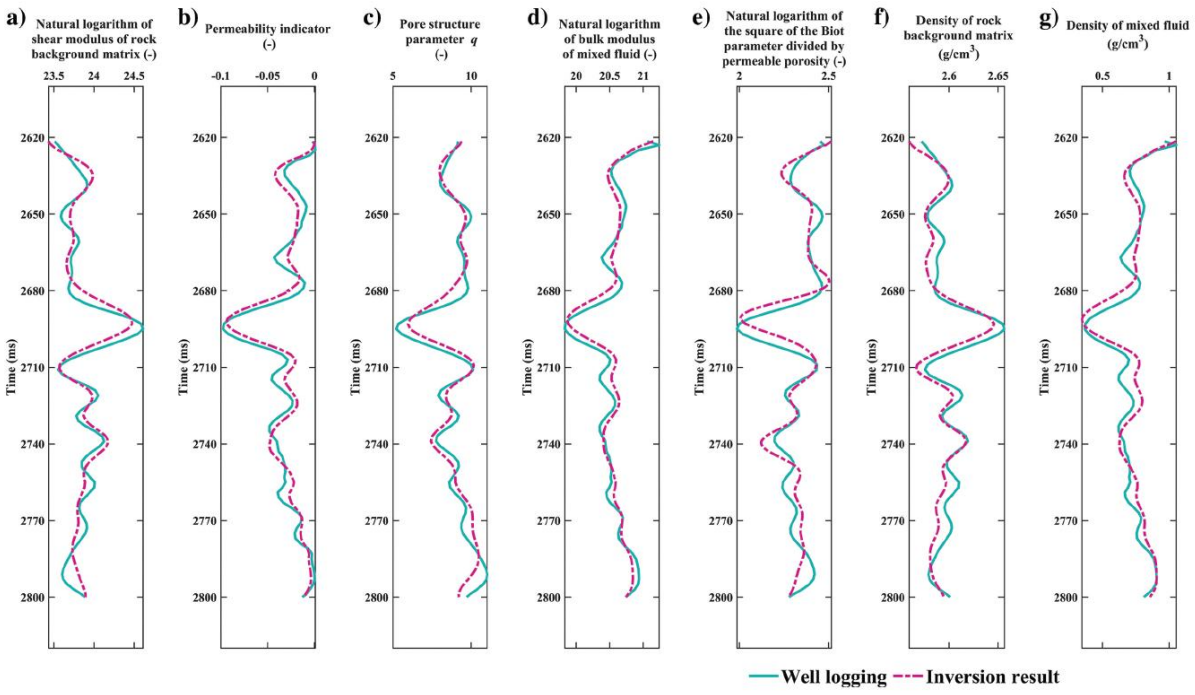
Is it possible to predict permeability from seismic?

In reservoir characterization and evaluation, permeability, pore structure, and properties of matrix and fluid are important to estimate hydrocarbon reserves and predict reservoir productivity. However, the quantitative relationships between these parameters and the reservoir's elastic properties, which can be determined from seismic, exhibit a complex relationship, posing significant challenges for predicting or inverting these parameters from seismic data.
If possible, it would be a significant leap forward.

A first attempt has been recently published.
It is based on developing a rock-physics model that relates microscopic reservoir properties to macroscopic elastic responses. Incorporating a linearised version into a linear AVA approximation and combining it with the Gassmann fluid term provides an expression between P-wave reflectivity and reservoir properties permeability, pore structure, matrix and pore fluids. The approach was tested on synthetic and real data. Of two fully logged wells in a 3D data volume, one was used to calibrate the newly developed rock-physics model and the other blind well the logs were compared with the inverted 3D volume of rock properties. The plots below show a satisfactory match between the derived and the measured rock parameters. This promising approach will be discussed in my courses on AVA and Quantitative Reservoir Characterization (www.breakawaylearning.nl).



Comparison of the inversion result and logging data at the location of blind well. (a) The natural logarithm of the shear modulus of the rock background matrix μ_{lnm}, (b) the permeability indicator F_κ, (c) the pore structure parameter q, (d) the natural logarithm of the bulk modulus of the mixed fluid K_{lnf}, (e) the natural logarithm of the square of the Biot parameter divided by permeable porosity F_g, (f) the density of the rock background matrix ρ_m, and (g) the density of the mixed fluid ρ_f.

Ref: Lian & Zong, Geophysics, 2025, N5