12.17: New Workflow to Predict Pressure in Unloaded Basins with Application in Delaware Basin

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ABSTRACT

I present an approach to empirically calibrate an unloading velocity model (UVM) based on the equations presented in Bowers, 1995, and demonstrate its application in two Delaware Basin wells: one for calibration, and one for prediction. The Delaware Basin has experienced significant erosional unloading; this affects the compaction state of mudrocks in a way that is different than loading. I capture these effects with an unloading parameter (U) and a pore pressure buildup coefficient (B). U captures the velocity change during unloading; B captures the partial response of pore pressure during unloading. In the calibration well, I fit U to the shallow normally compacted interval, and B to interpreted pressures in the deeper undrained section (Fig. 1). I find that U = 10 and B = 0.8 provides a best match to the calibration well data, and accurately predicts measured pressures in a nearby well.

CLICK ON IMAGE FOR LARGER VIEW

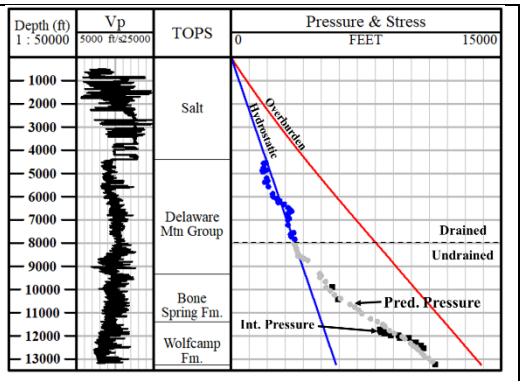


Fig 1: Calibration well. Unloading parameter (U) is adjusted until predicted pressures in drained section (blue dots) fall along hydrostatic gradient (blue line). Pore pressure buildup coefficient (B) is adjusted until predicted pressures in undrained interval (gray dots) fit to interpreted pressures (black squares).

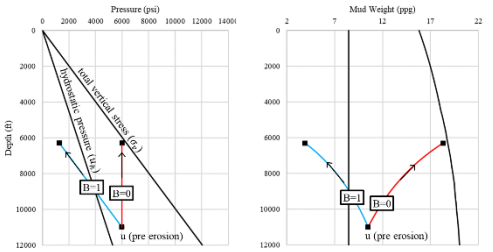
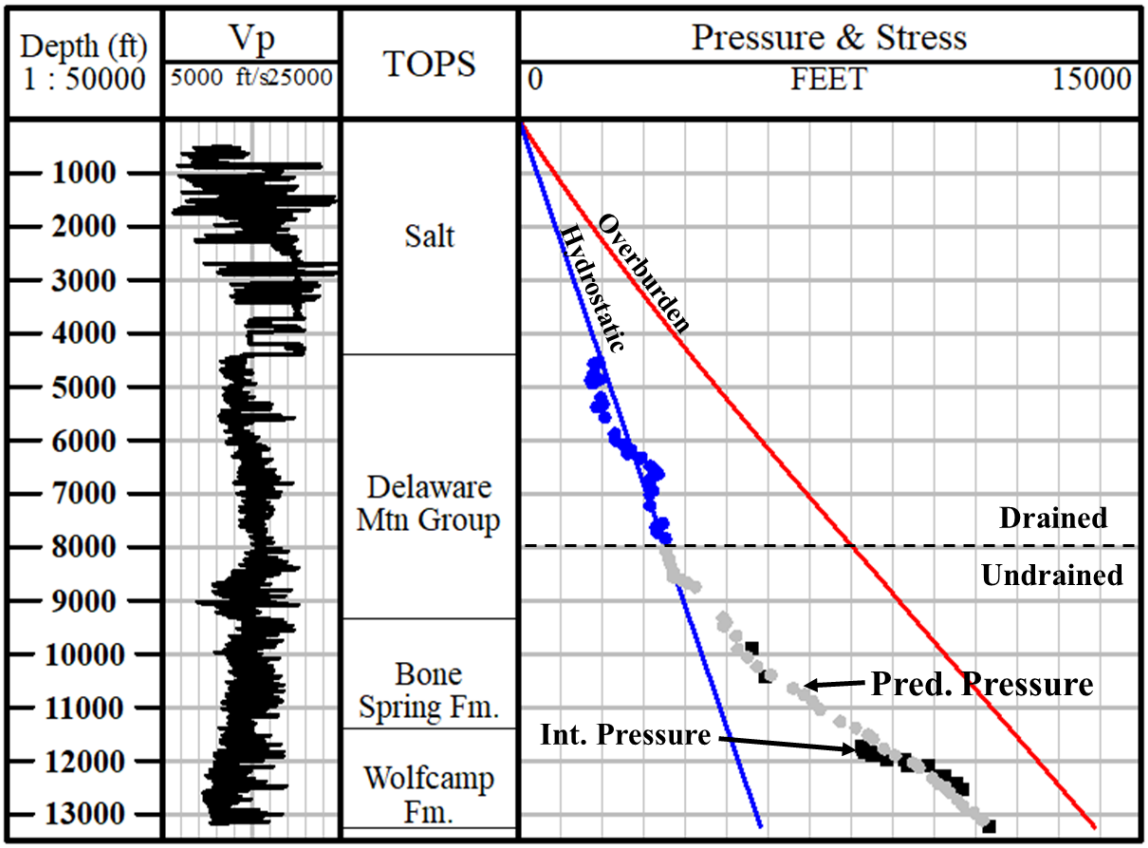


