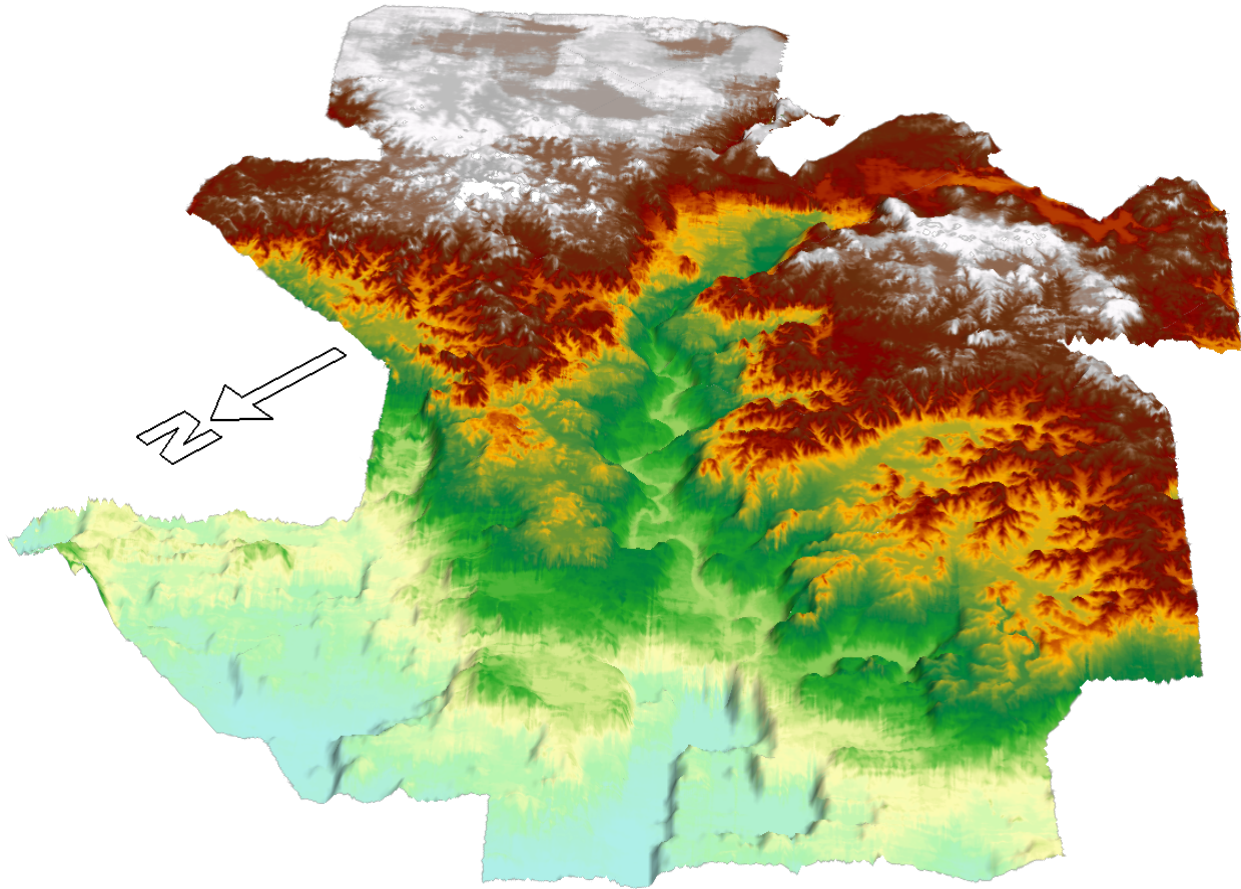


Challenged by Carbon: The Oil Industry and Climate Change

Bryan Lovell, Cambridge University

Imperial College Oil Technology
Centenary 24 September 2013

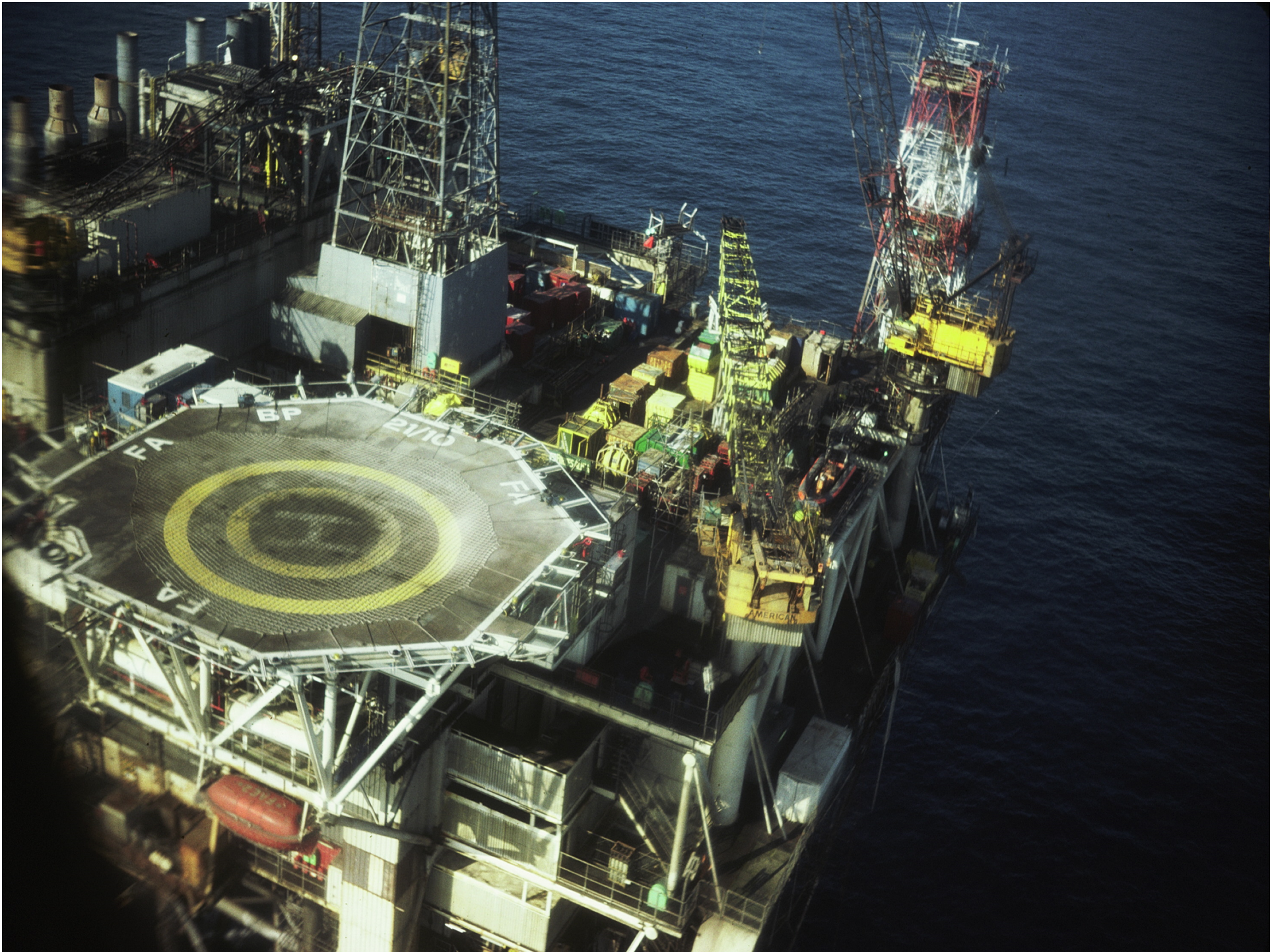




Sun, Earth and heat

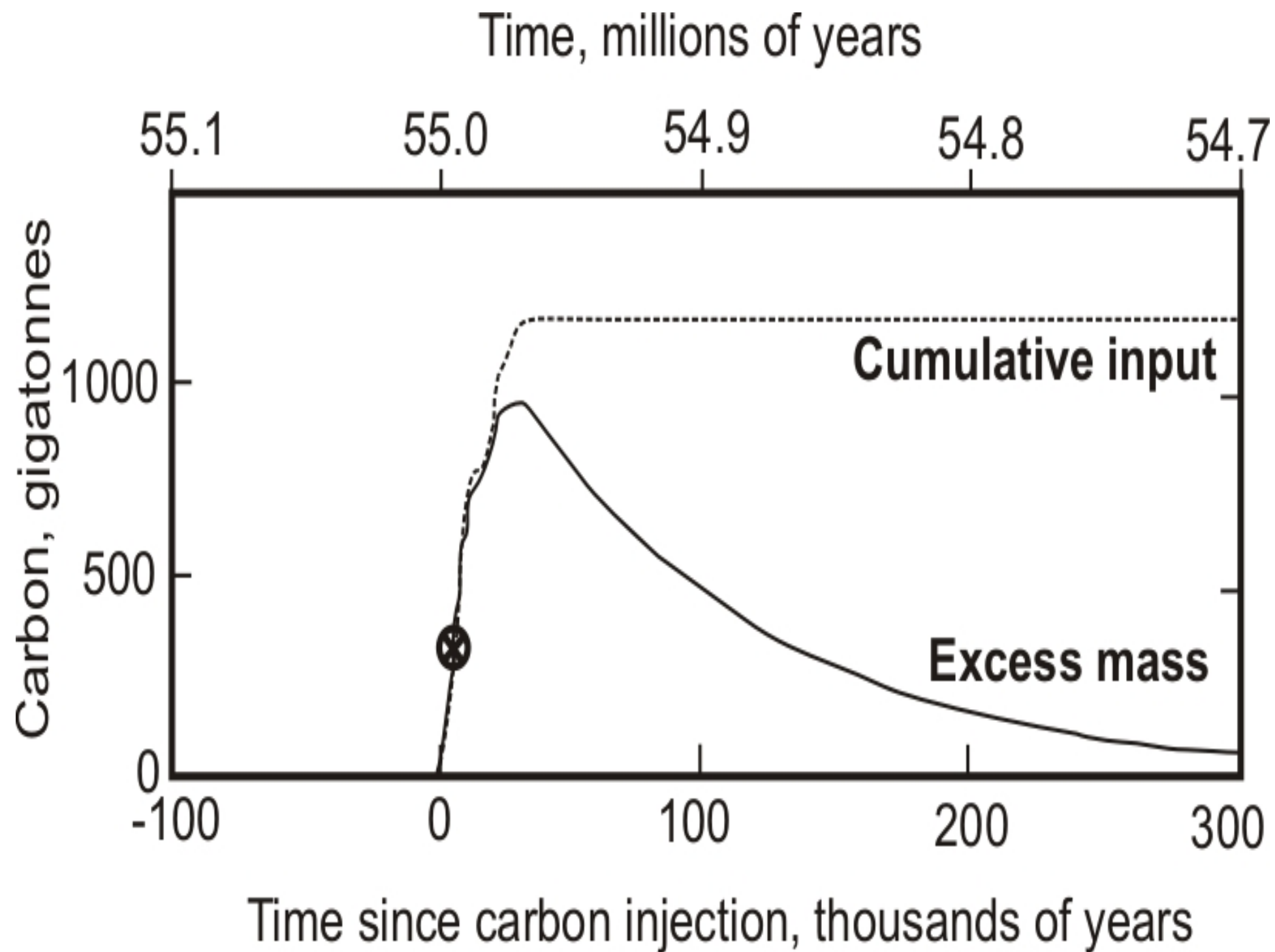
- Most heat reaching Earth's surface comes from the Sun
- But heat coming from within Earth can build mountains and moves continents
- Periodic variations in heat from Sun
- Episodic volcanic eruptions and earthquakes
- Climate controlled by heat from both Sun and Earth – and release of carbon

