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Importance of reliable oil & gas data: Update on US GOM data

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presentation via Skype from a long paper available on ASPO France site

Most discussions on Peak Oil come from the fact that technical data is confidential and that published data is political or financial.
The only places, where technical data is reported, are in UK (BERR), Norway (NPD) & federal US (MMS).
US GOM is a good place to study US “reserve growth”.

The last survey on oceanic hydrates was carried in the GOM in May 2009 and a very optimistic report was issued, despite the lack of core as shown in part 2. Without core, reserve estimates are highly unreliable

-Part 1: Oil & gas fields

What is deepwater?
Its definition varies from 656 to 1500 ft (200 to 457 m).
Royalties vary with water depth: 0-200m, 201-400 m, 401-800m, over 1000m.
But in MMS technical reports, to please the industry, deepwater is defined as >1000 ft (305 m) and ultra-deepwater is > 5000 ft (1525 m).
But EIA deepwater is > 200 m. IHS frontier data for GOM is over 400 m.

-1-1-Past production

For 2007, oil and gas from the GOM represents 25% and 14% of US production:

Figure 1: US oil and gas production: GOM share

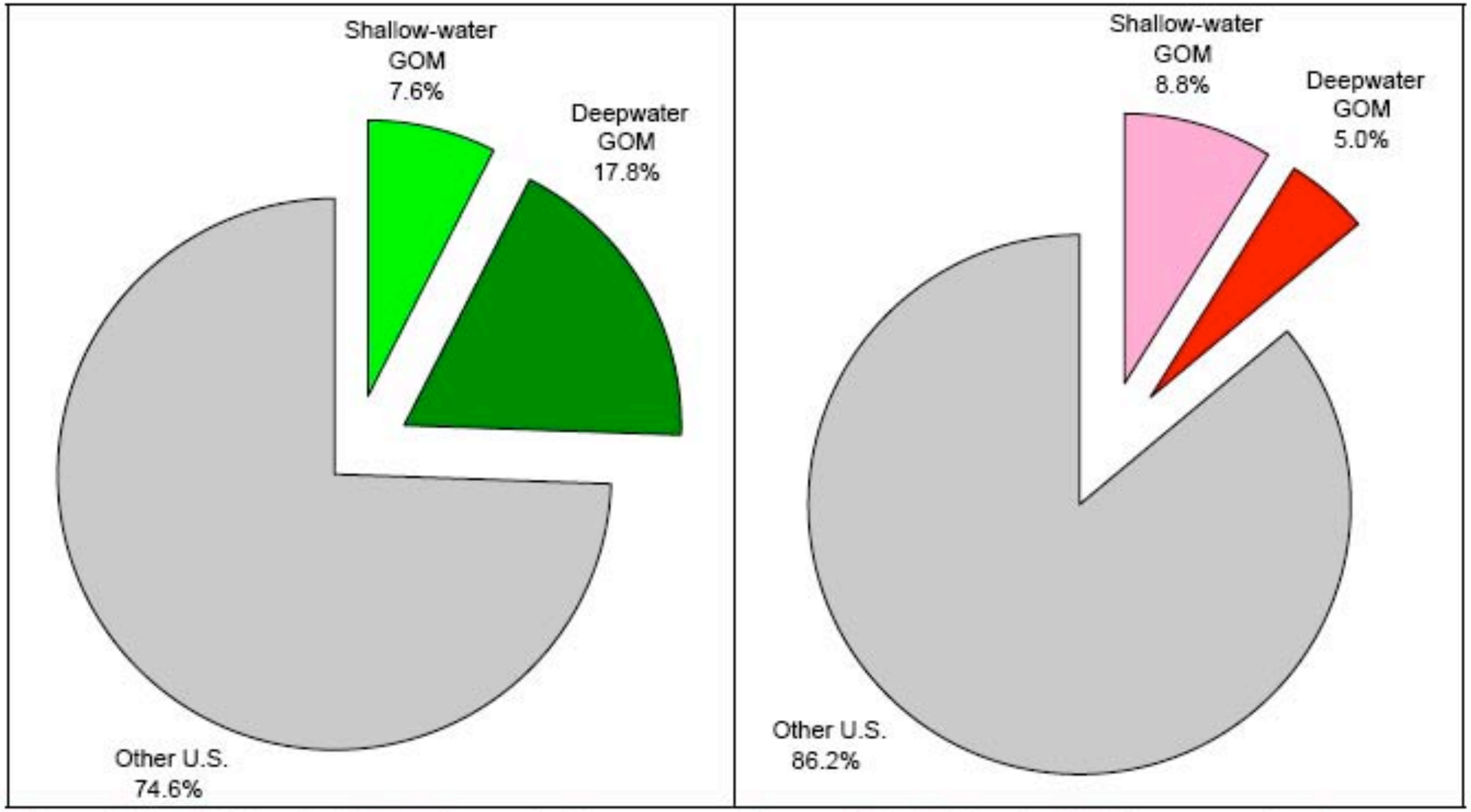


Figure 24a. Estimated U.S. oil production in 2007.

Figure 24b. Estimated U.S. gas production in 2007.

