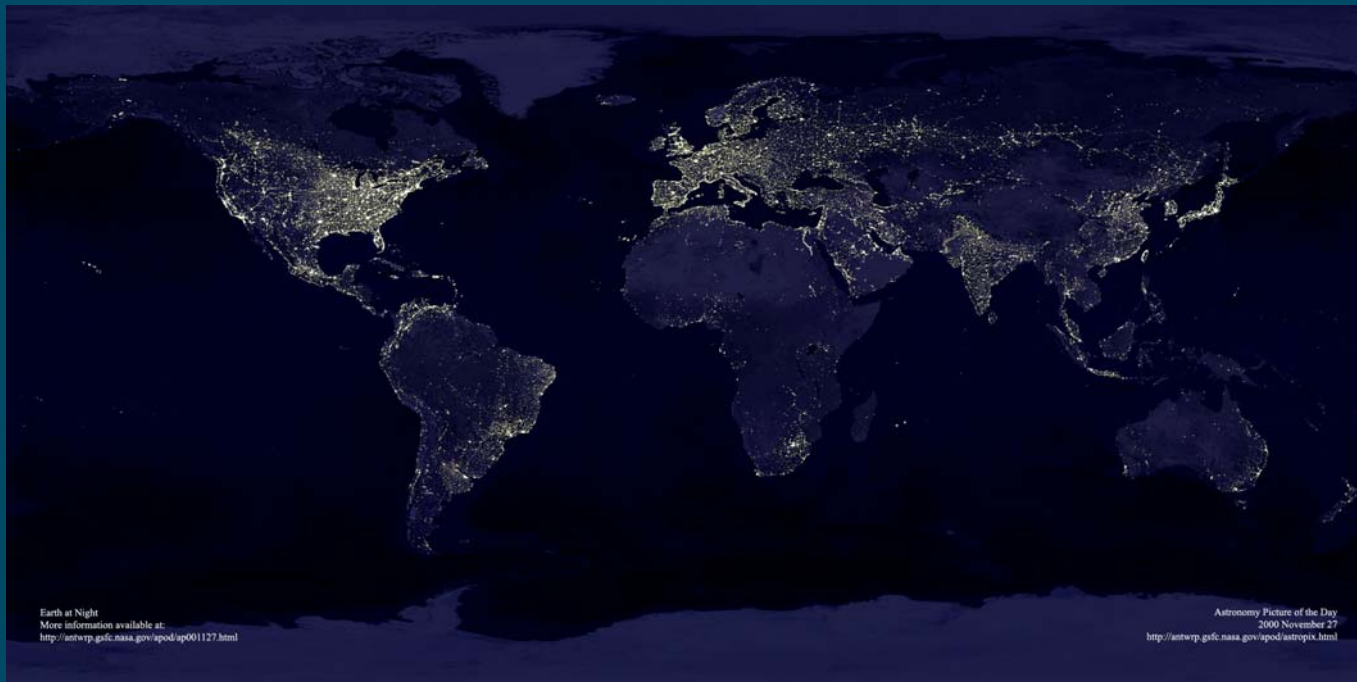




Australian Government
Geoscience Australia

Carbon Capture and Geological Storage



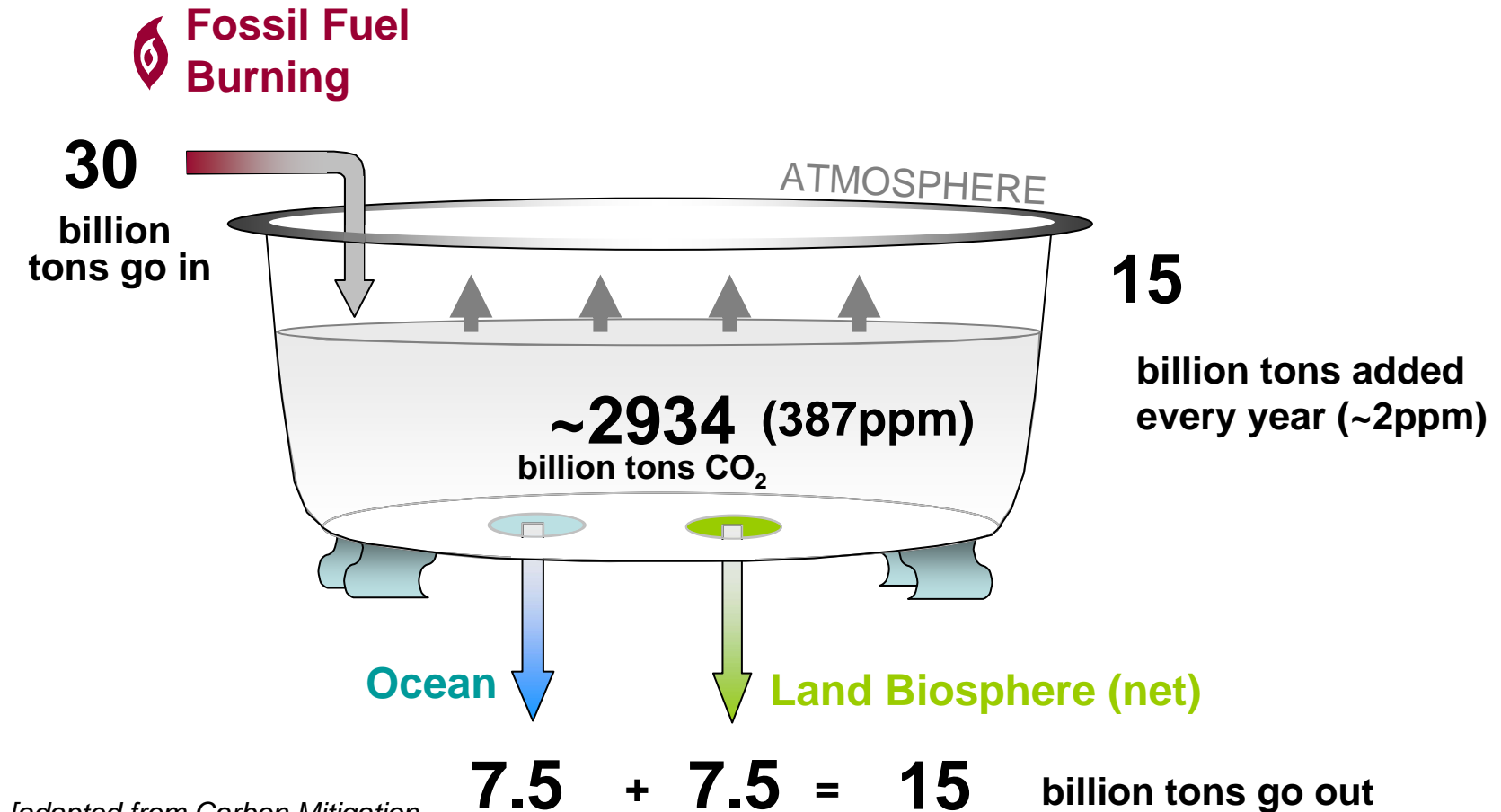
Earth at Night
More information available at:
<http://nswrp.gsfc.nasa.gov/spodsp001127.html>

Astronomy Picture of the Day
2000 November 27
<http://nswrp.gsfc.nasa.gov/spod/astropix.html>

Some take-home messages...