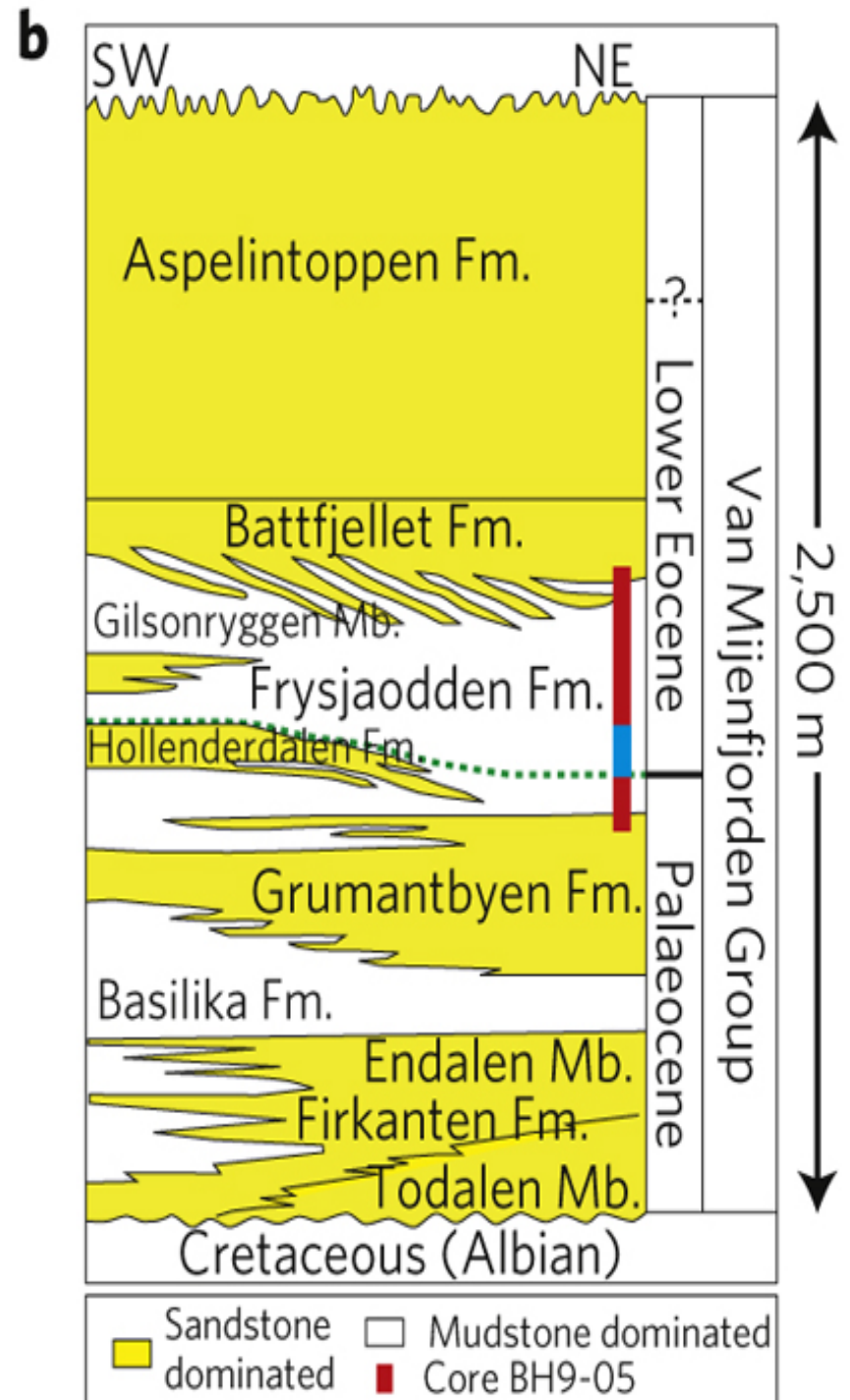
