Pore Volume Compressibility: UPVC, HPVC and RTCM

Core Lab
RESERVOIR OPTIMIZATION

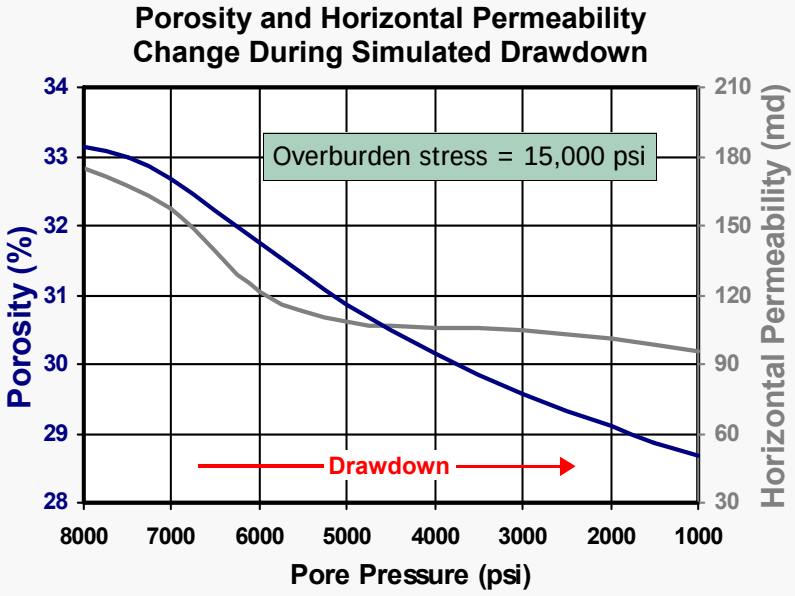
Applications of PVC Data:

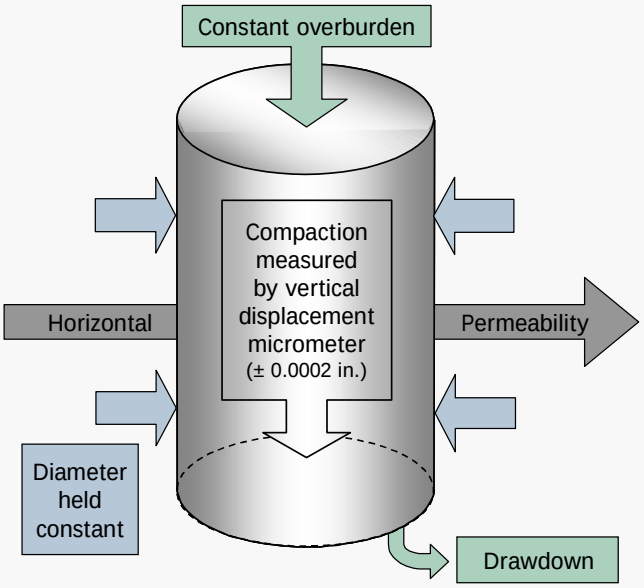
- Drive mechanism determination
- Recoverable reserves determination
- Subsidence prediction
- Reservoir compaction conditions
- Horizontal permeability analysis

Advantages of UPVC:

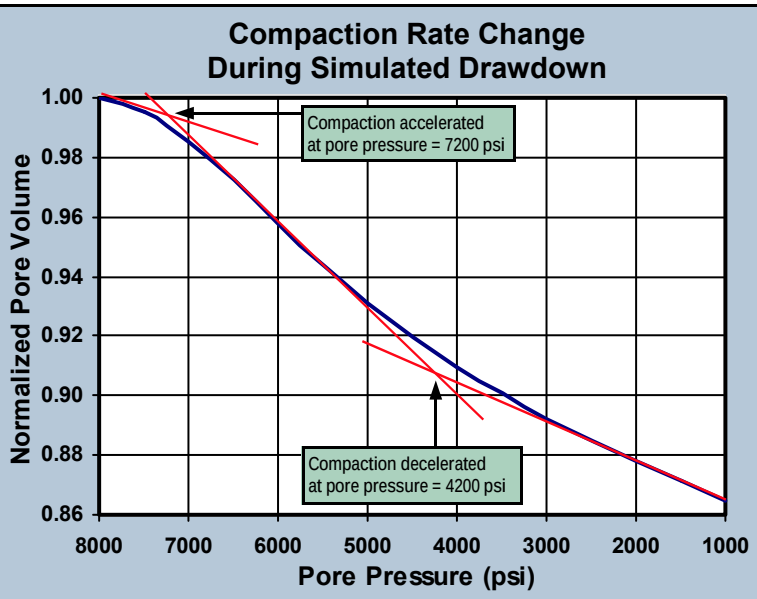
- Simulates actual reservoir production stress path
- Accounts for inelastic behavior of reservoir rock
- Measures compaction directly from axial strain
- Obtains compressibility as a function of pore pressure
- Differentiates horizontal from overburden pressure

