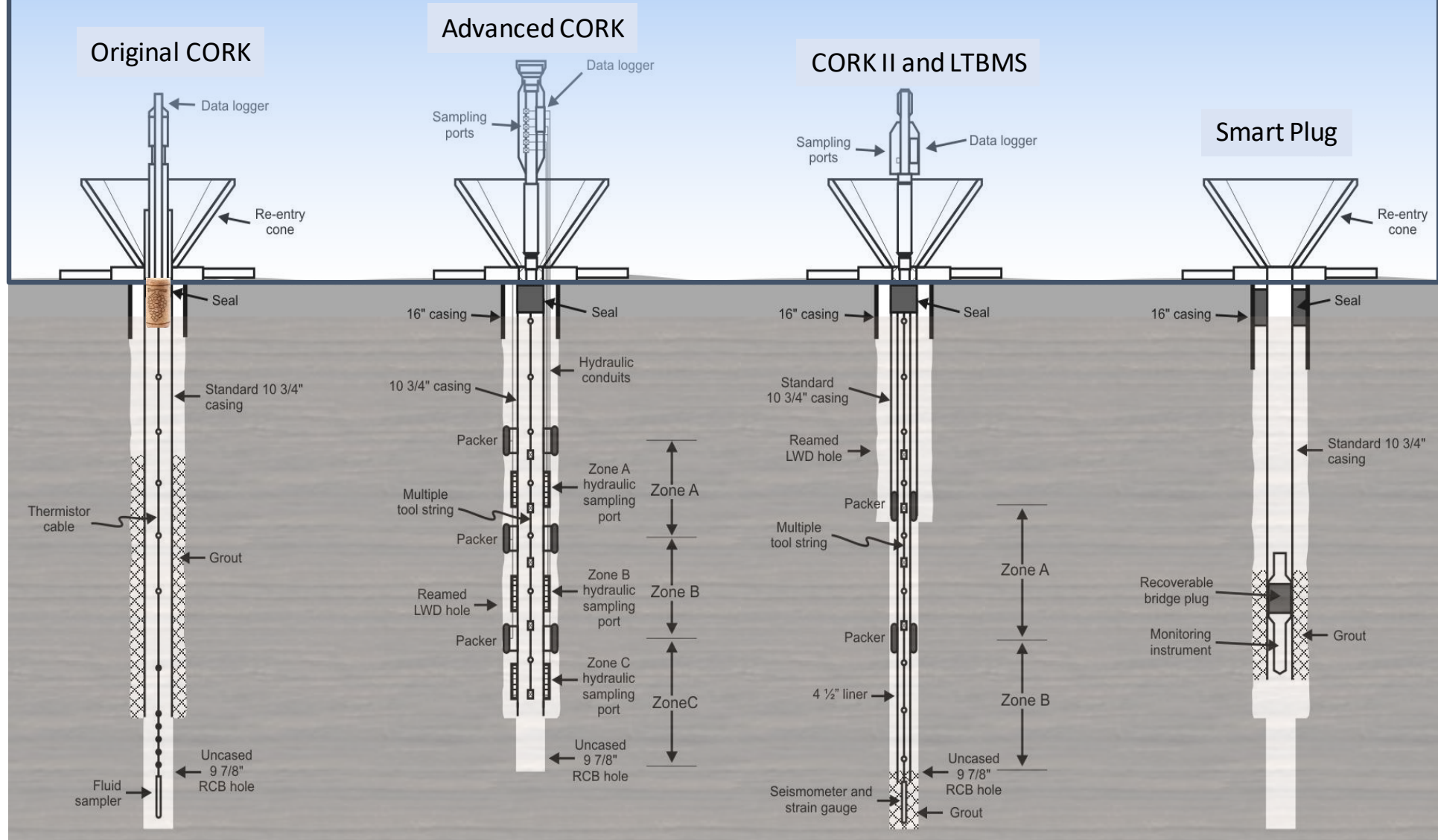
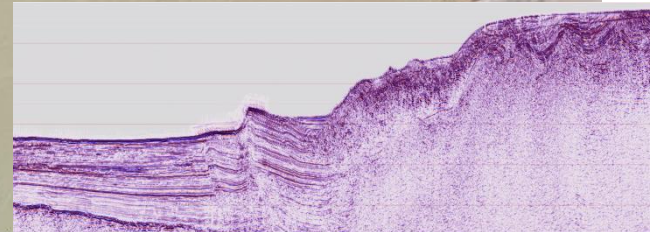
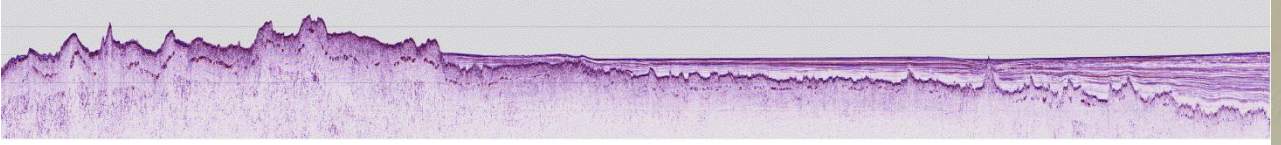
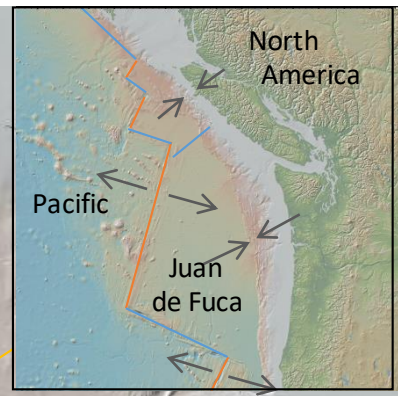
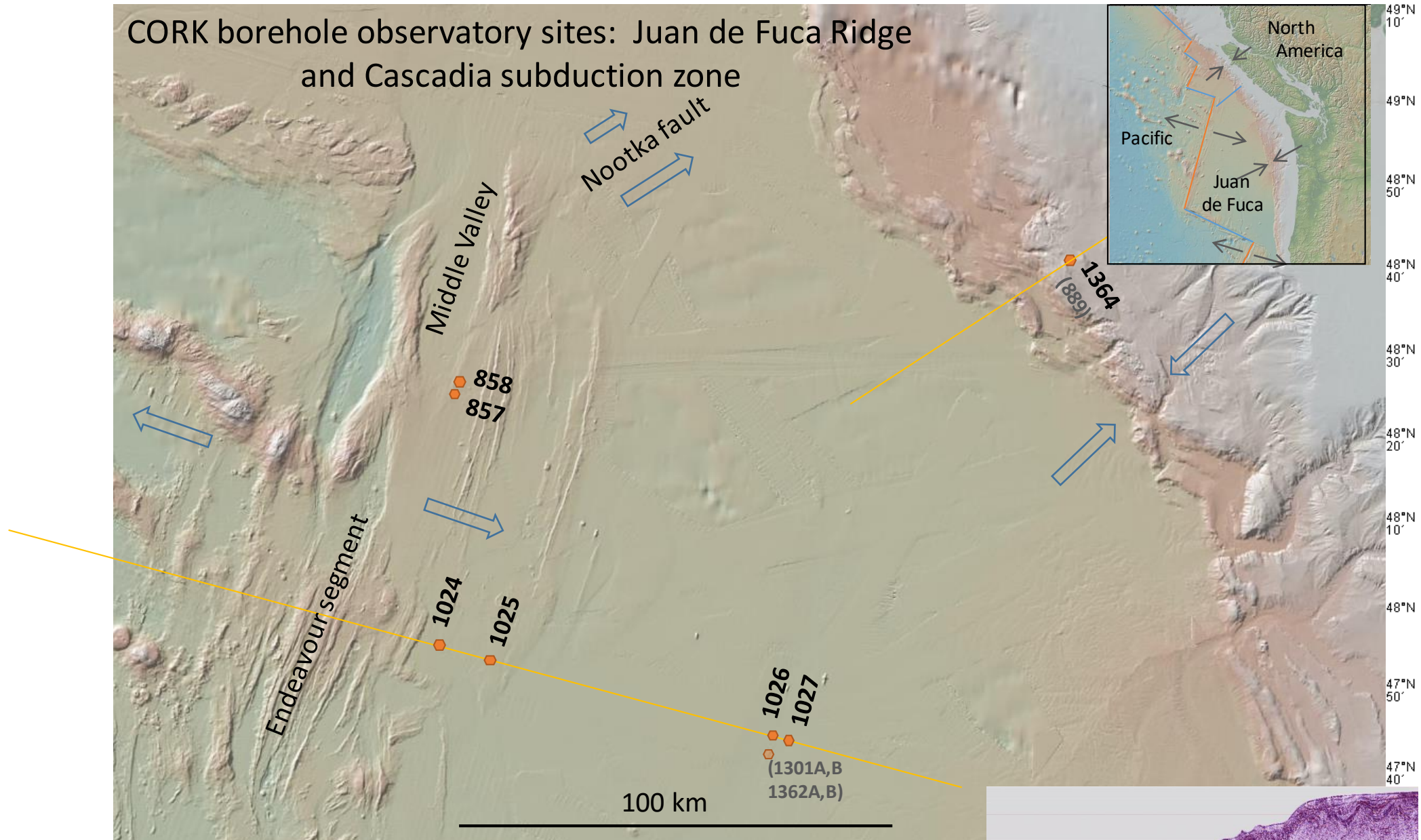


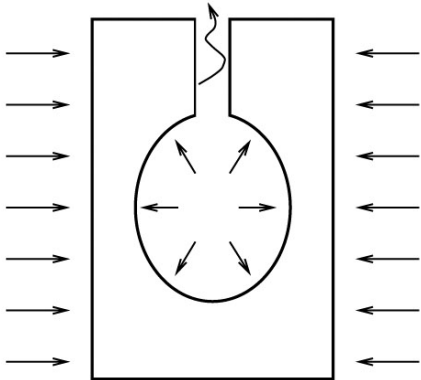
# Evolution of borehole monitoring configurations