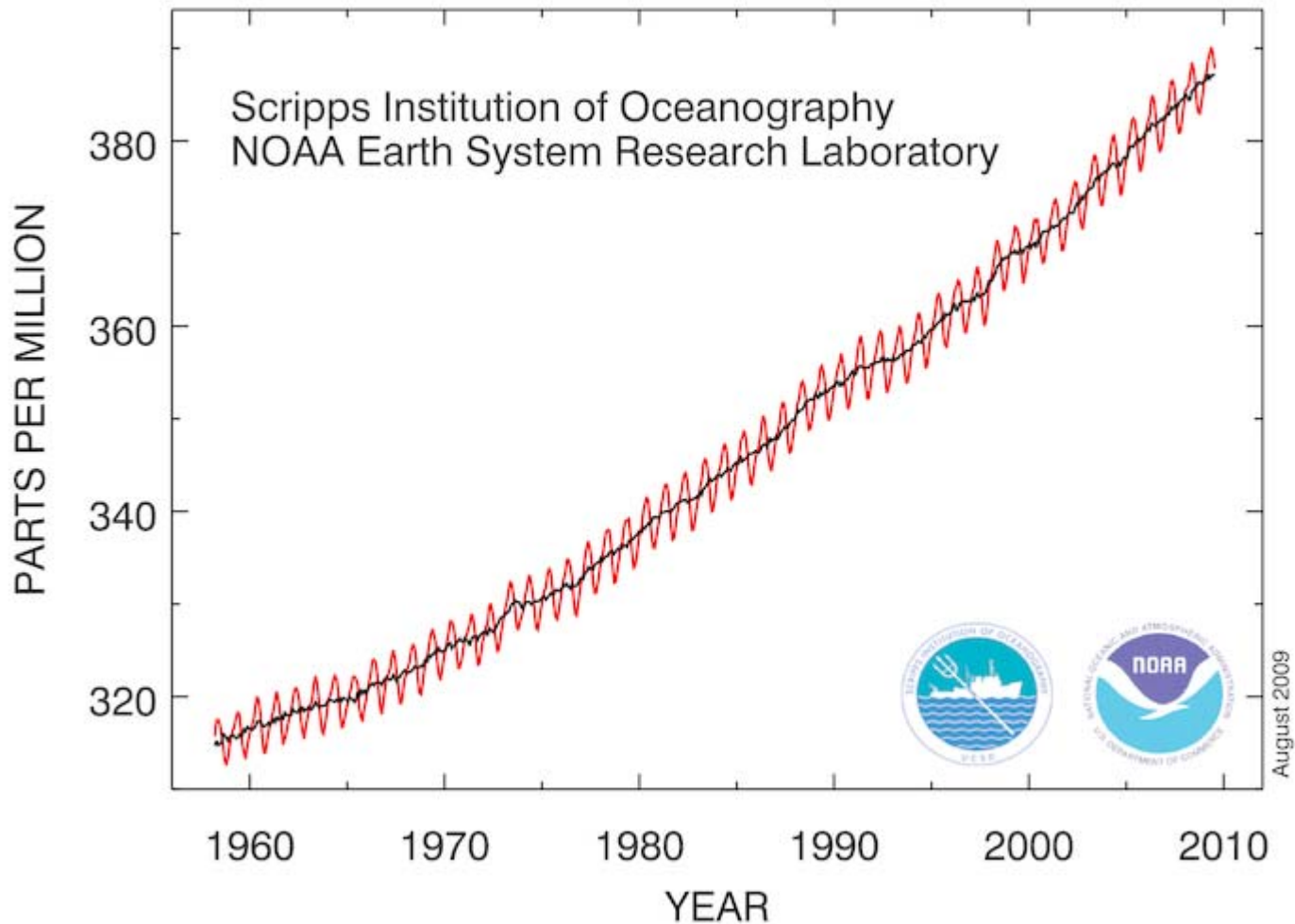
- CCS is one part of the solution to reducing greenhouse gas emissions to the atmosphere
- Petroleum studies show that oil, gas and CO₂ can be stored in the deep subsurface for geological time
- CO₂ is injected as a fluid into tiny spaces between grains in reservoirs (sandstones) and is trapped by seals (mudstones)
- The technology for the geological storage of CO₂ is mature and geological storage of CO₂ is already happening

The greenhouse gas problem



[adapted from Carbon Mitigation Initiative, Princeton University]

Atmospheric CO₂ at Mauna Loa Observatory



Dr. Pieter Tans, NOAA/ESRL
(www.esrl.noaa.gov/gmd/ccgg/trends)

Australia's 2008 greenhouse gas emissions

TOTAL
553Mt CO_{2e}

All Energy
416 Mt
Electricity 200 Mt,
Transport 80 Mt
Manufacturing &
construction 50Mt

Waste
15 Mt

**Industrial
Processes**
32 Mt

Agriculture
91 Mt

[Source: Department of Climate Change]

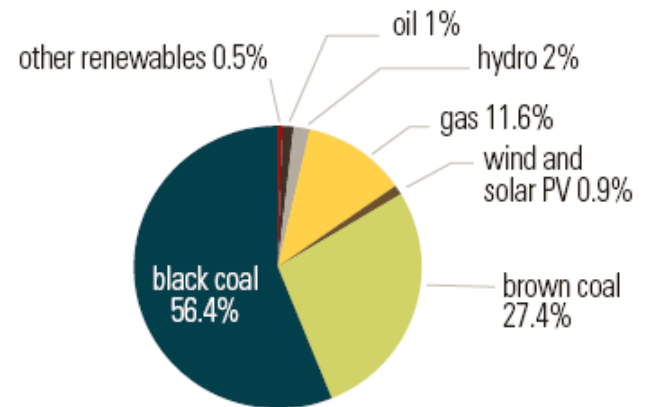
Emissions from electricity generation



- Total : about 200 Mt CO₂ per year
- A 500 MW power station:
 - Powers 300,000 to 500,000 homes
 - Emits 3.5 Mt of CO_{2e} per year (coal) or 1.6 Mt of CO_{2e} per year (natural gas)

[CSLF TRM, June 09]