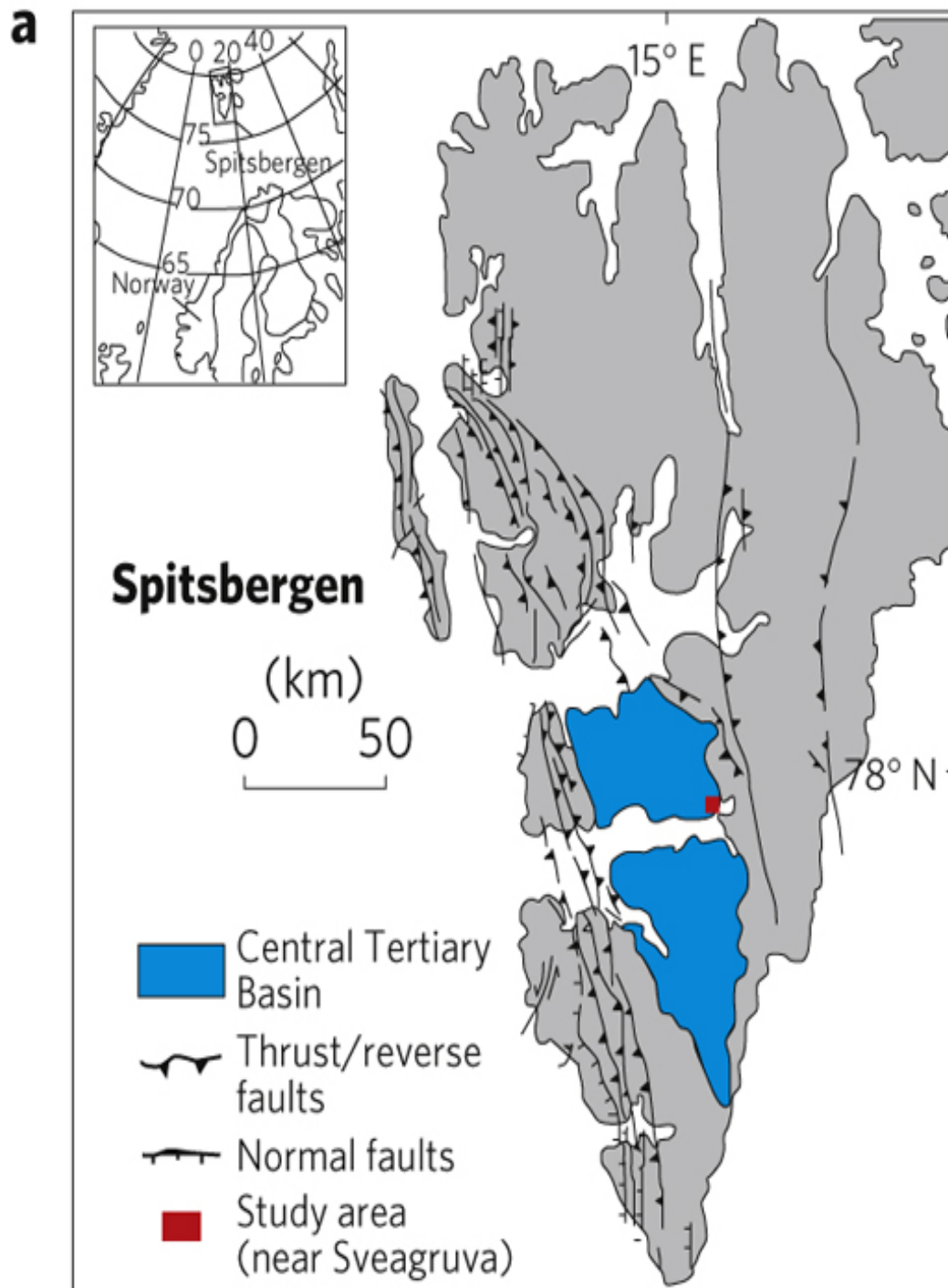




