Geometry- and Permeability- Based Centroid Prediction with Geofluids Software

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ABSTRACT

We present UTCENTROID, an online and MATLAB-based software package that incorporates the effect of reservoir geometry and mudstone permeability to predict reservoir pore pressure from estimates of mudstone pore pressure. This model expands on previous area-based pressure estimation methods by incorporating the effect of decreasing mudstone permeability with depth. For a particular reservoir geometry, and a far field mudstone pressure that parallels the lithostatic gradient, when reservoir area increases with depth, inclusion of the permeability effect results in a decrease in the predicted reservoir pressure. (Fig.1).

UTCENTROID can be used to predict the centroid depth (the depth where the reservoir pressure and the mudstone pressure are equal) for any reservoir geometry. The approach can be used to predict reservoir pressures for well design and trap integrity analysis (Fig. 2).

CLICK ON IMAGE FOR LARGER VIEW

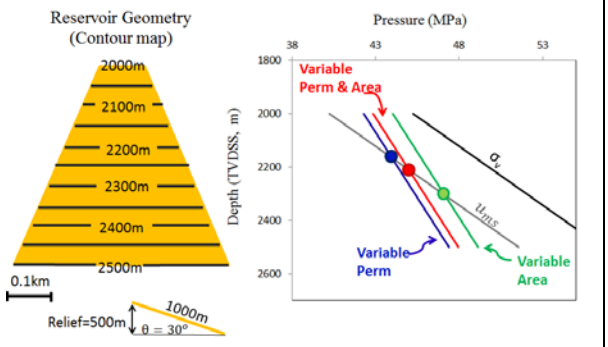

Fig. 1: Comparison of pressure predictions on a trapezoid-shape reservoir based on different approaches.

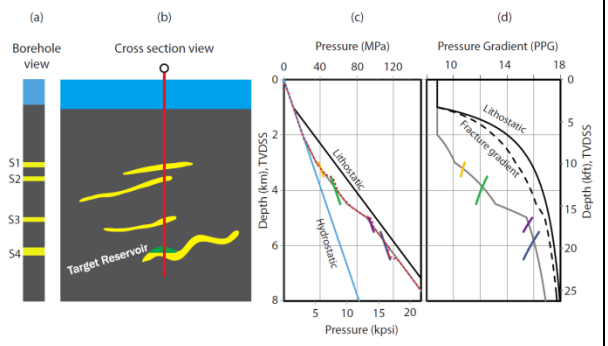

Fig. 2: Model insights and application.

