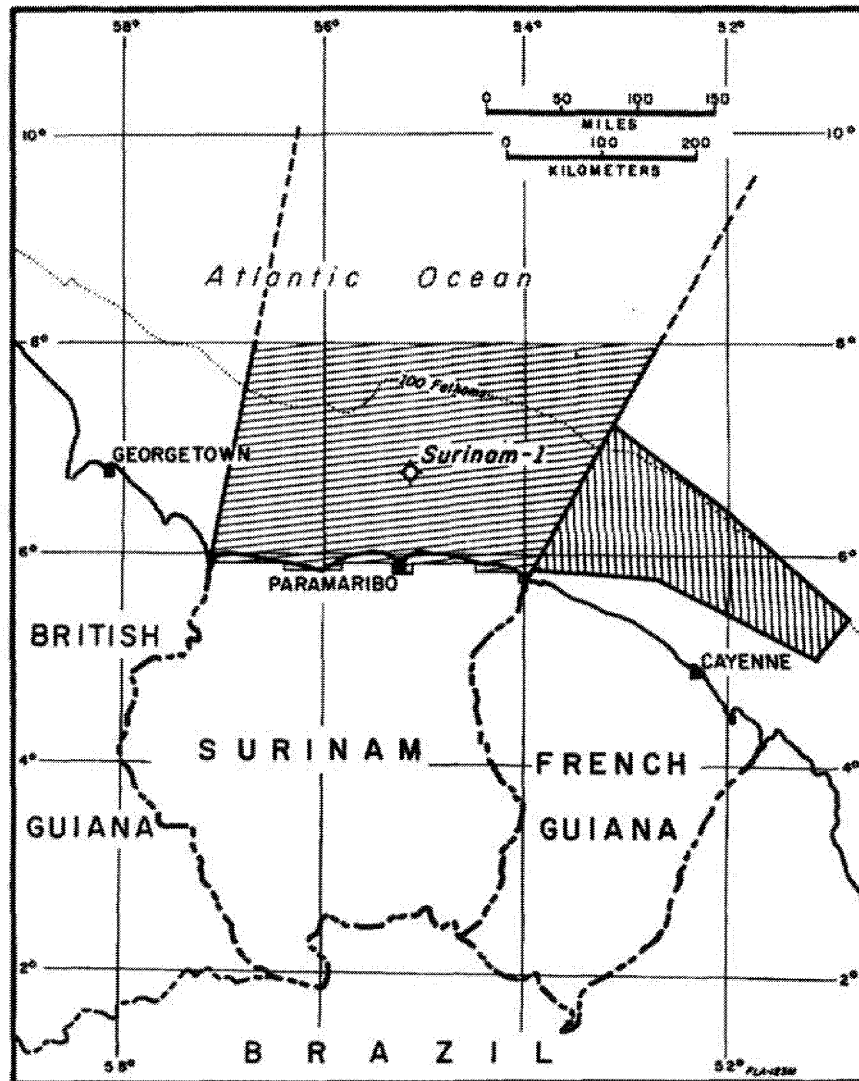


FIG. 14.—French Guiana-Surinam, December, 1965, concession map.

offshore shelf area, was followed in 1965 by 2½ party-months of conventional marine seismic work conducted by the Compagnie Générale de Géophysique under the joint supervision of Petrosur (operator for the French group headed by Petropar) and Gulf States Land & Industries of New York. These same two groups also conducted a joint offshore operation in adjoining Surinam. Several radio navigation stations were placed along the French Guiana coast for close geodetic control. A total of 3,200 km. of line was shot offshore from French Guiana in a reconnaissance pattern, and the combined results of mag-

netic and seismic surveys now leave no doubt that, during part of Tertiary time, there existed a 500-km.-wide, partly-enclosed embayment offshore from western French Guiana and all of Surinam.

GUATEMALA (Fig. 15)

By E. D. ACKERMAN, International Petroleum Company, Limited, Coral Gables, Florida

As during 1964, exploratory activity during 1965 was concentrated in the Pacific coastal area with no activity reported in the Petén.

