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True Triaxial Testing of Castlegate Sandstone

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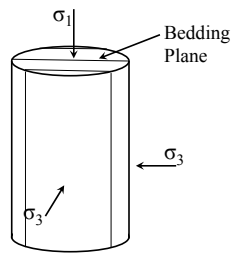
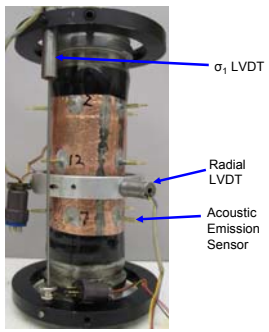
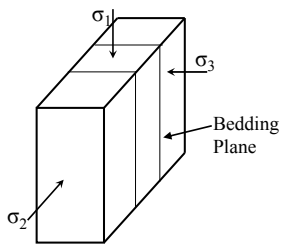
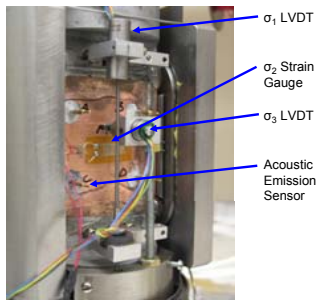
Castlegate Sandstone

- Grains of Quartz loosely cemented with Calcite
- 26.4% porosity
- Transversely isotropic
- From an outcrop in Utah
- Commonly used reservoir analog in petroleum industry
- Tests conducted with σ_1 parallel to bedding plane to prevent band formation due to a weak bedding plane, and because bands are observed angled to bedding in the field









Motivation:

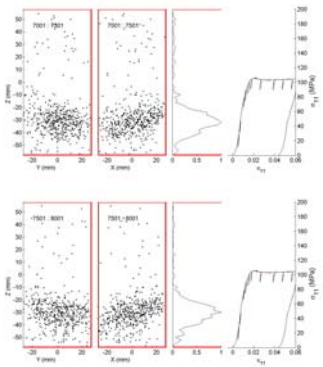
Theory states that band orientation is dependent on intermediate principal stress; to date there has been little to no investigation of the influence of intermediate principal stresses on band formation in high porosity rock.

This work seeks to shed light on the validity of the theory developed by Rudnicki and Rice '75, as the theory has yet to be investigated at stress states other than axisymmetric compression (ASC).

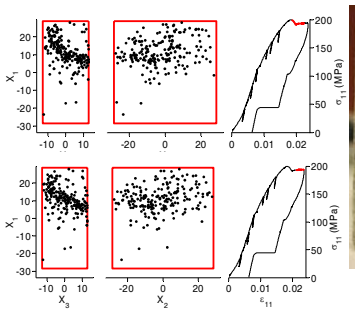
Test Plans

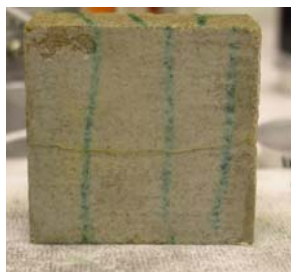
Tests will be run in 5 different deviatoric stress states, three of which require true triaxial testing, two stress states are presented here: ASC and ASC-PS (between axisymmetric compression and pure shear).

55 MPa ASC

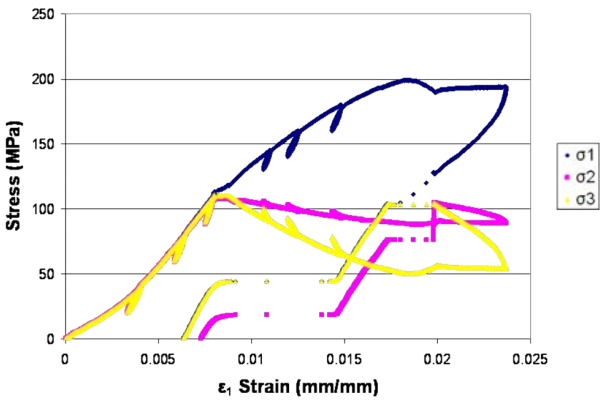


110 MPa ASC-PS

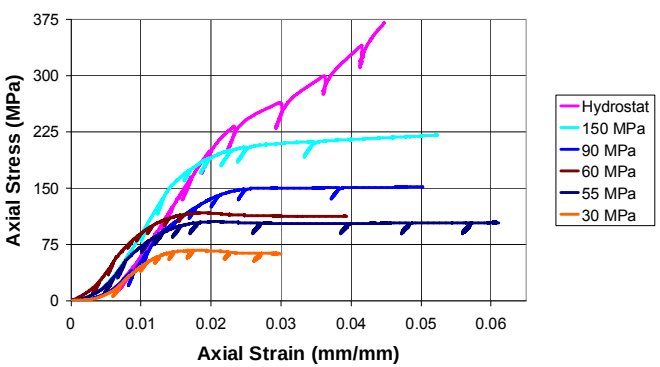




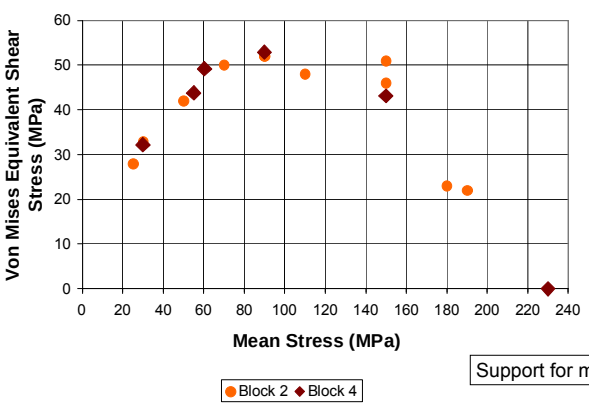
True Triaxial Stress Strain Plot

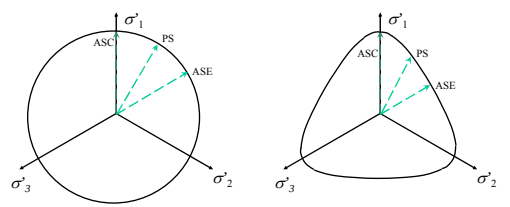


Axial Stress Strain for Constant Mean Stress Tests in ASC Stress State



Failure Surface for ASC Tests





Plots of stress paths in the pi plane. Left plot shows a non J_3 dependent failure surface, the right plot shows a J_3 dependent failure surface.(J_3 is the third invariant of deviatoric stress)

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References:

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