

# Finding Petroleum

Regional theme: bouncing between state ownership and encouraging private investment

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Oil policy and security risks

Finding Oil in Central & South America, London, Oct 17 2017

Special report

## Finding Oil in Central & South America

October 17 2017, London



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## Finding Petroleum

This is a report from the Finding Petroleum conference "Finding Oil in Central & South America", held in London in October 2017

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Many of the videos and slides from the event can be downloaded from the event agenda page.

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# Central and South America – opportunities and risks

There are plenty of opportunities for oil and gas companies in central and South America, but also many risks – our forum on October 17 aimed to get more understanding of them

Finding Petroleum's forum on Central and South America on October 17 2017 looked at opportunities and risks for oil and gas companies, with a particular focus on Mexico, Brazil and Argentina.

Our speakers included a former head of exploration with BP who had lived in South America for 10 years; the executive VP with Sierra Oil and Gas, the first company to be active in Mexico; the group exploration asset manager with Premier Oil, which is developing a block in Brazil's Ceará Basin; the CEO of Tridevi Capital, which makes investments in South American oil and gas projects, the director of geoscience from Spectrum, which is providing seismic data offshore Argentina, and a Latin America and lead analyst from Protection Group International, a risk management consultancy.

All of our speakers have a different perspective, but you will see common themes in the story most of them told about working in South America – a story about government policy fluctuating between being supportive of nationalised oil industry and then supportive of private industry, and then conditions more attractive or less attractive for private companies. Investors need to judge what is going to happen, and watch the politics closely.

## Life in the 1990s

Richard Herbert, conference chairman, and a former head of exploration with BP, opened the event by discussing his experiences working and living in Central and South America, starting in the early 1990s.

He started working in Venezuela, which had nationalised its oil and gas industry in the 1970s. By the early 1990s it was starting to reverse it, bringing in foreign investment and expertise, to re-activate fields and develop the heavy oil belt resources. There was a "lot of optimism it was a major new province opening up for international industry," he said.

Since then, "the country has failed to fulfil its promise of attracting and retaining international investors, which has been very disappointing. There are a few companies staggering on, North

Korean, Russian, Chinese. I think Chevron have managed to hold on to their heavy oil assets."

Also in the 1990s, Mr Herbert went to work in Mexico for 2.5 years, working for BP on secondment to PEMEX, doing a "technology transfer" project. The Mexican oil industry was nationalised at the time.

The PEMEX boardroom had a big mural in it celebrating the expropriation. "I could never imagine a board of PEMEX sitting under the mural reversing the expropriation, but it has happened," he said. "So here's another area which has confounded expectations."

After Mexico, Mr Herbert went to Colombia for 5 years. "It was fascinating from a professional point of view, but security was extremely difficult, with a threat of kidnapping," he said. "We worked on fortified well sites, with the Colombian army protecting them, flying in and out by helicopter. The country was going from one crisis to another."

"There was a poll of Colombians and 50 per cent said they'd like to leave the country."

Since then, the government has applied a "sort of forceful hand" to deal with the guerrilla problem, and turned it to a negotiation, which led to a peace process and gradual disarming of rebel group FARC. "Hopefully that will continue with other guerrilla groups," he said.

"What looked like a failed state is becoming quite a stable and progressive state."

A bigger point here is that a great deal has changed in these countries over 20 years, and none of it was predictable. Similar stories could be told of Argentina, Brazil, Ecuador and Bolivia.

## Mexico

In the oil and gas industry, Mexico is "the place in the region with the most excitement," he said.

Since the government's decision to open up the oil and gas sector, and many other sectors of



the economy, it has held 7 license rounds, including 1 in deepwater (Dec 2016). 70 blocks have been awarded to private companies, and 66 companies are active in Mexico oil and gas for the first time. Half of these are Mexican companies, something the Mexican government particularly wanted. About \$59bn of investment is promised.

The average government take on oil and gas production is about 70 per cent, “which on an international scale isn’t too bad,” he said. Although the actual amount paid varies according to what was offered in the bid.

“I think the Mexicans have also demonstrated they can run quite an efficient, open and transparent bidding process,” he said.

There have also been farm-outs from state oil company PEMEX. The most significant of these was the Trion Block farm-out signed with BHP Billiton in March 2017.

There have been announcements of significant exploration discoveries in shallow waters of the Mexican part of the Gulf of Mexico.

One of the most interesting discoveries is in a heavy oil field which ENI picked up in one of the earlier rounds, where drilling discovered a lot more pay than expected – and pay of lighter oil. “It increases the potential resources in this field to a billion barrels oil equivalent” he said.

In 2017 there was the announcement of the

Zama discovery by Talos Energy, Premier Oil and Sierra Oil and Gas. There was a lot of competition for this block in the bid round. “A lot of companies saw the potential of this,” he said. “When you look at the processed seismic, it is one of the better examples of amplitude conformance I’ve ever seen.”

Today, companies are having to bid quite a high royalty to the government to win the license rounds, which can affect overall performance, he said.

There was a deepwater round in December 2016. “I think most of the major international oil companies participated,” he said. There is another round at the end of 2017 or early 2018, covering the central part of the Mexican Gulf of Mexico, including a “wild frontier area” off the coast of Yucatan.

“According to government this round is three times as big as first round and prospectivity is twice as much. There’s significant momentum in Mexico,” he said.

### Brazil

Brazil has been “in a little bit of a difficult place” for a few years, Mr Herbert said.

