

The Potential Water Quality Impacts of Shale Gas Exploitation

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Introduction

- What is Hydraulic Fracturing Fluid?
- Chemical additives in Shale Gas:
 - Injected Water, Produced Water, Recycle Water
 - Friction-reducing additives
 - Other additives and Proppants
 - Produced water prediction

Motivation

Aim:

- To understand the geochemical processes during hydraulic fracturing so that we can predict the composition and impact of flow back fluids

Objectives:

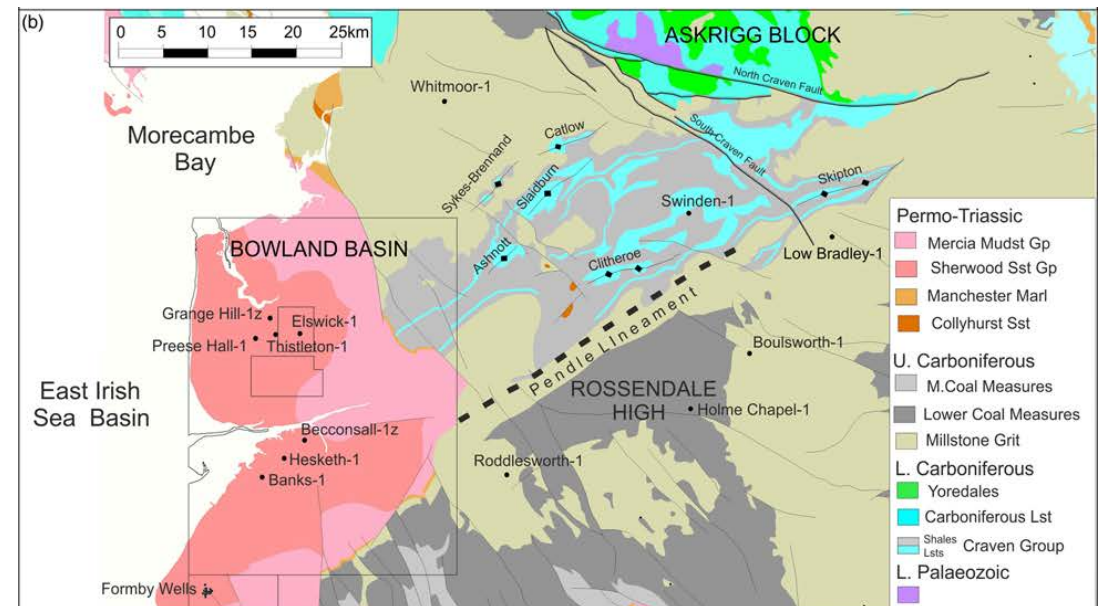
- Statistical analysis of produced and flowback fluids from US
- Use UK Geothermal catalogue to identify deep groundwater compositions
- Simulation of reactions in fracking with synthetic fracking fluids and groundwater compositions; shale samples and at high pressure and temperatures

Background

- **Bowland Basin:**

- Contains sufficient organic matter to generate considerable amounts of hydrocarbons, typically in the range 1-3%
- Mature for gas generation at depths between 1524-2895 m

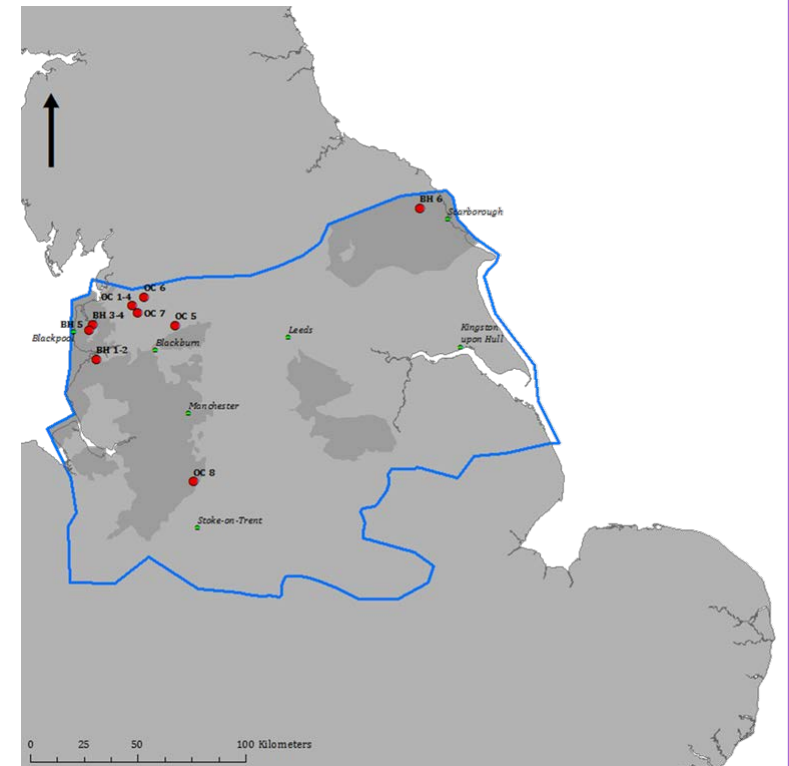
Shale gas resources of the Bowland Basin, NW England
Clarke *et al.*, 2018