What happens when carbon is dumped?

- Regardless of starting conditions, each major carbon excursion in the last 200 million years has broadly the same result.
- That result is not bad for the planet, but looks tricky for us.
- Analogy is 55 Ma warming event (Geological Society climate change statement, 2010)

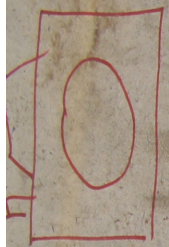






BH-10/2006

135-140M



135-140M

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What happened 55 million years ago?

- Over a thousand gigatonnes of carbon dumped into atmosphere.
- Global temperatures rose by several degrees centigrade.
- Oceans became notably more acidic, with less oxygen.
- Extinction of life in oceans and on land marks the beginning of a new geological epoch.
- Early primates appeared: descendants now repeating the carbon dump.

A problem we can solve

- We are at least a quarter of the way to repeating the volume of carbon dumped at 55 Ma, and we are dumping that carbon more rapidly.
- Geologists and engineers can put back underground the carbon we continue to use so eagerly.





Forties May 1982: smiling clean Chief



Will the oil industry help us to cope with the carbon dump?

- For us the debate on climate change is over.
Shell website, 10 February 2011.
- Carbon capture and storage is a crucial technology, especially for coal-fired power and also in the longer term for gas-fired power. If we do not get CCS proven and deployed over the next ten years, then we will not fix climate change.