There was a lot of excitement when the presalt play first opened up about 10 years ago, with the Campos and Santos basin. But recent factors have put a dampener on the development. First the onerous terms demanded by govern-

ment particularly around importing of equipment and local content requirements, and then the corruption scandal around Petrobras.

Mr Herbert was working in BP as head of exploration at the time of the 13th license round in 2015, and BP elected not to participate.

“It turned out, no other companies wanted to bid either, so it was pretty much a failed process,” he said.

Now, “Brazil is starting to stabilise and come back.” It has relaxed some of its restrictions on importing equipment and rigs, and relaxed local content rules ‘significantly’. As a result, “the investment climate is improving in Brazil.”

In September 2017, the 14th license round was held, resulting in a large number of blocks being offered, and \$1.2bn in “signature bonus”, the largest amount ever received for a bid round in Brazil. Nearly all of the signature bonus was awarded for two blocks in the deepwater Campos basin, with Petrobras bidding together with ExxonMobil.

“They see some pre-salt carbonate potential in those blocks, which is probably significant,” he said.

Another 35 blocks were awarded in 8 other basins, both offshore and onshore.

In the Santos basin, only post salt prospectivity was on offer, and only 1 block was awarded.



"Brazil is clearly heating up again," he said.

There were further licensing rounds planned for the end of 2017 in presalt, including some "very significant opportunities in Santos presalt," he said. Also "extensions of fields going to open acreage and frontier exploration acreage."

### Guyana

Guyana has an extension of Eastern Venezuelan geology. It was thought not to have any traps, but that is now shown to be false.

ExxonMobil has made 4 discoveries, the Liza discovery of 2015, thought to be over a billion barrels of oil equivalent, followed by Payara (500m boe), Liza Deep (100 to 150m boe), Snoek and Turbot. The gross resources are now estimated to be 2.5 to 3 bn boe.

There has only been 1 unsuccessful well, and the discoveries are all in a "very small area".

"There's a feeling that there's quite a lot of running room in Guyana," he said.

Exploration is also starting to take off in the neighbouring Suriname, with a lot of interest in the fan systems.

### Peru

Anadarko recently announced it was taking a position in 3 deepwater blocks off the coast of Peru. "It is not a big commitment, they are reprocessing some seismic. But the Peruvian government made a big show on this, this is very exciting for them".

"Peru has not had much recent fortune in terms of renewing its resource base," he said. "Production now 40,000 bopd, most of that from the Amazon. It is down from its peak in earlier times. Maybe offshore Peru will turn into a new province."

### Argentina

In Argentina a number of companies are committed to getting resources into commercial development – not just trial wells and testing concepts. This includes YPF and Tecpetrol.

Argentina has the Vaca Muerta, the first large scale unconventional oil and gas development in the world outside North America, with the possible exception of shale gas in the Szechuan basin of China.

The Argentinian government is keen to find an alternative to LNG imports for its own gas supplies, and so has tried hard to encourage unconventional development. There are 700 to 750m BTU of unconventional gas projects in the country. "I think there's a lot of opportunity and a lot of interest," he said.

"There are a lot of challenges - part of that is technical - the Vaca Muerta is very thick and has zones of high total organic content. There are some interesting complexities with stress fields and ability to frac. There are a lot of challenges around the cost of operating in Argentina, it is not as simple as working in Texas. Coming up with commercially viable schemes requires a lot of work."

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## Sierra Oil and Gas: understanding opportunities in Mexico

Sierra Oil and Gas was in a consortium to be the first winner of a license block in Mexico post liberalisation in 2015. Upstream executive director Read Taylor told the story

Sierra Oil and Gas was part of a consortium, together with Premier Oil and Talos Energy, which took the only two blocks which were awarded to private companies, in Mexico's first bid round in 2015.

From the nationalisation of the Mexican oil industry in 1938 to liberalisation in 2015, the only oil and gas company allowed to operate in Mexico was state oil company PEMEX.

Sierra went on to discover a greater than 1 billion barrel field, Zama, in Block 7, one of its blocks, with the discovery announced in July 2017.

Since then interest in Mexico has grown massively, with 67 oil companies currently active. This has led to an inflation in the amount of money companies are prepared to offer to get bids, both in terms of "bonus" (an upfront fee to the government) and royalty (a proportion of revenue which goes to the government).

It may be that two years ago was a much better time to enter Mexico than today, said Read

Taylor, executive director upstream – exploration and production with Sierra Oil and Gas. A company the size of Sierra "may be already priced out of the market".

However Sierra is still working hard to acquire more blocks. It has already participated in 7 bid rounds, an 8th around the time of the conference, and "2 more going on right now." This has been very intense work.

Mexico is following a similar path to Brazil, which is also aiming to bring in more private companies. But Mexico is pushing much harder, running 7 bid rounds in 2 years, where Brazil had normally held 1 per year. Mexico has a 5 year plan with 450 different opportunities. "It's a very active market," he said.

The amount of enthusiasm in Mexico in the early rounds is much higher than it was in the early rounds in Brazil, where Mr Taylor also had been working. Mr Taylor also believes the opportunities are much greater in Mexico than in Colombia.

Oil prices have halved since the reform was first announced in 2014. The initial bids were made in a time of volatility and decline. When the price crashed, there were questions about whether business was viable. But "we've all managed to survive at \$50," he said.

