

Anisotropy

ROSE

Rock Physics and Geomechanics

Course 2012

Erling Tjørr

Waves in a fractured rock

Many theories available (starting from Eshelby, 1957).

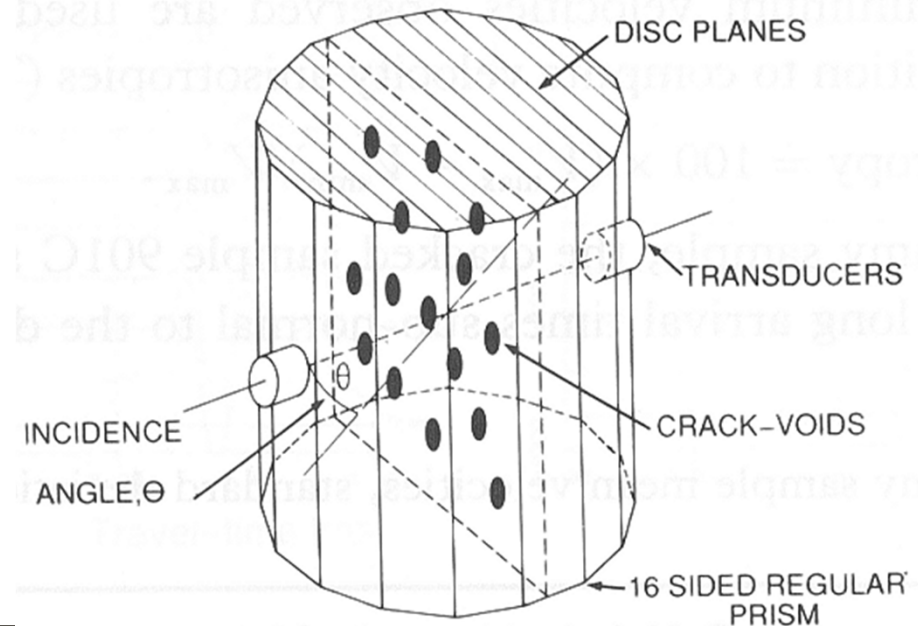
Very few well defined experiments.

- Crack size
- Crack shape
- Crack orientation
- Crack positions
- Number of cracks

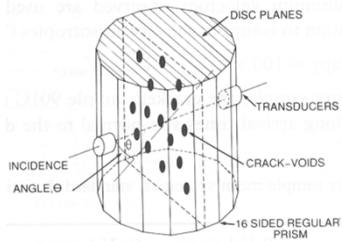
All
well
defined

Our approach:

Synthetic sandstones with controlled
crack geometry

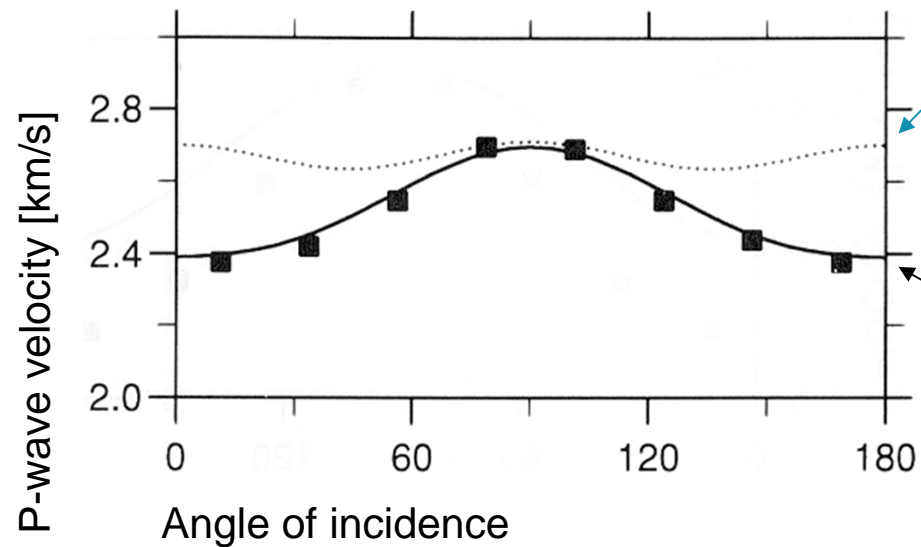


Rathore et al. (1995)



The technique has enabled resolution of theoretical discrepancies

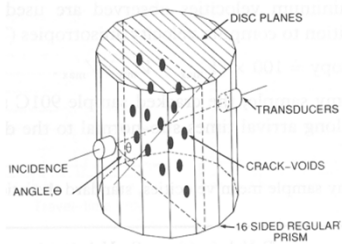
Impact of saturation on fracture induced anisotropy



