08.03: Pore pressure regression and flow focusing at Macondo

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ABSTRACT

We study pressure signatures regionally within the M56 sands to understand how hydraulic connectivity impacts compaction, pore pressure, and fracture pressure over geologic time scales within the Mississippi Canyon. We synthesize well log correlation, MDT measurements, and 3D seismic interpretation (Fig 1) to model reservoir structure, lateral extent, and connectivity. Both measured pressures and well log data record a pressure regression at Macondo well that is absent from the Isabella well 21 miles away. We interpret that a large sand-prone fairway provided a drainage conduit for compacting Middle Miocene sediments within the highly overpressured Mississippi Canyon minibasin. Differential loading of horizontally bedded sandstone encased in overpressured mudstone is known to mimic the centroid profile of a dipping permeable body. We attribute the pressure regression present at the Macondo well to flow focusing in a large continuous reservoir toward thinning overburden to the south (Fig 2).

CLICK ON IMAGE FOR LARGER VIEW

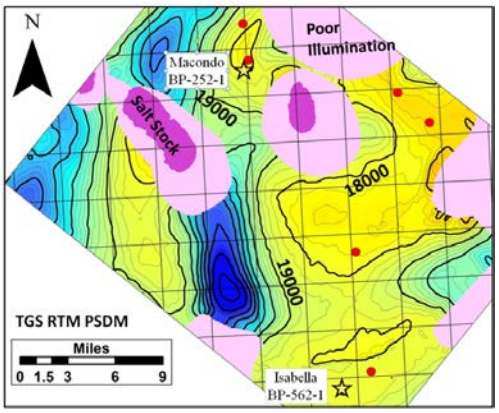


Fig 1: Structure map of the M56 reservoir interpreted from 3D seismic data. Depths shown in TVD_{ss}. Provides the basis for the M56 correlation between the Macondo and Isabella wells.

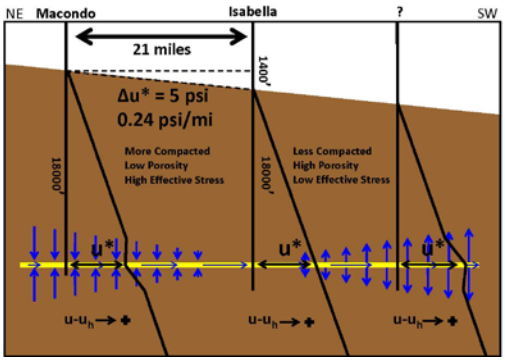
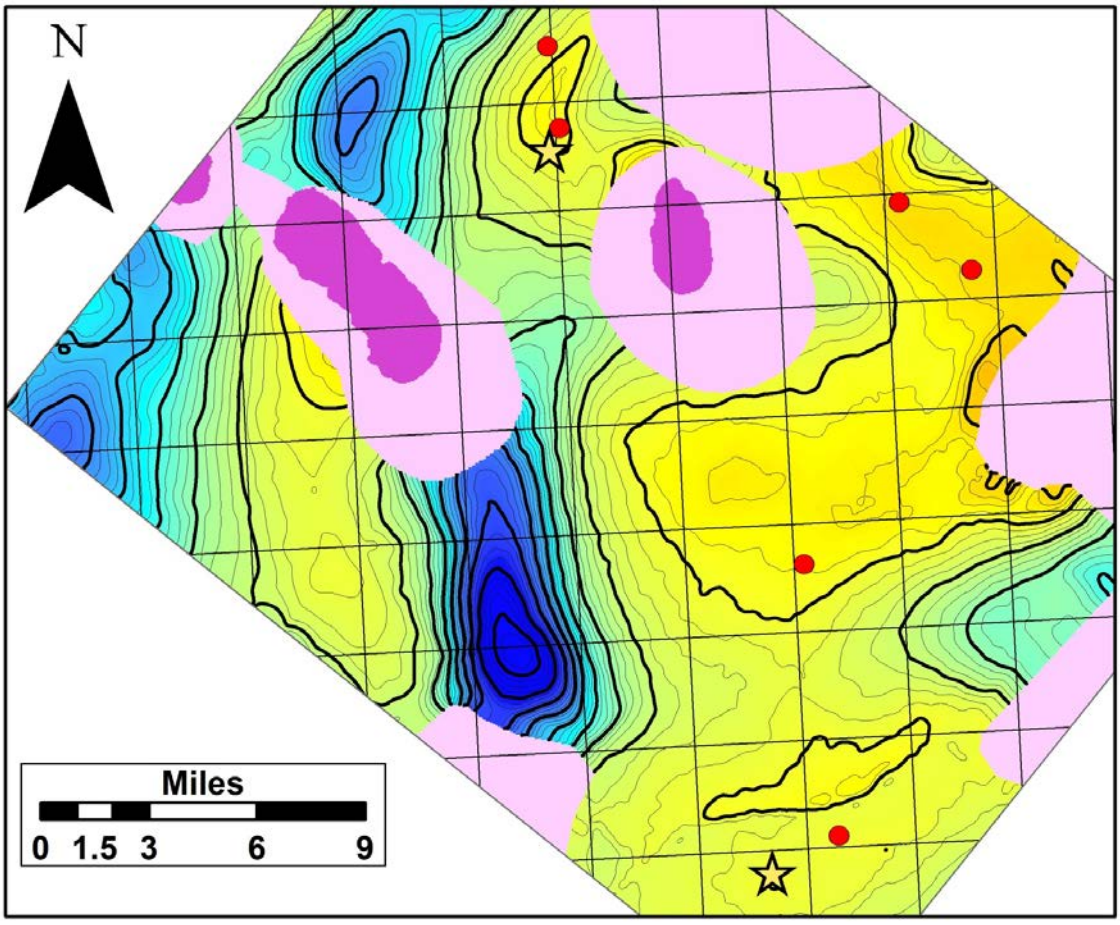