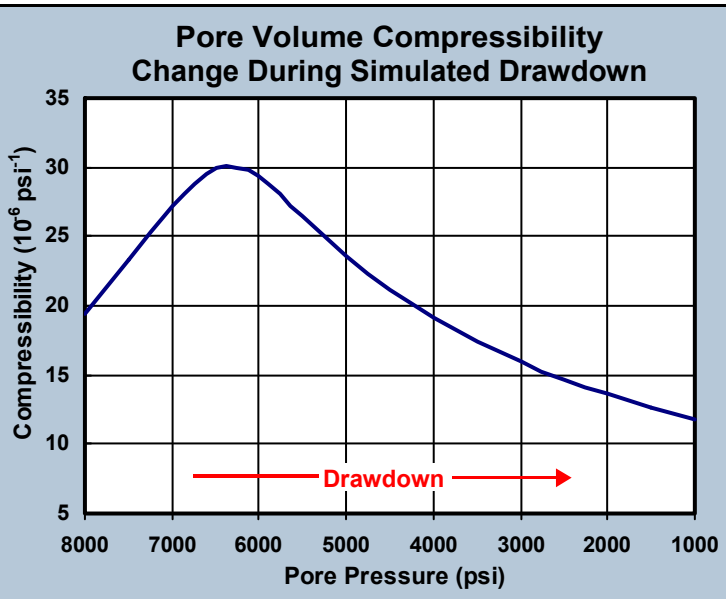
Uniaxial Pore Volume Compressibility (UPVC)





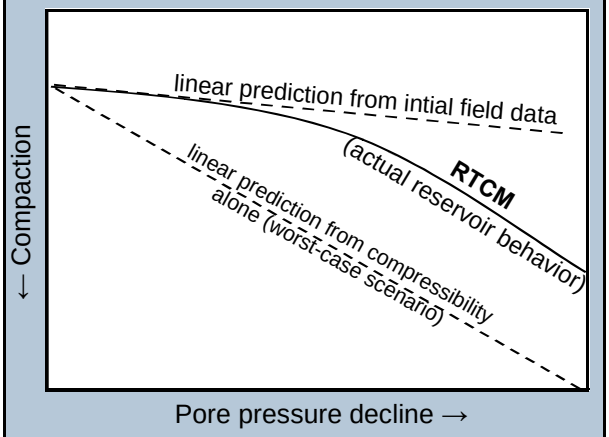
Uniaxial strain conditions duplicate the reservoir stress environment under which compaction occurs.





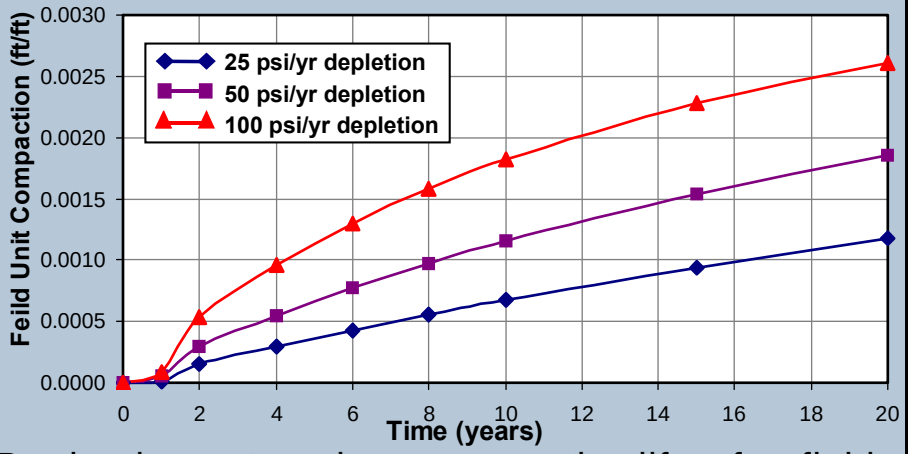
Compressibility and compaction rates change as a sample undergoes inelastic deformation and consolidation. This process changes nearly all aspects of a reservoir's behavior.