Figure 2: GOM annual oil & gas production 1947-2008

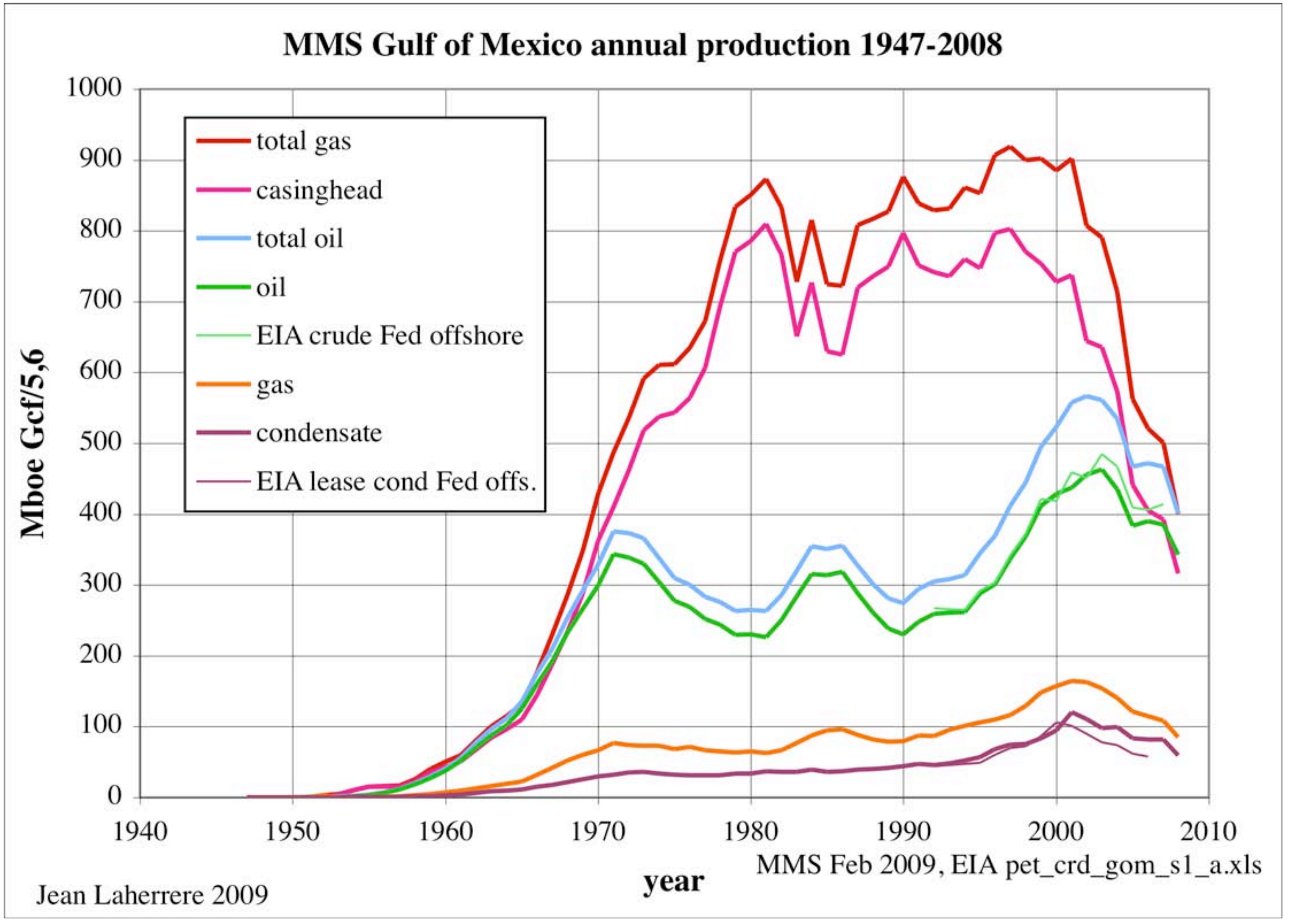


Figure 4: GOM Federal offshore oil production & MMS forecasts 1992-2018

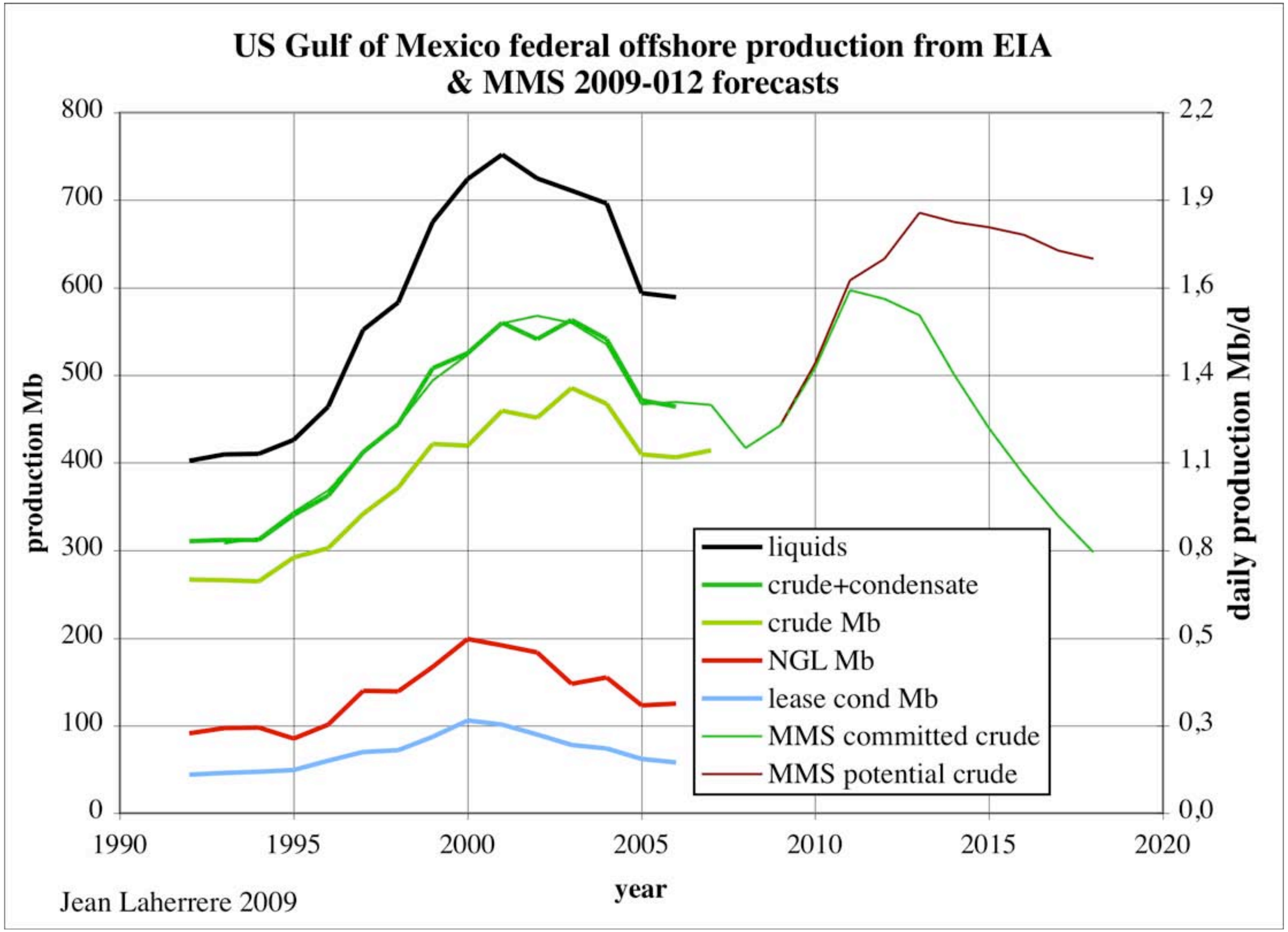
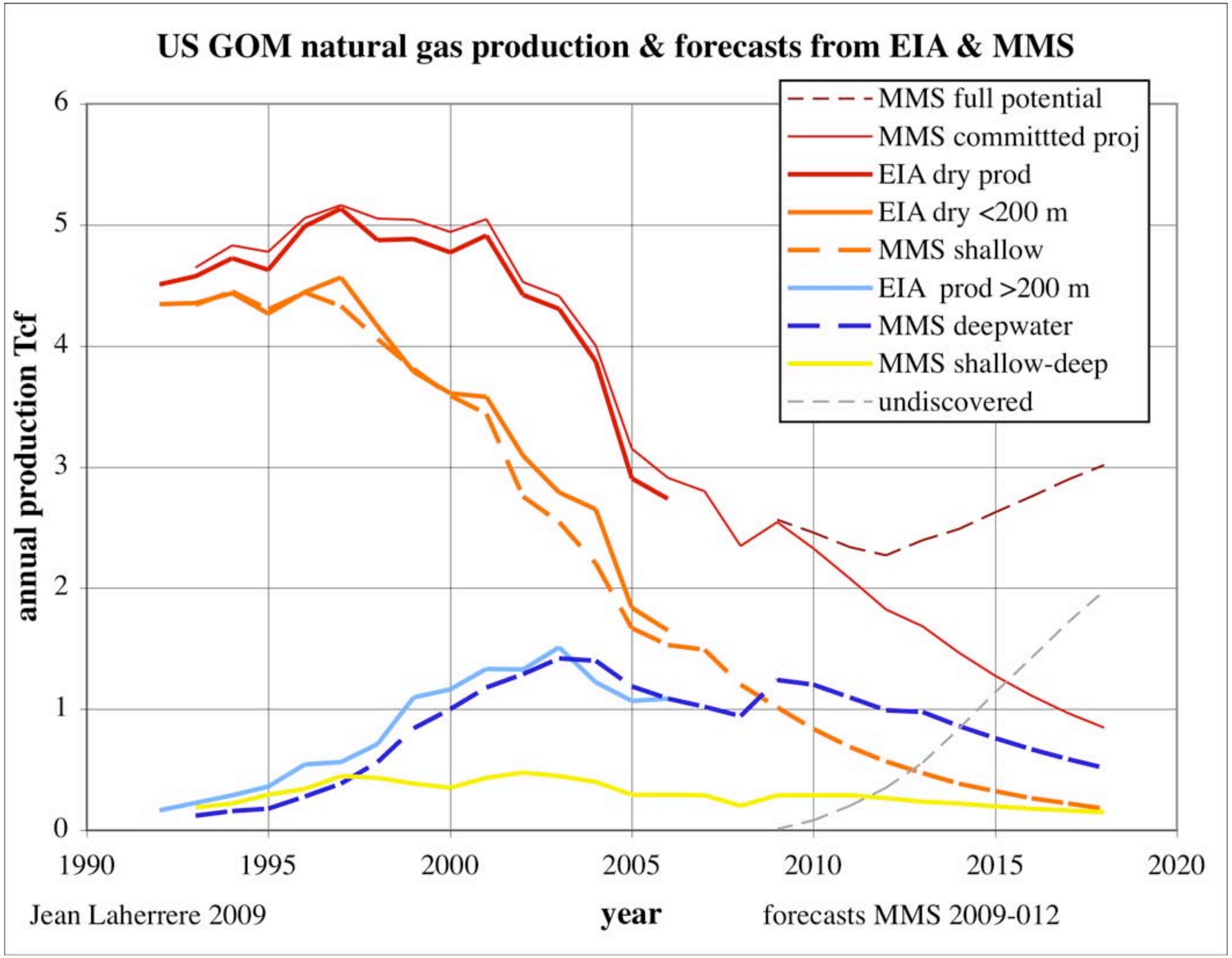


Figure 6: GOM Federal offshore natural gas production & MMS forecasts 1992-2018



-1-2-Reserves

The peak in number of discoveries is in 1984 (73) and in volume in 1956 (2,8 Gboe):

