

# Conclusions re Macondo's Geology. 1<sup>st</sup> Variable: *N*

## Limited Connectivity Between Channels

1. The reservoir is formed from a series of channel complexes, themselves composed of individual channels.
2. The channels are sinuous and run approximately North-West to South-East.
3. Oil can flow along the channels. But there may be little or no flow between channel complexes. This is the problem overlooked by the Government experts in assuming 100% connectivity of all the oil-bearing sands in the Macondo reservoir.
4. The Macondo well likely contacted three of these complexes: these are the three layers encountered when drilling the well – shown in Figure 4.5 as the red, orange and yellow strands of clay.

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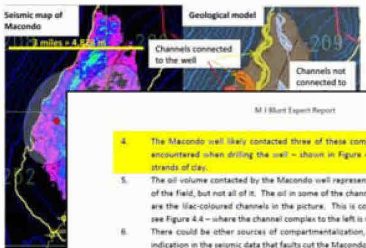


Figure 4.5. Left is BP's average, while area red sandstone. The red circle right is a photograph of a putative location of these yellow, orange and red channels are not connected.

BP, unsurprisingly, to Macondo well, indicate not drilled.

My own interpretation area on the right of attempted to capture relevant and support geology:

1. The reservoir is composed of
2. The channels
3. Oil can't connect

BP-HZN-2179MCO012

4. The Macondo well likely contacted three of these complexes encountered when drilling the well – shown in Figure 4.5 as the red, orange and yellow strands of clay.

5. The oil volume contacted by the Macondo well represents of the field, but not all of it. The oil in some of the channels are the blue-colored channels in the picture. This is correct see Figure 4.4 – where the channel complex to the left is not connected to the well.

6. There could be other sources of compartmentalization, indicated in the seismic data that faults cut the Macondo.

4.3.6 Evidence for limited connectivity in channelled reservoirs. The Macondo proposed drilling three wells to produce the field.<sup>117</sup> These lead to higher production rates, but also has the advantage of ensuring reservoir volume would indeed be connected to at least one of these assessments<sup>118</sup> "Estimate 30% of prospect resource recoverable from well is that even with three wells and a production time of several years, B field would be drained. BP stated that a single well "will confirm volume"<sup>119</sup>. BP considered "in the event of a compartmentalized reservoir required to adequately drain the reservoir."<sup>120</sup> In the opinion of BP gas very unlikely case that one well would drain the fully connected volume I believe is unrealistic.<sup>121</sup> BP's geological review states the channel may result in good communication. Flooding across permeability barriers prevent pressure support at the producer.<sup>122</sup>

Based on BP's analysis before the accident and the interpretation of experts' assumption that the well drained the entire field will over equation. It is very likely that not all the oil-bearing sandstone or otherwise conduct flow across the shale barriers that separate them.

Published petroleum reservoir literature also recognizes that the connectivity of turbidite channel reservoirs is a problem in field development.<sup>123</sup> "operators have encountered severely impaired reservoirs ... attributed in large part to reservoir compartmentalization."<sup>124</sup> Dr. Keikar is a co-author on a paper<sup>125</sup> that states, in reference to deepwater fields, "some of these reservoirs are highly

<sup>117</sup> For instance the red line in the BP seismic (upper part of the figure).

<sup>118</sup> BP-HZN-2179MCO00604108 (BP Pre-Drill Review) 112, slide 24.

<sup>119</sup> *Id.*, slide 24 (11); BP-HZN-2179MCO0107723 (BP Technical Assurance Memorandum, Section 3, row 33) (10).

<sup>120</sup> BP-HZN-2179MCO0107723 (BP's Technical Assurance Memorandum, [50]) section 3, row 11.

<sup>121</sup> *Id.*

<sup>122</sup> See Bryan Ritchie Deposition (46), page 122, line 21.

<sup>123</sup> *Id.*, page 104, line 17 (46), see also *id.*, page 105, line 13 (46).

<sup>124</sup> BP-HZN-2179MCO00604108 (BP's presentation of reservoir geology, slide 2) (39).

<sup>125</sup> See, for instance, Abreu et al. (2003), Ragupathi and Moore (2008), and Alpak et al. (2005).

<sup>126</sup> Alpak et al. (2005).

<sup>127</sup> Liu et al. (2008).

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