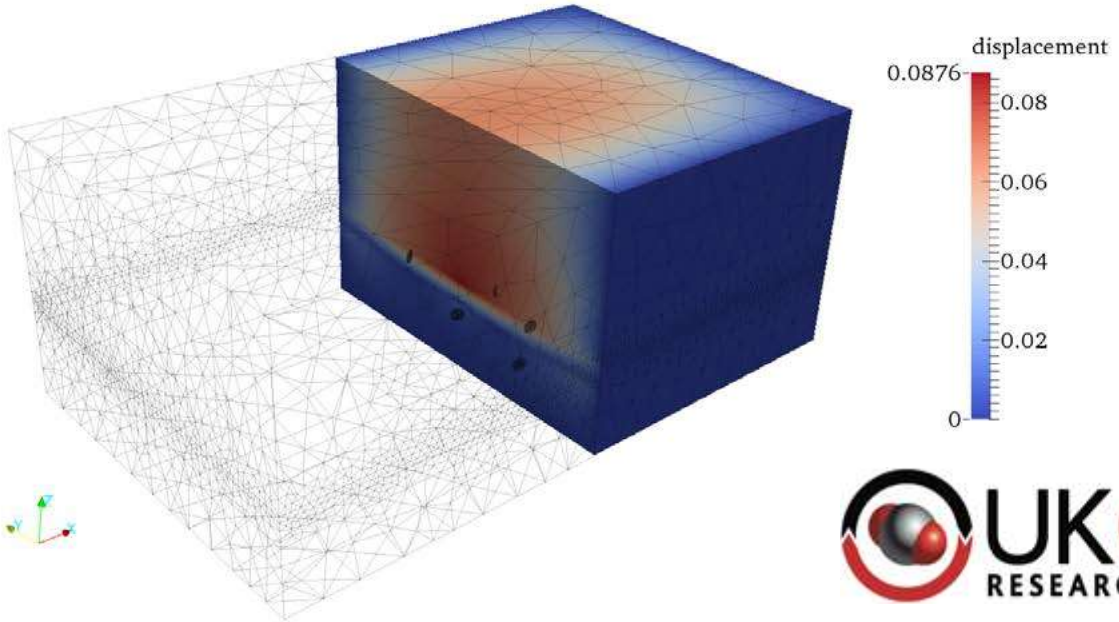
British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Gateway to the Earth



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CONTAIN: The impact of hydrocarbon depletion on the treatment of caprocks within performance assessment for CO2 injection schemes

Executive Group Meeting, BGS London, 20th April 2015

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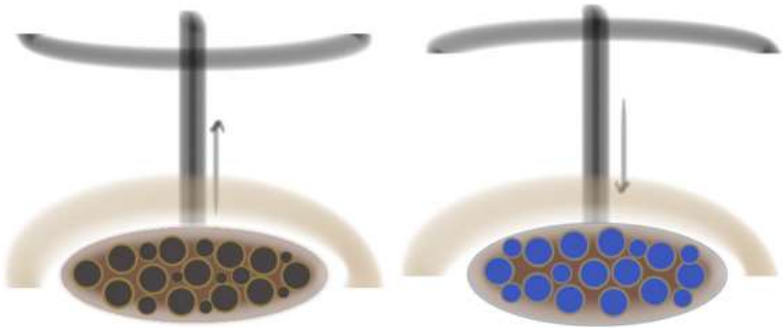
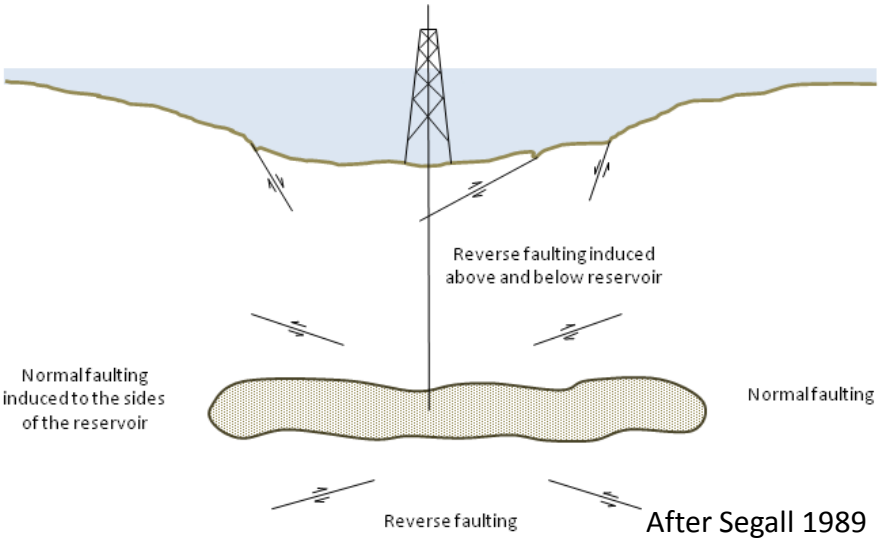
The impaCt of hydrOcarbon depletion on the Treatment of cAprocks within performance assessment, for CO2 InjectioN schemes