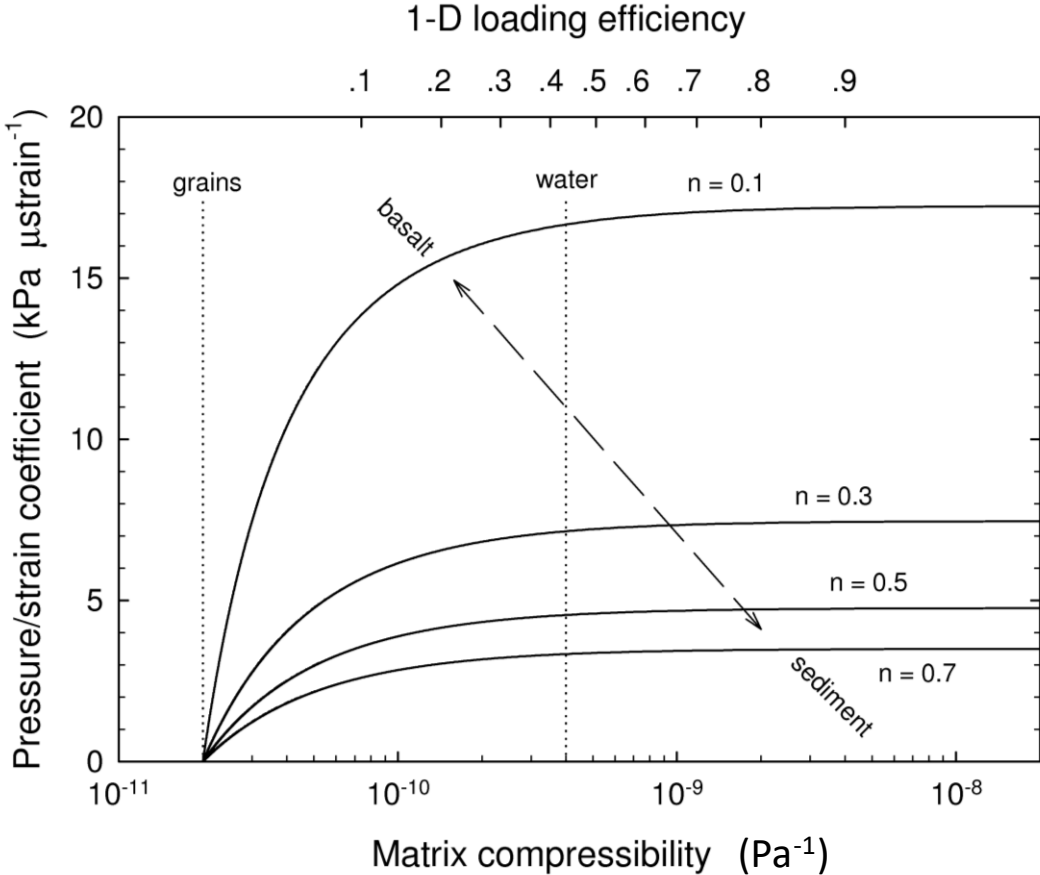
# CORK borehole observatory sites: Juan de Fuca Ridge and Cascadia subduction zone



# Using pressure as proxy for volumetric strain

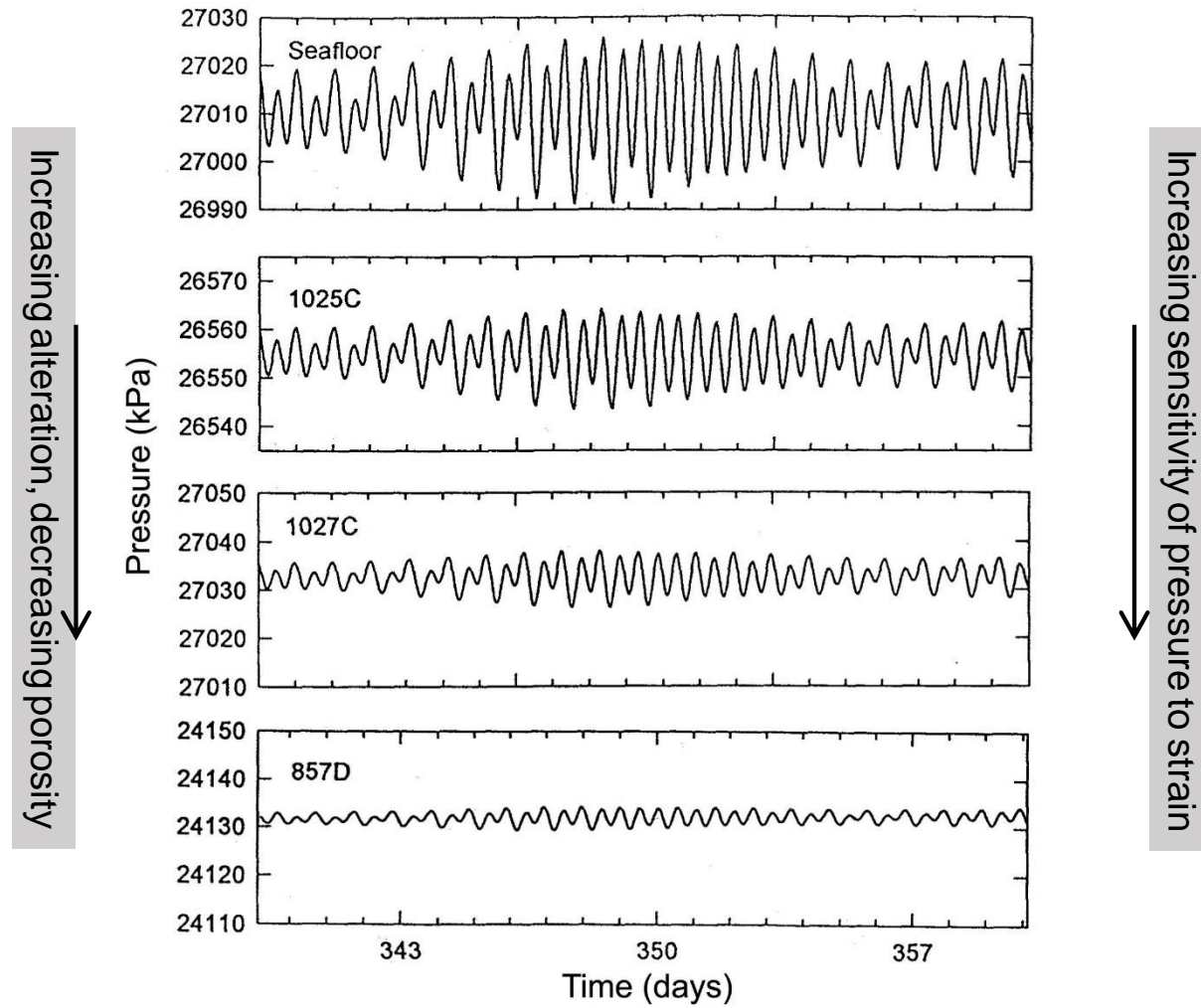


- Requirements for optimal sensitivity:
- low porosity
  - high matrix compressibility
  - low fluid compressibility
  - low grain compressibility
  - hydrologic isolation

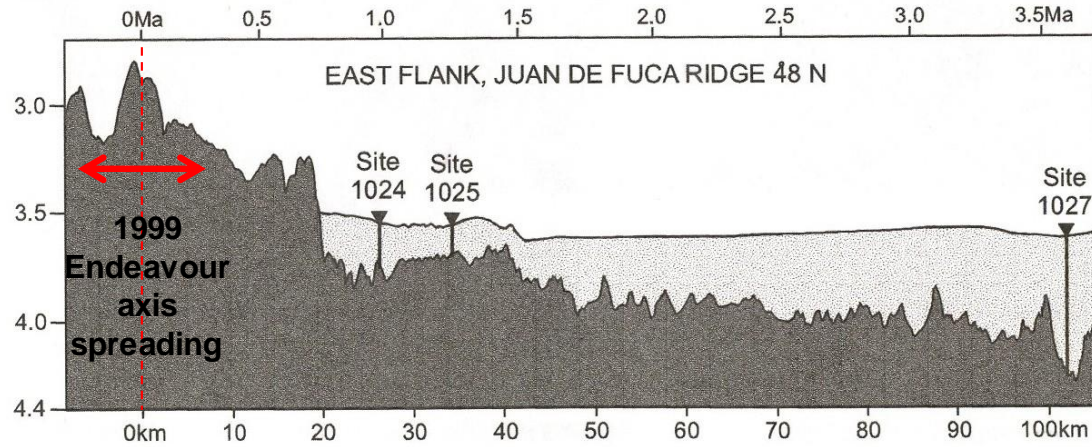


Strain / pressure conversion efficiency  
 (≈ 5 - 15 kPa / 10<sup>-6</sup> strain => 0.07 - .2 microstrain/kPa)

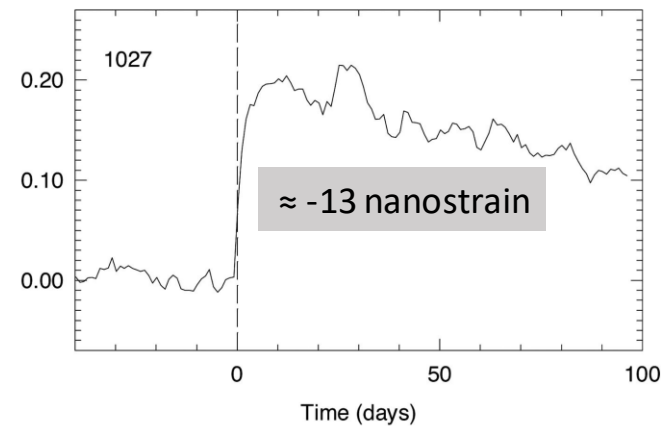
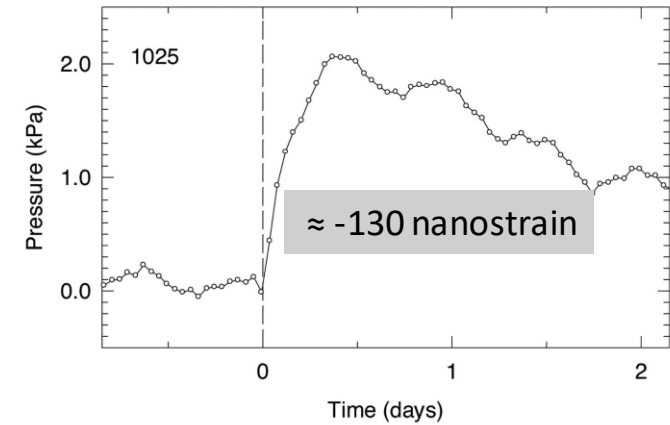
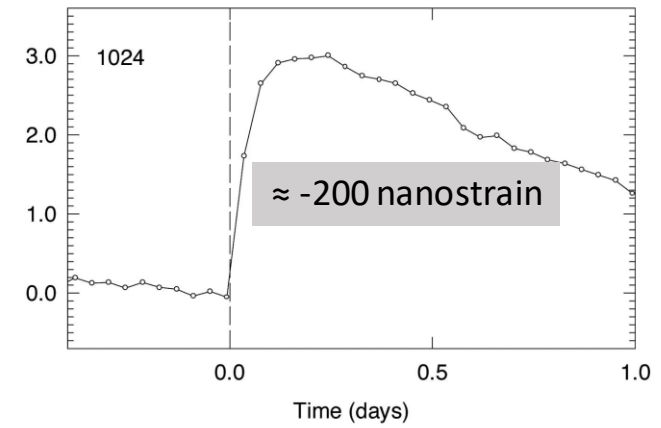
# Calibration of strain/pressure using seafloor tidal loading efficiency



# Episodic seafloor spreading at Juan de Fuca Ridge with associated plate contraction, then hydrologic drainage (and/or viscoelastic relaxation?)

