Pore Compressibility = c

@wikipedia

Synonym: Pore Compressibility = CPHI

A measure of formation porosity ϕ change due to reservoir pressure p variation:

(1) $$c_\phi = \frac{1}{\phi}\frac{\partial \phi}{\partial p}$$

There is a statistical correlation between initial formation compressibility $c_\phi(\phi)$ and formation porosity which can be picked by various compressibility-porosity models.

Pore compressibility stays constant for small pressure variations but in a wide range of pressure variations the dependence on ambient pressure $c_\phi(p)$ can not be neglected and should be tabulated from laboratory core tests or estimated from compressibility-pressure correlations.

The typical values are:

c = 0.5 ÷ 1.5 GPa^{-1}

but may go higher for poorly consolidated rocks.

In many practical cases the pore compressibility can be considered as poorly dependent on reservoir pressure variation: $c_\phi(p) = c_\phi = \text{const}$.

In this case porosity dependence on reservoir pressure can be simulated as:

(2) $$\phi(p) = \phi_i \cdot \left[1 + c_\phi\,(p - p_i) + 0.5\,c_\phi^2\,(p - p_i)^2\right]$$

But in case the reservoir pressure is changing substantially one may need to account for the effect it takes on pore compressibility (see Pore compressibility @model) and then reservoir pressure - porosity model is going to take the following form:

(3) $$\phi(p) = \phi_i \cdot \exp\left[\int_{p_i}^{p} c_\phi\, dp\right]$$

See Also

Petroleum Industry / Upstream / Subsurface E&P Disciplines / Petrophysics / Geomechanical Rock Modelling

[Compressibility][initial pore compressibility]

[Compressibility (rock)]

[Pore compressibility @model]