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Distribution and arrest of vertical through-going joints in shallow-water carbonates: Insights from an integrated virtual outcrop – field structural analysis of a reservoir-scale exposure (Sorrento Peninsula, Italy)

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Through-going joints cutting across several beds are often invoked to match large-scale permeability patterns in tight carbonate reservoirs. However, despite the importance of these structures for fluid flow, only few field studies focused on the understanding and estimation of through-going joint dimensional parameters, including spacing and vertical extent in relation to stratigraphy. Recent improvements in the construction of virtual models of outcrops can greatly help to overcome many logistic issues, favoring the evaluation of relationships between jointing and stratigraphy at the reservoir scale.
In this study, we present the results obtained from integrating field measurements and stratigraphic logs with a virtual outcrop model of a carbonate platform reservoir analogue in the Sorrento peninsula (Italy). The outcrop consists of a nearly vertical cliff exposing a monocline of alternating gently-dipping shallow-water limestones and dolostones, crossed by several vertical joints of different size. This study allowed us to define how major through-going joints pass across thick beds (bed thickness > 30 cm), while they arrest against packages made of thinly stratified layers. In essence, through-going joints arrest on “weak” levels, consisting of thinly bedded layers interposed between packages made of thick beds, in the same manner as bed-confined joints arrest on less competent interlayers.