Sierra did take a risk by entering so early, considering that exploration success rates in emerging markets can be as low as 6-12 per cent. Sierra has worked to neutralize these risks with a focus on obtaining the best data possible and working the technical issues very hard.

Sierra is funded by private equity companies Riverstone, Blackrock, and Encap Investments.

ENI has also made a big discovery announced in July 2017, with the Amoca field. "We bid on this field, we loved it, we came in seventh out of 8 bidders". "This was the beginning of inflated bids to be made by several in the Industry" he said. "They are talking about



using a FPSO and bringing out a fast track production.

"I said last year there would be 12 wells in the next 12 months and that's happening," he said. "There could be 25 next year. There are 60 committed wells over the near term. There's going to be a significant ramp up of activity - it's going to be an arena to watch.

It helps that the Mexican government is providing 3D seismic data at very low cost and there is a new WAZ product on the market. Sierra has access to 3D seismic data for the equivalent of a "couple of hundred Gulf of Mexico blocks" which would cost hundreds of millions of dollars to purchase in the US.

### Sierra today

Today, the company believes it has the number one offshore position 'net' in Mexico, or the 3rd biggest position overall. We currently have over 1.5 million acres of high potential acreage in 5 different assets. We have developed, in conjunction with our partners a deep drilling inventory of over 40 prospects. Several of which have Zama like characteristics. One of which has a giant carbonate prospect.

Sierra's own acreage could have up to 7bn barrels OOIP (of which about 2bn are already proven).

If Sierra's Mexican blocks were onshore, the size would be equivalent to 1.5m acres of land. In size, relative to GOM for example they are equivalent to 206 Gulf of Mexico (US) blocks. "If you do the math on what it would cost to get the same position in the Gulf of Mexico, it would be undoable."

From now onwards it is about "going through the assets we have obtained, reducing our risk profile through advanced geophysical tools including AVO, along with rigorous use of the new WAZ data set in order to high grade our drilling portfolio," he said.

Sierra Oil and Gas has over 40 prospects and leads, "more drillable prospects than I know what to do with," and 11 of those look "just like Zama".

Sierra also aims to position itself in the industry as an attractive joint venture partner to other companies, "by having the smartest people and the best data set, who developed its understanding of the basin early".



*Read Taylor, Executive Director, upstream*

The Mexican government has set a high standard for companies to operate in Mexico, saying they need a certain amount of production rate, and a balance sheet larger than Sierra's currently is.

This forced Sierra to partner with other companies in order to participate. "We attract world class companies like Murphy Oil, Premier Oil, Petronas and Repsol and others by our knowledge and our data. So far it has worked for us."

### Oil fields

The two most well-known and prolific basins in Mexico are Sureste, in the South East, and Perdido, further north, near the US border.

Sierra has been focussing on the South East Sureste basin, which has play types similar to the Gulf of Mexico, and deeper carbonate play types.

Understanding the opportunities today involves understanding PEMEX's strengths. PEMEX developed great expertise at exploring in carbonates at 5,000 to 6,000m depth. But they didn't know how to drill through or around salt, so they never developed the clastics from Pliocene and Miocene, which are often developed in the Gulf of Mexico, Mr Taylor said.

On a map, you can see the 61bn barrels already discovered by PEMEX in the carbonate play, but other areas which have a "really interesting salt basin, GOM like."

Most companies in Mexico are also mainly interested in the Sureste basin. Mexico has three "terrific world class source rocks," and there is light oil throughout most of the Sureste basin, he said.

"It is a great commercial place to play especially in today's service market as well as a relatively low risk place to play. That's where the government has focused on releasing most of the acreage in the last 2 years."

The Sureste basin is divided into 3 or 4 segments, all productive, with heavy oil to the Far East and light oil to gassy in the West.

Sierra bought a Schlumberger Wide Azimuth (WAZ) survey. "You pretty much have to have the WAZ data to image under that salt." The company now has about 90,000km2 of 3D for the Sureste basin, with data from 400 wells, and 1000 interpretation points within the wells.

The reservoirs have "some of the most beautiful structures you've ever seen in your career," he said.

"Multiple opportunities and structural traps will be drilled in the next few years," he said.

### Zama

Mr Taylor is very proud of the Zama discovery, announced in July 2017, on a block the company won a bid on in July 2015.

Before drilling, Sierra estimated its success rate in the "high 20s to low 30's" (per cent), which is high for an exploration prospect.

From the public seismic data, "it was obvious that Zama was a special prospect, a gorgeous structure with a big flat spot."

Zama can count as a "world class discovery", comparable with Tahiti and Thunderhorse fields in the Gulf of Mexico.

Sierra compares it to the Mars field in the Gulf of Mexico, where the reservoir has a permeability of up to 3 to 7 Darcy. "This thing will flow potentially at 150,000 bopd."

"We found over 1000 feet of continuous high porosity, high permeability, stacked single pay in the well. There's no breaks, no water contact yet that we know of.

There have been other indications on the seismic data of fields that "look at little bit like Zama". "So we're excited about drilling out some of these in the next few years."

The discovery was widely reported in Mexico. "It is a very big item for Mexico politically and otherwise," he said.

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On the seismic image, “you can see the nice amplitudes, this thing lights up like a Christmas tree.”

“The fault seal is great,” he said. “We couldn’t have asked for more”.

The risk in Zama really came from the lack of data and information, with very few offshore wells having been drilled in the area into this prospective section. The best analogues for reservoir quality were actually onshore wells.