Figure 7: GOM annual discovery from MMS 2009-022

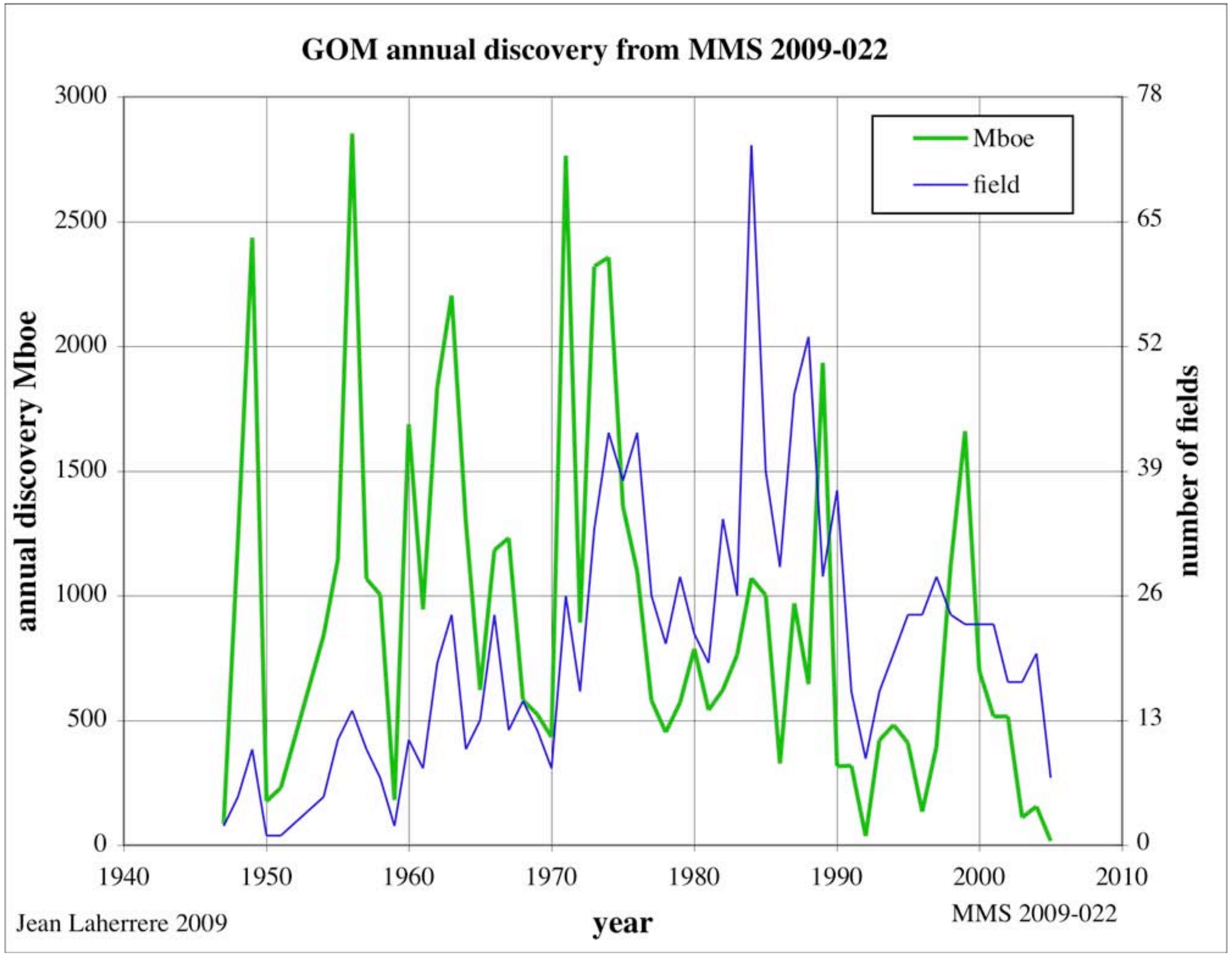


Figure 9: GOM deepwater proved fields location

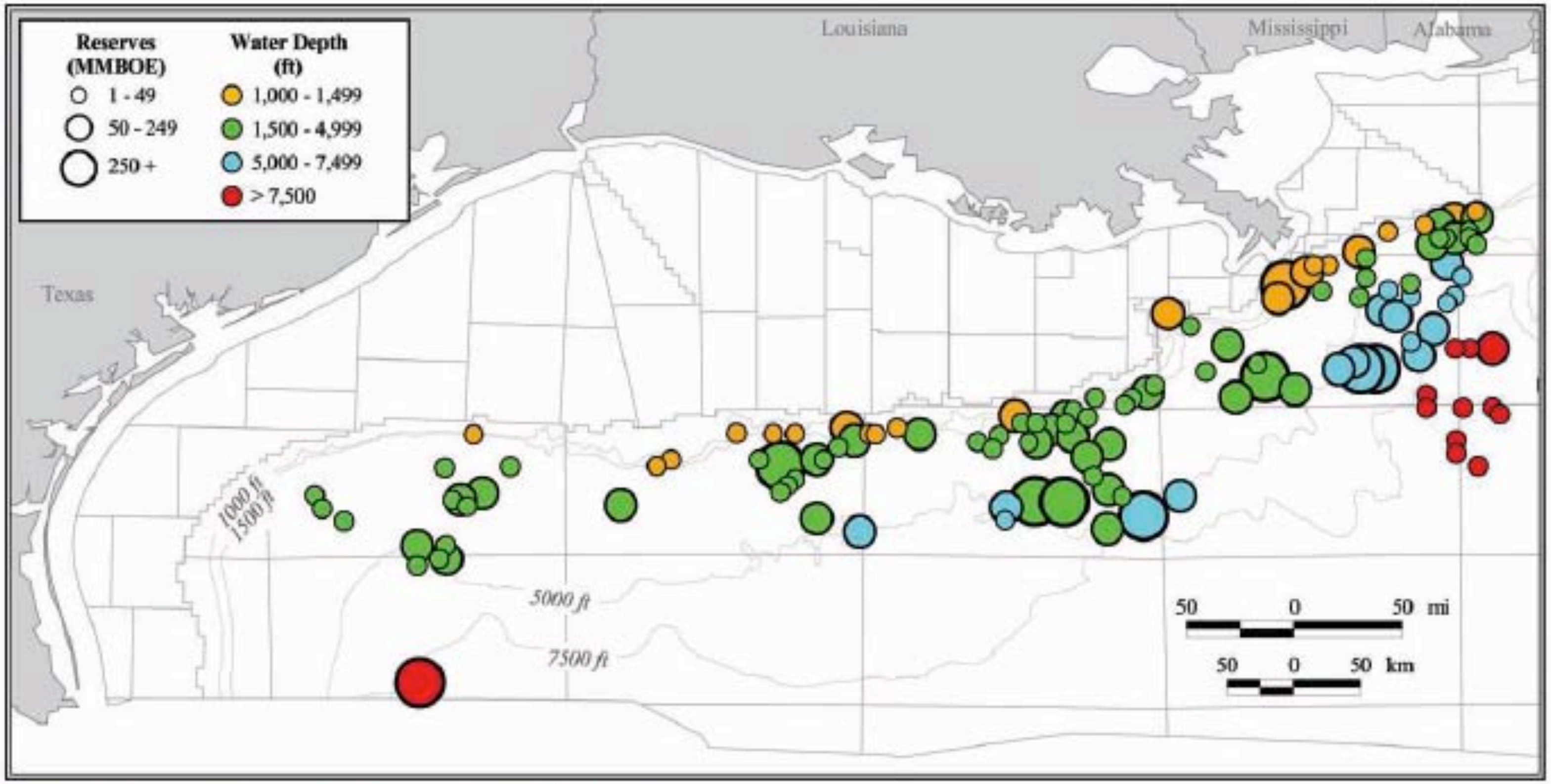
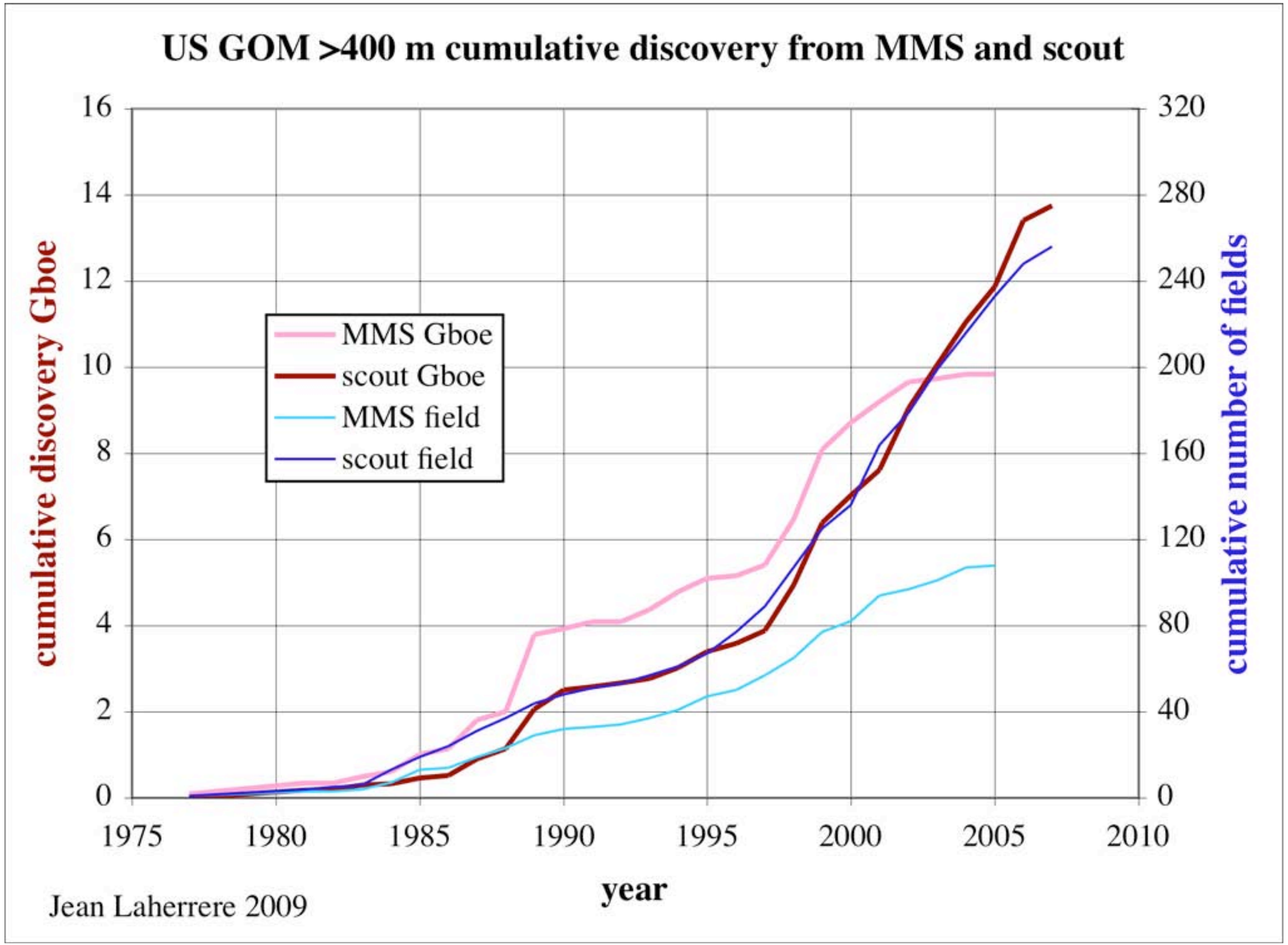