Fuel inputs into Australian electricity generation, 2006-07 a

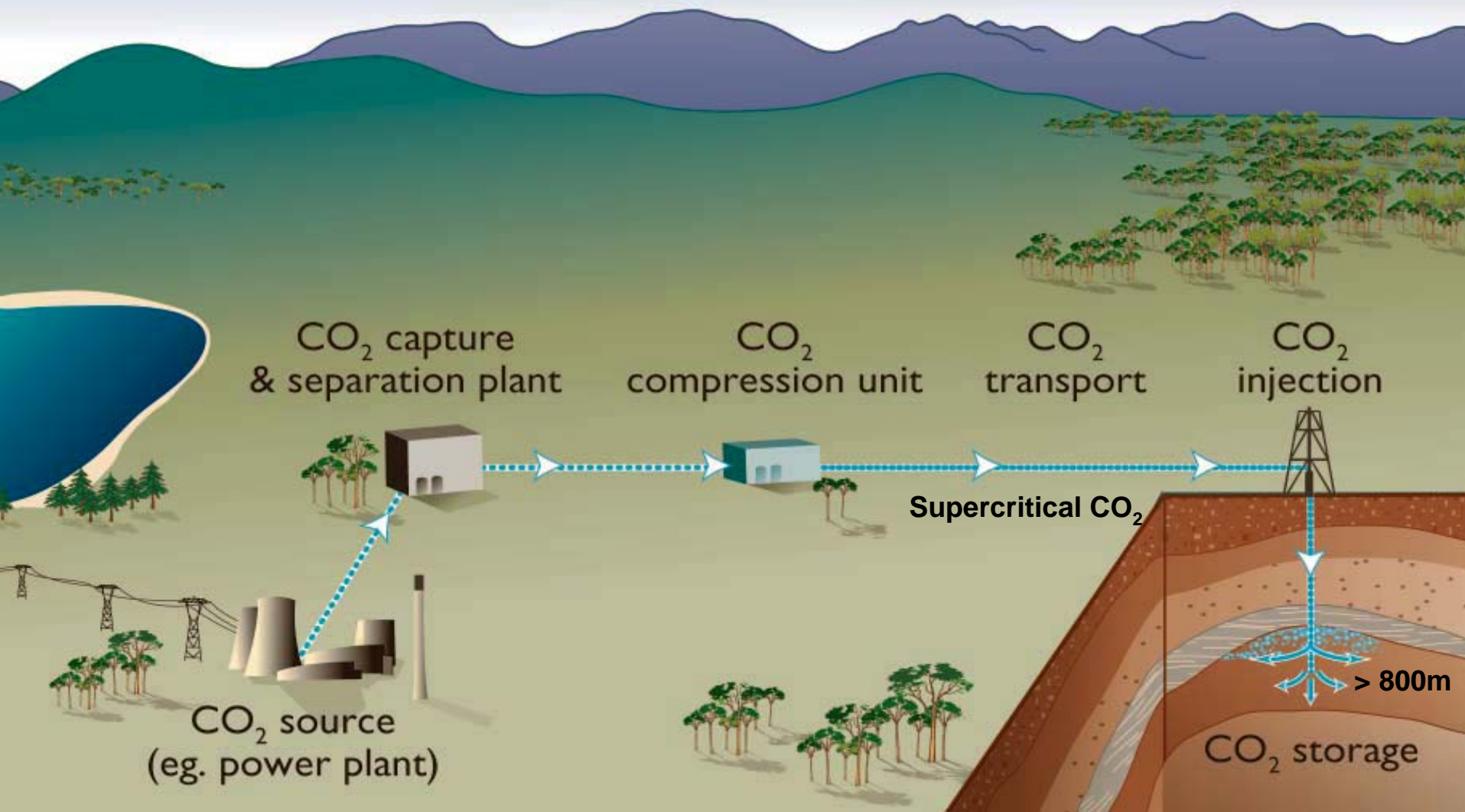


a This chart should not be compared with the chart of electricity generation by fuel in Energy in Australia 2008 because that chart represented electricity generation output, rather than fuel inputs into electricity generation. Hydroelectricity accounts for a larger proportion of electricity generation output than of fuel inputs into electricity generation.

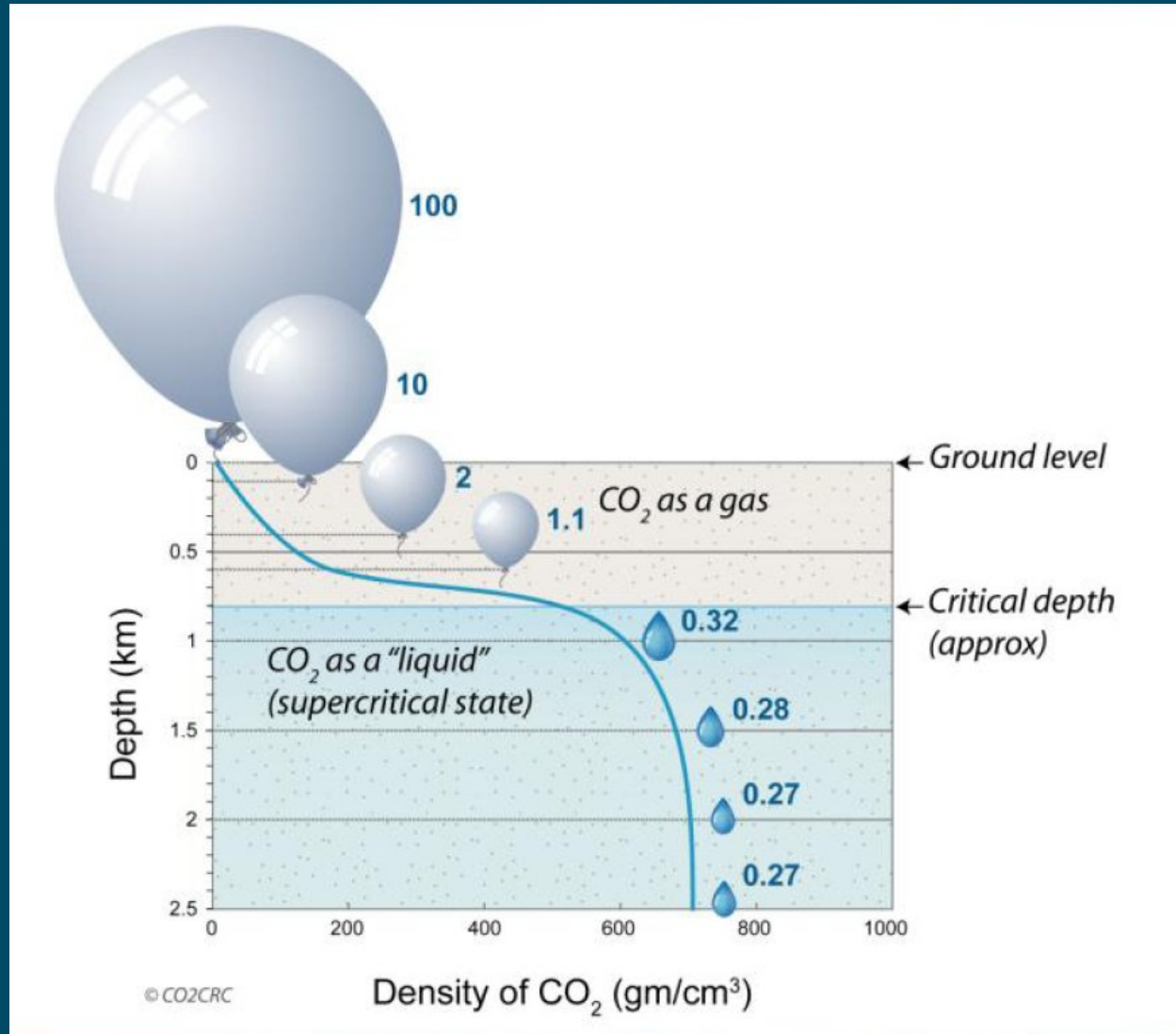
Source: ABARE, Australian energy statistics.

What is carbon capture and storage (CCS)?

[CO2CRC]