The company’s exploration manager tracked sand packages from the onshore wells into a developing offshore model.

The hydrocarbon deposition comes from a series of smaller rivers, not a giant river, and they could be tracked from onshore to offshore. We now have the WAZ in hand to do a larger comprehensive analysis that takes us to the next level of interpretation. Additionally this important strategic well was drilled in the “best low cost [drilling rig market possible]”, “Our rig rates were never seen before lows.”

### Price inflation

Sierra did not have to pay any cash bonus to get its acreage, and two of the blocks did not require drilling commitments to get.

But today, it is a normal thing companies are offering the government cash bonuses to secure blocks. There are some examples of “ridiculous” amounts being paid in cash bonuses to secure onshore fields, he said.

“In order to win a block out here, in the last bid round, you’re bidding the maximum royalty and government take and putting cash on the table. The government took \$600m in cash and bonuses in this last bid round.

“The environment has already changed in 2.5 years. Timing is everything.”

“When I heard the first onshore bid round, people were bidding 90 per cent royalty, for a small onshore field we looked at and couldn’t find technical merit to. I thought, there has to be a mistake

The bids in the first round for onshore operations were mainly from local players – ‘mom and pop’. Then they went to a 90

per cent royalty, which was “completely irrational.”

The most recent offshore round companies are bidding very high government take for some of the best blocks. The cash bonus system then comes into play when there is a “tie breaker” needed. The high bids might make sense if it was a mature market. But there are still strong elements of geotechnical risk, as well as commercial including questions of how to transport oil to markets. “You have to wonder how they can bid that.”

Perhaps it is an expression of how hungry oil companies are for acreage, after so many years of not exploring, which is leading to overbidding.

But it is a funny dynamic when companies are more keen to bid at a \$50 price than they were at \$100.

In one example, an onshore “relatively small mature field “ had (in Sierra’s estimation) 30m to 40m barrels of oil, and it gathered 5 or 6 bids, and the winning bidder agreed to give the government \$400m cash on day one. “I don’t know how you do that math,” he said.

“There’s a perception and a premium to these onshore fields which I don’t commercially understand. We think it is a -7, -6 per cent rate of return at best.”

Premier is making what it considers reasonable bids for fields and getting outbid. “This premium will push companies like us out of the market,” he said.

“We’ll see what happens in the next few bid rounds. Maybe people are running economics differently to how we are,” he said.

Sometimes there has been around \$200m in a difference in bid between the winner and the second place bid. “Amazing money exposed there,” he said.

“That’s how markets change, going from zero interest and people trying to figure it out, to very competitive.

“The playground is getting full with some very smart people. That’s a good thing for Mexico,” he said

Last year, many oil majors came to Mexico looking for acreage. It meant that the

government could finally say that the oil reform has been successful.

British companies are “finally at the table” with the first entry of Premier, then Ophir Energy, and now Cairn and Capricorn.

### Government

From the Mexican government’s point of view, “Mexico is still in its early stages,” he said. “They are continually trying to improve the contract. Every bid round is a little bit better.”

“We always congratulate the government, they’ve done a fantastic job,” he said.

Mexico has a plan for how the oilfields will be offered, which should help companies work out how to build their businesses (so long as the costs of winning bids don’t get too high).

There are new basins that will be made available, with deepwater gas. There are significant opportunities to be offered onshore.

Some people wonder whether the reform will be able to maintain its energy. “That’s a big risk we spend a lot of time on,” he said.

There is a lot of interest in developing shale reservoirs in Mexico, but probably after all of the conventional resources have been developed.

### PEMEX

State oil company PEMEX still holds “some of the best acreage” in Mexico. They have commitments to drill about 55 wells on their acreage over the next few years.

“PEMEX will be a partner that we’ll all have to reckon with either in farm outs or joint ventures,” he said. “They are the biggest dog in the room.”

The big business opportunity going forward might be in a ‘secondary market’, doing business with PEMEX. There will also be many service companies required in Mexico in the next few years.

“The farm outs however right now are very attractive technically but commercially very expensive,” he said.

# Premier's plans for Brazilian deepwater

Premier Oil acquired shares in 3 blocks in the Ceará basin, in Brazilian deepwater. Group exploration asset manager Tim Davies explained why he believes the commercials make sense

In May 2013, UK oil and gas company Premier Oil acquired a 50 per cent share in 2 deepwater blocks in the Ceará Basin, on Brazil's equatorial margin. The blocks are 717 and 665. The other 50 per cent is owned by Spanish oil company CEPSA.

In April 2015, Premier grew its Ceará Basin position by farming into Block 661. The other owners are Total and Brazilian operator Queiroz Galvão Exploração e Produção S.A.

Deepwater development has been going out of fashion in the oil and gas industry in an era of high prices, but exploration asset manager Tim Davies believes that some of the benefits may have been overlooked, particularly when you consider deepwater opportunities are typically twice the size of shallow water opportunities – because most of the good shallow water opportunities have been taken. “I think all of us should have a bit of deepwater in our lives,” he said.

Premier identified the Ceará basin and decided to take a ‘material footprint’ in it, so it could focus, make sure it had ‘running room’, and get to grips with the entire geology.

Blocks 717 and 665 lie on two sides of the “Pecem” well, drilled by Petrobras and BP in 2012, which was an oil discovery, in a cretaceous drift sequence. This helps de-risk the overall petroleum system.