After Segall 1989

- Potential UK storage capacity in depleted reservoirs ~ 9 billion tonnes (UKSAP)
- Focus on depletion and 'reinflation' response

- Paucity of data including: reservoir stress-path during inflation and long-term response of faults, well-bores and mechanical stability of caprock
- Improved understanding of effects on reservoir behaviour and seal integrity

- Explore controls on public and stakeholder understanding and acceptability

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Partners and contributors

Transport
Properties
Research
Laboratory

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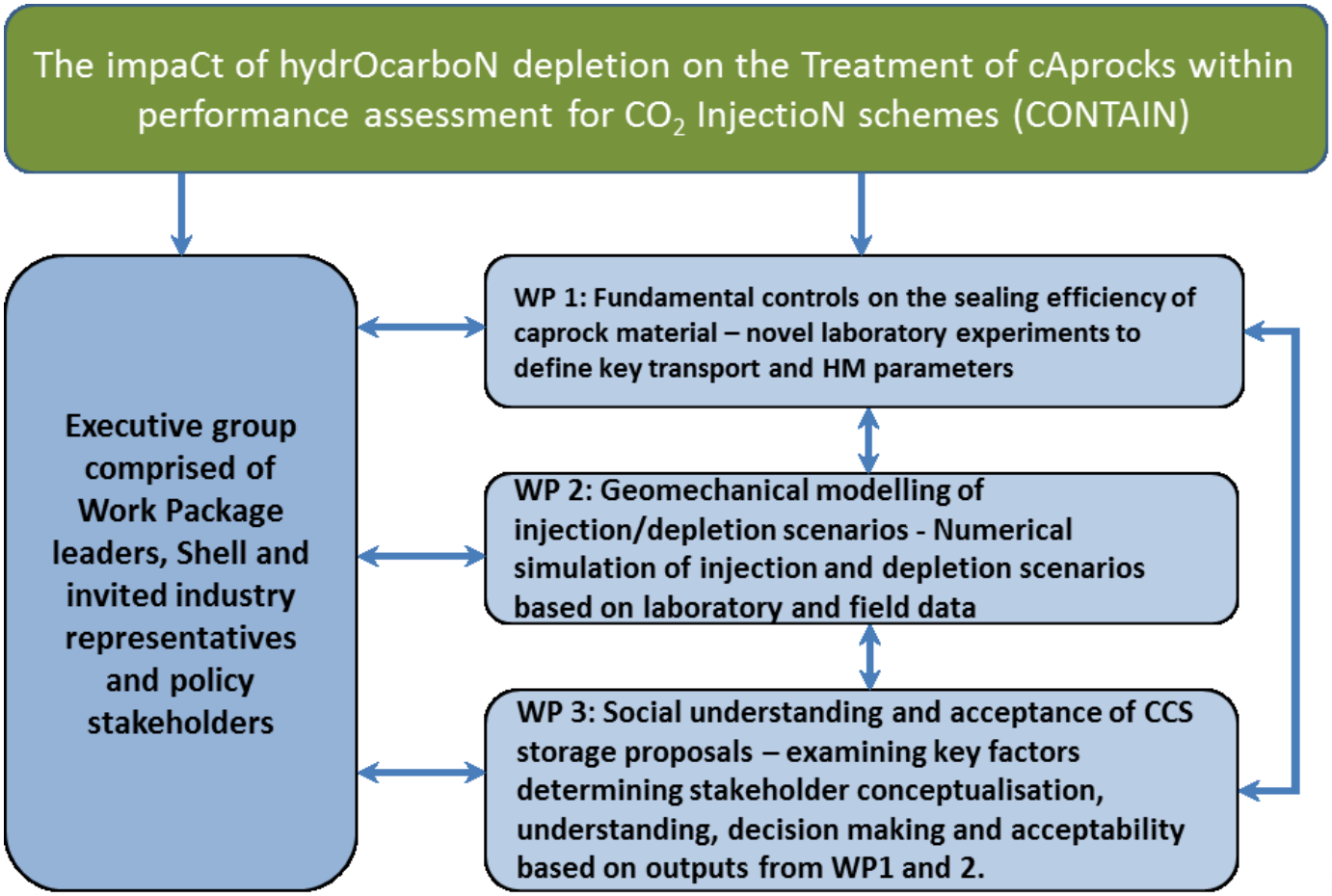
Project Structure