Figure 4. Estimated volume of proved deepwater fields.

Frontier scout data reports only discoveries for water depth deeper than 400 m and they are compared to MMS at end of 2005:

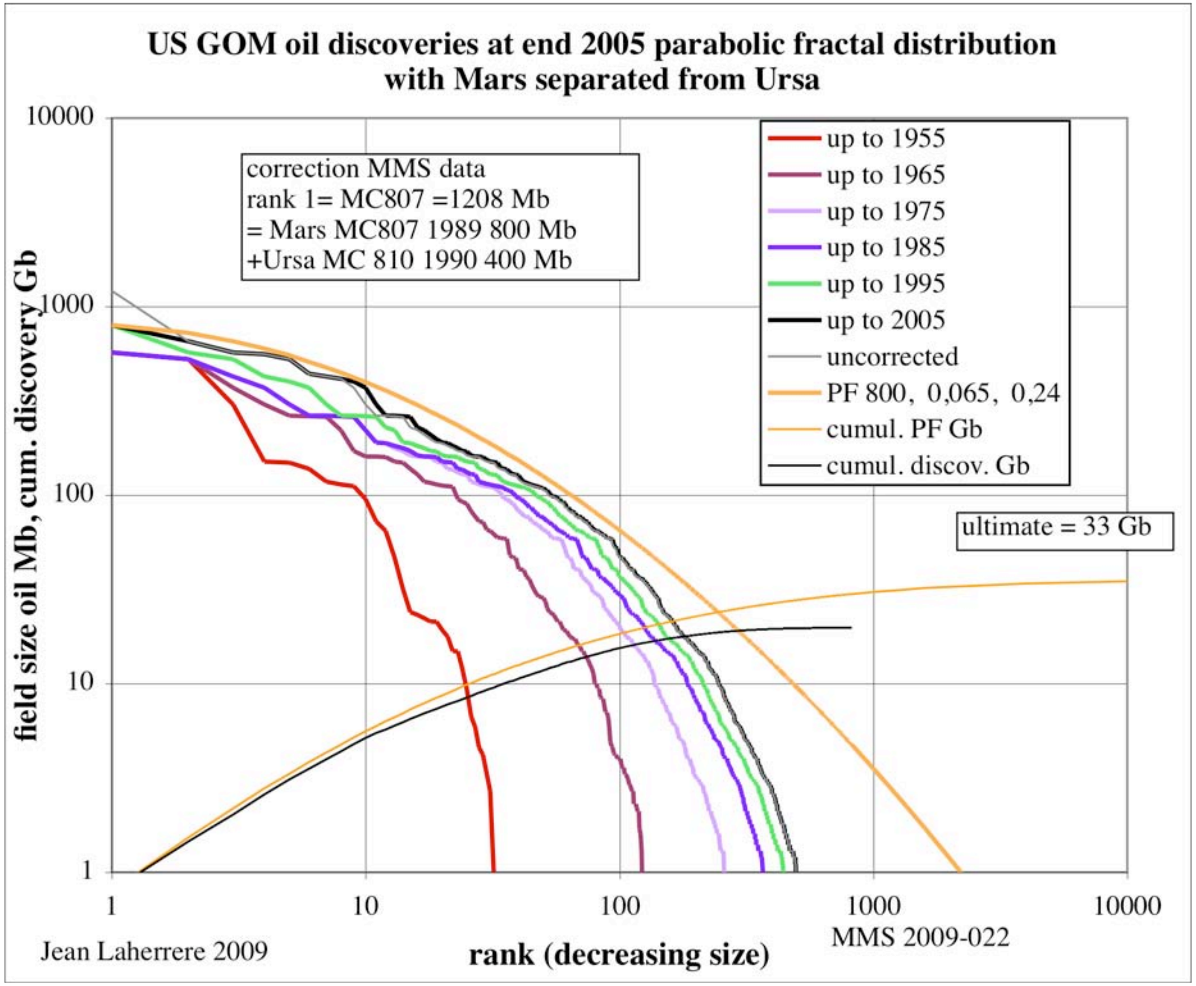
Figure 10: GOM >400 m cumulative discovery from MMS & scout



The difference (4 Gboe & 120 fields) is so large that it should be a good explanation!

