

The Oil Drum: Europe

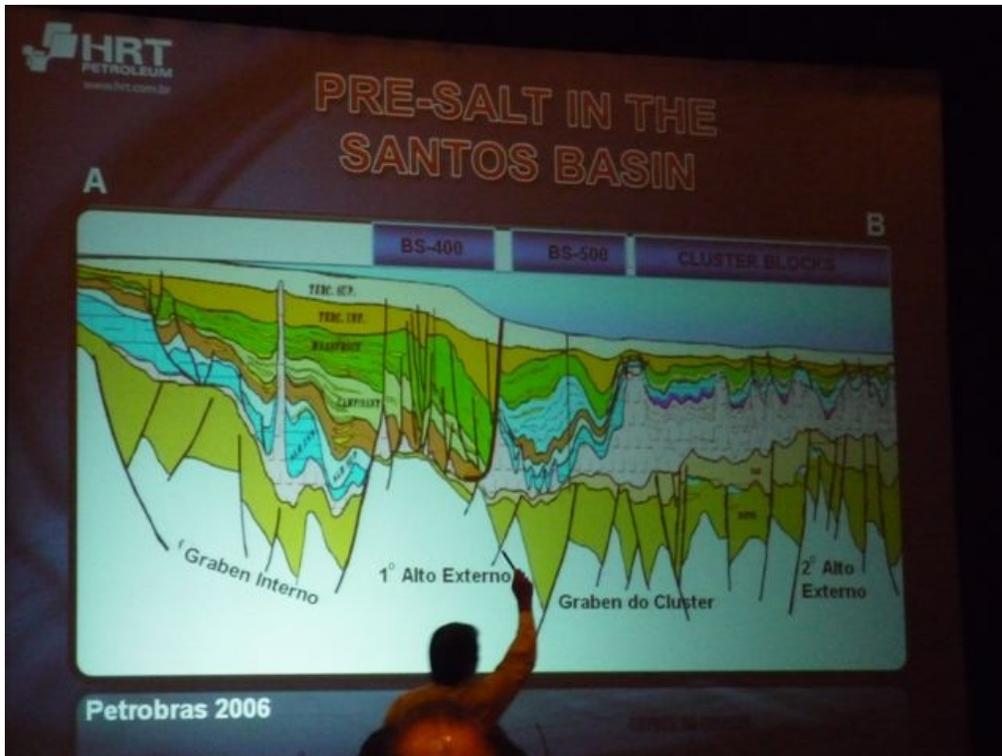
DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

Half a trillion barrels more than we thought? (Or, "The Tupi Field, the Pre-salt, and the Very Distant Future")

Posted by [Euan Mearns](#) on October 13, 2009 - 8:20am in [The Oil Drum: Europe](#)

Topic: [Geology/Exploration](#)

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At the end of the first day of the ASPO conference in Denver, we were treated to a fantastic presentation on the oil potential of the sub-salt basins on the margins of the South Atlantic Ocean given by Dr Marcio Mello who presented the evidence for a half trillion barrels of reserves in this new frontier province. So has a new Saudi Arabia been found?

Marcio Mello is president of **HRT Petroleum**, a Brazilian geological services company. Dr Mello's talk began with some background to the Tupi discovery in the Santos Basin, Brazil, and went on to extrapolate the geological and petroleum systems of Tupi to basins off southern Africa, the Amazon Basin, The Gulf of Mexico and The Congo Basin.

Dr Mello explained how the discovery of "diamondoid" structures in oil at shallow depth in Brazil gave evidence for mixing two types of petroleum, one that must have been formed at great depth below the Salt that blankets this basin. He had for many years tried to persuade Petrobras to drill deep, into the sub-salt strata, which of course they did eventually do leading to the discovery of Tupi.