Rate Type Compaction Method (RTCM)



First demonstrated by Waal and Smits in 1988, RTCM testing describes reservoir compaction non-linearity.

RTCM Forecast

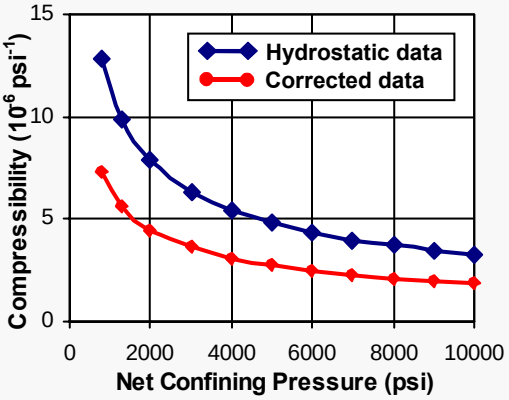


Production rates change over the life of a field. Rate Type Compaction Method testing is used to obtain compaction as a function of production rates.

Hydrostatic Pore Volume Compressibility (HPVC)

HPVC Pros:

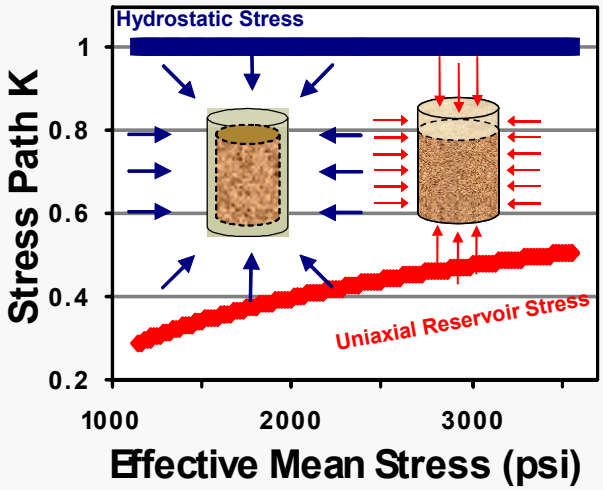
- Simple, easy to perform
- Quicker data at low cost

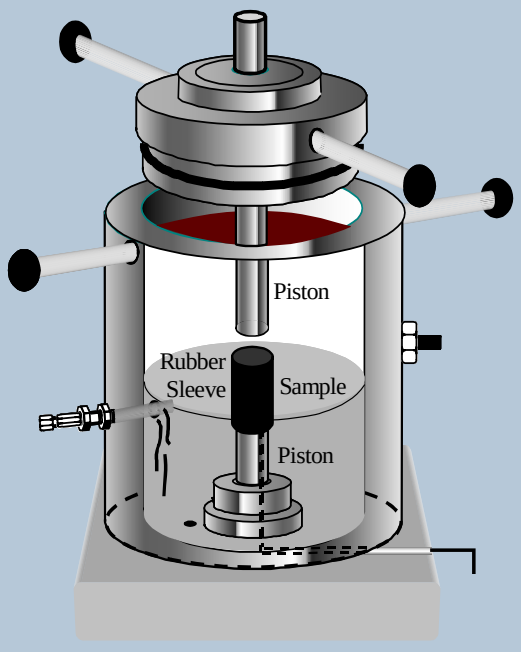


HPVC Cons:

- Doesn't simulate reservoir stresses
- Indirectly estimates compressibility from the volume of expelled water
- Assumes the sample is isotropic
- Requires a Poisson's ratio dependent correction to guess uniaxial values

HPVC and UPVC Stress





UPVC Apparatus

Case Histories:

- UPVC testing has successfully been performed for more than two dozen companies on hundreds of wells.
- RTCM testing has been successfully used to predict reservoir compaction and subsidence.
- UPVC and RTCM testing was successfully used to prevent pore collapse in carbonate reservoirs.
- HPVC is widely used to estimate compressibility properties.

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