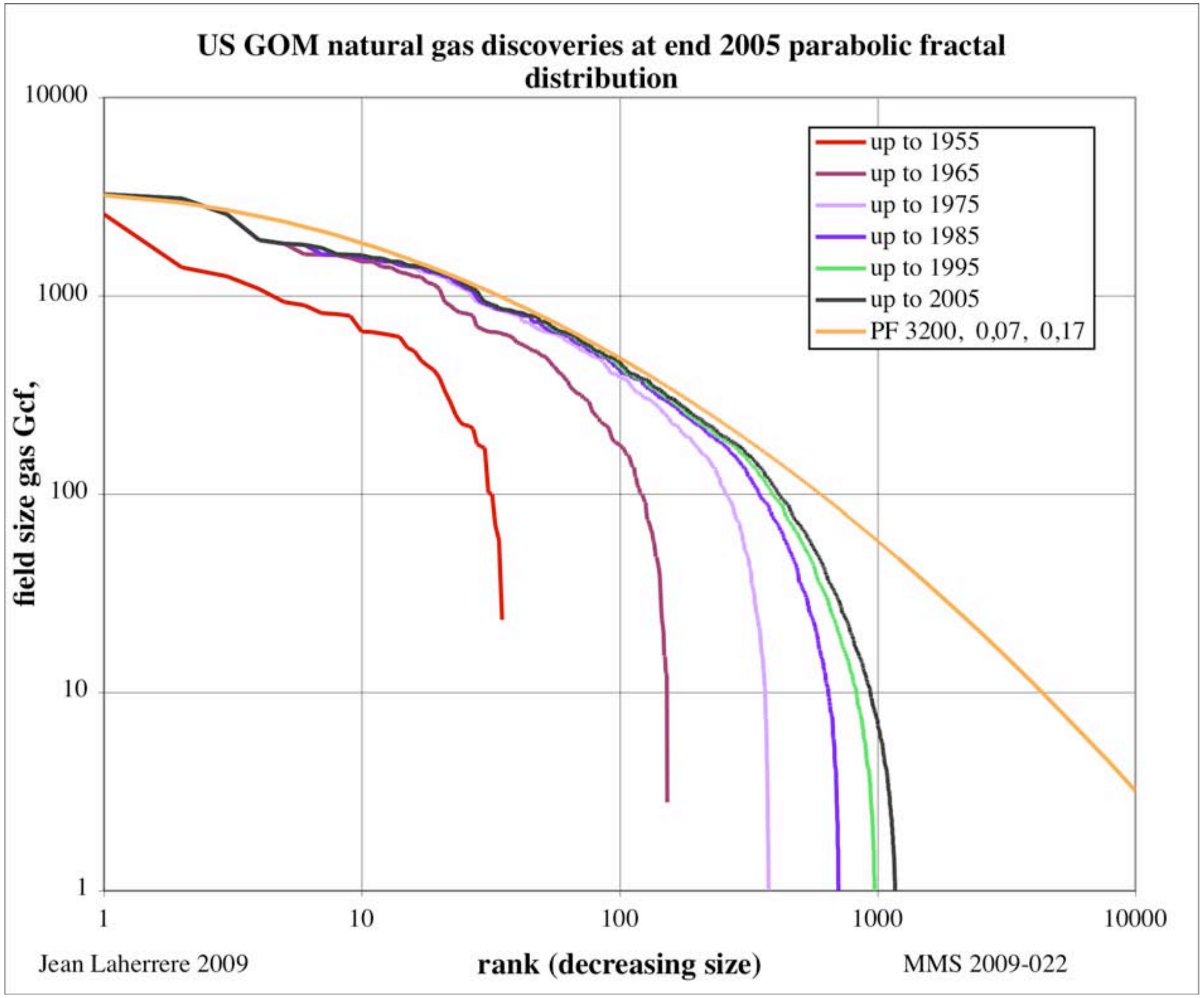
-1-3-discovery fractal display

Figure 11: GOM MMS oil discoveries parabolic fractal distribution & model



Using the parabolic model an ultimate of 33 Gb can be estimated.

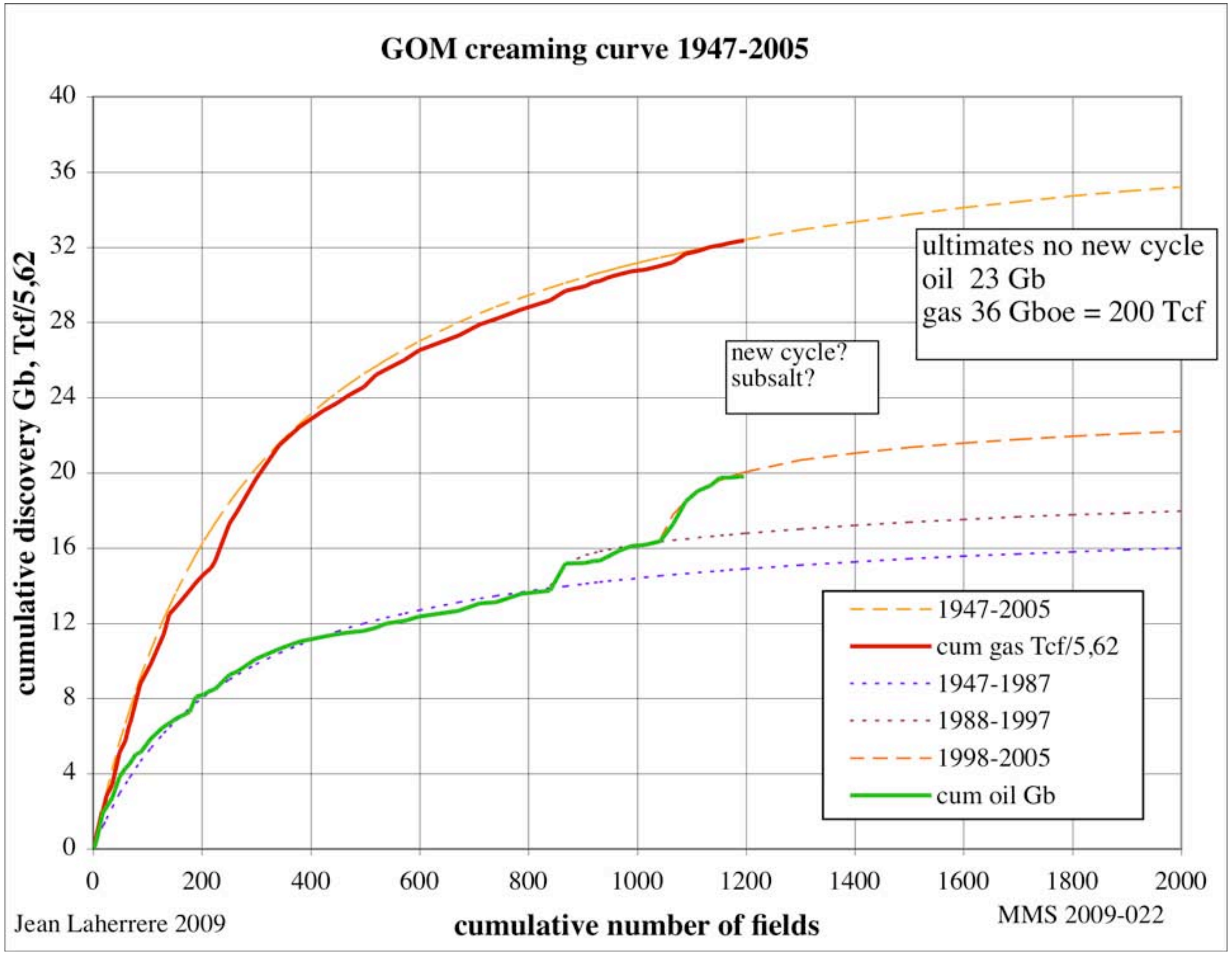
Figure 12: GOM MMS natural gas discoveries parabolic fractal distribution & model



-1-4-creaming curve

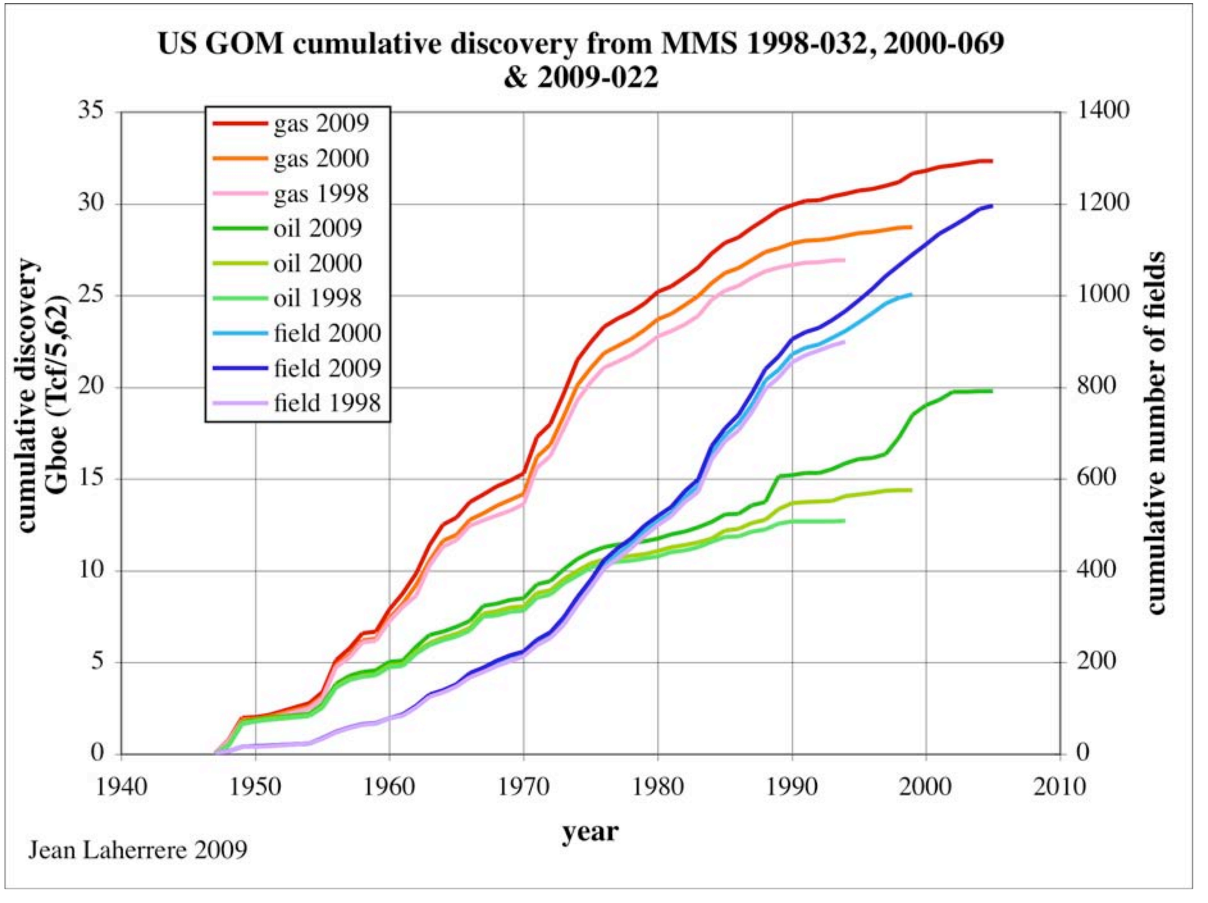
The creaming curve = cumulative discovery versus the cumulative number of New Field Wildcats (or of fields when NFW are not available) is the best tool to estimate ultimates,