Hudson (1980): No normal compliance in thin, saturated cracks
 \Rightarrow saturation nearly eliminates anisotropy

Thomsen (1995): Pore pressure equalization between cracks and pores
 \Rightarrow **anisotropy** prevails also in saturated rocks

Rathore et al. (1995)

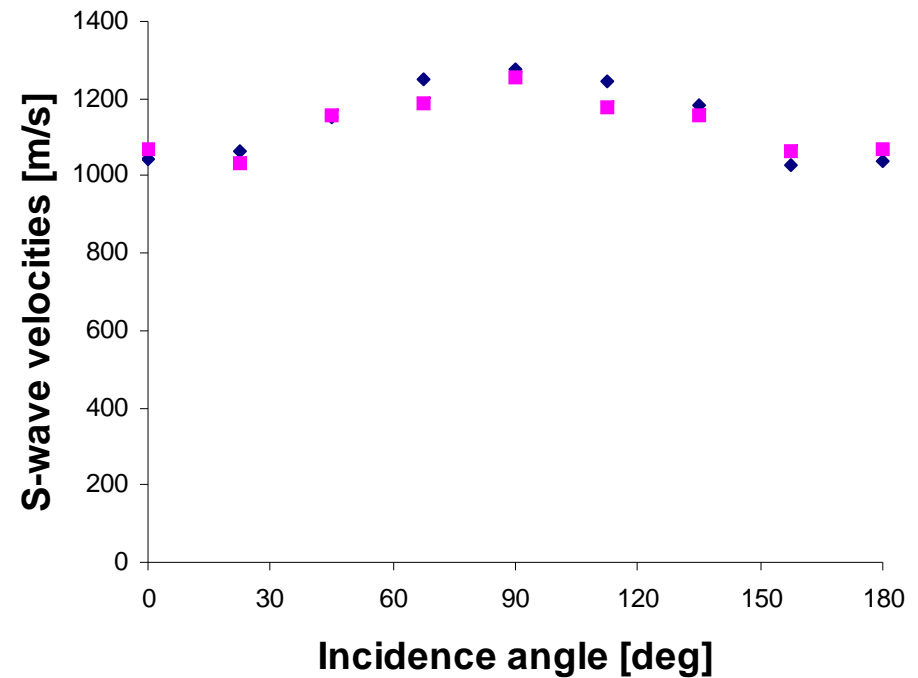


The technique has confirmed the validity of common, unproved assumptions

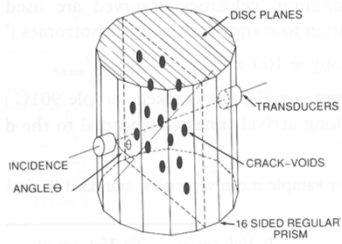
Impact of fracture shape on fracture induced anisotropy

Budiansky & O'Connell (1976):
 "All fractures of convex shape produce almost the same signature on acoustic velocities"

The non-circularity of cracks should induce a shear wave splitting, however – the effect is very small.