Background

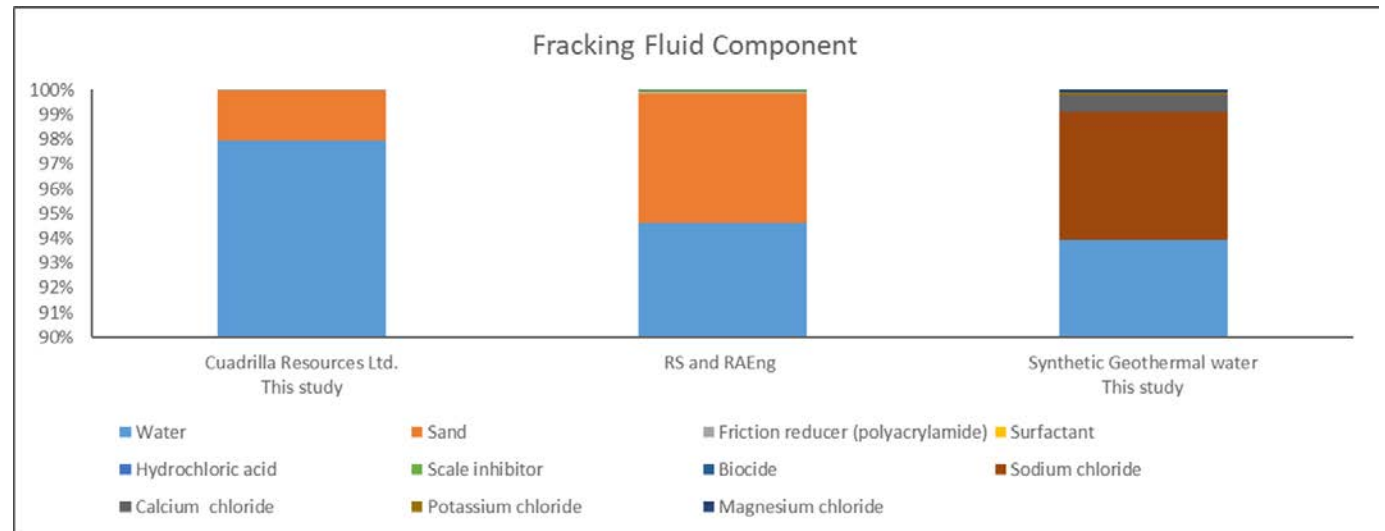
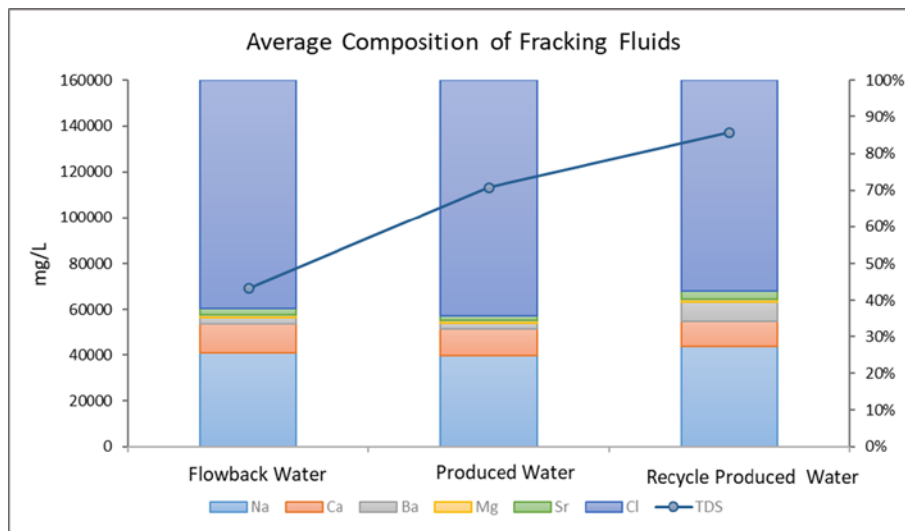
- **Samples:**

