CO₂ STORAGE KNOWLEDGE INFRASTRUCTURES
- SEISMIC MONITORING IN THE SLEIPNER PROJECT
CO$_2$ trapping mechanisms over time according to the IPCC (2005: 208).
The technology for such storage of CO₂ is considered proven by the CO₂ storage at the Sleipner field in the North Sea.

Scientific paper discussing the Snoehvit CCS project (2004)

The Norwegian Government reports that after 10 years of injection operations at Sleipner beneath the North Sea there has not only been no leakage but no migration outside the limits predicted. With the passing of time stored CO₂ becomes more stable and leakages even more improbable.

EU Parliamentary discussion (2008)
How have beliefs, outputs and research processes been conditioned by common practices?

Knowledge infrastructures comprise robust networks of people, artifacts, and institutions that generate, share, and maintain specific knowledge about the human and natural worlds. (Paul Edwards, 2010: 17)

Often we must combine both knowledge and technical know-how from a large number of different fields to produce a model that will agree well enough on the matter we are looking to predict, with the method of combination justified at best very locally. (Nancy Cartwright, 1999: 10)

Thus ignorance is endemic to scientific knowledge, which has to reduce the framework of the known to that which is amenable to its own parochial methods and models. (Brian Wynne, 1992: 115)
The Sleipner publication network
Sleipner
core-set
coa-authorship
network
(24).

Nodes represent individual authors (70).
Lines indicate co-authorship. Colours are coded by institutional affiliations. Sizes are coded by degree centrality.

Secondary data analysis

Cambridge
BGS (UK)
BRGM (FR)
Sleipner core-set and reference additions co-authorship network (115). Nodes represent individual authors (197). Colours are coded by country affiliations. Red = Norway, Dark Blue = UK, Pink = France, Black = US, Dark grey = Netherlands.
Sleipner extended co-authorship network (215).

Nodes represent individual authors (296). Colours are coded by affiliation types. Red = Industry, Blue = University, Green = Research Institute, Brown = Regulator.
Main component of the extended co-authorship network. Nodes have been sized according to degree centrality. Colours are coded by institutional affiliations.

- **Yellow** = BGS (UK)
- **Pink** = TNO (NL)
- **Red** = Statoil (NO)
- **Dark Blue** = SINTEF (NO)
- **Dark Green** = BRGM (FR)
- **Teal** = GEUS (DA)
Betweenness centrality in the main component. Vertical position and node size indicate greater local dependency.

4D seismic monitoring

Geochemical simulation modelling

Fluid-flow simulation modelling

Reservoir geology
clear, single community that I'm a part of

we think that you can inject carbon dioxide into them and that it will remain there effectively forever
Seismic imaging in hydrocarbon exploration.

1. Seismic base survey
2. Well observations
3. Production history

Update reservoir model

Reservoir modeling

Flow simulation

Seismic modeling

Production data

Seismic field data (possibly inverted)

- Signal
- Noise
- Distortion
We are working backwards from oil and gas of course, where there you start producing and you learn a lot from your production already, and here we start in some kind of virgin area, inject something, and that works like a contrast fluid, which we use in medicine for example, and it illuminated the area that is affected by the CO$_2$. And we learn more about that area, but as soon as you go out of that area we are a little bit more in the dark.
Increased compressibility from shales
- Showed surprisingly small gaseous accumulations below the normal detectability limit
- Thought to improve detection of future CO$_2$ leakage events
any major leakage into the overlying cap rock succession would have been detected
It is important to stress the need for caution in this type of analysis. Seismic detectability depends crucially on the nature of the CO$_2$ accumulation. Small thick accumulations in porous strata would tend to be readily detectable. Conversely, distributed leakage fluxes through low permeability strata may be difficult to detect. CO$_2$ at lower saturations can give comparable...
On its own, seismic delivers a very limited and general understanding of a reservoir: for example in the oil industry you wouldn't go running off to the boss and go right, I found a five metre thick reservoir based on a seismic resolution of 50 metres, because you can spend 50 million pounds drilling a well and find out that it's not there.
That point is now increasingly also stated within CO$_2$ storage research circles: it's probably the Cinderella area of carbon capture and storage at the moment, is what will be required for long-term cost-effective monitoring that can give you both a comprehensive overview of what might be going on, plus some early indication of what's going wrong. And that is a big research area.
I am afraid I do have total respect for the idea that we don't really know what's going on underground. We think we do and I think geologists, one of the failings of geologists as a general rule, is we tend to overestimate how much we know about what's going on underground… And actually, it is alarming when you actually drill a well, and find out that everything everyone said and everything anyone's told you, is wrong…

Geologists tend to become married to models, and I think they tend to reinforce those models by talking to fellow geologists.
Thank you