Altogether, there have been two hydrocarbon discoveries in the region. They show that there are good high quality, relatively shallow sands, and the field is easily accessible.

In Block 717, two plays will be pursued, firstly a potential extension of the Pecem discovery south into the block, and secondly a slope channel play (subject to seismic data analysis).

In Block 665 a large Cretaceous onlap play has been identified and being analysed with seismic.

In understanding the geology, Premier Oil has also applied insights from oil and gas exploration across the Atlantic in Ghana, which is the conjugate geology (formerly joined to that part of Brazil).

The basin is on the Ronmarch fracture zone, which crosses the Atlantic, and is conjugate to the discoveries offshore Ghana. “We have a bunch of guys working in Brazil team who are ex Hess and have intimate knowledge of that [Ghana]” he said.

Premier has also done a large amount of basin modelling. It uses software by Geoteric (formerly Foster Finlay Associates) which uses an algorithm previously developed for a body (MRI) scanner to bring out the colours, so it makes subsurface imagery “always look like intestines to me,” he said. “But they do create the most spectacular images”.

In one example you could see a canyon coming off the margin, the Pecem high, and the 160 well. You can see the river system evolving, with more meandering, and the development of an unconstrained fan lobe.

In terms of scale, blocks 661, 665 and 717 all contain “multiple stacked plays and prospects of material scale and size,” he said.

Premier has very high quality Broadseis seismic data across the whole block, which can be used to discriminate architectures, geologies and traps.

Premier calculates that the total volumes are between 1 and 3bn barrels, depending on how the channels are filled and the column height.

There are 4 potential source rock intervals in the basin – Turonian, Albo Cenomanian, Triari (the key source rock, mature all the way across the block), and the top Albion with ‘spotty maturity’.

## Reservoir risk

One question is why hasn't anyone done this before. Perhaps it is due to the high reservoir risk. There is no “magic bullet” direct hydrocarbon indicator which can be used to de-risk.

There is no rock physics which can be done on the sands to de-risk the reservoirs, so decisions can only be made on geology, and upper cretaceous sands are generally harder to understand than shales, he said.

You can see and pull out facies (rock layers) from the seismic image, which “gives us con-



Tim Davies, Group Exploration Asset Manager, Premier Oil

fidence that sinuous bodies have got sands within them.”

You can't see direct hydrocarbon images, because sands are too “stiff” to be able to see fluids.

## Development plan

The two Ceará blocks are right on the shelf edge. To produce the oil, Premier Oil plans to put a platform in shallow water (approx. 150m deep), and then connect that to the deepwater wells via subsea tieback. This should be a much less expensive way to develop the field than a deepwater FPSO.

This has also been done by Spanish Petroleum Company (CEPSA) on a development in Spain, with 740m subsea pipelines up to a platform on the shelf. Husky Oil has a similar project in China and Shell has a similar project in the Gulf of Mexico.

You can use multiphase pumps to handle all of the different fluids from the production off-take platform.

The reservoirs will not produce wax, and do not contain hydrogen sulphide or carbon dioxide, which makes the production fluids much easier to handle. But they are likely to need water injection.

There is a great supply base on the Ceará, which is unusual for a transform margin, he said. Ceará also has a gas export route.

By comparison, Premier already has acreage on the nearby Foz do Amazonas basin, which is thousands of kilometres from the nearest supply base, and so will need to “build an entire industry” to develop.



### Fiscal terms

On these three blocks, there is no government ownership. Typically Premier pays a 10 per cent royalty on sales to the government. Then there is a “special participation tax” of between 0 and 40 per cent, only incurred at production of greater than 30,000 barrels of oil per day, and corporate income tax.

The government tax on this 200m barrel field is 53 per cent, better than the global average of 67 per cent. The company calculates that it could reduce the government take to 36 per cent by using more local “content” (people and equipment). Brazil has an established workforce in the hydrocarbon industry so this should not be too hard.

### Deepwater economics

Mr Davies’ perspective is that it makes sense for all oil companies to have some deepwater projects in their portfolios, since the reservoirs can be typically much larger than shallow water fields, because they have been less developed to date.

But you need to pick the project carefully, looking for the best possible reservoirs but ideally not so deep in the subsurface.

“You need to be in the right place,” he said. “If you can take the play risk out with proven petroleum system that makes life better.”

Deepwater drilling has gone out of fashion to

some extent in the oil and gas industry, following analysis made around 2015 into how much value had been destroyed in deepwater drilling over the previous 6-7 years, with high drilling costs and low success rates.

As an example, deepwater drilling in Africa dropped from 23 wells in 2014 to 2 in 2015.

From 2012 to 2014 there were 510 deepwater wells drilled in 55 countries. From 2015 to 2017, there were 231 deeper wells drilled in 37 countries.

Since then, there has been a big reduction in oil price, and a reduction in exploration spending, which has pushed companies to go to simpler and easier wells, so frontier and deepwater plays look less attractive, he said.

We have recently seen the Liza discovery (Guyana, 2015), discoveries off Senegal (2014 onwards) and other deepwater discoveries like Zohr (offshore Egypt).

Deepwater exploration delivered 77 per cent of the discovered volumes over the 2012 to 2017 period, with an average discovery size of 400m barrels.

Deepwater typically costs twice as much as shallow water to develop a field as shallow water. But it helps that rig rental rates are much lower today than in previous years.