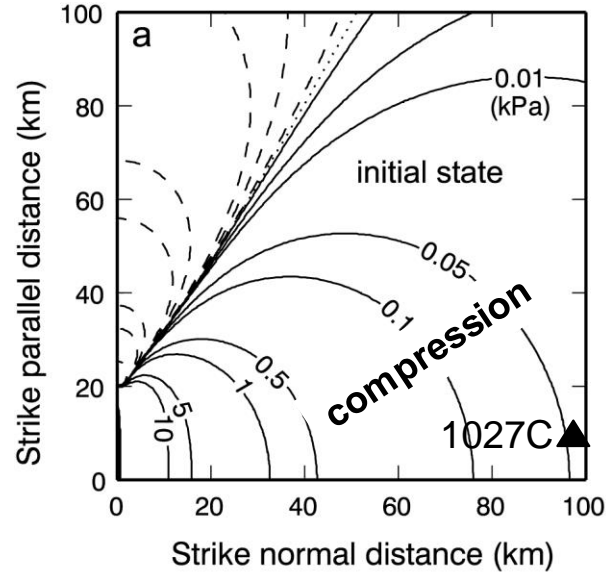


→ → →  
 Decreasing pressure signal amplitude, decreasing strain ...  
 → → →  
 Increasing time constant, increasing drainage path

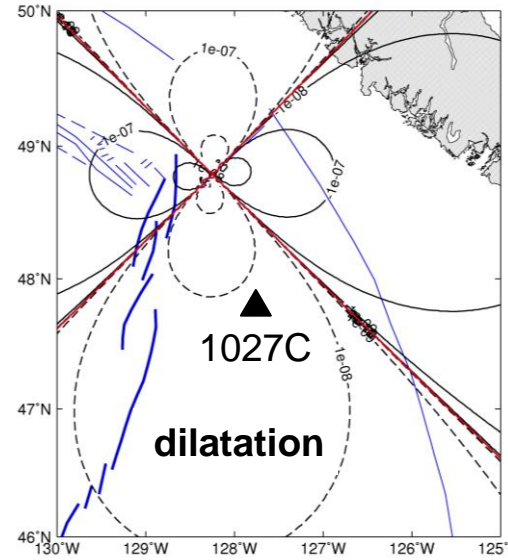


This and other examples show signs are always consistent with predicted strain  
 ... and magnitudes often > seismic moment

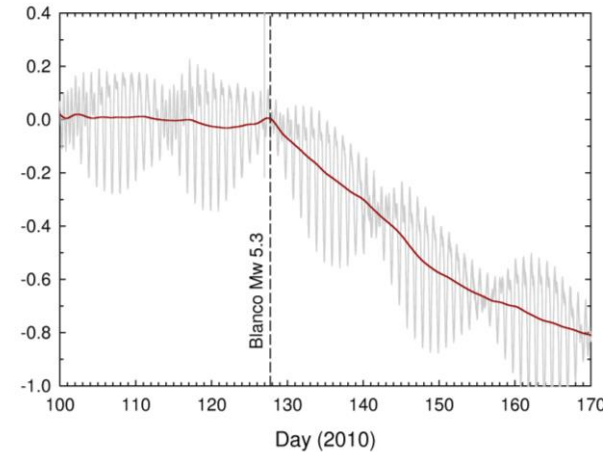
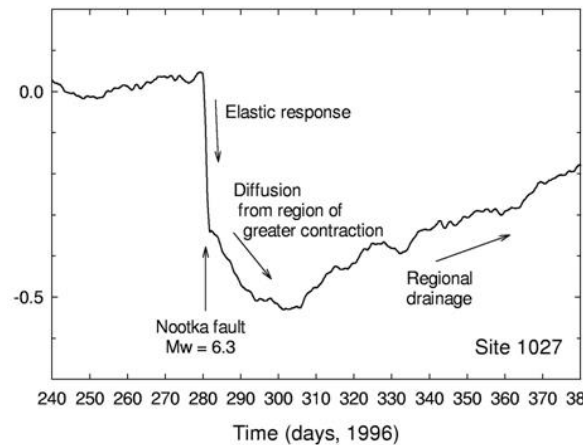
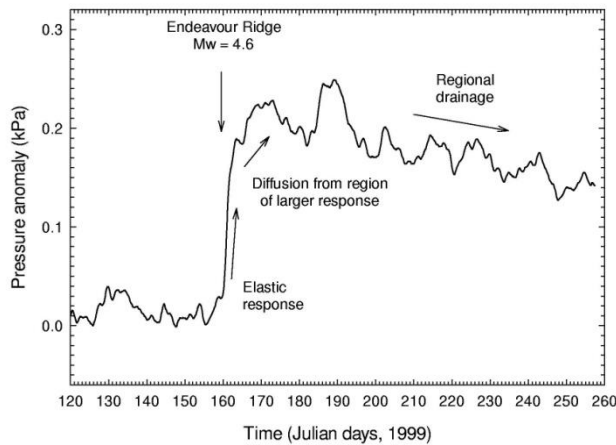
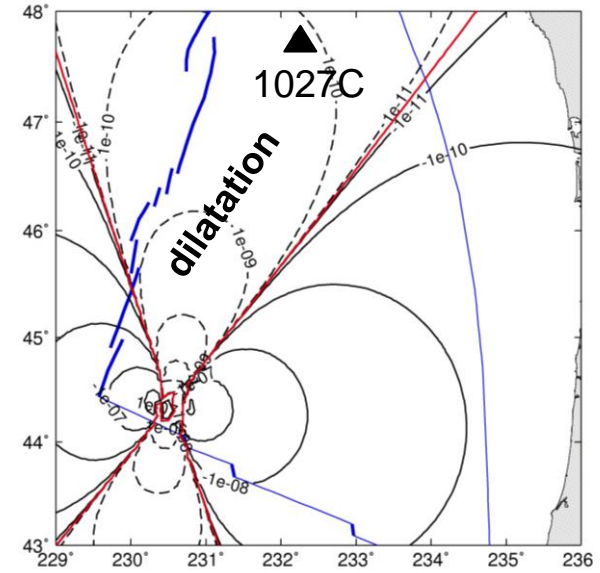
Endeavour axis Mw 4.6



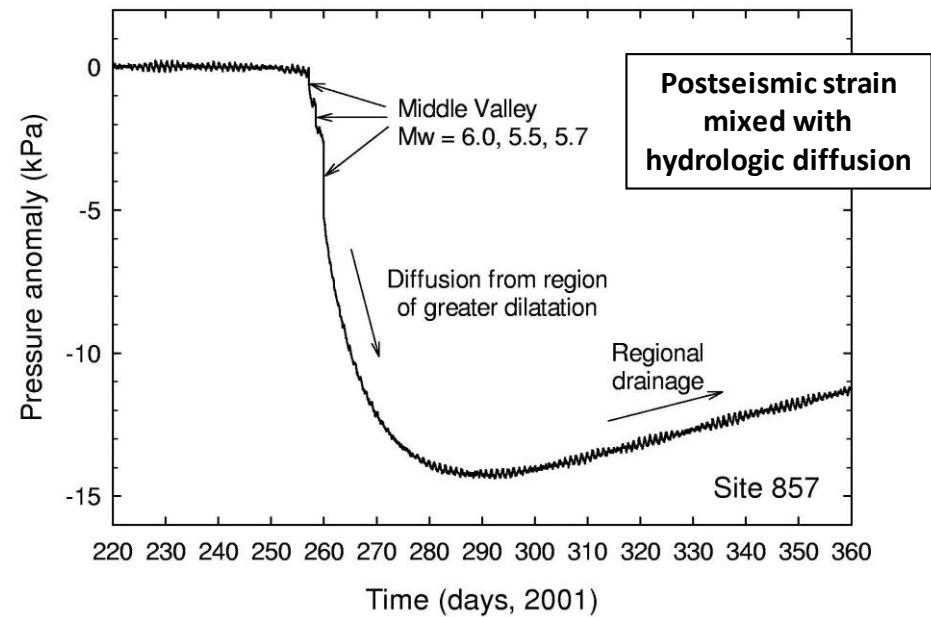
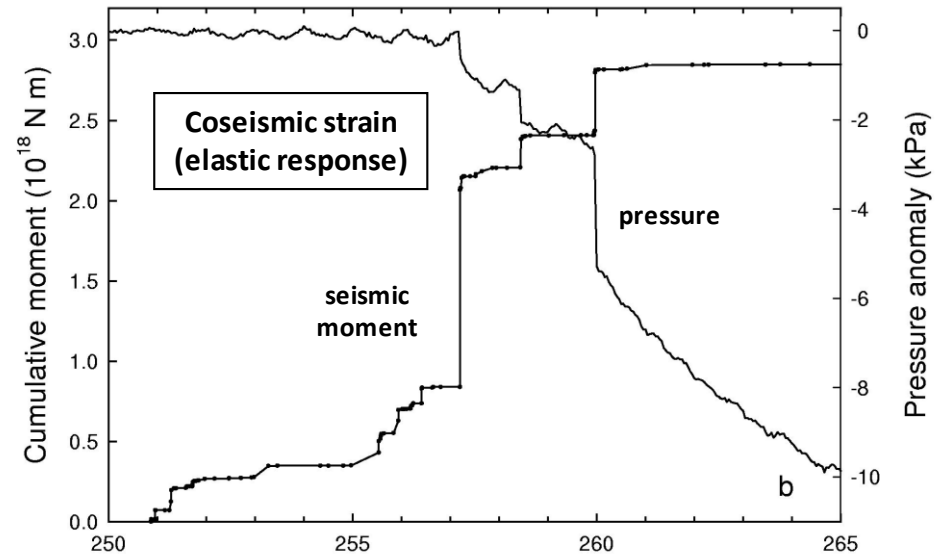
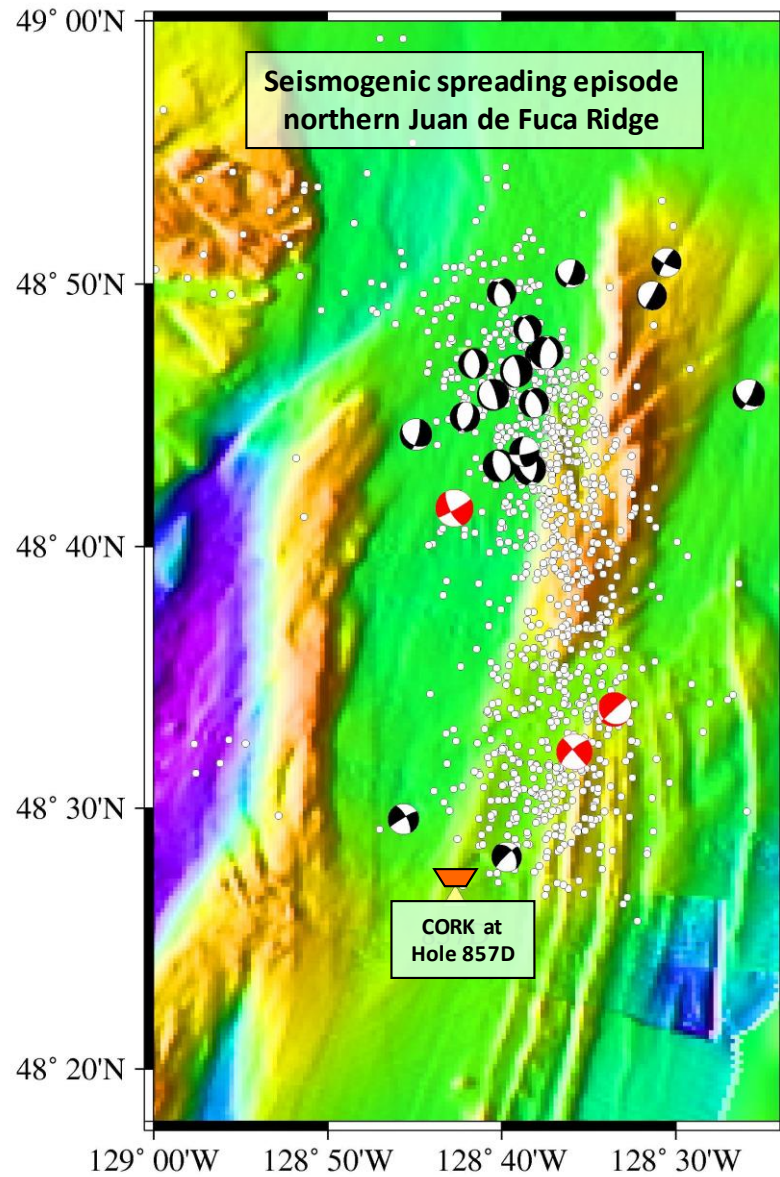
Nootka fault Mw 6.3



