Global Approach for Seismic Interpretation Driven by an Automation-Assisted and Structurally Consistent Sequence Stratigraphic Framework: Applications and Perspectives

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Abstract

The characterization of a sedimentary basin requires to build a correlation framework. A traditional approach consists of interpreting a few major horizons, mostly based on key seismic reflections and eventually well markers and logs. The author here shows the results and perspectives of a unique approach directly driven by the seismic amplitudes. The presented four-phase workflow illustrates how an automation-assisted and signal-driven Relative Geological Time (RGT) model (Pauget et al, 2009) can be used to ease the modelling and understanding of regional to reservoir scale stratigraphic features, ultimately converted into a ‘simulation ready’ model. The described approach embeds geoscientists to keep the full control on the conversion of signal discontinuities with vertical displacement into faults, seismic reflections into horizons, and every seismic sample into RGT. The first phase aims at imaging and extracting the faults from the seismic data. In the second phase, the fault network constrains the auto-tracked, stratigraphically sorted and editable seismic horizons in a discrete stratigraphic framework called ‘Model-Grid’. A 3D interpolation of the discrete Model-Grid then converts each seismic sample into relative geological time and delivers a continuous RGT model. During the third phase of the workflow, an RGT-derived attribute called Thinning is combined with Wheeler-transformed seismic sections to enhance seismic stacking patterns, geological discontinuities, stratigraphic terminations and hiatuses. They enable to delineate key stratigraphic surfaces then subdivide stratigraphic units in a vertically continuous way, ultimately driving the creation of a sequence stratigraphic model. Well logs and QI results can eventually be used as guidance to encompass thin beds at a sub-sample resolution and define higher-order sequences. Over a fourth and last phase, the stratigraphic model is converted into a corner point grid, and cells can be populated with early stage QI results in order to model seismic expressions in a ‘simulation ready’ format. The proposed workflow relies on the synergy between automated processes and geoscientists who can focus on the application of basin characterization concepts. The applicability has been proven in a broad range of challenging projects with various geological settings (systems, depositional environments, scale). Such a methodology offers new perspectives and insights in the integration of geoscientific disciplines for subsurface modelling and georesource potential evaluation.