- Samples come from the Upper, & Lowland Bolwand shales, and Pendel Grits
- Samples locations shown in Figure
- Samples from outcrops and boreholes
- Characterised by: XRD, XRF and TGA



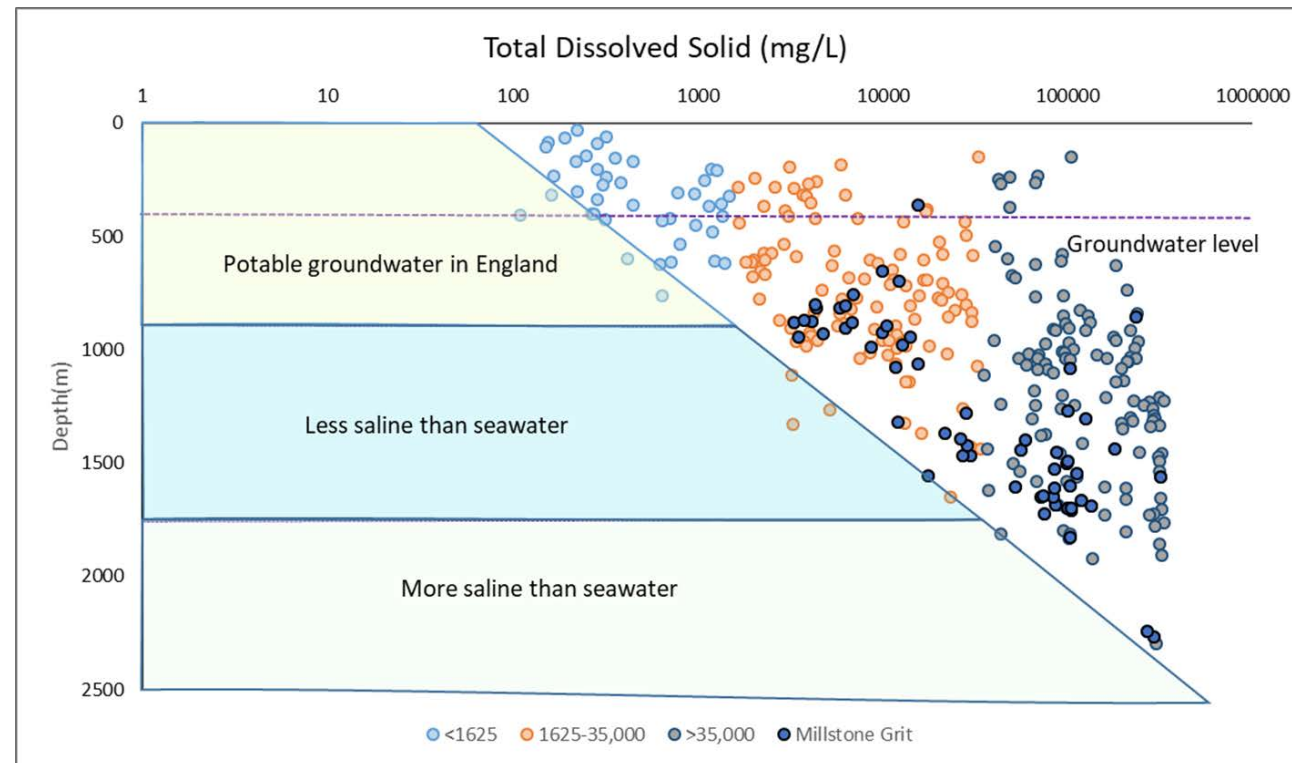
Results

- Case Study: **Marcellus shale Gas, Pennsylvania, USA**
 - Waste fluids contain high levels of salinity, toxic metals, and radioactivity
 - Groundwater and surface water concentrations of salinity are exceeding aquatic ecotoxicological water standards by a factor 10–100