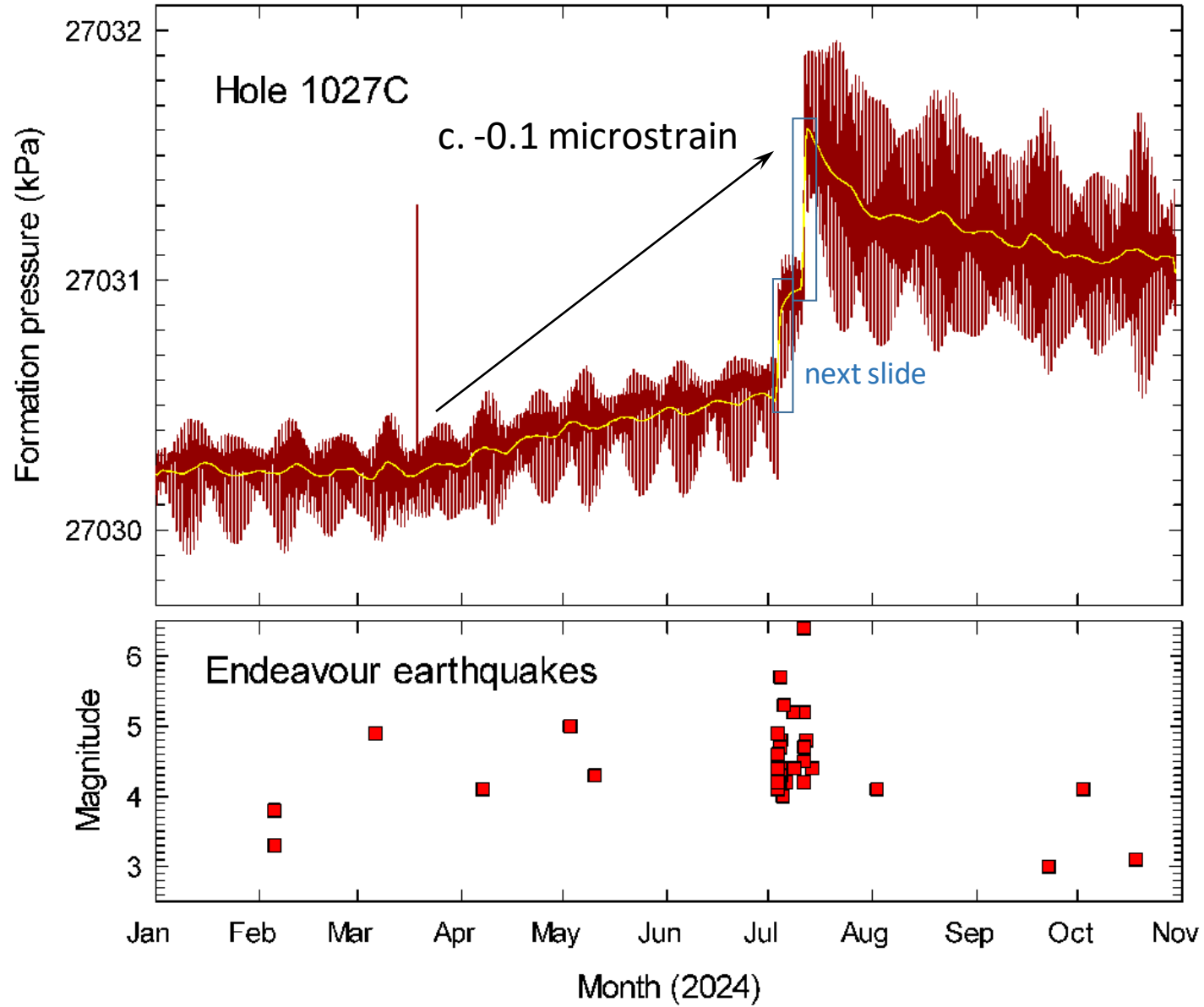
Blanco fault Mw 5.3



# Near-field strain at Hole 857D, Middle Valley

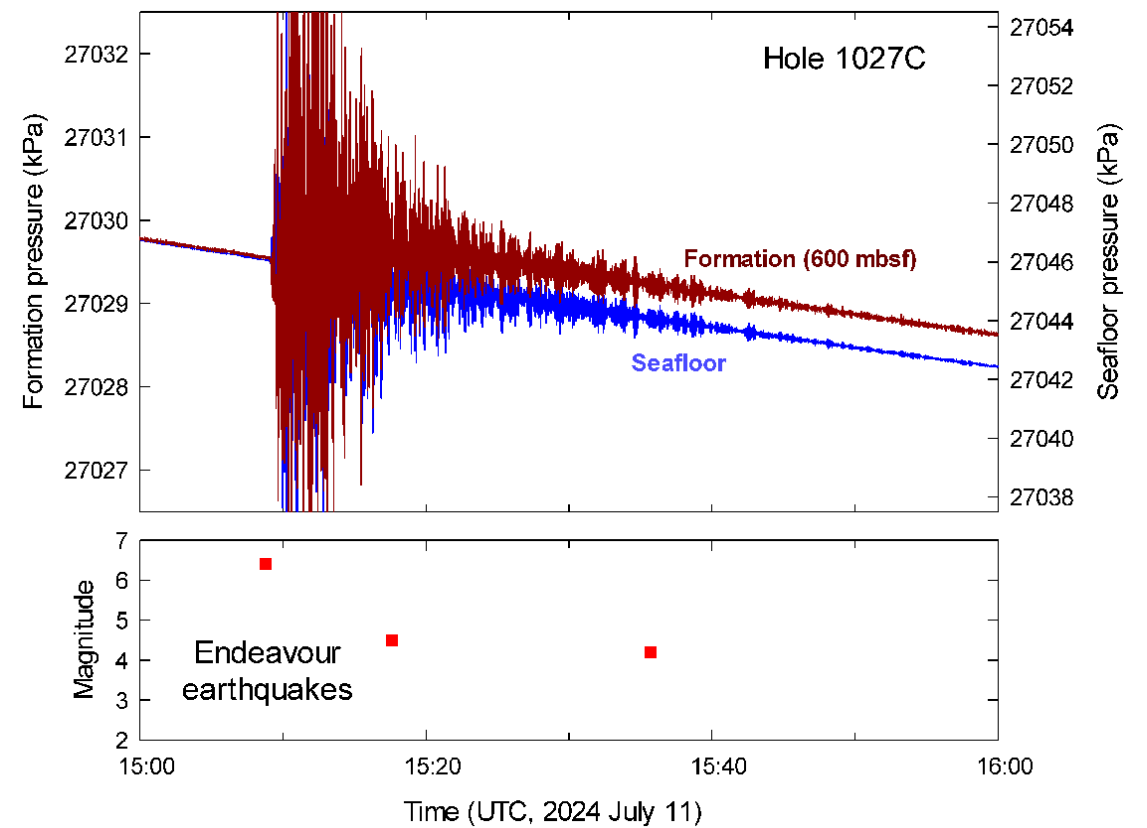
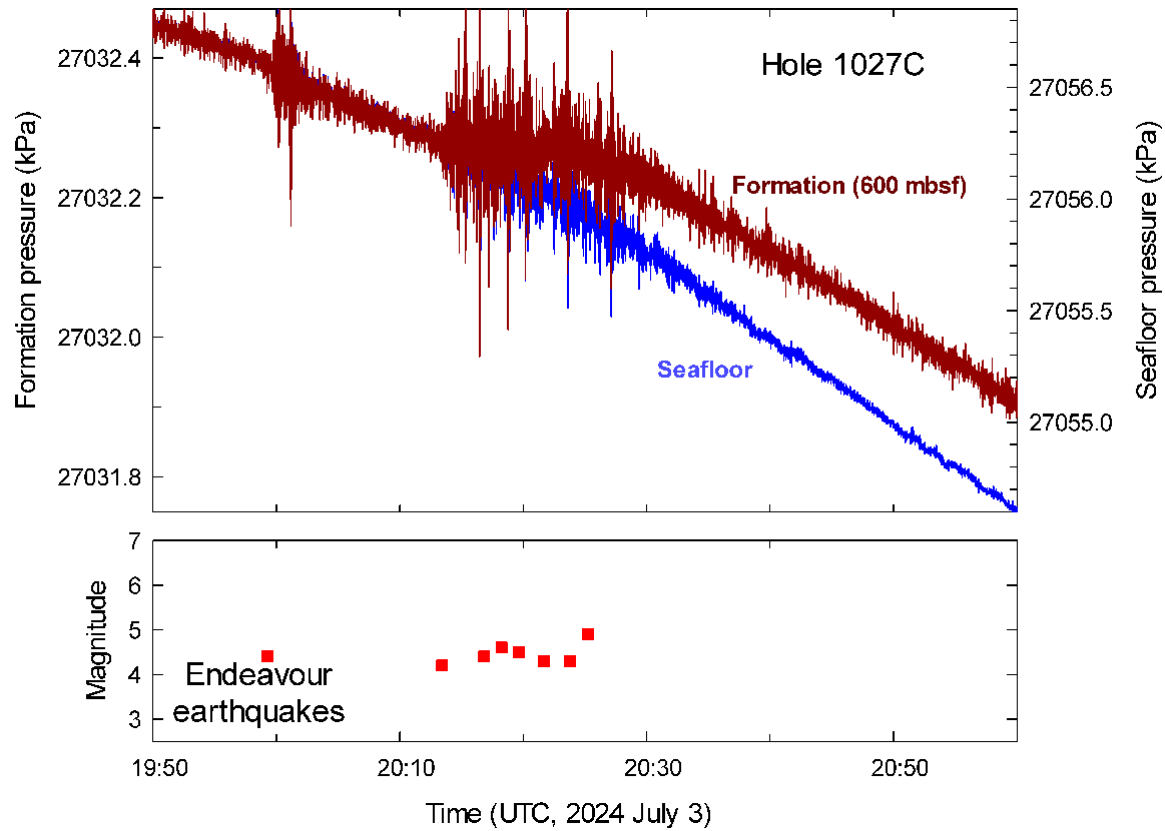