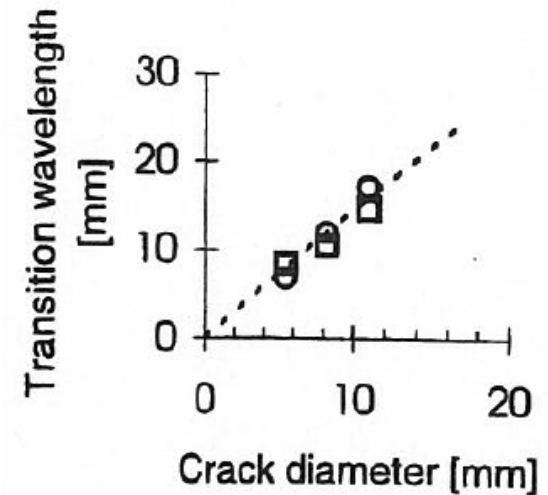
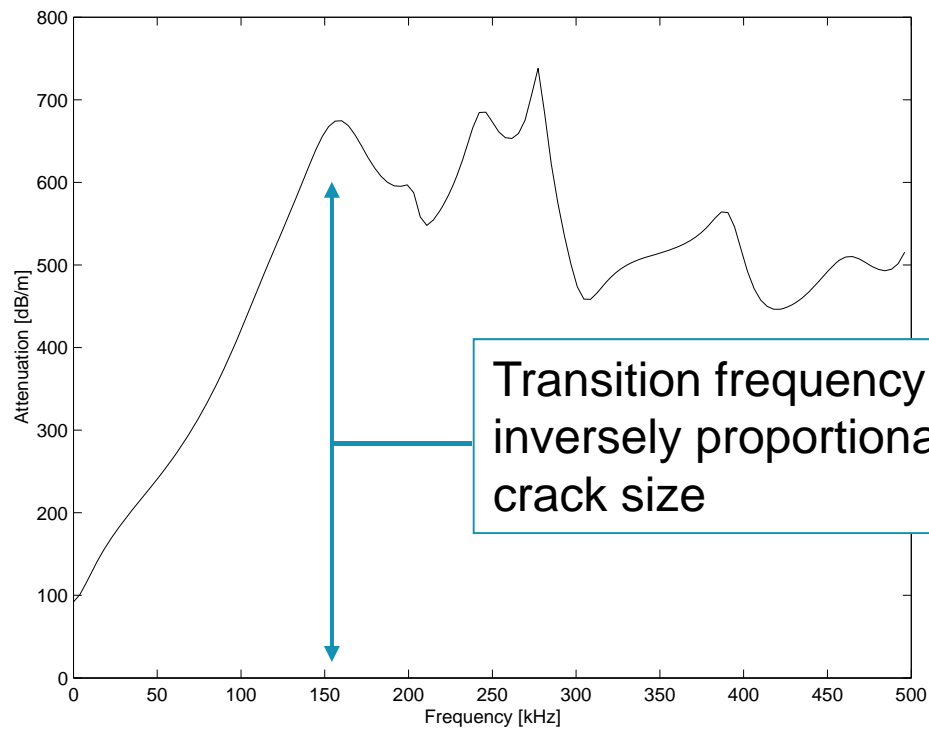


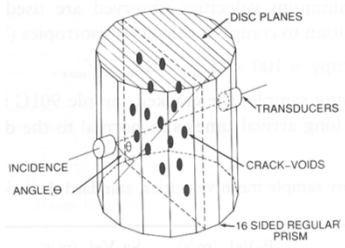
Skjærstein et al. (1996)



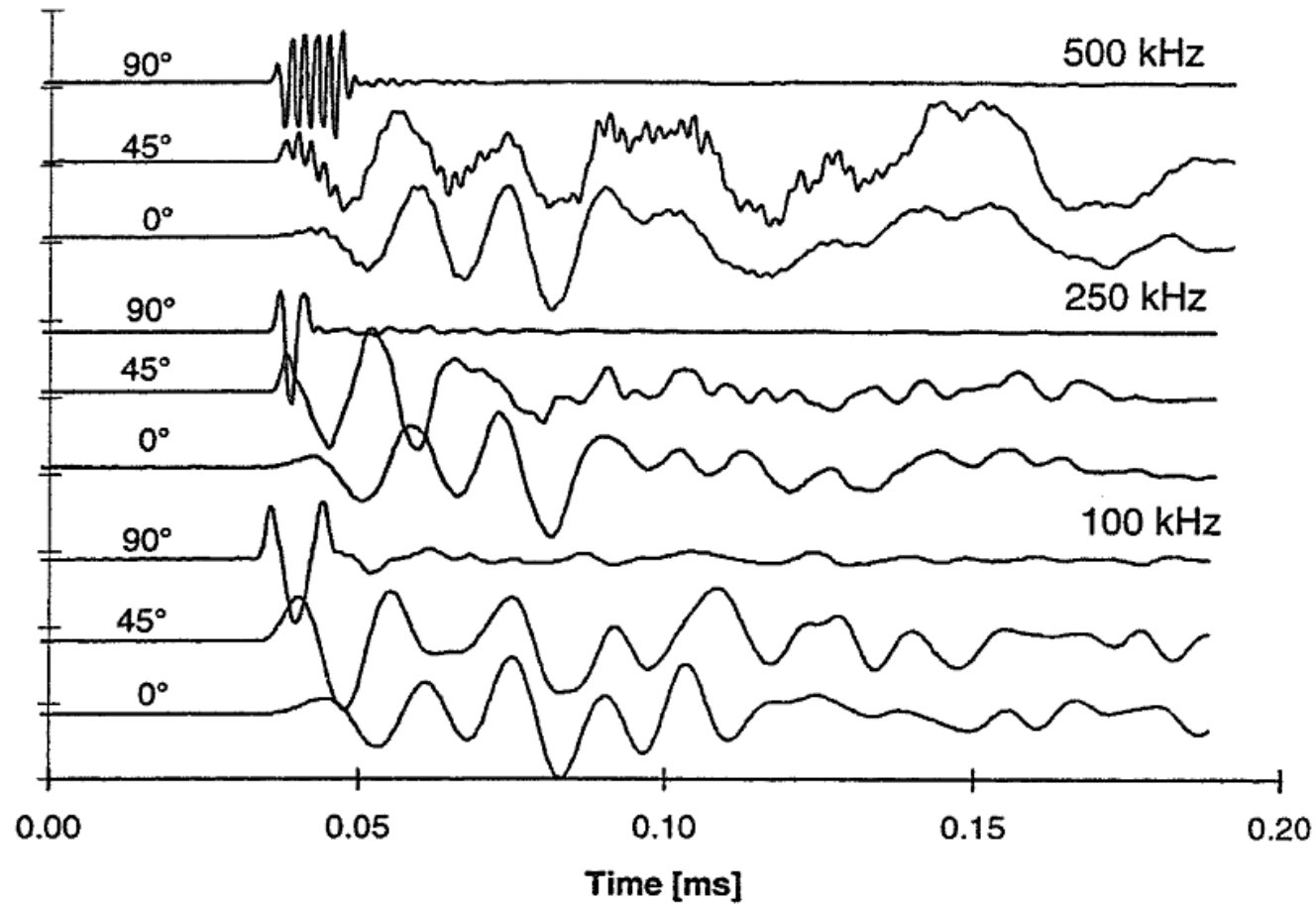
The technique has allowed for studies of areas poorly described by theory