The Abularach San José-1 stratigraphic test,

done because of mechanical difficulties. This is the first platform to be installed along the west coast of South America.

MISCELLANEOUS

Cabeen Exploration Corporation, a California independent, acquired Peruvian Pacific, an affiliate of Cities Service in which Richfield had a 50% interest.

The shipments of crude oil from the Aguas Calientes field to the Brazilian refinery at Manaus were discontinued after 10 years of operation, and the entire production from this field is now used in the domestic Peruvian market.

PUERTO RICO

By HARRY WASSALL & ASSOCIATES, INC., Geneva, Switzerland

From all available information, no oil rights were held in Puerto Rico, and there was no petroleum exploration *per se* in 1965.

EL SALVADOR

By HARRY WASSALL & ASSOCIATES, INC., Geneva, Switzerland

No firm developments related to oil exploration in El Salvador during 1965 have come to the writers' attention.

SURINAM (Fig. 14)

By Dr. HAN C. SWOLFS, Consultant for Gulf States Land & Industries, Inc., New York, N.Y.

After the signing of an amended agreement between the Surinam Government and Colmar Surinam Oil Company, active exploration of the Surinam offshore area was resumed in 1965 with a conventional marine seismic survey conducted by Western Geophysical Company. This work was done under the joint supervision of Petrosur (operator for the French interests headed by Petropar) and Gulf States Land & Industries of New York. These same two groups also conducted a joint offshore operation in adjoining French Guiana. Preparatory to the seismic work, several radio navigation stations were established along the coast to provide close geodetic control. The Surinam survey covered most of the wide shelf area on a reconnaissance pattern; additional detail was added over indicated closures. Two party-months of work was completed, and 4,358

km. of profile shot. The work program for 1966 includes interpretation of these seismic data, which will be followed by the drilling of at least 3 tests, beginning in the second half of 1966.

TRINIDAD AND TOBAGO

(Figs. 19-21; Tables LII-LXIII)

By R. A. THOMAS, Permanent Secretary, Ministry of Petroleum and Mines, Port-of-Spain

Highlights of the Trinidad and Tobago petroleum industry during 1965 were: (1) an increase in crude oil production during the last 3 months of the year to the high level attained in mid-1963; (2) an increase in drilling activity during the year from 12.5 rigs in January to 17 rigs in December; (3) continued rapid growth and modernization in the refining and petrochemical sectors; (4) improvement of gas-collection facilities; and (5) publication of Part I of the Report of the Commission of Enquiry on the marketing of petroleum products in Trinidad and Tobago. Table LII presents in summary form the overall drilling and production statistics for 1965, with comparative data for the 2 preceding years.

TABLE LII. TRINIDAD AND TOBAGO SUMMARY DATA

	1963	1964	1965
Crude oil prod. (bbls.)	48,678,270	49,730,998	48,858,937
Nat. gas prod. (Mcf.)	99,385,888	110,731,592	111,502,617
Aver. GOR (scf./bbl.)	2,042	2,227	2,282
CHPS (nat. gas prod., bbls.)	170,399	199,725	196,778
Total wells compl.	232	194	224*
Aver. depth compl. wells (ft.)	5,601	5,513	4,823
Total footage	1,246,251	1,056,337	1,058,736
Oil and gas compl.	199	168	201
Per cent success	85.8	88.4	90.9
Aver. rigs running	19	15	15

* Includes 3 suspended wells.

CONCESSIONS

Concession changes onshore during 1965 included the surrender by Apex (Trinidad) Oilfields Ltd. of oil mining leases over 9,874 acres of Crown and alienated lands in the eastern Central Range. Offshore, Dominion Oil Limited surrendered approximately 115,383 acres of its Gulf of Paria concession.

SURFACE EXPLORATION

A breakdown of 1965 surface exploration activity is given in Table LIII, together with comparable information for 1964.