Fig 2: Response of pore pressure to unloading based on B value. B can range from 0 to 1. A B value of 0 corresponds to no change in pore pressure during unloading. A B value of 1 corresponds to a change in pore pressure equivalent to the change in load.



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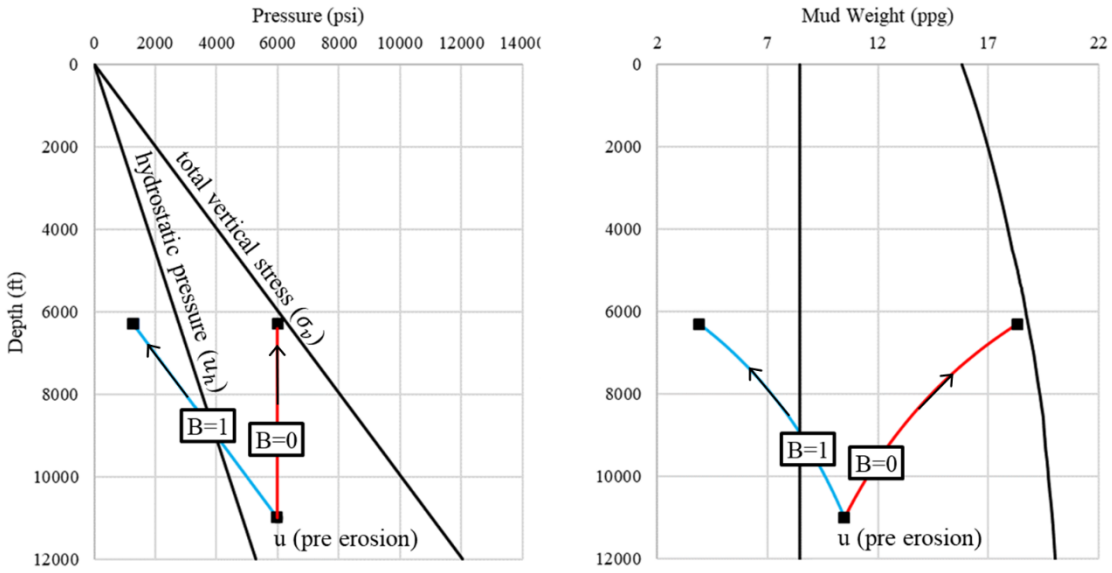

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