“So deepwater is delivering significant volumes of hydrocarbons in the constrained en-

vironment we currently find ourselves,” he said.

2015 was not a particularly great year for success rate, but that could be due to a ‘hang-over’ of wells which were committed at a time of a higher oil price, on poorer plays. Today, “we are drilling the wells we want to drill, and being successful and better at it.”

This leads to a paradox. “I’m constantly getting beaten up by my boss, who says, the less money I give you, the more successful you get,” he said.

“I’d like to prove him wrong, but statistics show 8 year high on success rate.”

“Maybe we shouldn’t have as much money, when we have money we waste it,” he mused.

The deepwater commercial success rates have actually been lower in shallow water basins than deepwater basins, probably because shallow water basins are usually more mature. “We’ve done the easy stuff, and shallow water works, we understand it and know how to deal with it, but remaining running room is less, so we have to look at things more challenging.”

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The talk included a large amount of geological / reservoir description which has not been included in this written account – but is available with online video and slides.





# Spectrum – opportunities offshore Argentina

Geoscience company Spectrum is acquiring a large amount of 2D seismic offshore Argentina, because the company believes there is very good oil potential. Karyna Rodriguez, director of geoscience explained why

Geoscience company Spectrum is acquiring 35,000km of 2D seismic data offshore Argentina, including coverage of the deepwater Salado and Colorado basins, because it believes that the basin fan floor fans offer strong hydrocarbon potential, probable for oil.

The company also believes that this is a good time to explore in Argentina deepwater, with large amounts of open acreage available for the first time.

Spectrum has put 2 seismic lines through a fast track interpretation process, and they are “already showing interesting characteristics,” she said.

The data is being acquired with a 12km streamer, with record length of 15 seconds, recorded continuously. The data is de-blended with an in-house system. The 15 seconds is long enough to image the Moho (line between the crust and the mantle).

The aim is to image from the Moho to the seabed, in a very fast track process. But it needs very careful velocity picking, with just a 2 to 3 per cent change in process we lose the Moho.

Spectrum is doing broadband data processing, which means it can expect to preserve high resolution and still target the deep image.

## Background

Offshore Argentina has been “quite active for many years”, with 153 wells drilled, including 18 wells in the Colorado basin and 7 wells in the Salado. This data can be used to calibrate future seismic.

The first offshore well in Argentina, Samar D x-1, was drilled in the Salado Basin in 1969 by Sun Oil. Argentina’s first offshore discovery was in the San Jorge Basin towards the south, drilled in 1970 by AGIP.

The first offshore production in Argentina was the Hidra Reservoir in the Austral basin, discovered in 1982, with first production in 1989. (See a GeoExpro article at <http://bit.ly/2DDJWO1> for a map).

In the last 17 years there has been barely any exploration at all in offshore Argentina. This



*Karyna Rodriguez, Director of Geoscience, Spectrum*

is mainly due to the political environment, not for oil and gas reasons, she said. But wells drilled in the Salado basin between 1948 and 1984 indicate that there is a working petroleum system. This can include 2 wells drilled to the North in neighbouring Uruguay, which has waters in (what is considered by some to be) the same basin.

## Geology

Looking at past wells in the Salado basin, the Samar 1 well, the first well drilled in Argentina in 1969, had residual oil, Tertiary sediment and Cretaceous sandstones, all with hydrocarbon indications.

The Samborombon B well, drilled by Unocal in 1969, encountered quartzite basement. It also had traces of residual hydrocarbons in Palaeocene sandstones. The quartzite basement is interesting because this was also found in a well on the other side of Atlantic, in South Africa, where there are producing oil fields.

The Argentinian coastline in the region has a very steep transition from the shelf slope to the basin. Exploration benefits from an extended shelf with 70km of shallow water.

Sediment is carried into the basin by the Salado River, which is still a major river today, transporting large amounts of clastic material, with high sediment rates. There is an interesting question of what kind of sediment the river would have been carrying in the geological past.

Similarly, the Colorado formation wells are showing coarse clastics (rock which has been moved). There is a lot of sediment prograding down onto the basement. There are basin floor fans and basin-slope fans.

There is a ‘high’ which means that the sediment

is draped over the high, providing an opportunity for structural traps and stratigraphic traps.

## Compare to South Africa

The basins would have been formed before the Atlantic rift (splitting up of South America and Africa), so you can expect to see similar geology in Africa.

If you look across the Atlantic, to see what Spectrum calls the “Outer High” in Namibia, you can see the sediment draping over the high, and a possibility of a structural closure in the deep basin.

The Argentinian source rock has the same character as source rock proven in Namibia, she said.

There is a possibility that the Colorado Basin is a continuation of the Cape Fold Belt, a sequence of sedimentary rock layers in the South-western corner of South Africa.

If you look at a seismic line from the Cape Fold Belt, going offshore to the Outeniqua Basin, you can also see box folds, she said.

There is also a quartzite fractured basement in the Cape Fold Belt, as was seen in the Salado Basin Samborombon B well offshore Argentina. The well went some metres into the basement and found hydrocarbons. So there could be fractured basement oil in Argentina, she suggested.

Another interesting comparison is to compare the Colorado sediment supply in Argentina with the Orange River, the longest river in South Africa, a world class drainage system bringing a lot of sediment into the South Atlantic.

“The Colorado basin has had consistent supply of sediment from the Jurassic time to the present time. That is all prograded down in to the basin in much larger quantities than the Orange Basin.”