Why supercritical CO₂

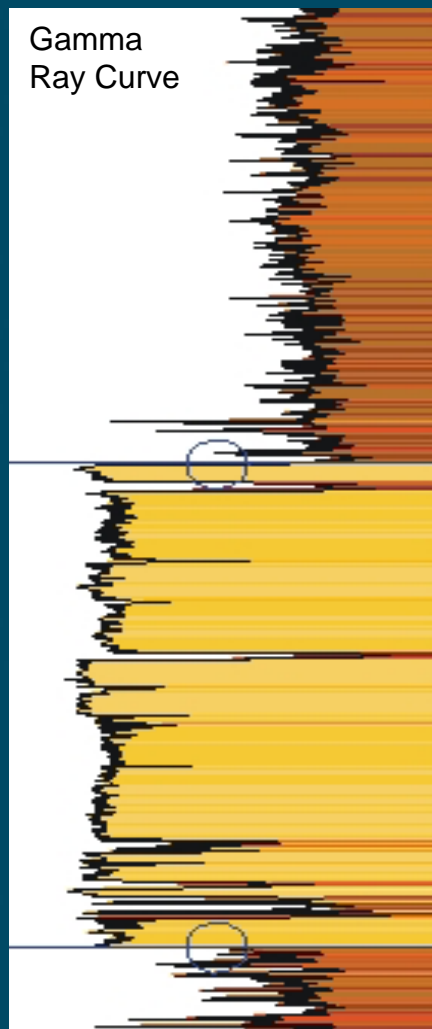


Source
CO2CRC

**How can
you store
anything
in solid
rock?**

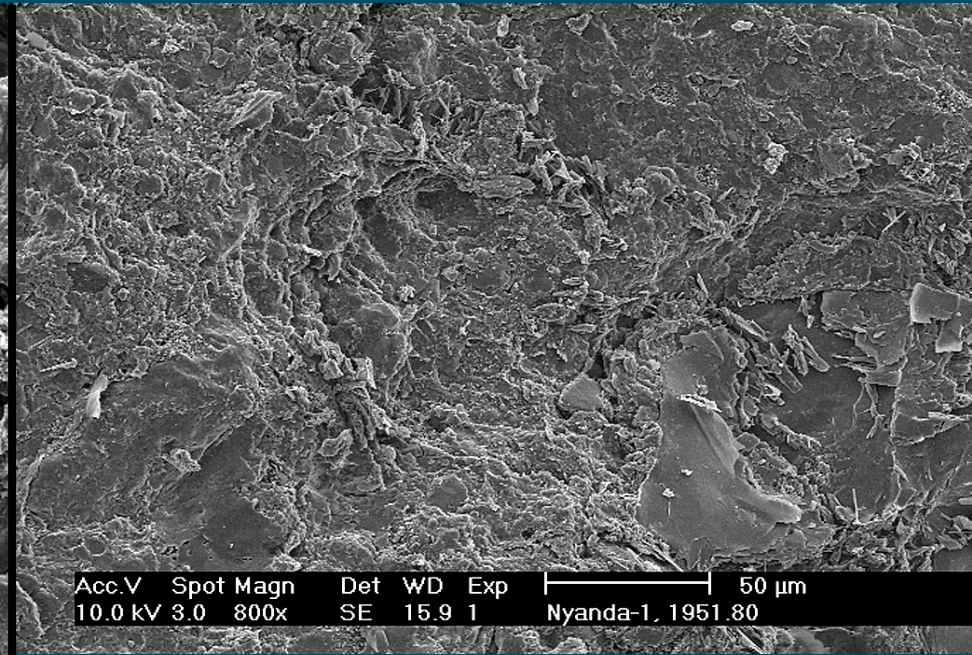
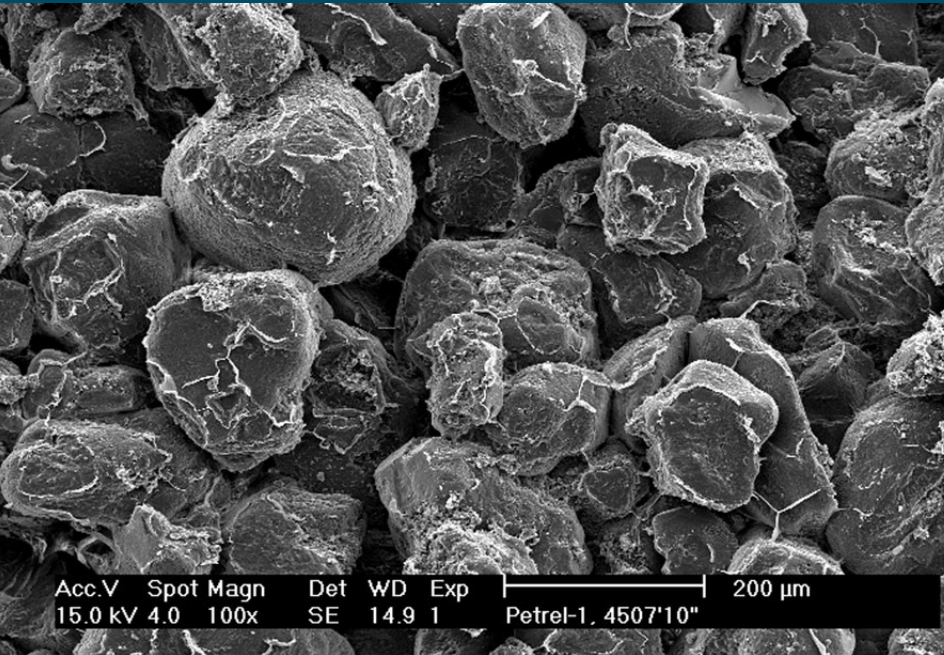


*Adapted from
CO2CRC*



Adapted from
CO2CRC

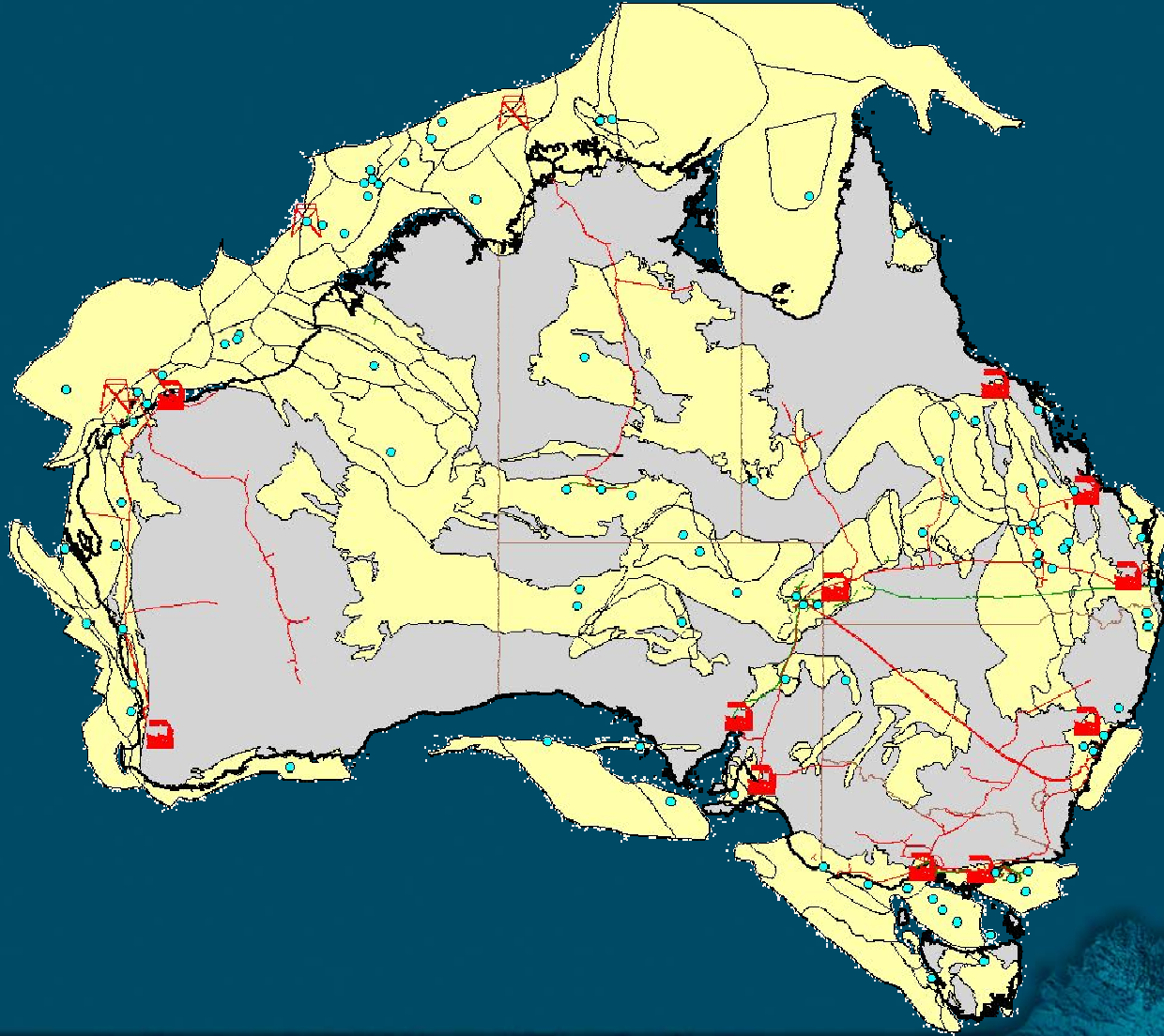
Reservoir v Seal



~1 millimetre
(Container)

~1/4 millimetre
(Lid)