James Smith, Chairman of Shell UK, newnet, 25 January 2011.

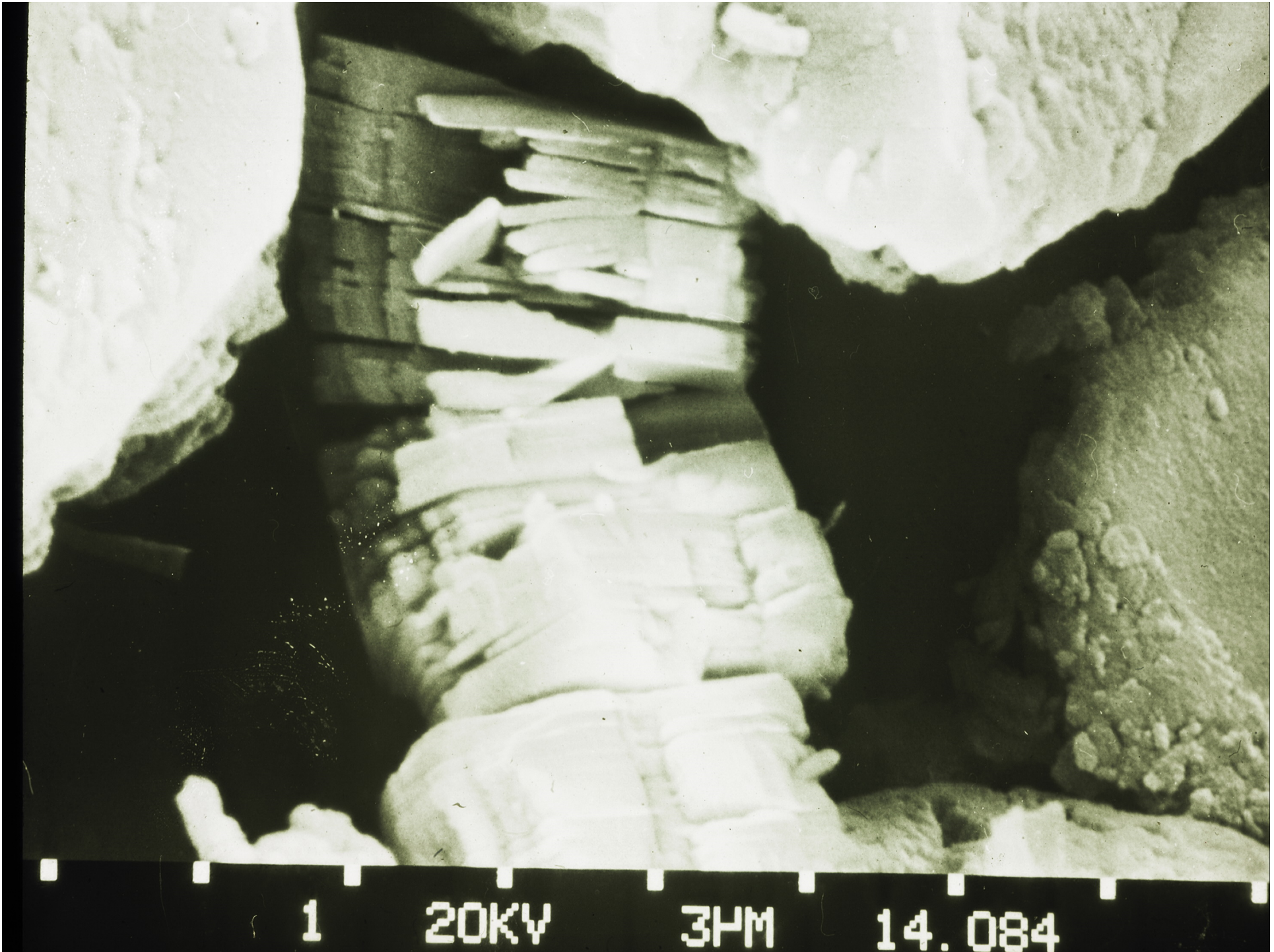
Will the coal industry help us to cope with the carbon dump?