It can also be worth looking at the Karoo basin trend of East Africa, going through Kenya, Tanzania, Botswana to Namibia in East Africa. The Salado and Colorado basins in Argentina fit exactly with the trend of the Karoo basin, she said. And the Karoo reservoirs and source rocks are world class.

# PGI – oil policy and security risks

One of the big themes of both politics and security in South America is state control of the oil and gas industry, often with governments looking to raise private investment, amid public protest

One of the big themes of both politics and security in South America is state control of the oil and gas industry, often with governments looking to raise private investment, amid public protest and strikes. Another theme is low levels of security in general, with risks both to personnel, such as kidnapping, and fuel theft.

Since 2014, most governments have been looking for ways to liberalise the oil and gas sector, although it is subject to ebbs and flows, said

Jennifer Bates, political risk analyst for Latin America with Protection Group International.



Jennifer Bates, Political Risk Analyst, Protection Group International

## Venezuela

Venezuela has the largest oil reserves in the world, but the working environment is becoming increasingly difficult with high levels of state intervention.

Hugo Chavez nationalised the oil and gas industry in 2006, transferring ownership of oil projects to companies where the state has a majority interest.

Since then, international oil companies like ConocoPhillips and ExxonMobil have been seeking international arbitration.

But the country is becoming increasingly turbulent and authoritarian, Ms Bates said. The government has long suppressed statistics on crime - but independent research by NGOs indicates country has highest rates of kidnap and homicide in the world, and increasing as economic situation deteriorates, she said.

The country has witnessed several episodes

of mass unrest in recent years, which has prompted firms Statoil and Repsol to withdraw foreign staff from bases in Caracas.

Politically, the United Socialist Party of Venezuela dominates the government, although the opposition has a majority in government.

It is hard to say if President Nicolás Maduro, from the socialist party, will be able to complete his term, which ends in 2019. "He needs to maintain the support of the military, which has been very important in propping up government," she said.

## Mexico

Mexico saw a landmark liberalisation of its oil industry in 2013, and poses a really important opportunity, she said. The next oil round is in March 2018, covering 35 shallow water areas of the Gulf.

The government has shown 'considerable pragmatism' in improving the regulatory system in response to industry concerns, simplifying contracts, reducing restrictions on consortium bids and local content requirements, all with a commitment to market economics.

There is an upcoming presidential election in July 2018 raising concerns with investors, with the frontrunner the left-winger Andrés Manuel López Obrador, who has pledged to reverse the 2013 reforms.

"His presidency would likely lead to a stall in liberalisation thus far, but his election would not threaten existing oil contracts, because it would require change in constitution through congress which is largely supportive of energy reforms," she said.

In terms of security, Mexico is frequently presented as a lawless country, but there is a big difference in crime rates between states, and companies working onshore face greater risk than offshore, she said.

Fuel theft has grown significantly in recent years, currently accounting for \$1.1bn losses for Pemex every year.

The 2013 energy reform is still a key political issue and so could be a cause of civil unrest.

In 2017 a liberalisation of fuel prices led to a wave of looting of petrol stations and revealed a large negative public sentiment.

## Brazil

Brazil saw measures in Nov 2016 for PETROBRAS to do production sharing agreements in presalt areas, and in 2017 bidding rounds for concessions and production sharing regimes, and more flexible local content requirements. It is definitively in a "positive state," she said.

But the wider political uncertainty remains an issue, with the government engulfed in production scandals for several years.

The current president Michel Temer says he will only rule until 2018, which could lead to the return of former president Luiz Inácio Lula da Silva, which could mean a shift to more state control.

There are risks of civil unrest, with powerful unions representing oil workers, with a history of threatening or actually holding industrial action. A strike in 2015 led to large reductions in production.

## Argentina

In Argentina there are examples of both softening and hardening of the regulatory environment.

The regimes of Néstor Kirchner and Cristina Fernández (2003-2015) had been extremely protectionist and hard for private investors. But President Macri, coming into power in 2015, was very pro-business, and pro-reform, and targeted the oil and gas sector, said Ryan Turner, lead political risk analyst with PGI.

The government sees the potential of the "Vaca Muerta" play, estimated to have the second largest recoverable shale gas reserves in the world.

He looked at what it could be done with the regulatory environment to make Argentina more attractive to business.

In January 2017 he negotiated a deal between oil companies, governments and unions to lower the risk of industrial unrest. Although



the changes haven't been widely supported, with a backlash on streets, strikes and civil unrest, Mr Turner said.

Former president Cristina Fernandez won a senate seat in Dec 2017, which could encourage her to run again for president in 2019, perhaps leading to reversing of some of the reforms.

Crime and civil unrest are a major consideration in Argentina, including a protest in Vaca Muerta, calling for a greater share of profits for indigenous communities.

### Ecuador

Ecuador is the smallest member of OPEC, with a socialist government, and major policy changes are not expected. President Rafael

Vicente Correa Delgado (2007 to 2017) oversaw a period of increasing state intervention, replacing production service contracts with service contracts, which are less flexible and profitable for oil companies. He also withdrew Ecuador from the World Bank Arbitration Court.

The current president Lenín Moreno appears to be less hard-line for oil and gas companies, and the country is seeing a reversal of the most hard-line policies, with a plan to offer production sharing contracts again, and allow Chilean courts to be used as international arbitration mechanism.

### Peru

Peru has modest reserves but benefits from an existing energy infrastructure.