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Laboratory testing

Reservoir materials:

- stress path tests simulating a range of production histories
- simultaneously monitoring changes in σ, P_w, ε_v and k

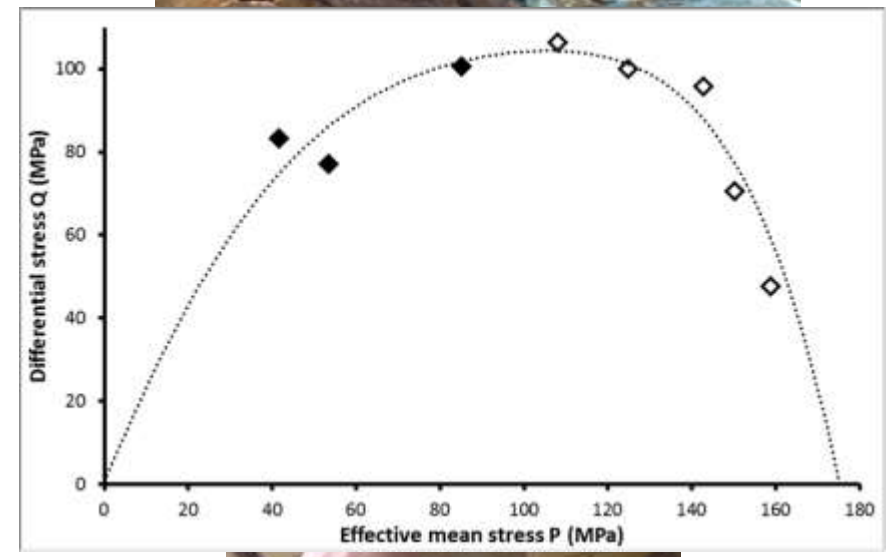
Caprock materials:

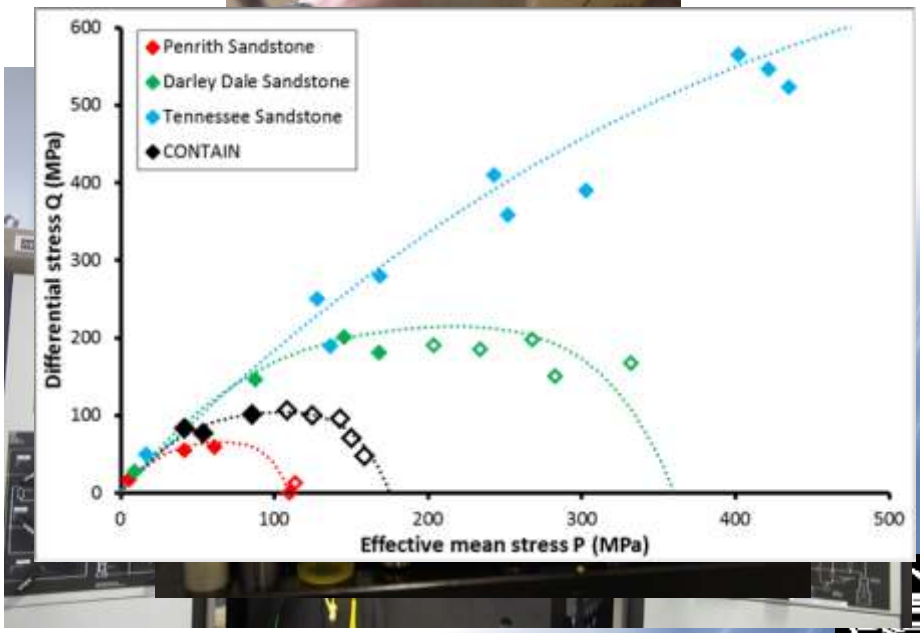
- simulate impact of reservoir depletion and re-inflation on caprocks
- Monitoring changes in σ, ε_v and k as a function of P_w

Critical state parameters:

- define yield envelope for various reservoir and caprock strata

Provides operational limits, allows scenario analysis, provides parameterisation and validation for modelling





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Numerical simulation

Initial poro-elastic simulations:

- production period of the reservoir calibrated using new experimental data

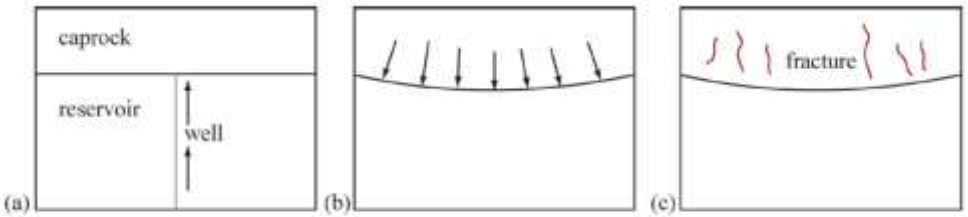

Figure 1- Deflation of the model (a) creates strains in the reservoir that create bending of the caprock (b) and generates fractures (d) in the caprock

3-D simulations of post-depletion consolidation and re-injection:

- impact on existing fracture networks and faults
- focus on features at the caprock/reservoir interface

Temporal upscaling of geomechanics:

- system response during post-operational phase (<10,000 yrs)

Thermal effects incorporated:

- fully coupled thermo-hydro-mechanical (THM) model

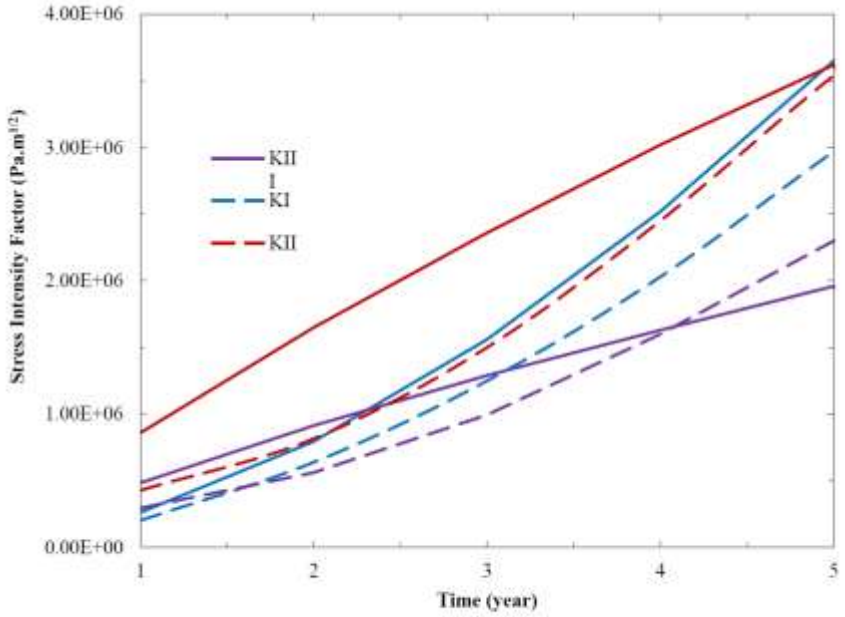

Figure 30- The evolution of maximum modal stress intensity factors during production, for the small-scale model with faults (solid lines) and with fractures (dashed lines)

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Social understanding and acceptance

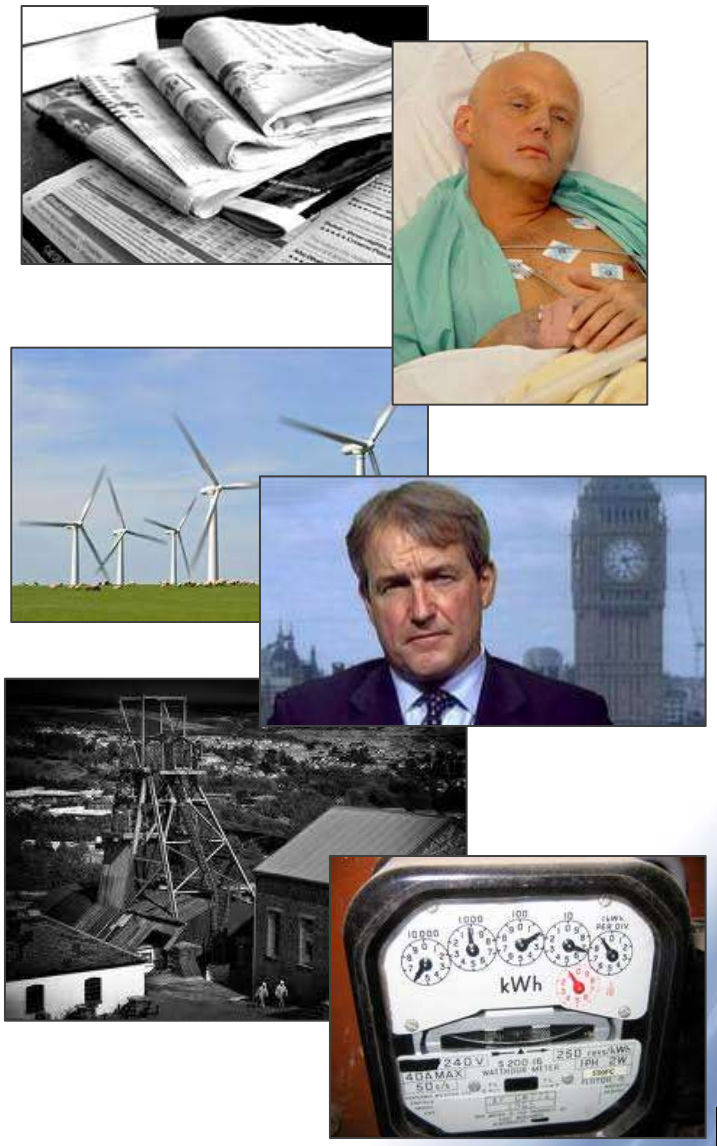
Explore controls on public and stakeholder understanding and acceptability of CCS

Develop and test novel information materials and engagement methods

- Mental model interviews with stakeholders and publics (understand conceptualisation of CCS and perceived risks and benefits)
- Deliberative survey to examine influences on acceptability (e.g, framing, audience and communication characteristics)
- Deliberative workshops to explore effective engagement methods for encouraging societal involvement/acceptance of CCS proposals

Lessons and knowledge derived from this work will be summarised in an outreach and engagement toolkit

Work begins this summer



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Dissemination

www.co2contain.org/ 1st project reports due to go live shortly

Public dissemination event at the British Science Festival, September 2016

Questions? Caro5@bgs.ac.uk

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