From: Stephen Hickman [hickman@usgs.gov]
Sent: Thursday, July 22, 2010 8:37 PM
To: Enomoto Cathy; Nelson Phil; Mooney Walter
Subject: Fwd: Geological evidence for aquifer
Attachments: geology_to_reservoirs.pptx; Untitled attachment 00216.htm

Stephen Hickman
U. S. Geological Survey, MS977
345 Middlefield Rd.
Menlo Park, CA. 94025

Begin forwarded message:

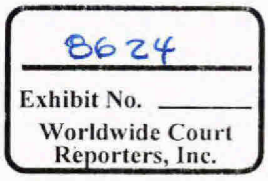
From: "Flemings, Peter B" <pflemings@jsg.utexas.edu>
Date: July 22, 2010 3:32:18 PM PDT
To: Paul A Hsieh <pahsieh@usgs.gov>, "Moran, Kathryn" <Kathryn_Moran@ostp.eop.gov>, Stephen H Hickman <hickman@usgs.gov>
Cc: "Blankenship, Douglas A" <dablank@sandia.gov>
Subject: Geological evidence for aquifer

Paul, Kate, Steve, Doug, and Cathy (I can't find your email) and Bill (can't find email).

I think tomorrow would be a good time to follow up the pressure modeling with a summary of the geological evidence that it makes good sense there is an elongate heterogeneous reservoir with a significant probability of poor connectivity. That would nail the coffin on this discussion.

I propose a draft, but perhaps you would like to modify. I could present, or any of you could.

Regards
Peter

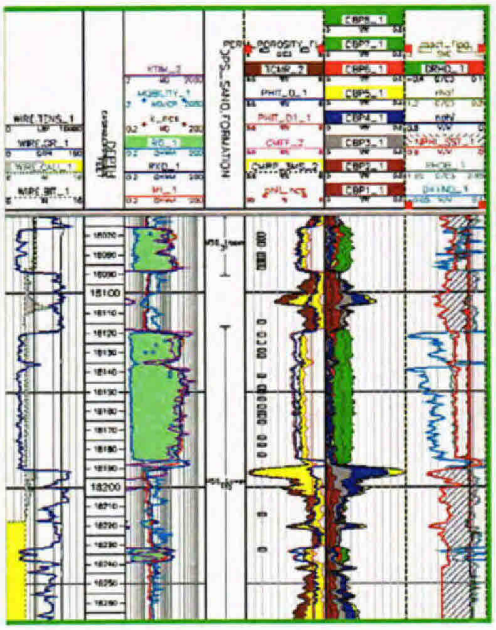


Geological evidence for an elongate, heterogeneous reservoir

The USGS Team, Bill Shedd, Peter Flemings

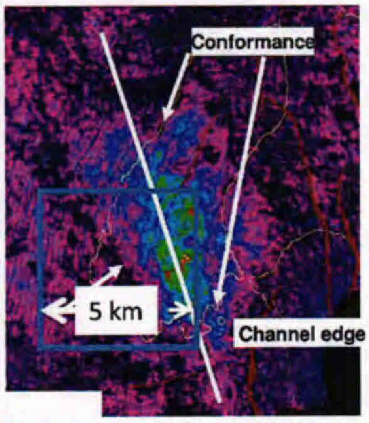
The Data

Log.



3 blocky sand bodies.