There are high levels of unrest, with 600 indigenous protestors taking over 50 oil wells in Peru in September 2017, the largest oil and gas site in Peru.

### Bolivia

Bolivia has had a socialist government for some time. President Evo Morales came into power in 2006 and nationalised the oil and gas sector, with a negative impact on investment. However he opened previously closed off areas to investors.

"We see this playing out - balancing behind leftist [politics] and practical reality," he said.

A policy shift is "very unlikely. He'll be in office until 2019."



## What did you enjoy most about the event?



**Learning of the state of play in Mexico.**



**The presentations were good and the first two especially so.**  
*Bryan Moseley (Geologist)*



**Integrated approach with technical quality and strong chairmanship.**  
*Bryn Austin (Brynterpretation Ltd.)*



**Updating on Latin American activity; Networking.**



**5. Wide ranging overview of the current exploration focus in South America.**  
*Richard Walker (Consultant Geophysicist)*



**Informative view of the countries by the operators involved.**



**Variety of presenters from industry, regulators, and finance.**



**Presentation on Mexico.**



## Finding Petroleum: Non-seismic Geophysical Technologies and Non-Conventional Seismic Attendees

London, October 17 2017

Geoffrey Boyd, Field Development Consultant, Antium Frontfield	William Slade, Ikon Science	Tim Davies, Global Portfolio & NV Manager, Premier Oil
Julian Moore, Technical Director, APT UK	Abbey Hunt, Impact Oil and Gas	Daniel Buckingham, Broker, Pronto Business Funding
David Craik, Consultant, Atlaslocal	Neil Simons, Independent consultant	Colin More, Prospect Geoscience
Antone Cerrotta, Sales & Commercial Coordinator, Bibby Maritime Limited	Mike Hibbert, Independent consultant	Jennifer Bates, Senior Analyst, Protection Group International
Bryn Austin, Director & Geological/ Geophysical Consultant, Brynterpretation Ltd	Manouchehr Takin, Independent consultant	Richard Herbert, R Herbert Associates Ltd
Robert FE Jones, Director, Caithness Petroleum	Greg Coleman, CEO, Independent Resources Plc	Josh King, Analyst, RAB Capital
Chris Matchette-Downes, MD & Owner, CaribX and MDOIL Limited	Phil Penfold, Partner & Global Director BD, io oil & gas consulting	Patrick Taylor, Director, RISC (UK) Limited
Andrew Webb, Manager, Petroleum Reservoir and Economics, CGG	John Griffith, Upstream Advisor, JIG Consulting International Ltd	Brian Hepp, President, Rocky Mountain Limited
Roger Doery, Consultant	Colin Clarke, Geophysicist, Lloyd's Register	James Hodson, Senior Sedimentologist, RPS Energy
Richard Walker, Consultant Geophysicist	Yoanna Siciliano, Senior Reservoir Engineer, Lloyds's Register	David Webber, Seismic Operations Supervisor, Sceptre Oil & Gas
Dan Kunkle, Director, Count Geophysics	Rolmys Espinoza Senior RE, LR Senergy	David Jackson, Principal Geologist, Shearwater Geoservices
Marco Bartholdy, Analyst, Critical Resource	Richard Bootle, Lukoil	Read Taylor, EPV, Sierra Oil & Gas
Lucia Graham-Wood, Analyst, Critical Resource	Artem Kotenev, Lukoil Overseas UK Ltd	Alexander Chalke, Business Development Director, Simpson Booth
Robert Ward, Advisor, Decision Frameworks	Lauren Mayhew, Geoscientist, Lyme Bay Consulting	Laura Lawton, Principal Geoscientist, SLR
Darren Jones, Data Analyst/Cartographer, DrillingInfo	Duncan Macgregor, Consultant Geologist, MacGeology	Hannah Aylwin, Geoscientist, SLR Consulting Ltd
Mark Lonergan, Senior Business Development Manager, EPI Group	Hussain Kubba, Norton Rose Fulbright LLP	David Lawton, Chief Geoscientist, SLR Consulting Ltd
Avinga Pallangyo, Conference Organiser, Finding Petroleum	Mike King, Oil & Gas Manager, NPA Satellite Mapping	Karyna Rodriguez, Director of Geoscience, Spectrum
Karl Jeffery, Editor, Finding Petroleum	James Thadchanamoorthy, CFO, NRL	Nigel Flood, Multiclient Sales Manager Spectrum Geo Ltd
Jerome Foreman, Principle Geoscientist, Foreman Consultants	Dave Waters, Director and Geoscience Consultant, Paetoro Consulting UK Ltd	Phil Houston, Founder / CEO, TalEng
Dominic Lewenz, Managing Director, Frontier Advisory	Robert Parker, Consultant, Parker	Richard Nolan, CEO, Tridevi Capital
Bryan Moseley, Geologist	David Sendra, Associate Consultant Petrophysical Consultant	Pierrick Rouillard Geoscientist, Westwood Global Energy Group
Rebecca Head, Geoscientist, Halliburton (Landmark)	Ryan Turner, Political Risk Analyst, PGI	Alastair Bee, Westwood Global Energy
Don Jameson, Director, Hedera Consulting Limited	Iain Brown, PGS	
Norman Hempstead, Director, Hempstead Geophysical Svcs	Craig Koch, Project Geoscientist, PGS Reservoir	
	Frederic Yeterian, Director, Philax International (UK) Ltd	