Figure 13: GOM MMS creaming curves at end 2005



-1-5-reserve growth

But a comparison with the MMS 1998-032, MMS 2000-069 and MMS 2009-022 shows that obviously the past data was incomplete when plotting the cumulative number of fields (in blue). Figure 15: GOM MMS cumulative discovery reported in 1998, 2000 & 2009



-1-6-Conclusions of part 1:

The GOM field database is among the best ones to study the evolution of discoveries and to estimate ultimates, but unfortunately the data is incomplete (missing fields and discoveries) and reserves estimates are only proven (because of the obsolete SEC rules) and not the reliable proved + probable value used in the rest of the world outside the US.

But in the future with the new SEC rules allowing the reporting of 2P, it will be interesting to see the evolution of GOM reserves reporting in 2011 or 2012!

Part 2: Hydrates -2-1-What are the hydrate in-place resources estimates?

MMS 2000-017 stated that the distribution of worldwide organic carbon in gas hydrate was twice the weight of fossil fuels (coal, oil and natural gas). It is still shown in USGS 2006 (Collett et al).

This was unrealistic because most hydrates are located in the oceanic first 600 m recent sediments (water depth > 500 m) which covers a period of time of few millions years, when fossil fuels sediments cover a period of about one billion years with larger surface and thickness (>6000 m).

Figure 16: Global submarine gas hydrate estimates from Milkov 2003

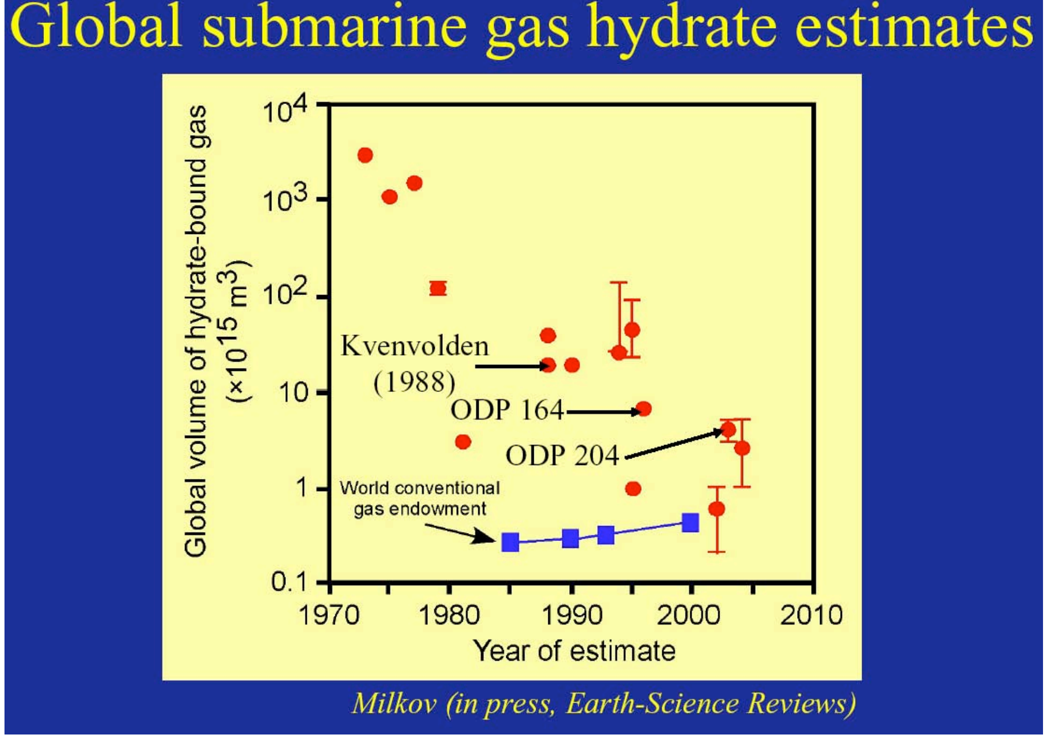
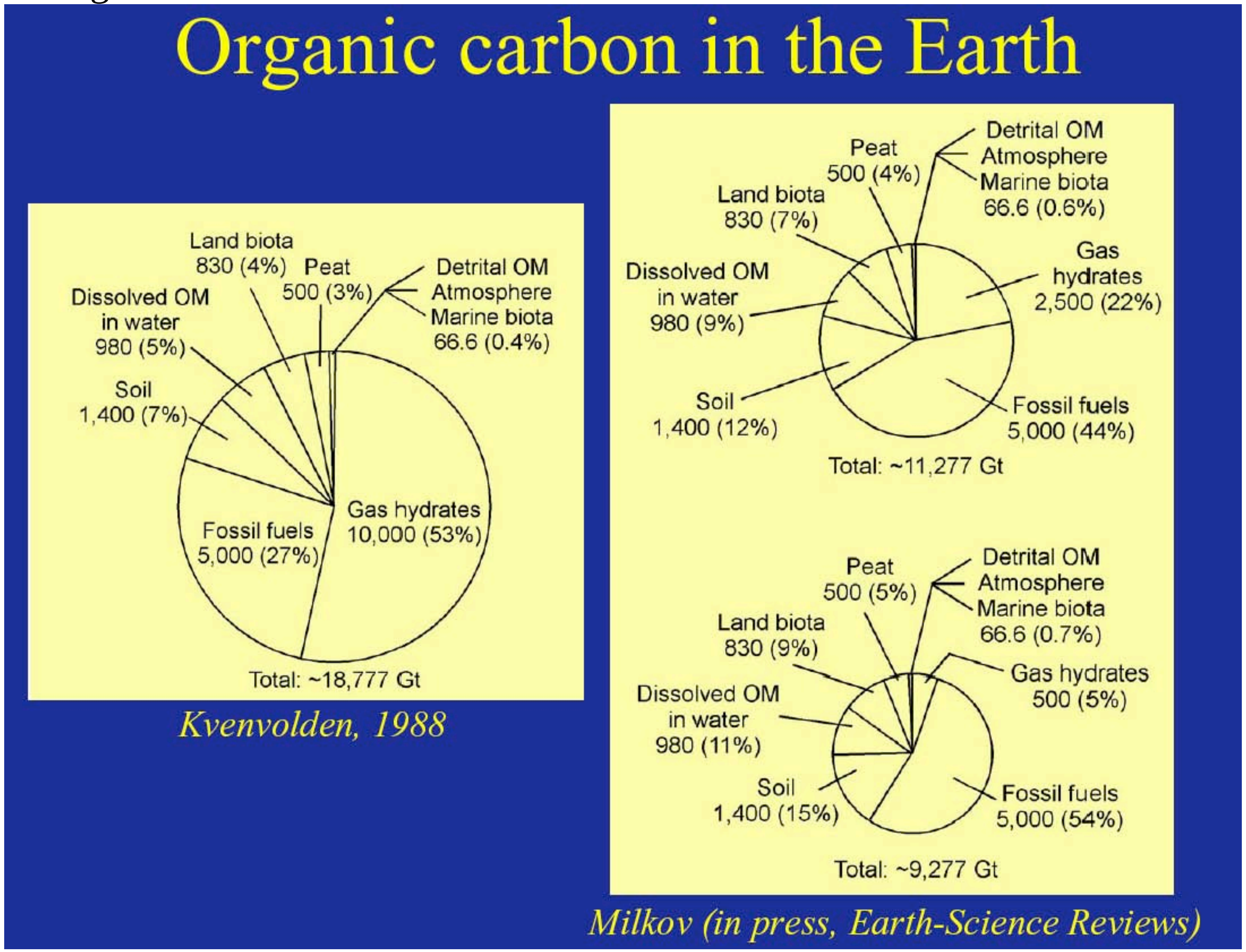


Figure 17: Organic carbon in the Earth from Milkov 2003



With 500 Gt, hydrates are in lower amount than dissolved methane in geopressured aquifers which 30 years ago were described (50 000 Tcf in the Gulf Coast) like the energy of future.

