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Andrew Hurst¹, Anne Schwab¹, Bryan Cronin² (1) Aberdeen University, Aberdeen, United Kingdom (2) Aberdeen University, Aberdeen

Modeling of Seismic Character from Rock Descriptions

A method is described that enables the generation of 2-D seismic sections from visual rock descriptions of outcrops. Sedimentary logs are used as a basis for forward-modelling synthetic wireline log responses of bulk density and interval transit time. Bulk density (ρ_b) is estimated from the mineralogy, porosity and the fluid composition, and interval transit time (Δ_t) is calculated using Wyllie's time average relationship using the porosity and the transit times of the interstitial fluid and matrix. Validation of the accuracy of the forward models is made by comparison of synthetic data with core descriptions and wireline data from boreholes for a range of sedimentary facies. ρ_b and interval transit time Δ_t are multiplied to give acoustic impedance and synthetic seismograms are calculated. 2-D seismic lines are then generated from several deep-water clastic outcrop localities using the synthetics and the geologically defined correlation framework. The forward modelling allows the sensitivity of the synthetic data to variations in input parameters to be evaluated. Hence, rock description can be tuned to provide the optimal information for modelling. As the outcrop models resolve more information than typical subsurface seismograms, variations in frequency are used to degrade them and facilitate comparison. The method allows quantitative physical parameters to be computed from a rock description hence, permitting seamless transfer of outcrop data into subsurface models.