

Investigating the Effect of Bedding Plane Orientation on the Mechanical and Elastic Properties of Shale

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BACKGROUND

METHODOLOGY

a sedimentary rock, shale As possesses a laminated structure that clearly influences its crack initiation and propagation processes, strength, and fracturing pattern. In this work, bedding plane orientation (β) is defined as the angle between the bedding planes and loading direction. Apart from and fracture failure pattern modes, many studies evaluated effect of bedding plane the orientation on the strength (e.g., UCS), elastic modulus (E), Poisson's ratio (v), and the velocity of stress waves (P and S) in shaly rocks [Zhai et al., 2022].

Four bedding plane orientations (i.e., $\beta = 0^{\circ}$, 30° , 60° , and 90°) were selected to study the anisotropy in strength and elastic properties of the Sulphur Mt. outcrop. Non-destructive measurements of P-wave and S-wave velocity were performed using a Proceq Pundit 200 ultrasonic device. Dynamic elastic modulus and Poisson's ratio were then calculated using the measured transit time along the length of the samples. Subsequently, uniaxial compression tests were done on the samples to measure the UCS and static E.

RESULTS

The axial stress-strain provided σ curves are tor





velopment witnessed increased activities in recent years. A large percentage of unconventional plays are associated with shaly rocks with ultra-low permeability, where hydraulic fracturing is used properties of shaly rocks affect their failure modes and fracture complexities, a thorough investigation is necessary to improve exhibit Different shaly rocks different shape trends for their UCS and their static E with varying bedding plane orientation [Wang et al., 2022, Zhang, 2021]. On the other hand, ultrasonic wave speeds show a decreasing trend with varying bedding plane orientation. Due to this variability, there is a need to further investigate these relationships. In this study we use a samples from the Sulphur Mt. Formation outcrop, a Montney shale equivalent rock from the Western Canada.





PETRONAS

GEOMECHANICA