-2-2-No core, no reserve estimate

Oil and gas field reserves need wells samples and production tests to calibrate all the other measures
To be brief: **no core, no reserve estimate**
All hydrate programmes mention this **need for coring:**

*For marine hydrates, there is a need for multi-well drilling expeditions in the Gulf of Mexico, **with coring** and logging (similar to the 2006 Indian hydrate expedition) to characterize hydrate deposits and to validate emerging exploration technologies.*

***Pressure core analysis** has become the keystone that links these data sets together and is an essential component of modern gas hydrate investigations*

*The **main objective** of the JIP cruise was to collect **sediments cores** and a full suite of logs on seismically well-characterized sediments that show evidence for occurrence of gas hydrates. Although the petroleum industry has operated in the Gulf for decades, relatively little information has been collected on the nature of the shallow sediments, and **seismic records and well logs have not been calibrated** for the interpretation of gas hydrates.*

*Until we devote resources to undertake such logging, **coring**, and laboratory measurements, **current estimates of possible gas that can be obtained from gas hydrates must be questioned.***

-2-3-Where are the cores showing oceanic hydrates?

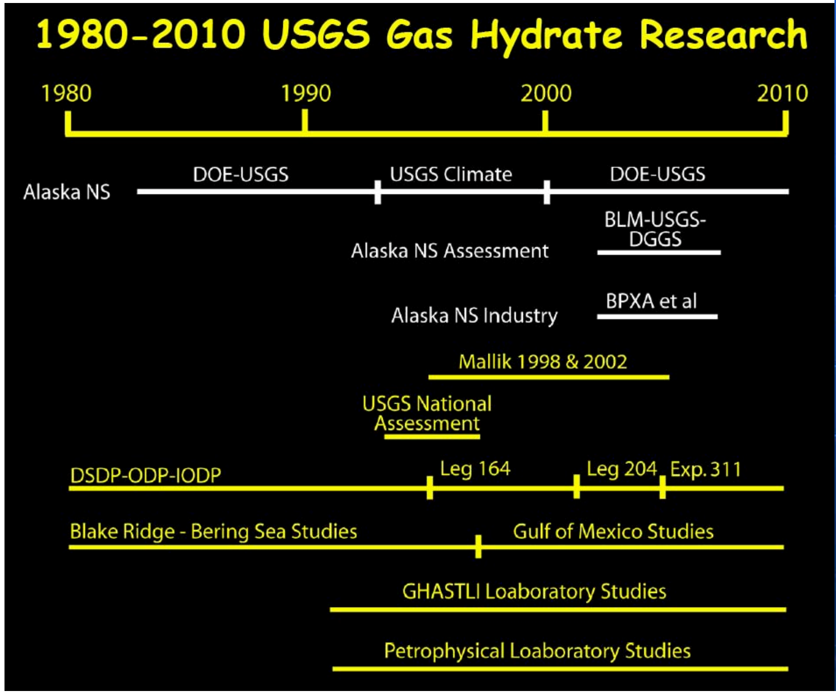
Figure 18: sand dominated gas hydrate reservoirs in permafrost

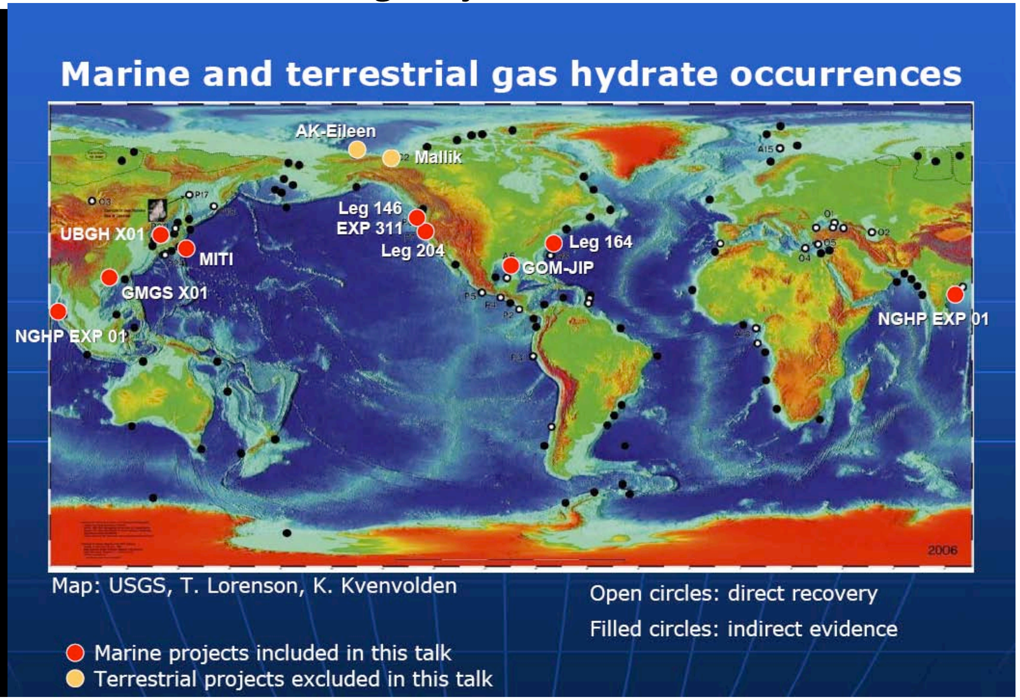
Figure 19: clay dominated gas hydrate reservoirs offshore

-2-3-1-GOM

Figure 20: 1980-2010 USGS gas hydrate research

Figure 21: marine & terrestrial gas hydrate occurrences from Riedel





-2-3-1-1-JIP Leg I

The JIP launched a 35-day expedition in Spring 2005 to acquire well logs and sediment cores at sites in Atwater Valley lease blocks 13/14 and Keathley Canyon lease block 151

***No gas hydrate was recovered at the drill sites**, but logging data, and to some extent cores**, suggest** the occurrence of gas hydrate in inferred coarser-grained beds and fractures*

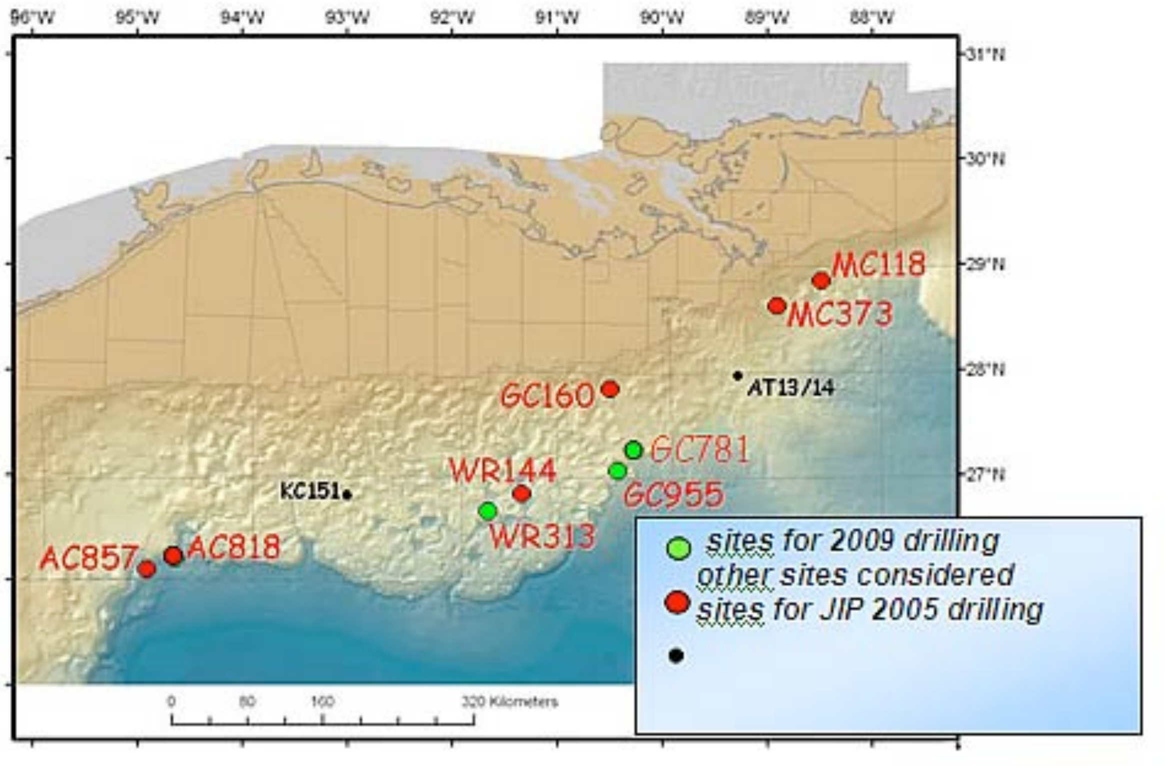
*The expedition **did not recover visible gas hydrate during any of the coring operations**, nor was gas hydrate directly imaged in pressure cores that were subjected to X-ray analyses (Claypool, 2006)*

2-3-1-2-JIP Leg II

In 2009 JIP Leg II used slim hole techniques only with logging seven wells at 3 different locations (WR313, GC 955 and AC21), but no core despite that on all programmes on leg II sites, coring was planned.

