

# Can Modeling Solve Heterogeneity Challenges with Reservoir Geomechanical Characterization of Carbonates?

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## ABSTRACT

The prediction of geomechanical properties for carbonate rocks has become a topic of increasing interest due to existing unconventional hydrocarbon resources, such as the Grosmont formation in Alberta with an estimated 64.5 billion m<sup>3</sup> of in-place bitumen resources. The heterogeneity of limestone and dolomites presents a challenge in providing accurate estimates applicable to the wide variety of texture and porosities, sometimes encountered within a single reservoir. Vuggy dolostone lithofacies present some of the most promising areas for bitumen extraction in the Grosmont reservoir; thus knowledge of the changes imposed by vugs on the geomechanical behaviour of carbonates is relevant for future developments in this area. The current simulations use PFC3D, a discontinuum modelling software based on particle mechanics, to evaluate the effect of vug volume, location and shape on the stiffness of laboratory scale samples. The simulated vuggy samples were subjected to virtual tests analogous to laboratory uniaxial compressive strength tests and elastic wave velocity measurements. The impact of increasing vuggy porosity in both a static and dynamic strain application are evaluated and compared. Wave measurements can be applied and measured through the samples in different directions, providing a measure of heterogeneity by evaluating changes in arrival time from different directions. The study hopes to further understanding of the stiffness reduction caused by the presence of inclusion within carbonate rocks.