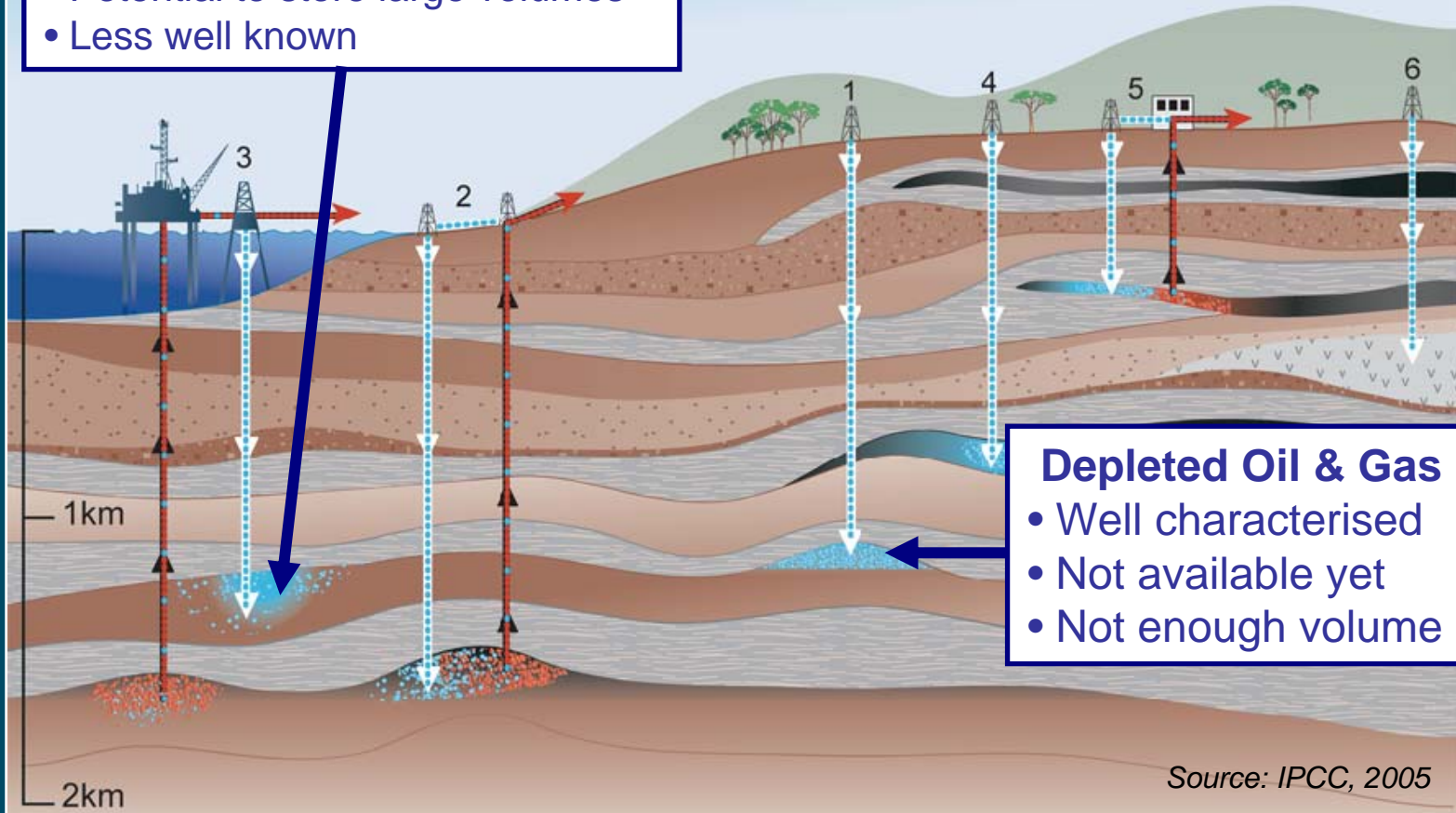
Suitable rocks and storage sites will be found in sedimentary basins



Potential storage in the sub-surface

Deep Saline Reservoirs

- Found everywhere
- Available now
- Potential to store large volumes
- Less well known

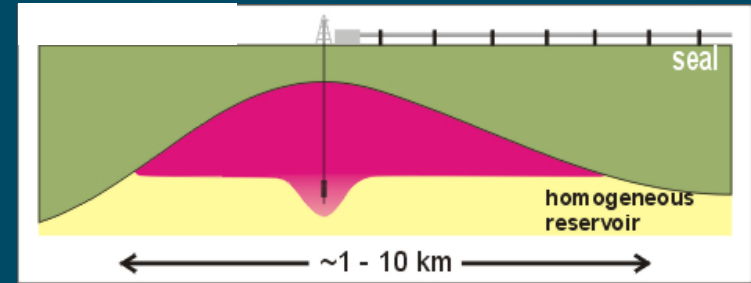


Depleted Oil & Gas Fields

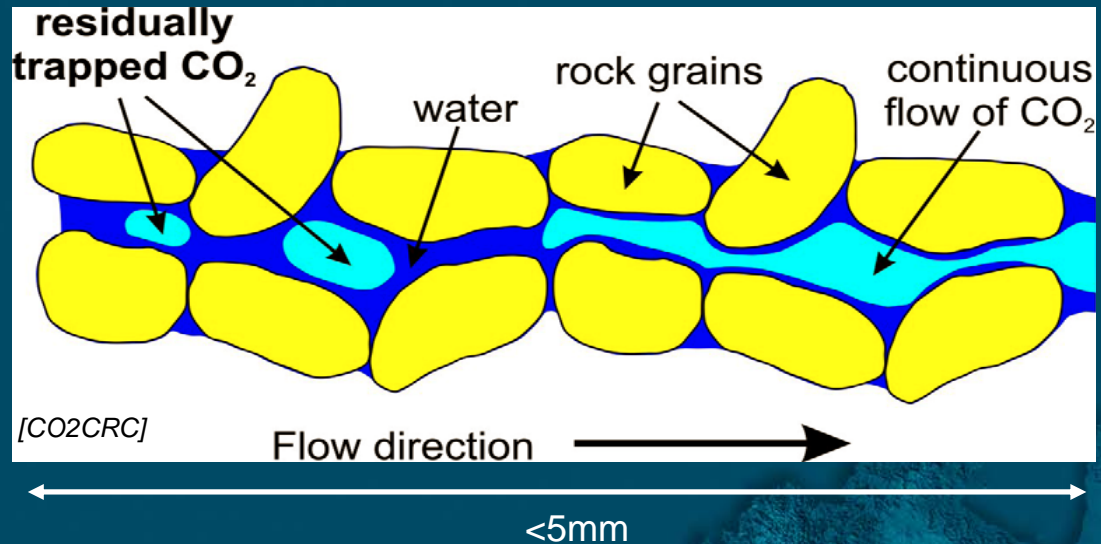
- Well characterised
- Not available yet
- Not enough volume

Trapping CO₂ underground

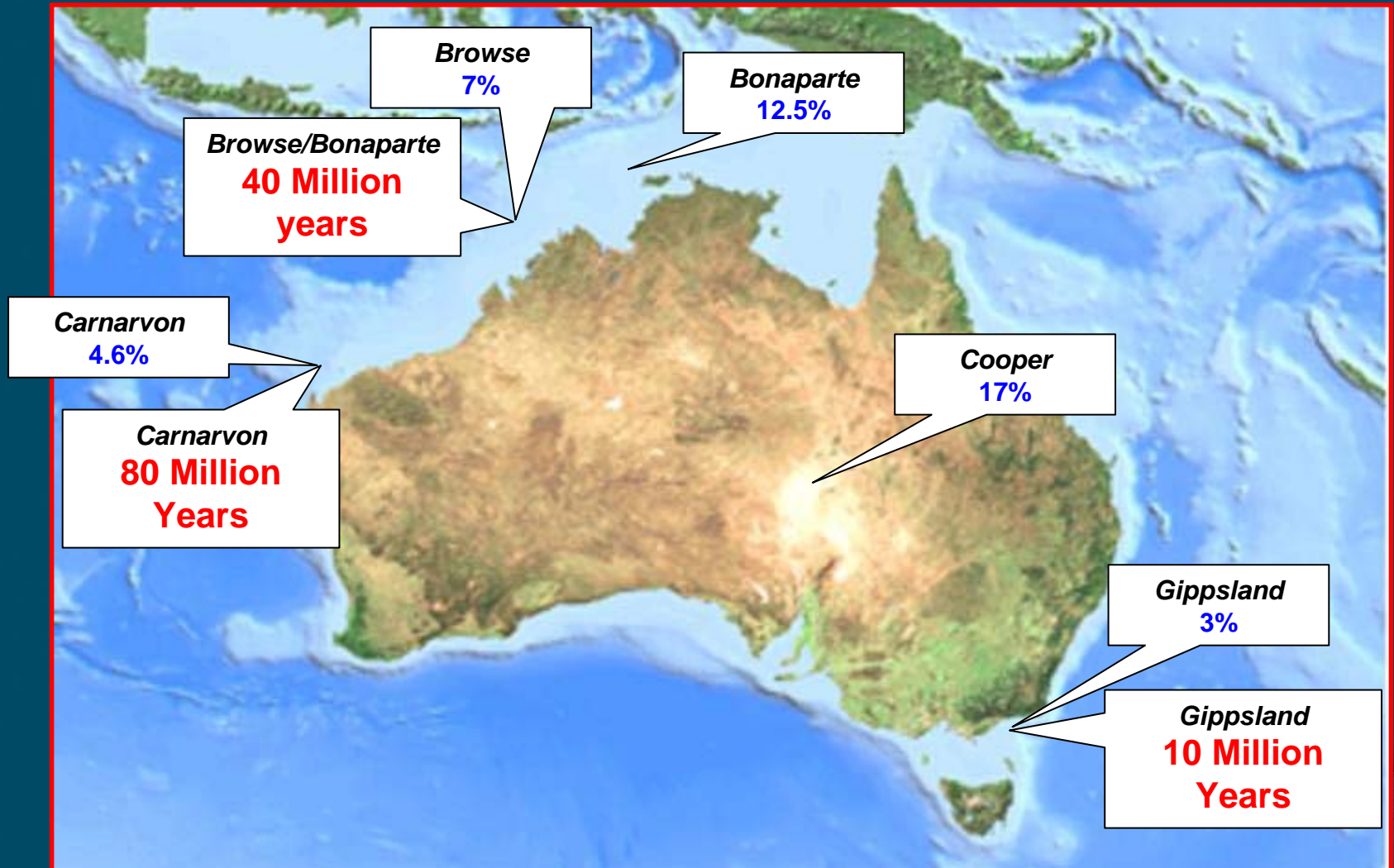
- Physical trapping (container + lid)
- Dissolution of supercritical CO₂ into formation water
- Residual trapping
- Mineralisation