# This year's events



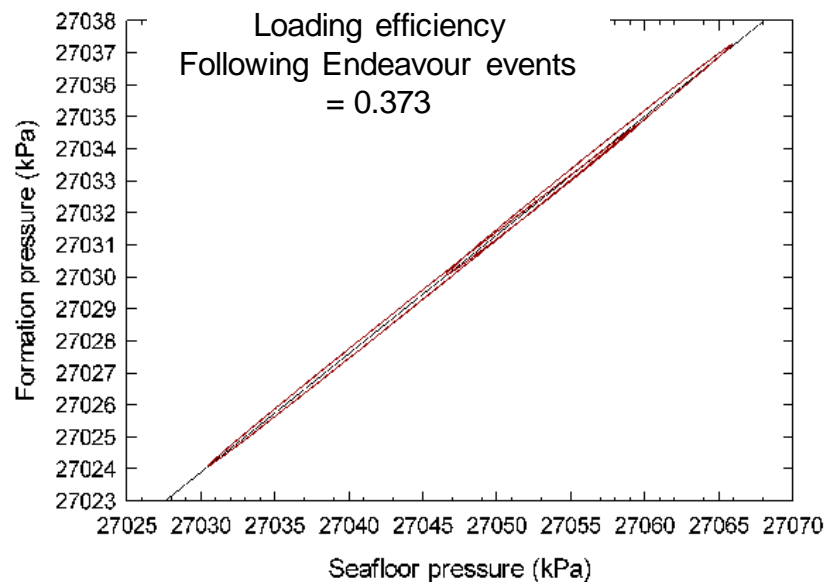
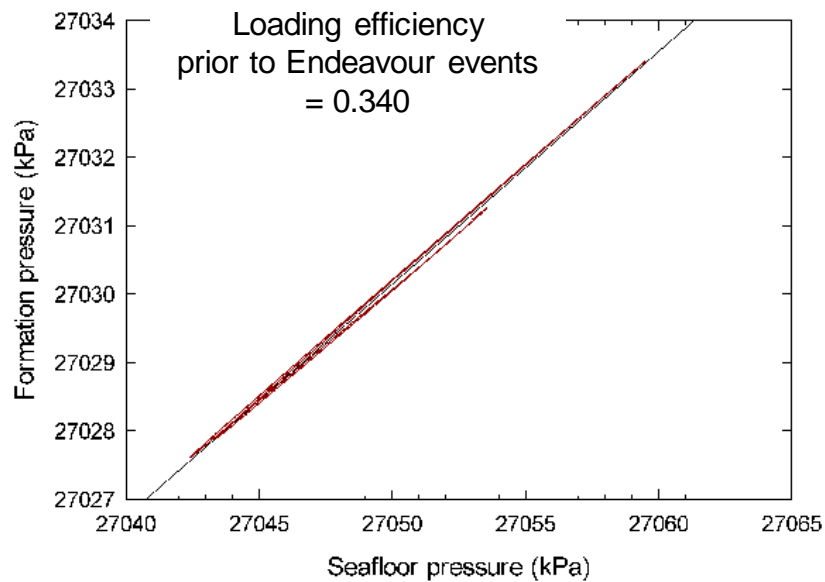
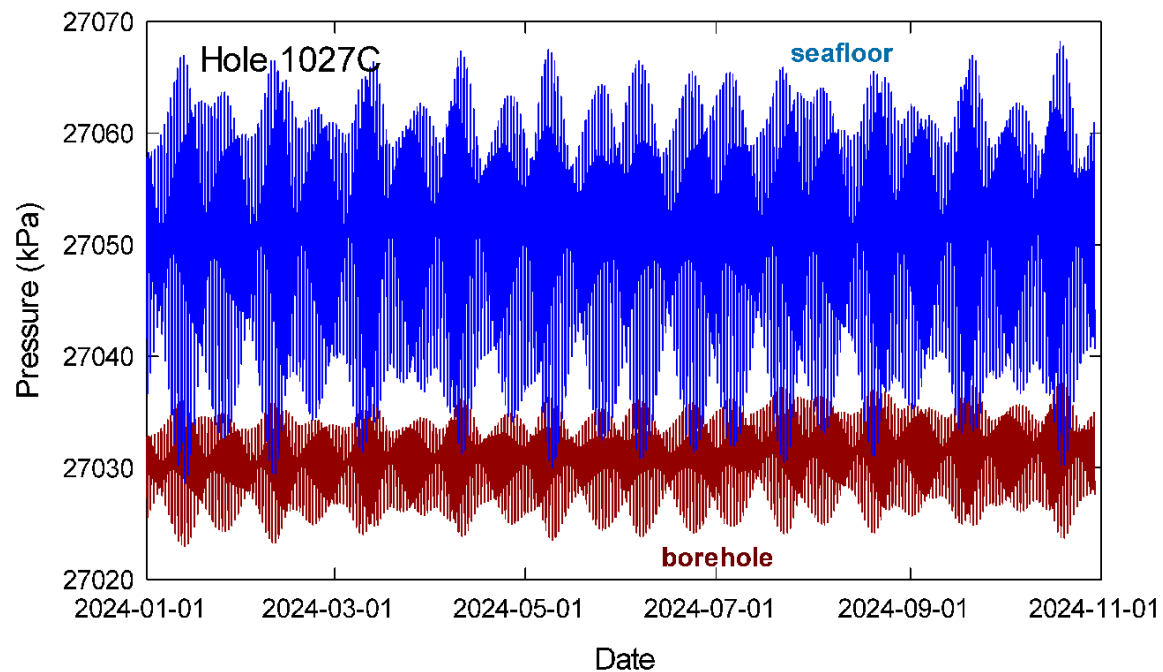


