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Stochastic and forward modelling of a carbonate platform constrained by outcrop data: the Upper Cretaceous Beausset carbonate margin, South of France

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Within the context of the GECO-project, a joint ENI EP - University research consortium on the "Geometry of Carbonate Objects", the Upper Cretaceous carbonate margin of the Beausset area, South of France was studied as a potential analogue to hydrocarbon carbonate reservoirs.

The Beausset Carbonate Margin can be divided into three stratigraphic systems (2nd order) separated by major surfaces materializing significant changes in sedimentary dynamics:

- The Cenomanian carbonate system corresponds to a "rimned shelf-to-slope", characterized by an extensive rudist-bearing platform grading southward into thick, mixed carbonate and siliciclastic sediments, deposited in a subsiding area.

- The Lower to Middle Turonian carbonate system corresponds to a "carbonate ramp" grading southwards into silicilastic-dominated basin.

- The Upper Turonian to Coniacian system corresponds to a "platform topped-faulted shelf edge" characterised by a sharp transition between shallow marine carbonates and resedimented deeper marine carbonates mixed with basinal siliciclastics.

The main objective of the project was to realise 3D numerical models of these spatially continuous carbonate platform outcrops, in order to improve our understandings of such sedimentary systems and to support further developments in carbonate reservoir modelling methods. Prior to the model realisations, our main challenges were to acquire and compile many qualitative and quantitative data in a geo-referenced sys-

tem. The gOcad software was used to integrate in 3D stratigraphic surfaces, facies maps, faults and structural parameters, stratigraphic logs, laser scanned DOM, wells and highres seismic.

The first modelling step was to realise coherent 3D stratigraphic grids in the present day geometrical domain at the relevant resolutions. The second step was to model the spatial distribution of fifteen facies in 3D within the stratigraphic grids. Several geostatistical approaches such as interpolation (Indicator Kriging) and simulation (SIS, TGS) have been used in gOcad. Only the truncated Gaussian method allows a good match between the models and the reality as expressed by the outcrop data set. In addition, we have shown that the distribution of these facies in the models is highly influenced by environmental trend maps and the resolution of the stratigraphic models, confirming the necessity of introducing precise and coherent stratigraphic framework in reservoir models.

The third modelling step consists in a process-based approach ("stratigraphic forward modelling"), constrained by the established 3D stratigraphic and facies models. Rather than trying to reproduce the reality represented by the stochastic facies models, our goal was to run sensitivity analysis on significant parameters such as initial topography (pre-Cenomanian), carbonate production and transport, differential subsidence and sea level changes. Preliminary results will be shown on the relationships between subtle changes in sedimentary profiles and facies deposition and preservation. Modelling carbonate reservoir workflows integrating such process-based approach can be proposed.