Seismic: field scale



Seismic mapped by BP,
Seismic is proprietary

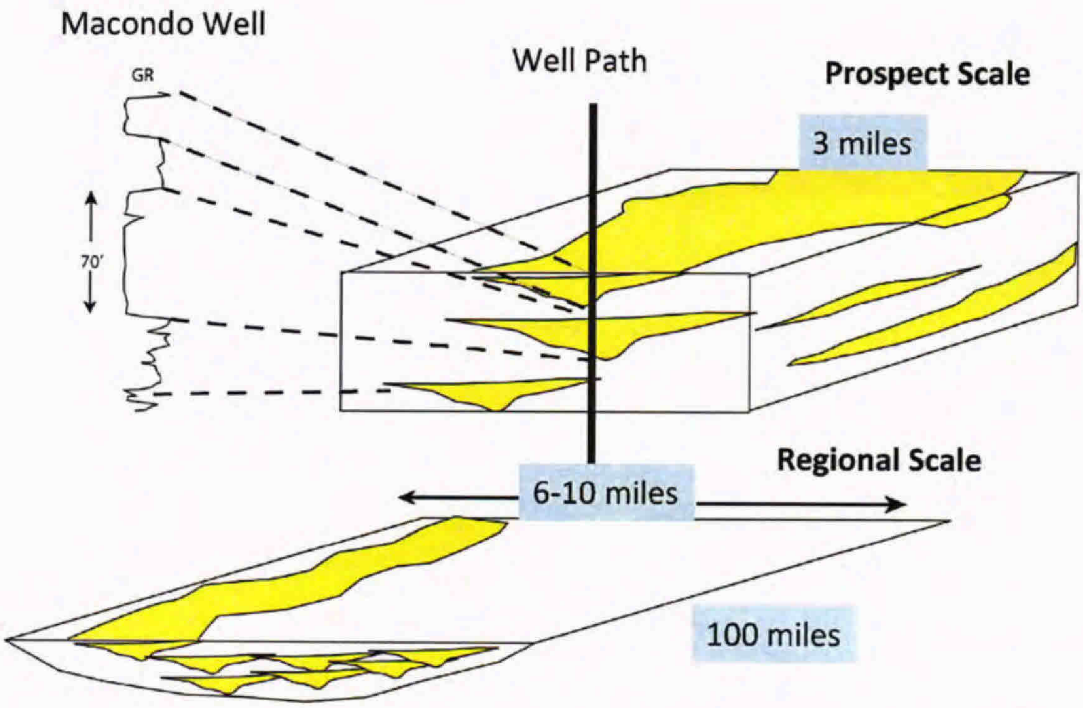
Seismic at field scale
Is blotchy, with NE/SW lineations.

Higher amplitudes (both in and out of hydrocarbons are interpreted to record thicker sands

Seismic: regional

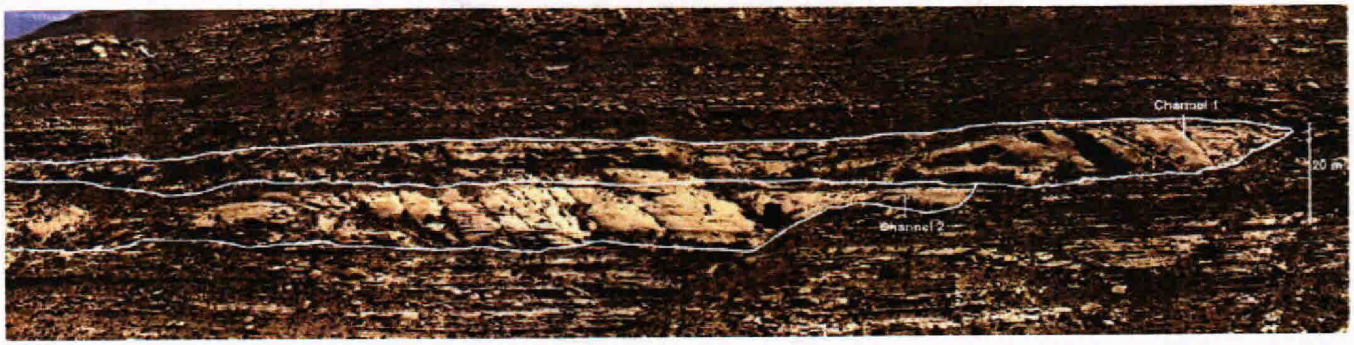
Regional map clearly shows amplitudes (interpreted to be sand rich zones that are order 10 km wide and 100 km long. (did not show seismic because it illustrates exploration strategy beyond Macondo Well and not appropriate.