Results

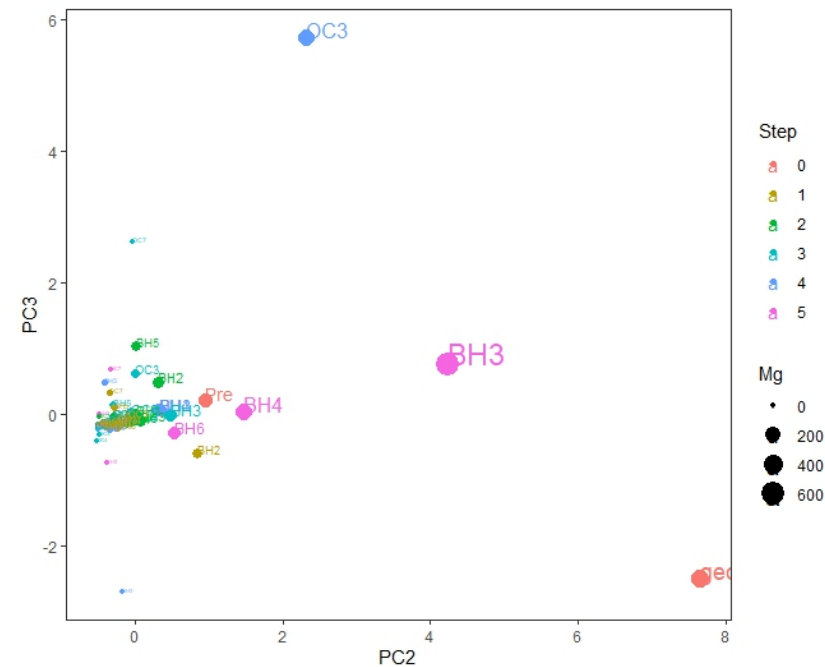
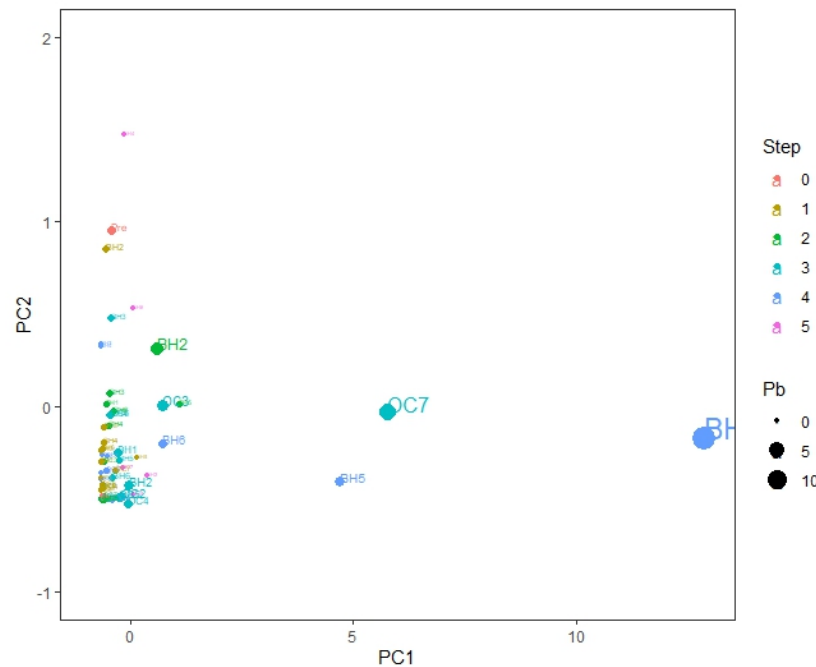
- The statistical study of UK geothermal data results helps to understand the formation of water composition in associated research area.



Loveless *et al.*, 2018

Results

- Controls of flowback composition
 - Included compositions for: tap water, Preese Hall flowback fluid & geothermal fluid



Future

- Shale Gas:
 - Understanding of the reservoir characteristics, including stratigraphy and petrophysical characteristics
- Characterization of potential contamination pathways
 - Geodatabase: Data collection and Database Development
 - Statistic analysis of Produce water and Recycle water
 - Aquatic toxicology and improved waste water treatment
 - Strontium isotope analysis to trace the source of mixing fluid