Coring is now planned for 2011

Figure 23: GOM JIP Leg I & II locations



Sites for the drilling/logging expedition in April – May 2009. Sites are in Green Canyon 955, Walker Ridge 313, and potentially Green Canyon 781.

We have to wait until 2011 to know more about GOM hydrate potential!

Figure 24: JIP Leg II site GC 955 target map

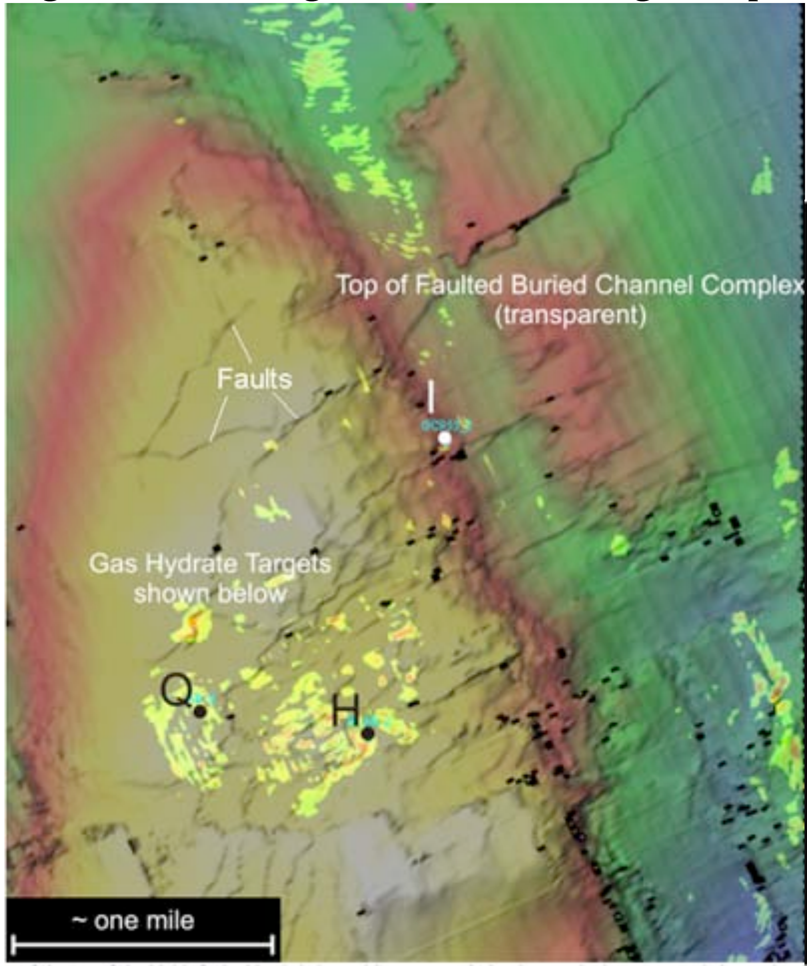
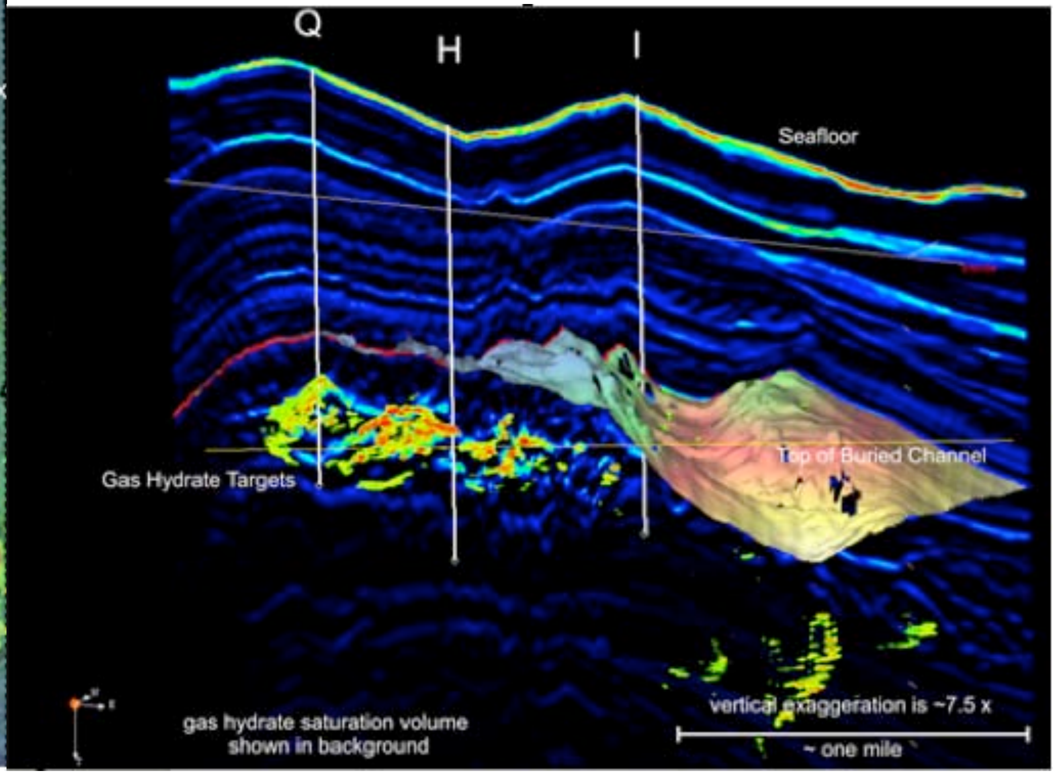


Figure 25: JIP Leg II site GC 955 target profile



The result was claimed by Dr Collett to be great: *"Our drilling at Walker Ridge block 313 and Green Canyon block 955 has discovered the* ***most promising marine gas hydrate accumulations*** *in the world,"*

"What's unique about the Gulf of Mexico accumulations identified is this. It's the first time we've seen highly concentrated hydrates in conventional sand reservoirs that could be ***commercially producible****,"*
It is based on wishful thinking on interpretation of proxy data, not on cores!

-2-4-permafrost hydrate: Alaska

USGS estimates Alaska hydrate resources in a range of 25 Tcf to 157 Tcf with a mean of 85,4 Tcf

2-4-1-Hot Ice 1 Anadarko

In 2003 & 2004 Hot Ice was cored for more than 200 ft and no hydrate was found on core or logs!

-2-4-2-Milne Point BP 2007 Mt Elbert gas hydrate project 2007

500 ft of continuous core was recovered and logs indicate 30 m (in two layers) of gas-hydrate saturated, fine grained sand reservoir). Figure 26: Mt Elbert hydrate core

Figure 5. Whole round core sample of gas hydrate-bearing sand. Rind of oil-based mud coats the left end of the core.

-2-5-Production:

Permafrost hydrate in sandy sediments is quite different from oceanic hydrate in clay, mostly unconsolidated sediments. Permafrost hydrates were drilled in oil & gas producing basins: they are old accumulations and mainly thermogenic seem quite uneconomical (Mallik test was less than a coalbed methane production)
There is no production concept for oceanic hydrates, because no one knows how to do it, mainly in unconsolidated impermeable sediments? Furthermore the heterogeneity of the oceanic hydrates (few centimetres vertically and few meters horizontally) seems to be a difficult obstacle to overcome.

-2-6-Conclusions of part 2

Hydrate is the Santa Claus of many who do not want to change their way of life, but hydrate occurrences are hard to be evaluated mainly by lack of samples (cores) which is the only way to calibrate all the visible proxy which are well logs and seismic data.
GOM is now claimed to have the « ***most promising marine gas hydrate accumulations*** *in the world,*" but unfortunately it is only wishful thinking without the coring which is now planned in 2011 or later.
As usual, the data is too incomplete to rely on such optimistic claims, in particular for the GOM.

-Conclusions on the GOM

The GOM is the most concentrated oil and gas activity in the world and being owned by the Federal government, all data is public and is the best source to study oil and gas patterns for discovery and production.

Published data is well reported, unfortunately with a 3-4 years delay, and allows plotting many curves.
But MMS reports what operators report and unfortunately the data is incomplete.

Having reliable and complete field data is a must in worldwide oil and gas production forecasts.
The US government should oblige operators to be more accurate in reporting and MMS should try to report discovery data better and sooner.