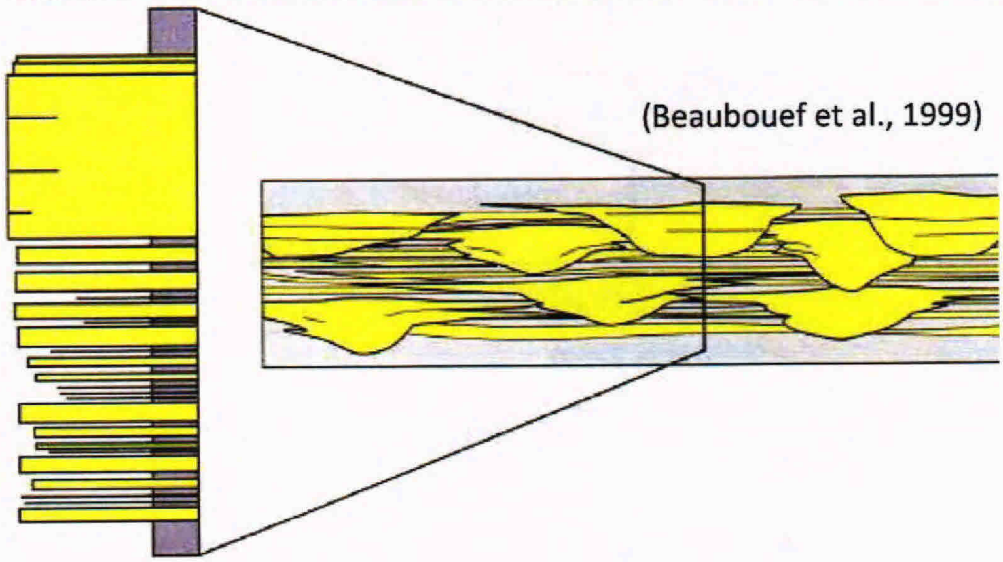
The Interpretation:



Macondo Sands are elongate stacked channels. The may erode and truncate into each other

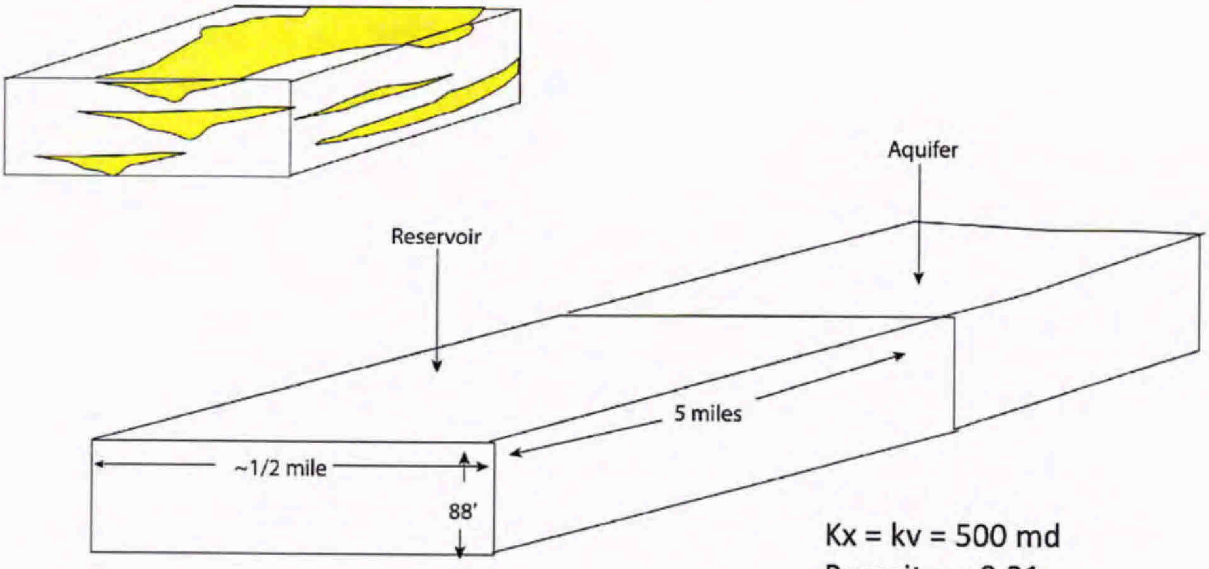
Geological Analogue: Submarine Channel Fills





(Beaubouef et al., 1999)

We are trying to represent this complex heterogeneous geometry with a simple geometry.



Kx = kv = 500 md
Porosity = 0.21

Summary

- Macondo reservoir sands are stacked elongate channels.
- It is geologically reasonable that there is limited channel connectivity and thus limited aquifer connectivity. Channels may cut into each other and shale layers may limit aquifer connectivity.
- There is a long history of challenges predicting water drive due to sand body connectivity problems.
- It would be possible to generate much more complicated reservoir models with multiple sand bodies, but not at the time scale we are working