How can fracture size be determined from acoustic measurements?

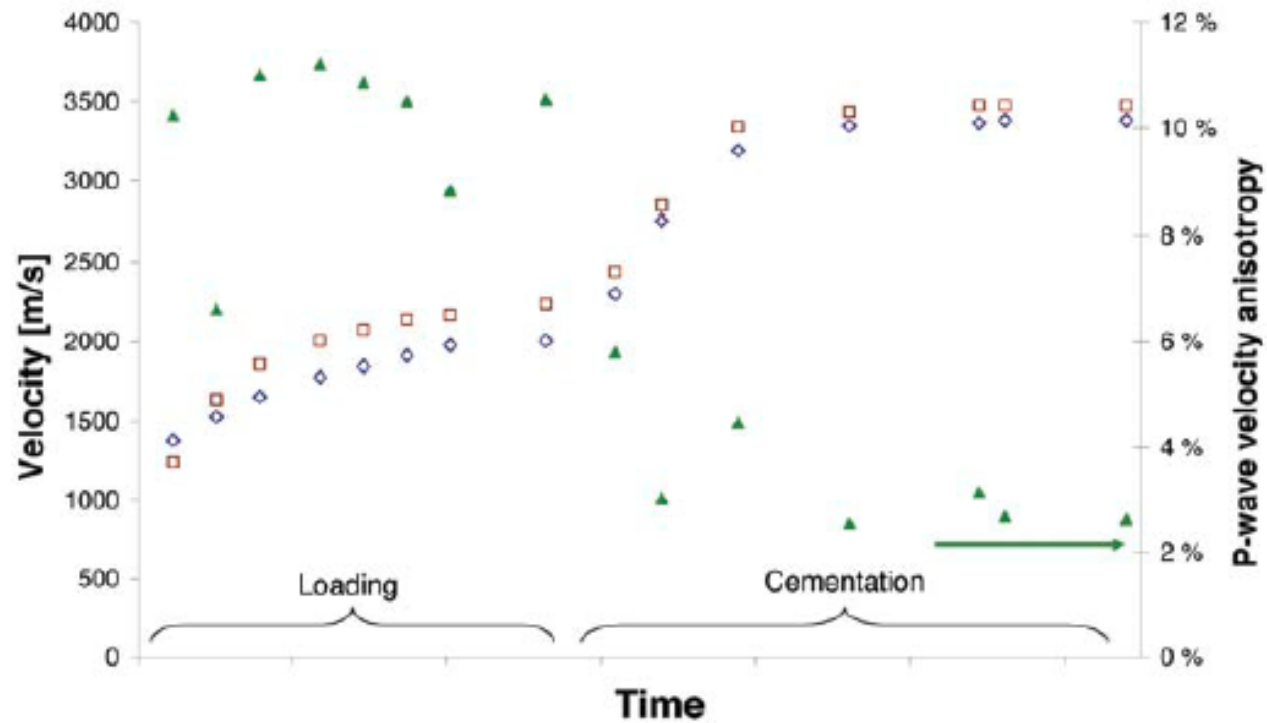




Cracks \leftrightarrow low-pass filter



Stress-induced anisotropy: reset by cementation



References:

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