# Possible confounding effects of dynamic loading now resolved with 1 s.p.s. resolution

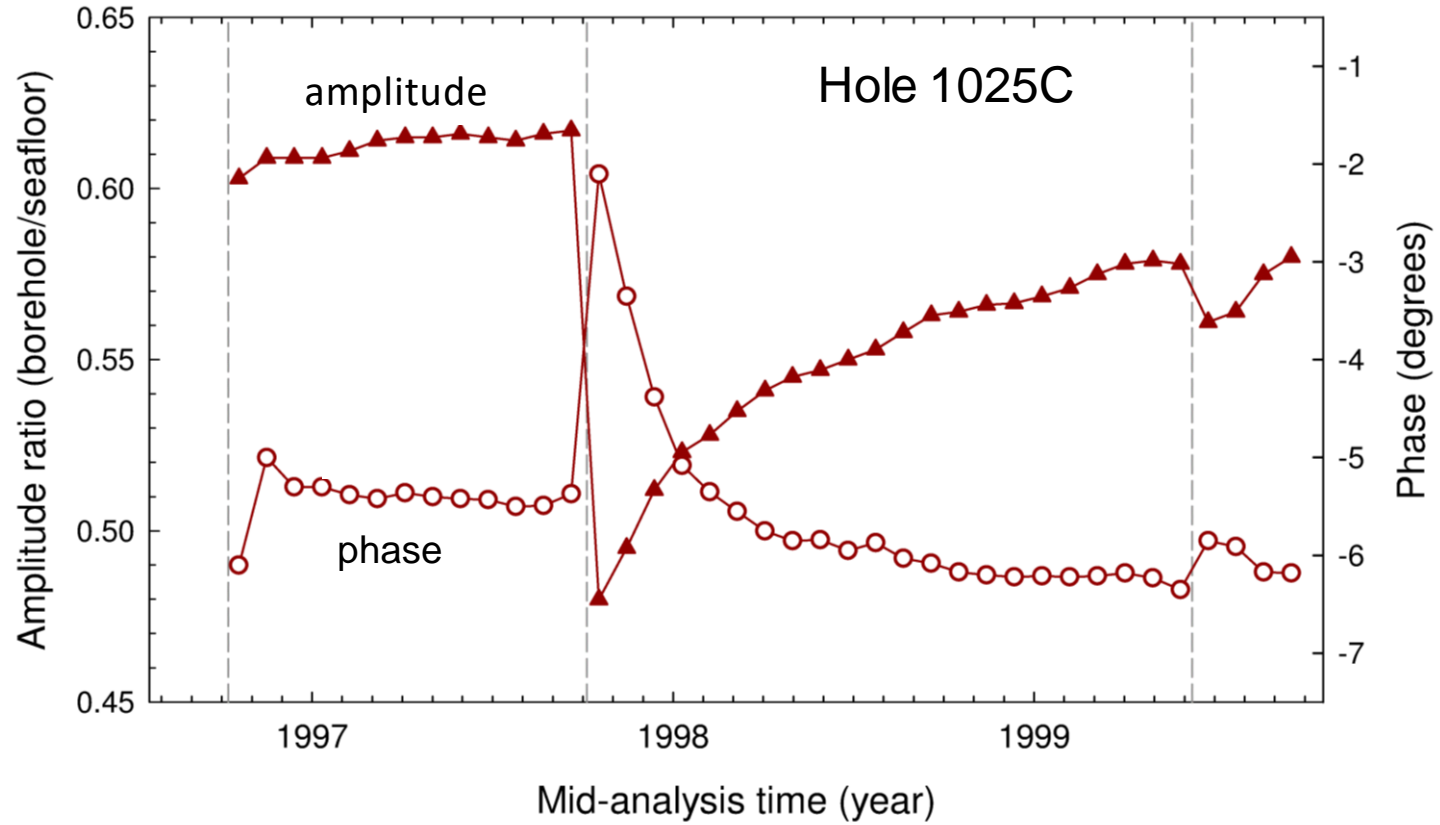




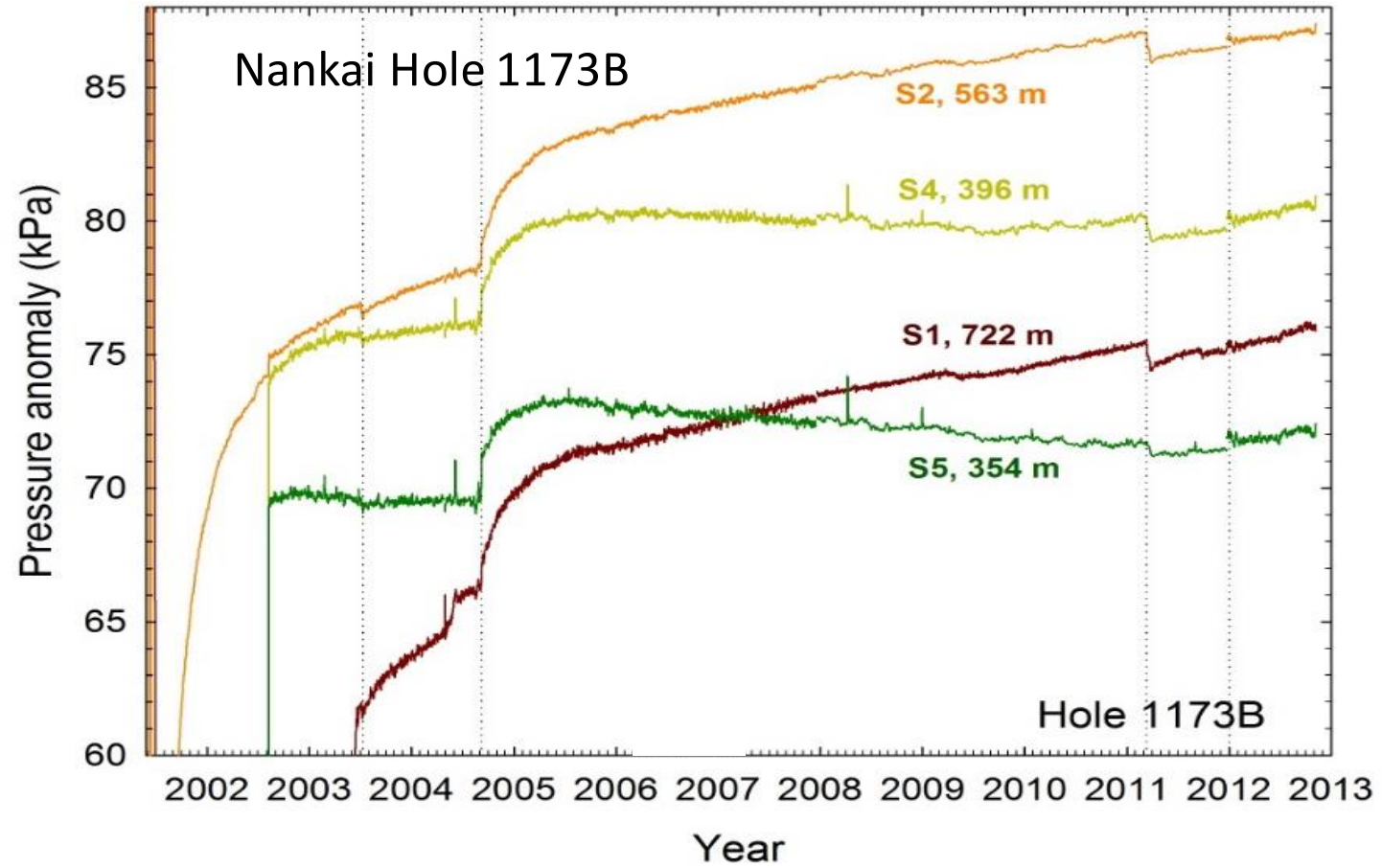
# Changes in tidal loading response

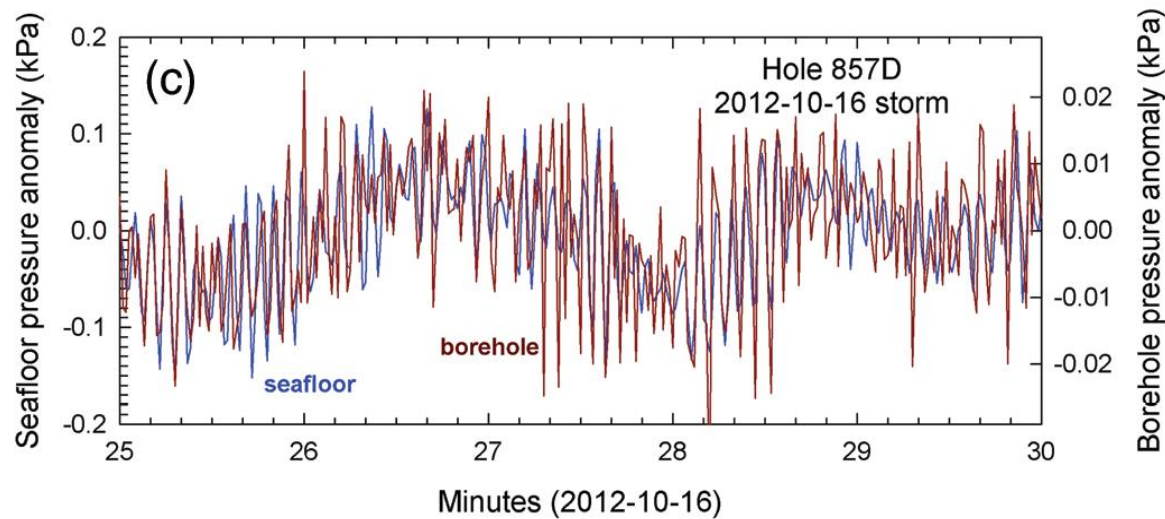
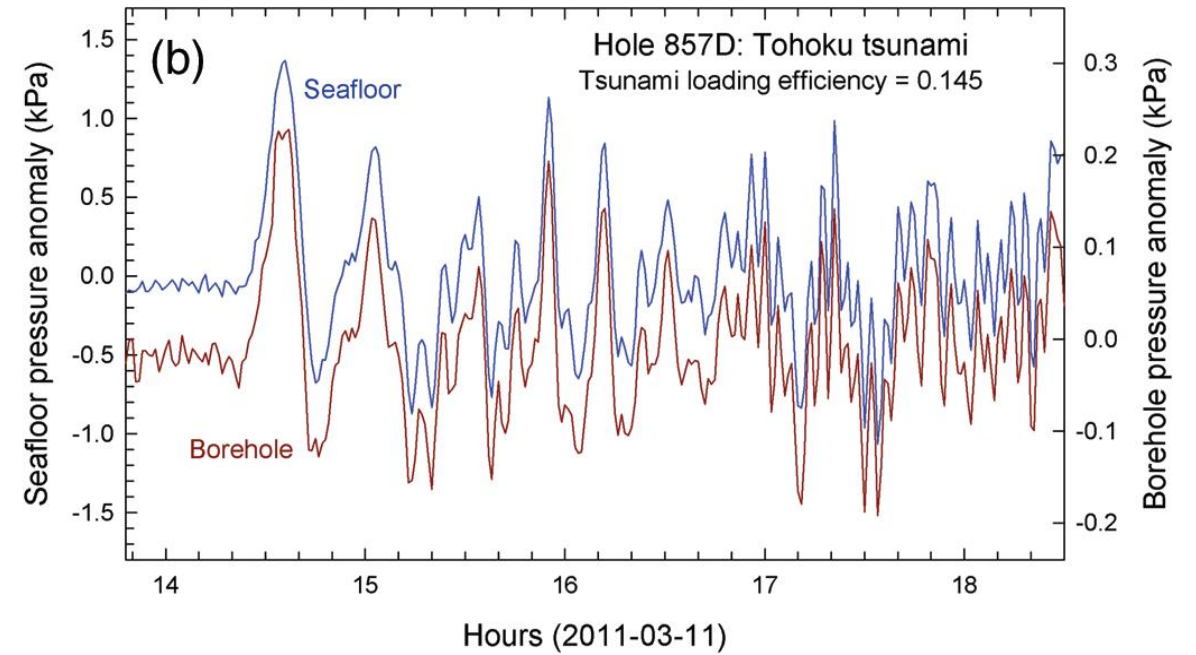
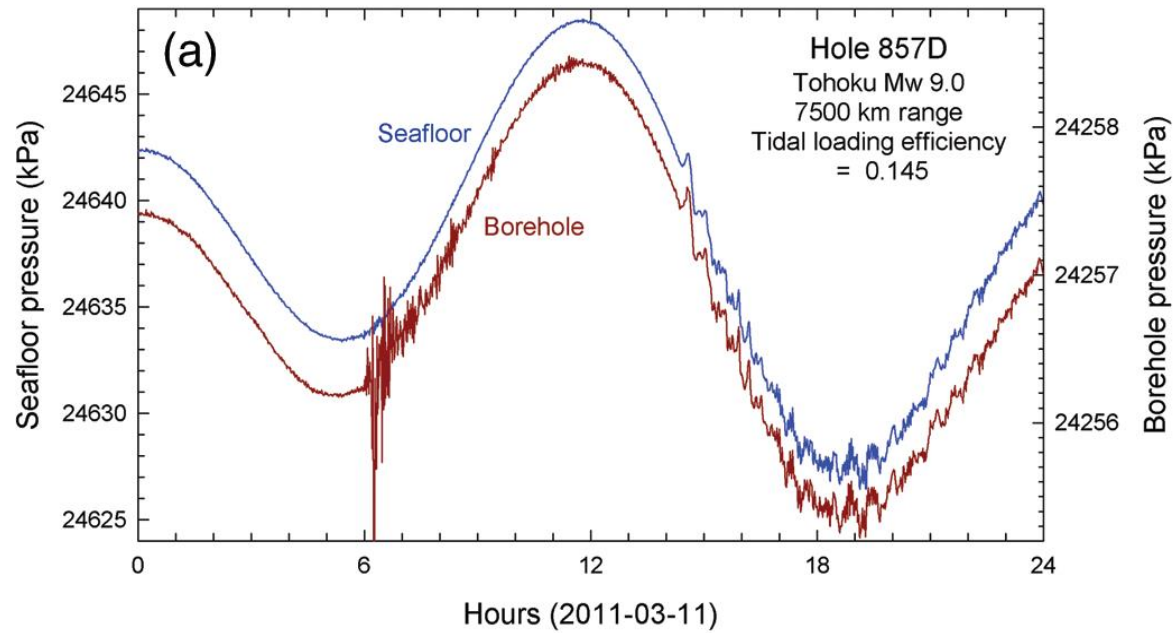


Changes in amplitude *and* phase indicate changes in elastic (modulus) \ *and* hydrologic (permeability) properties