[Robert Root]



Petroleum accumulations prove capacity of basins to store fluids for long periods of time

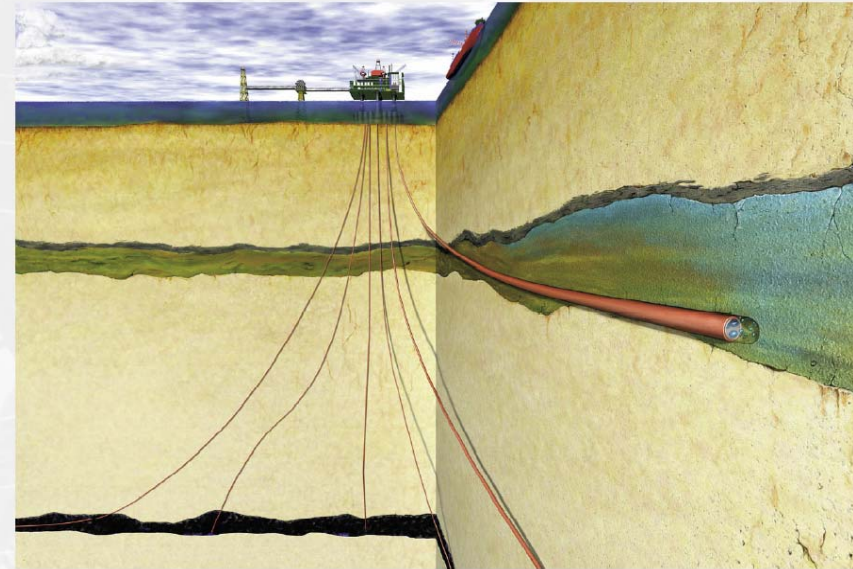


Geography of Sleipner

The Sleipner CO₂-injection into the Utsira Formation at 1000 Meters Below Sea Bottom
 - About 1 million tons/yr -