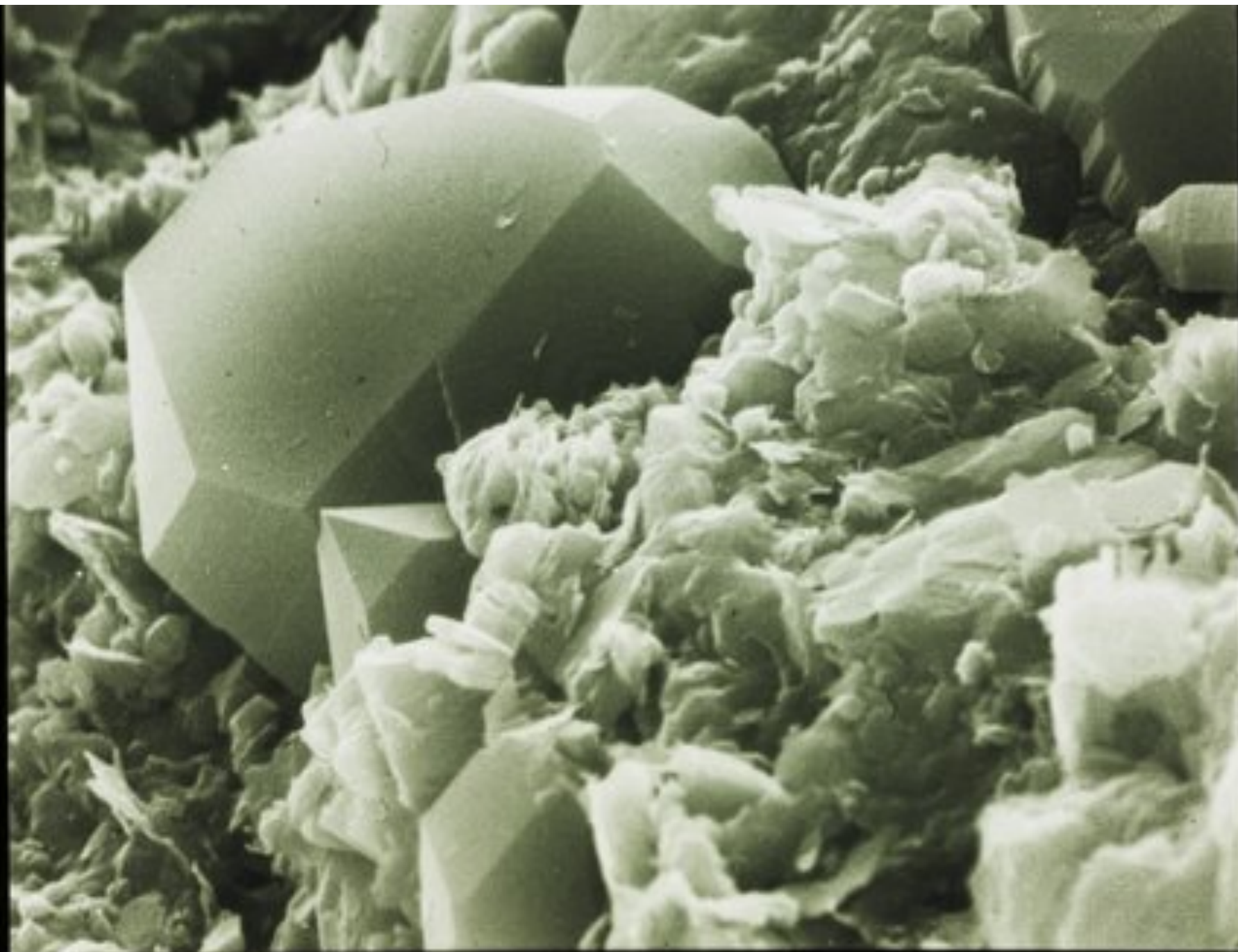
- Key is generation of electricity from coal in China and India
- Australian coal industry is taking the initiative on CCS
- Does storage of carbon dioxide have to be in conventional oil-industry traps?

How can we store CO₂ underground?

- In structures that have retained oil and gas
- In solution in the pore water
- Trapped in pores by capillary forces
- In new minerals formed by reaction of CO₂-rich pore water with host rock







4µm

Whose responsibility?

- Fossil-fuel companies?
- Their customers?
- If both, how does that work?

DIRTY OIL

Canada's tar sands stand out in a ranking of total greenhouse-gas emissions associated with different types of oil.