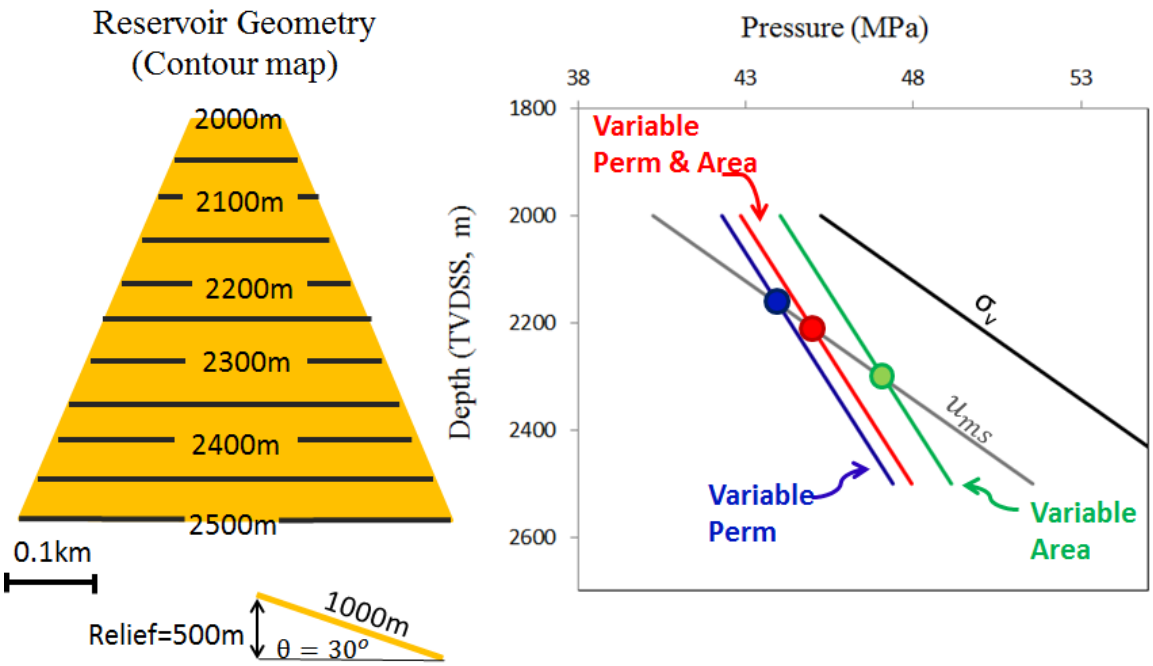

Fig. 1: Comparison of pressure predictions on a trapezoid-shape reservoir based on different approaches. Left graph is the applied reservoir geometry. Right graph shows the pressure prediction by applying different methods. Green dot is centroid position predicted by only considering the reservoir geometry effect. Blue dot shows the centroid position predicted by only considering the mudstone permeability variation. Red dot shows the centroid prediction by taking both geometry effect and mudstone permeability effect into consideration.

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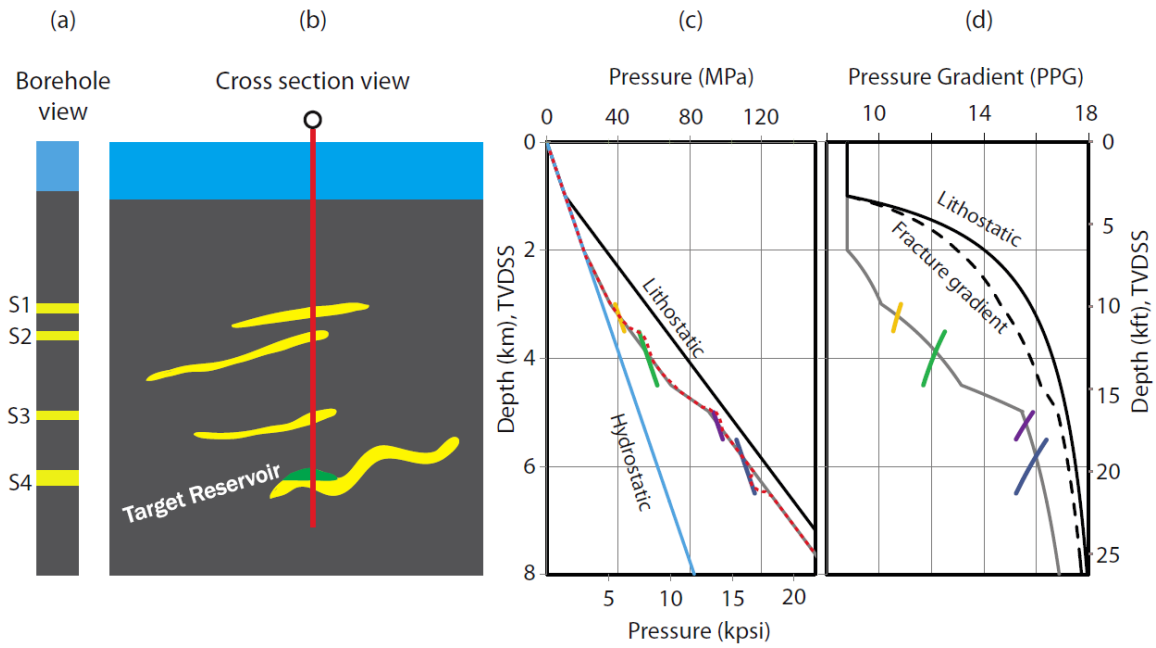

Fig. 2: Model insights and application

(a) The sandstone layers (S1,S2,S3,S4) in a borehole view. The yellow layers represent sandstone and the grey layers represent mudstone.

(b) The cross section view showing the 2D extension of the layers. The red line shows the well path of Fig.2a. The green color shows the hydrocarbon accumulation.

(c) The pressure plot. The light blue line, grey line and black line are the hydrostatic pressure, farfield mudstone pressure and lithostatic pressure respectfully. The red dash line shows the predicted pore pressure along the drilling path in Fig. 2b.

(d) The pressure gradient (mud weight) plot. The grey line is the farfield mudstone pressure gradient and the black line is the lithostatic pressure gradient. The black dash line is the fracture pressure gradient with assumption of k_o=0.8.

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