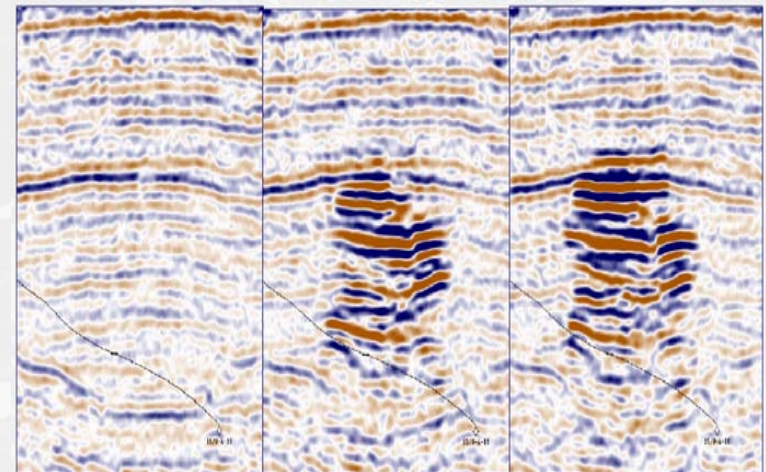


3



3D Seismic survey at Sleipner

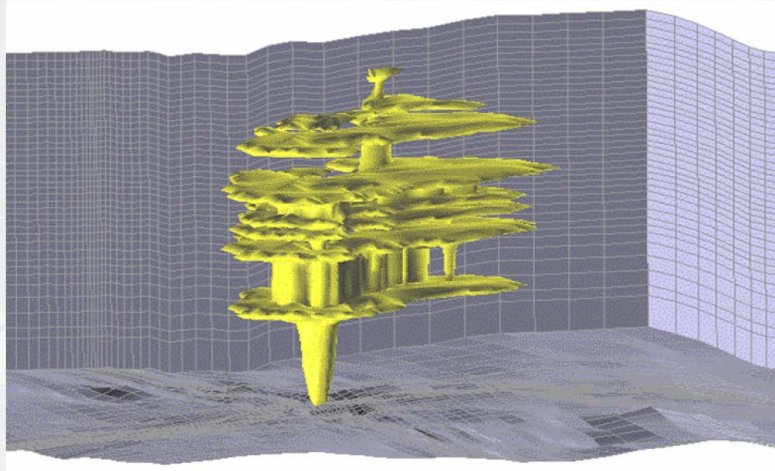
1996 1999 2001



Source: SACS, Best Practise manual 2003

8

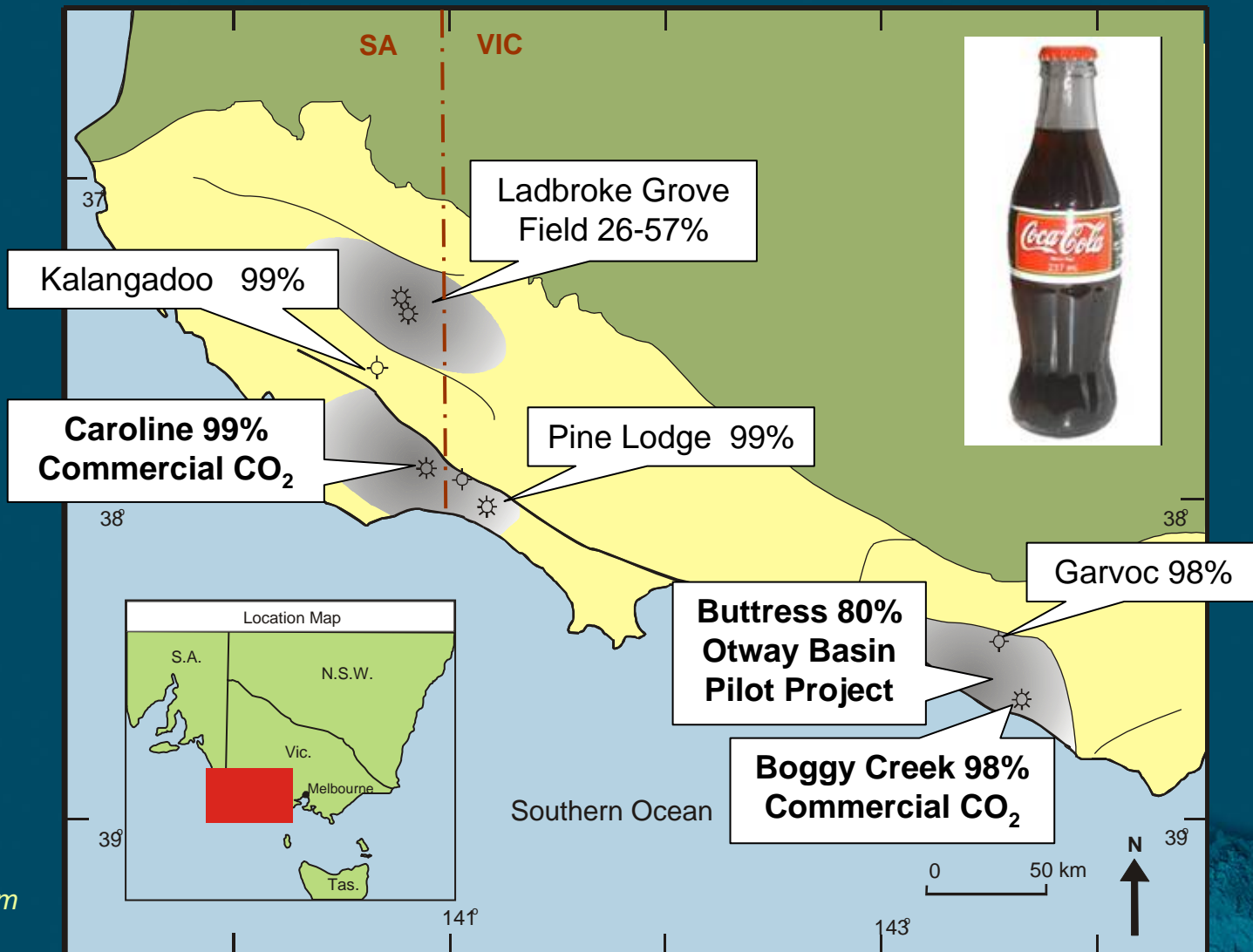
Reservoir model of CO₂ after 3 years



Source: SACS, Best Practise manual 2003

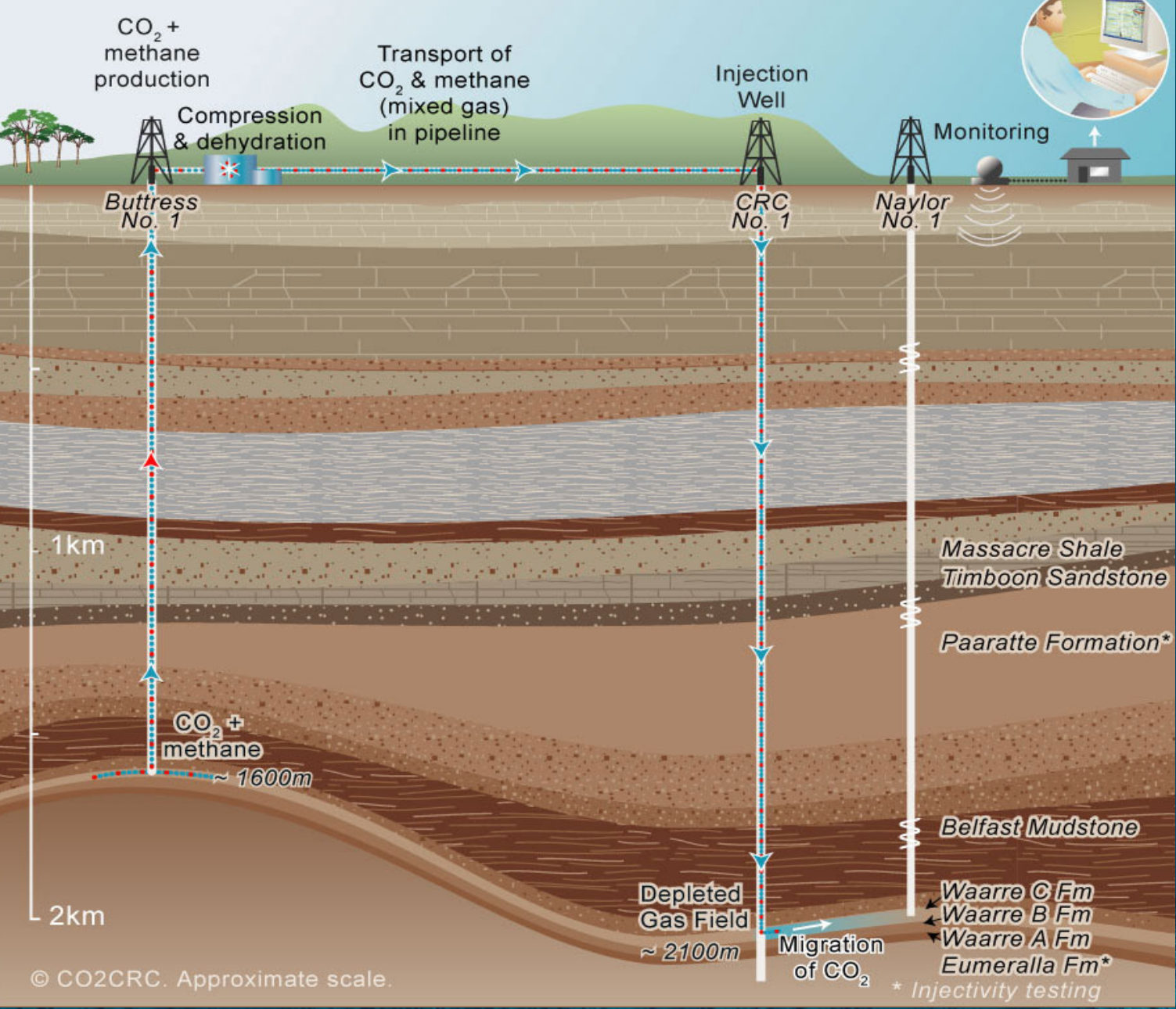
9

CO2CRC Otway Basin Pilot Project



Adapted from
CO2CRC

STAGE 1. Geosequestration Research Project (Otway Basin)



The CO2CRC Otway Project

This involves:

- Production of CO₂ rich gas
- Compression
- Injection into Waarre Fm
- Monitoring and verification
- >55,000t injected

Source
CO2CRC

GEOSCIENCE AUSTRALIA



Monitoring at OBPP site

CO₂ Atmospheric station

CO₂ Flux station

Naylor-1 monitoring well

Downhole geophysical and geochemical measurements

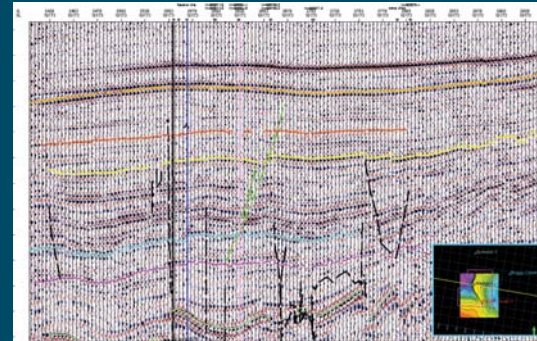
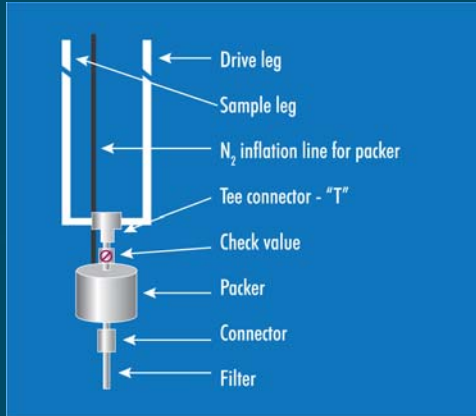
Seismic monitoring