Fig 2: Cartoon of flow focusing model with relative locations of Macondo and Isabella shown. Excess aquifer pressure is constant in the M56 at all three locations, but relative shale pressure varies by position within the centroid. Compaction-generated pore fluids flow from north to south due to different overburden stresses.



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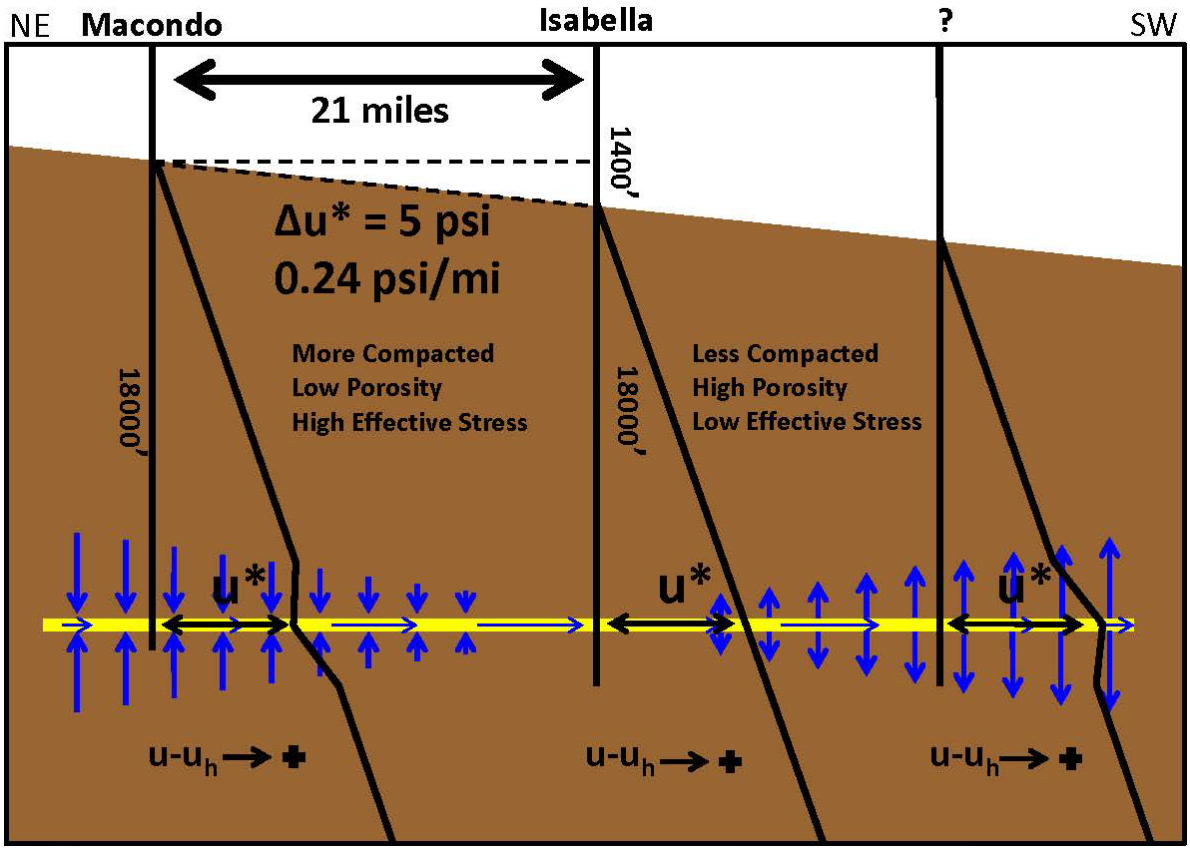

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