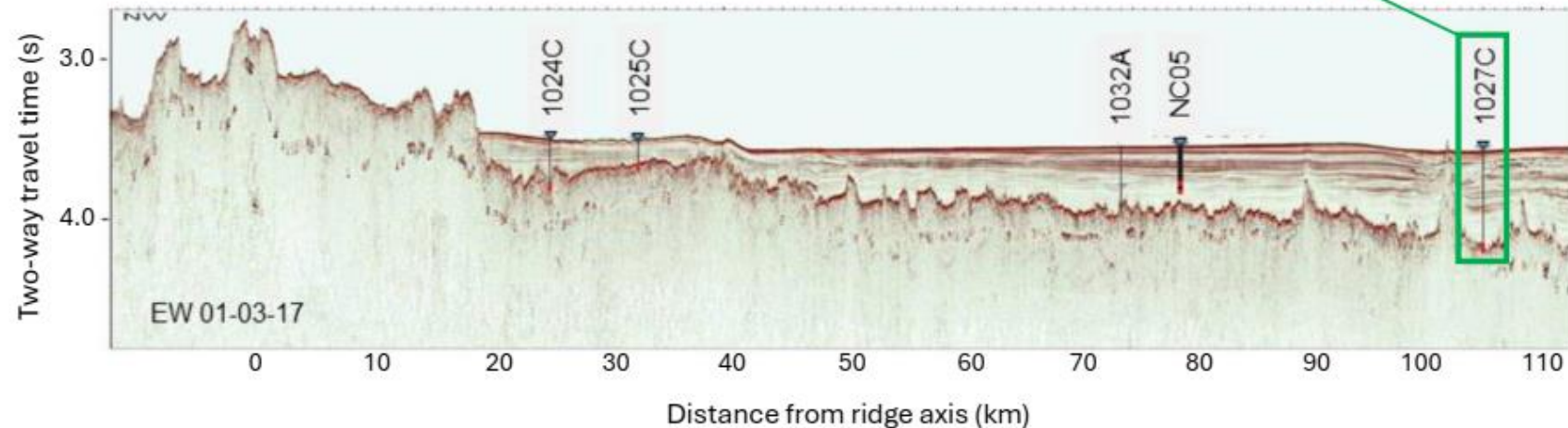
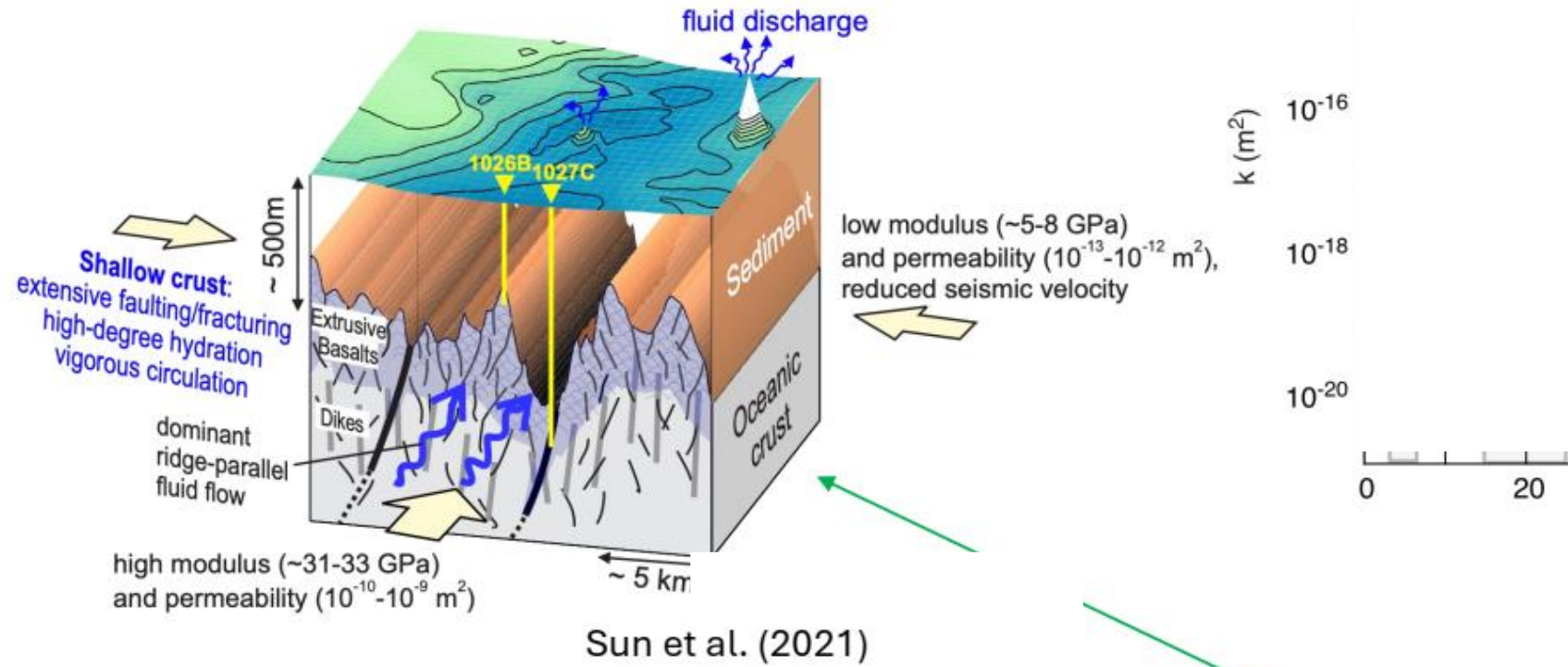
## Unwanted influence of hydrologic drainage



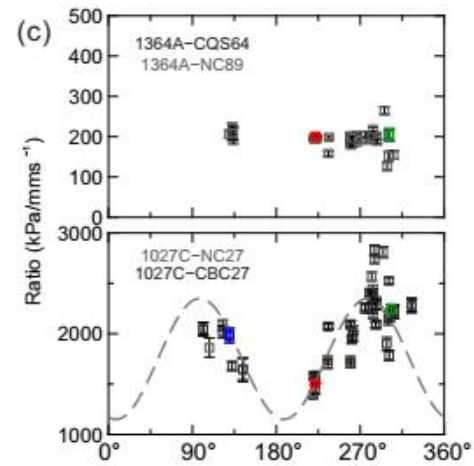
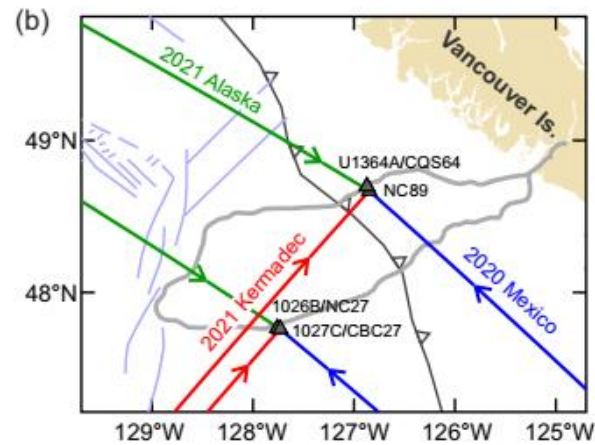
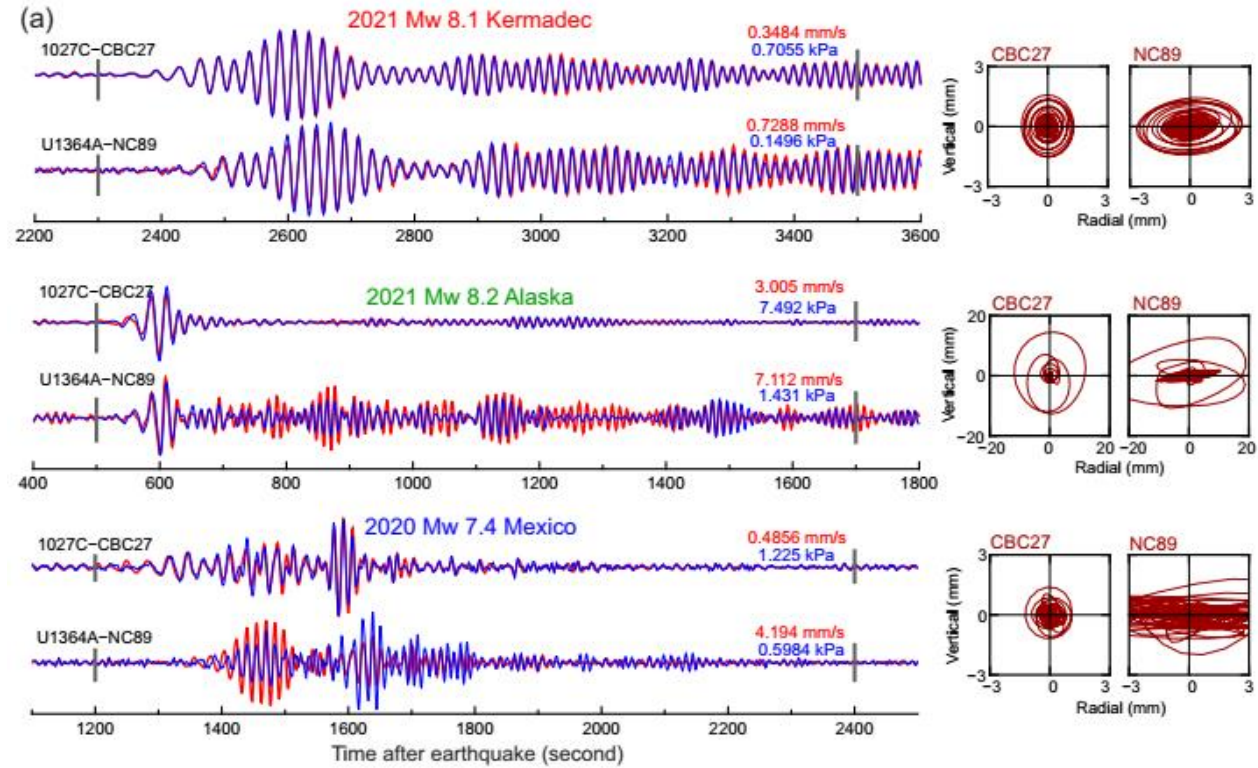


