13.20: Pore Pressure Prediction in the Delaware Basin

Landon Lockhart, The University of Texas at Austin

ABSTRACT

I present a velocity model that incorporates unloading to predict pressure in the highly unloaded Delaware Basin. Mudrock compaction behavior is different between loading and unloading; empirical velocity-effective stress models developed for normally compacted mudrocks do not properly describe the behavior for unloaded mudrock. I incorporate the unloading effects using a velocity-effective stress relationship, which includes an unloading parameter (U) and a pore pressure buildup coefficient (C). U defines the velocity change during unloading; C describes the change in fluid pressure for an increment in total stress under uniaxial conditions. In a calibration well (Fig. 1), I fit U to the normally compacted sediments in the shallow, drained interval (U=10), and constrain C to best describe the measured pressures in the lower overpressured mudrock (C=0.8). I predict pore pressure in four wells and find that my results predict pressures (orange circles in Fig. 2) that better match the observed pressures (black squares in Fig. 2) than the traditional (Bowers, 1995) loading model (blue circles in Fig. 2).

CLICK ON IMAGE FOR LARGER VIEW

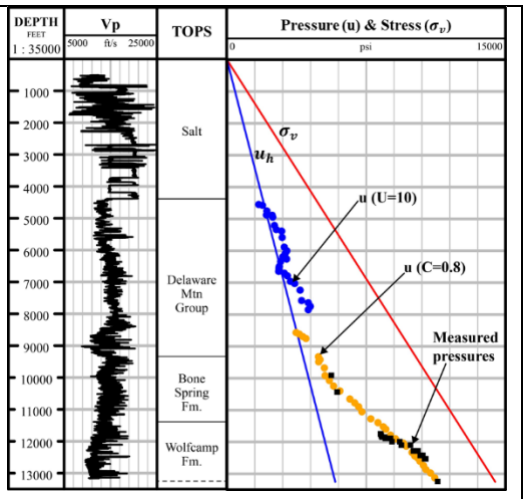

Fig 1: Velocity model constrained to calibration well. Model is tuned to predict pressures (blue circles) in the normally compacted sediments in the shallow, drained interval (U=10), and to predict pressures (orange circles) in the deeper overpressured interval (C=0.8). Black squares represent measured pressures.

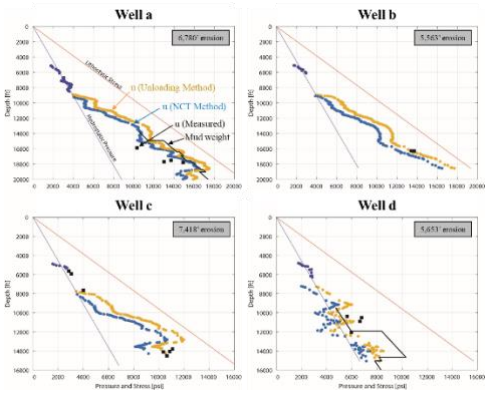

Fig. 2: Pore pressure prediction in wells a-d. Orange circles show pressures predicted with unloading velocity model. Blue circles show pressures predicted with traditional Bowers (1995) loading velocity model. Black line records mud weight.