The Tupi Field occurs in limestone reservoir at extraordinary depths of around 6000 meters

beneath a salt layer that is around 2000 m thick. At such depths, temperatures would normally be too high for oil to survive but the secrets here are a combination of deep water and the conducting character of the salt which results in hot but tollerable temperatures at these great depths where the drill bit has proven intermediate grade crude oil to exist.

The geological story

The story starts during the Early Cretaceous when the continents of S America, Africa, Australia and Antarctica were joined in a supercontinent called **Gondwanaland**. A series of deep lakes formed along an axis of rifting that would eventually lead to the opening of the Atlantic Ocean. This is a tectonic setting similar to the East African rift valley. High levels of organic productivity lead to organic rich shales forming on the Lake bottom that were destined to become the source rocks. With progressive rifting the sea eventually invaded the rift valley lakes and an elongate shallow sea formed in which limestones were deposited. This is a setting not unlike the Red Sea today. The limestone, sitting on top of the organic shales, were destined to become the reservoir rocks.

And then something unusual must have happened to limit open access to the oceans, and with high evaporation rates, saline water built up in this shallow sea leading to the deposition of a very thick layer of salt, which formed an extensive seal, across the seabed.

The perfect geological storm

With progressive rifting, S America was eventually separated from Africa and the Atlantic Ocean began to open. The rift valley strata of black shale, limestone and salt was buried beneath sand and mud eroding off the newly formed continental margin and was buried to great depth, heated and squeezed. Eventually the source rocks matured and oil formed but with the extensive layer of salt above it could not escape and gathered instead in the limestone reservoirs that have now been drilled and called **Tupi, Jupiter, Iara and Guara**.

A mirror image in Africa?

When the continents split apart, roughly half the rift basin strata followed S America and half followed Africa. Dr Mello then went on to speculate that a mirror image of the Santos Basin may exist on the African side. I believe it has already been identified on seismic. Somewhat higher heat flows on this side would likely mean a gas and condensate play instead of oil.

Mapping oil seeps using satellites

Dr Mello also presented data acquired by satellites that could identify and map ocean surface oil slicks, formed by oil escaping from sub-surface reservoirs. Mapping these slicks with time allows the source on the seabed to be located and if this lies above a geological structure this may suggest a mature petroleum system below. A case study from the Cantarell Field was presented along with prospects mapped in this way from the deep water in the Gulf of Mexico.

500 billion barrels of reserves?

Dr Mello's talk was extremely slick and enjoyable. One has to remember he is a salesman as well as a scientist, accustomed to selling his ideas and reports to the oil industry. He speculated that the sub-salt basins on the margins of the S Atlantic together with the Amazon and Congo basins may contain 500 billion barrels of oil. So is this our oil supply problems solved? If he is right, then another Saudi Arabia may be found, but in much more hostile environment.

Cautionary notes

With a world economy intolerant of oil price >\$80, there is a major question whether these ultra deep fields can be developed and produce oil at a price the world can afford. In the future, when our economy has adapted to a higher energy price environment and we are desperate for oil, then it seems likely that they will be developed one day. Indeed Tupi is currently on an [extended well test](#).

Oil seeps sometimes are and sometimes are not good indicators of oil fields below. Explorationists need to be optimistic and there will inevitably be many disappointments in the years ahead.

Much of Dr Mello's presentation was extrapolation and speculation, but I will not be surprised to hear about a string of new discoveries from these plays in the decades ahead. 500 billion barrels will likely prove to be a wild over-estimate, but I do suspect that oil from the sub-salt will help soften the decline curve of future global oil supplies.

There is the ever present question of EROEI, and Professor Hall was on hand to volunteer his services in exchange for a few barrels or their proxy - \$\$\$. Personally, I'd guess that EROEI will not be an issue here since 20,000 bbls per day from single wells represents a very high flow of energy.

It will be many years before significant production volumes comes from the Santos Basin and this will not impact near term oil supply issues until at least 2020.

Finally, Dr Mello seemed very surprised to learn during the Q&A that 500 billion barrels was just 15 years global oil supply.



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