

Paleo Overpressure in the Delaware Basin determined from DST, Resistivity and Mud Logs

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The Wolfcamp overpressured cell in the central portion of the Delaware Basin, West Texas, was first defined by early drilling of deep gas prospects in the 1960's. Blowouts, increased mudweights, liner and casing seat data provided empirical data on the overpressured section. This analysis uses Mud Weights, AIFE Drill Stem test pressures, and Resistivity Logs to define the overpressured cell, and suggests the presence of a paleo-overpressured sedimentary section in the Delaware Basin.

Mud Weight data was gathered on 356 deep Delaware basin wells. These mudweights were converted to pressure gradient data to define overpressured areas against a Permian Basin normal hydrostatic gradient of .48 psi/ft.

AIFE Drill stem test data is scant as Wolfcamp reservoirs were seldom tested and were impermeable in general, but extrapolation of DST pressures to reservoir pressure was useful in seventeen wells to define a DST derived pressure gradient.

Resistivity trends with depth in normally pressured areas show an increase of resistivity with increasing depth, however given similar lithology, resistivity drops in an overpressured section. The Delaware Basin low resistivity overpressured shale section shows a similar response as in other overpressured basins such as the Gulf Coast and Anadarko Basins. A relationship between shallow resistivity trend vs overpressured resistivity measurement, and measured pressure gradient was established using the AIFE DST database. Using that relationship to convert resistivity data to pressure gradient data; 92 resistivity logs were selected for derivation of Pressure Gradient; 43 of these wells had an accompanying Mud Weight derived Pressure Gradient.

Mud weight derived pressure gradients show a current area of overpressure smaller than the area shown by the Resistivity derived Pressure Gradient data, even when accounting for lithologic changes. It is suggested that overpressure in the Delaware Basin was more prevalent before Laramide Uplift. A similar paleo-overpressure phenomenon has been interpreted for equivalent observations in the Anadarko Basin; both basins have a similar uplift and erosion history.