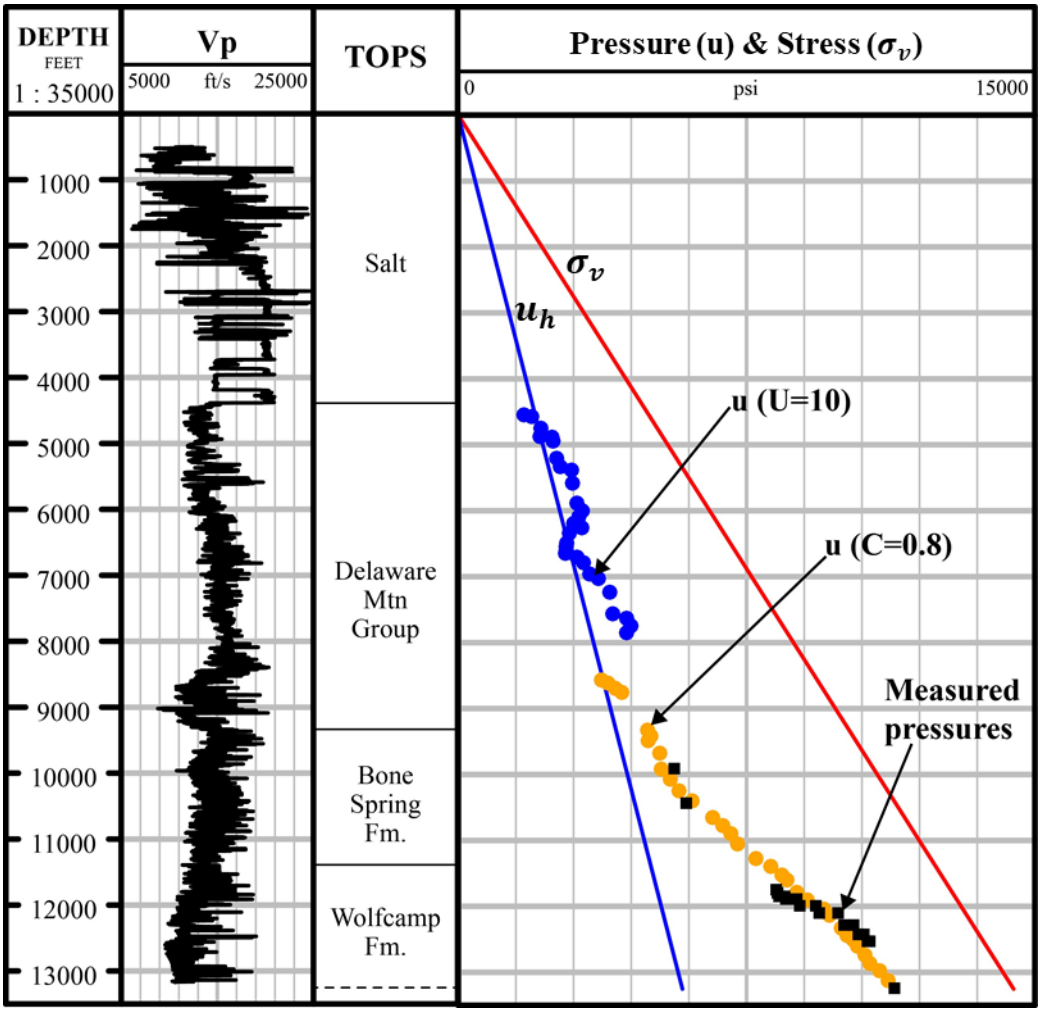

Fig. 1: Velocity model constrained to calibration well. Model is tuned to predict pressures (blue circles) in the normally compacted sediments in the shallow, drained interval (U=10), and to predict pressures (orange circles) in the deeper overpressured interval (C=0.8). Black squares represent measured pressures.

Back

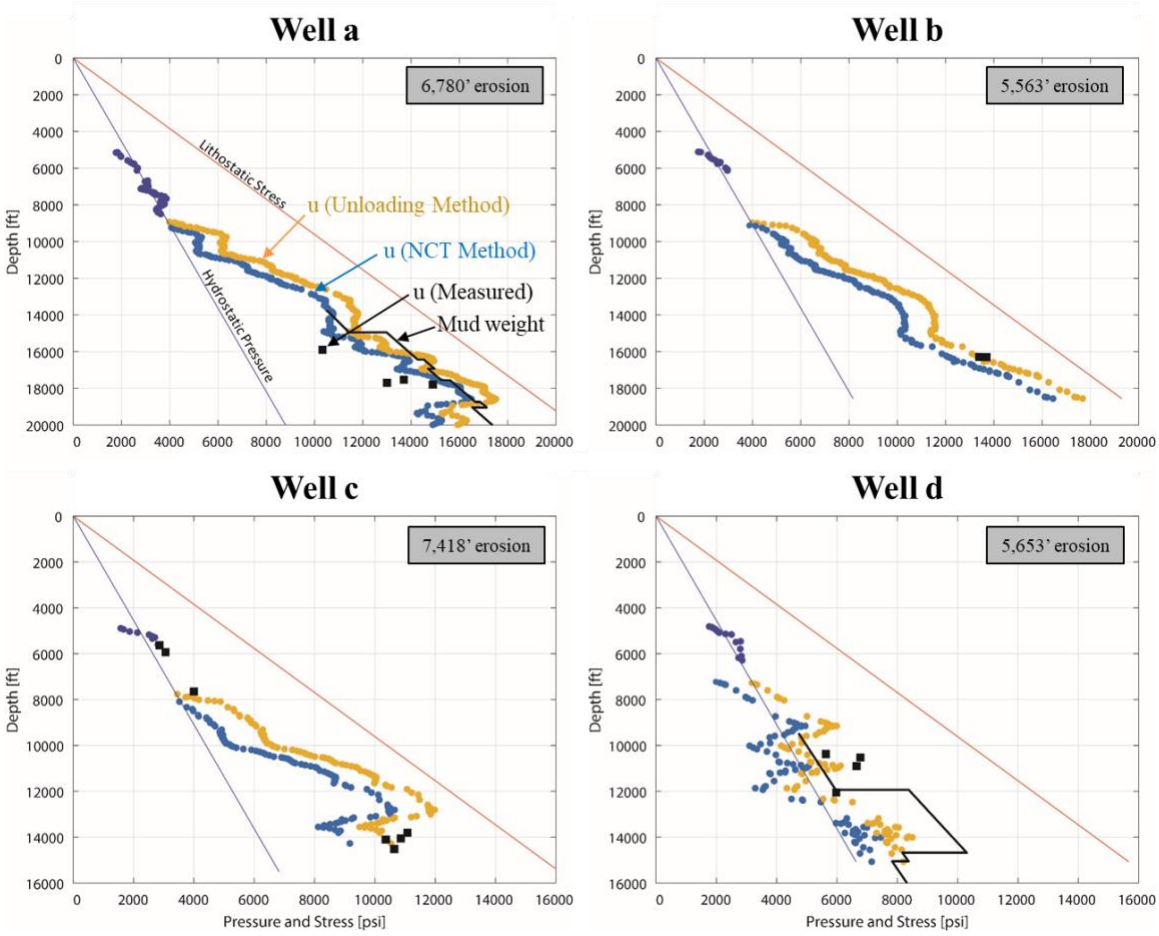

Fig. 2. Pore pressure prediction in wells a-d. Orange is pressures predicted with unloading velocity model. Blue is pressures predicted with traditional Bowers (1995) loading velocity model. Black line is mud weight.

Back

Bowers, G. L., 1995, Pore pressure estimation from velocity data: Accounting for overpressure mechanisms besides undercompaction: SPE Drilling & Completion, v. 10, no. 02, p. 89-95.

Back