Broad bandwidth of signals  
from ocean and body loading

# Structural context at Holes 1026B and 1027C

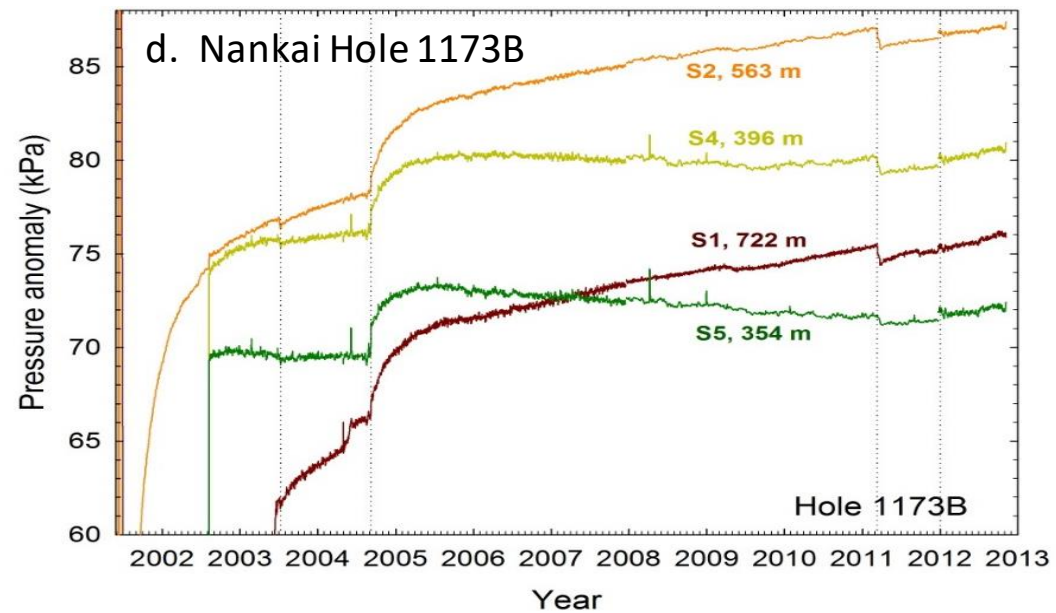
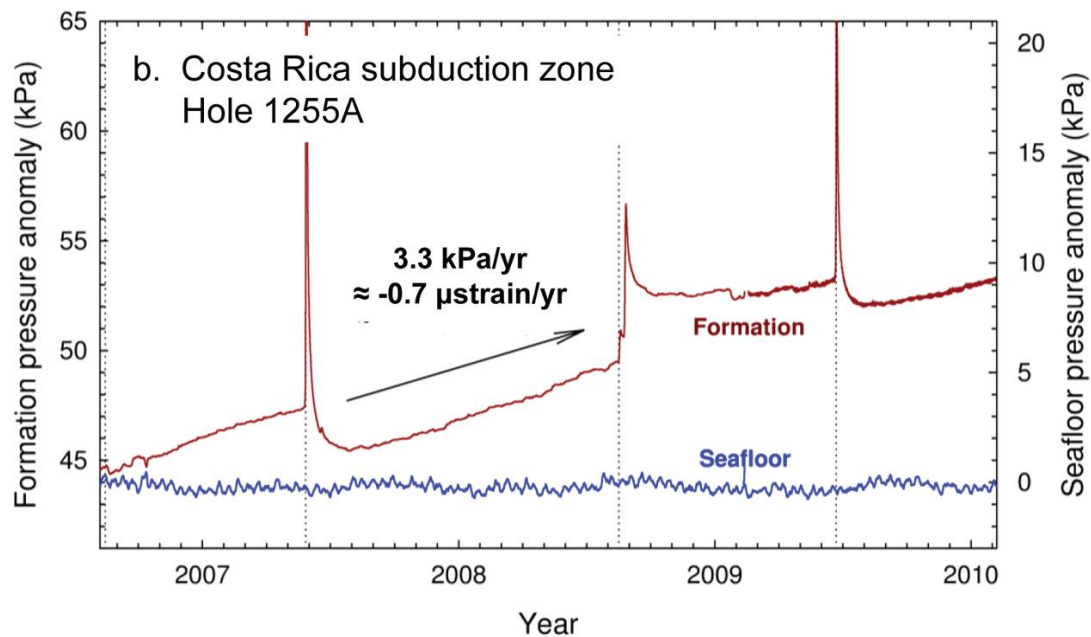
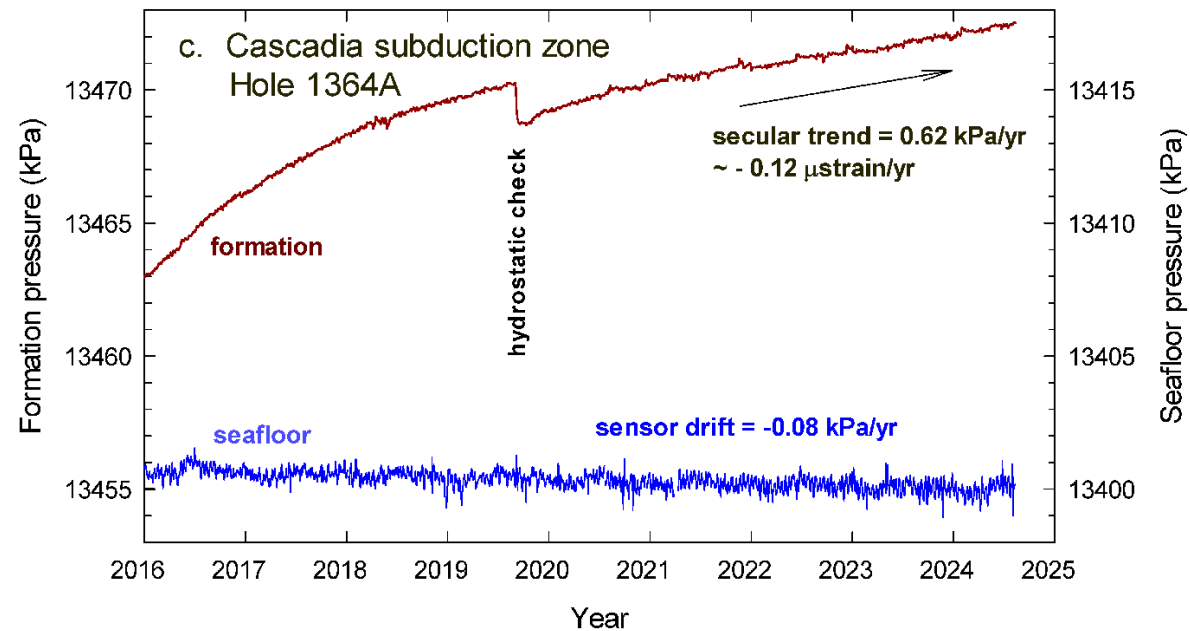
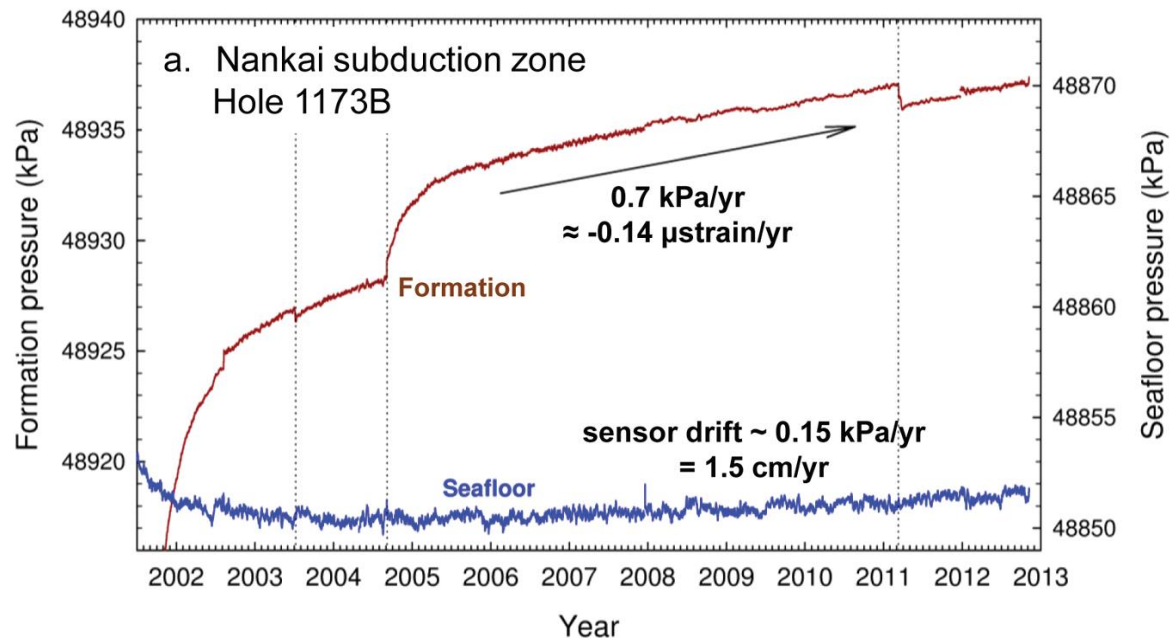


# Crustal anisotropy revealed by pressure response to Rayleigh waves



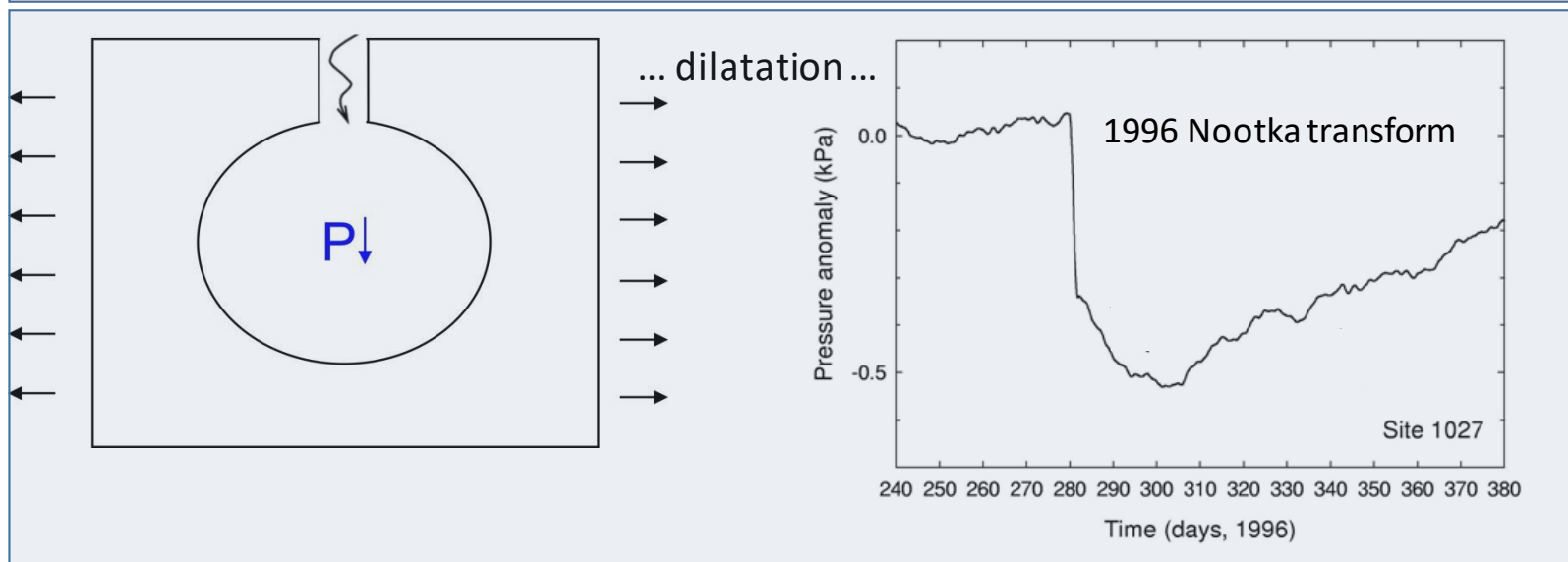
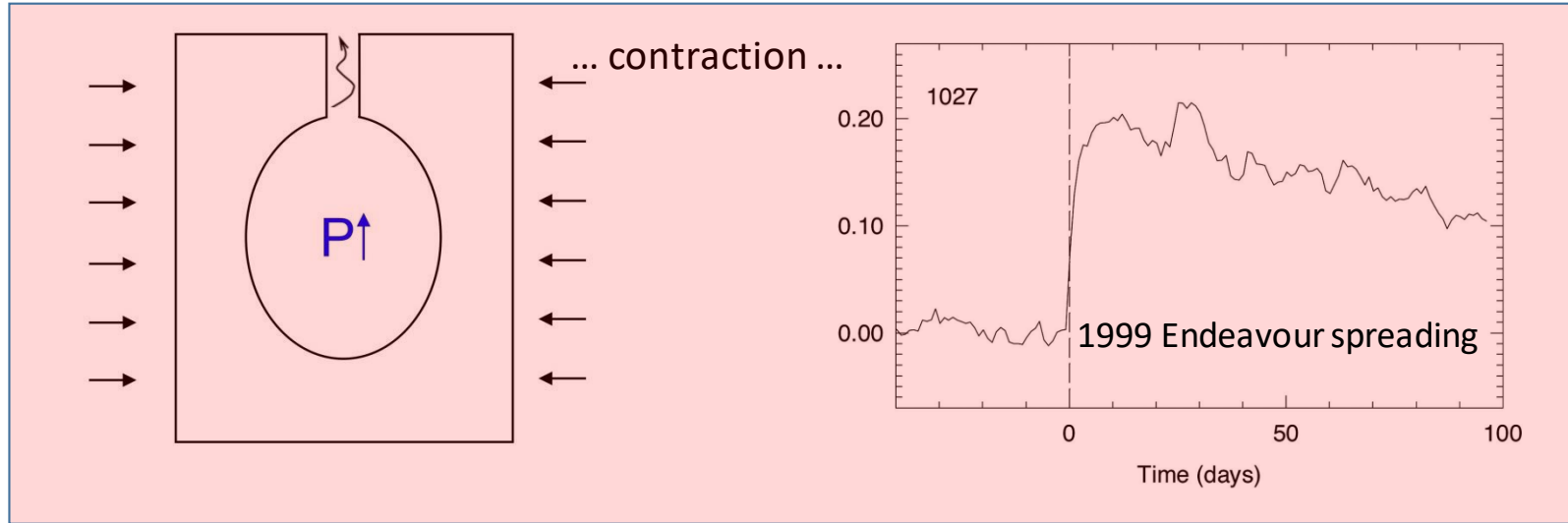


# Strain inferred from pressure at subduction zones



# Examples of strain signals from contrasting sources

Sign of signals consistent with Coulomb stress change



... but dynamics  
are known also to contribute