Soil sampling

U-tube sampling

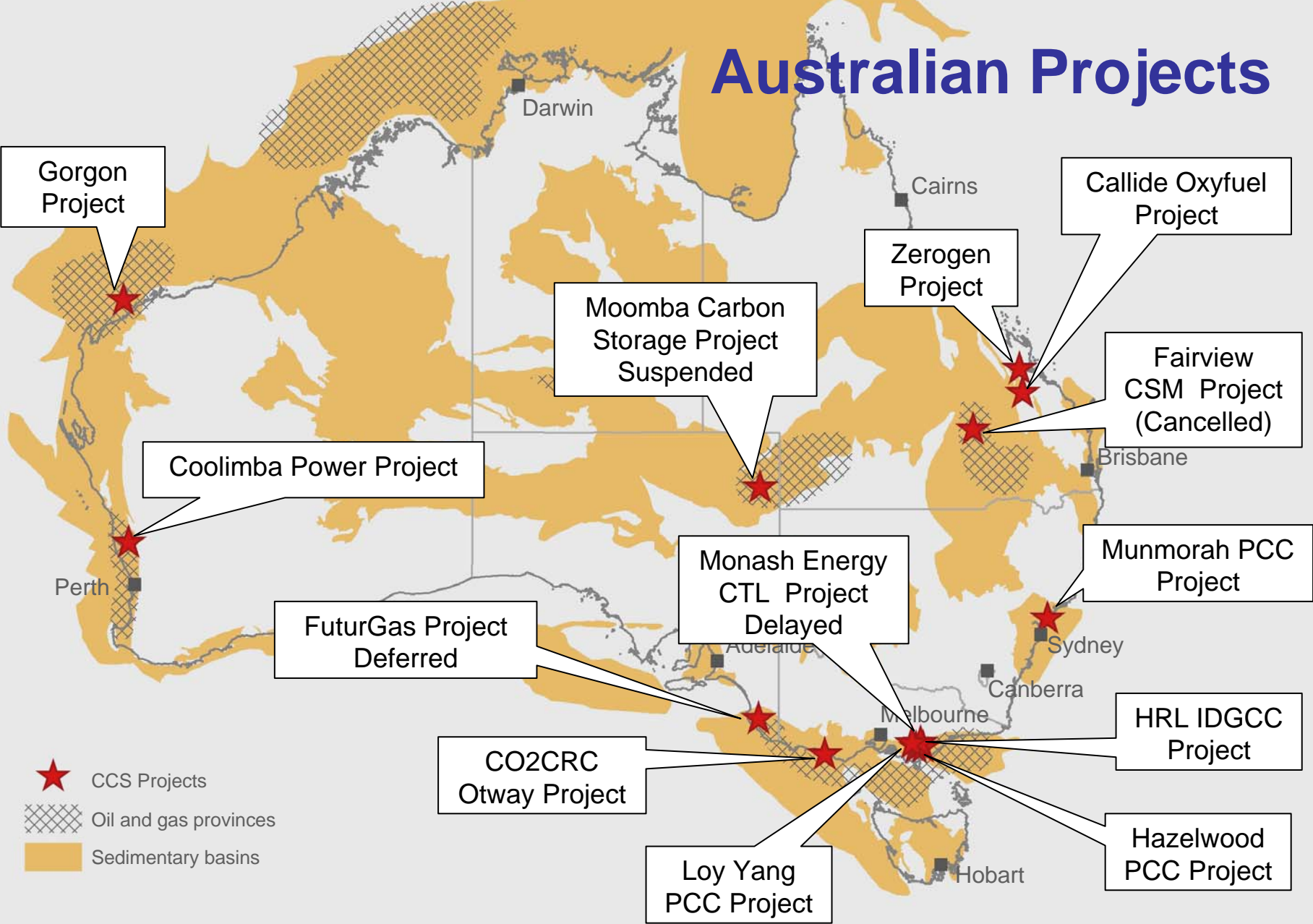
Gas sampling in headspace of a water well

Bore fluid and gas sample analysis



Source: CO2CRC

Australian Projects



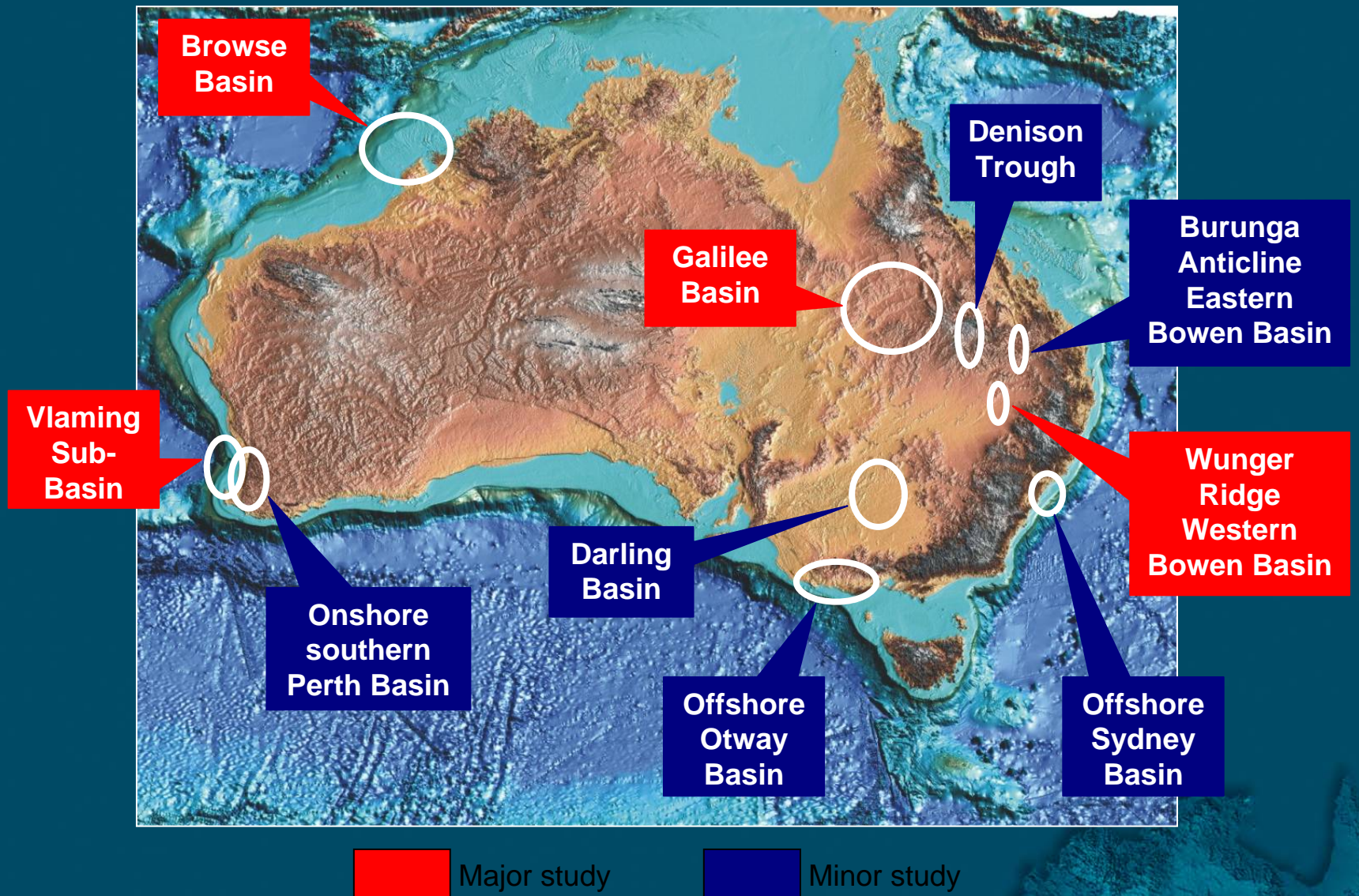


The map displays Australia with several offshore basins highlighted in red and circled in white. These include the Petrel Sub-basin in the north, the Vlaming Sub-basin in the southwest, the Otway Basin in the south, the Torquay Sub-basin in the southeast, and the Gippsland Basin in the east. Major cities like Darwin, Perth, Adelaide, Melbourne, and Sydney are marked. The map also shows the Indian Ocean, Timor Sea, Gulf of Carpentaria, and Coral Sea. The text 'GHG Acreage Release 2009' and 'A World First: 10 Blocks in 5 Basins' is overlaid in large blue font.

GHG Acreage Release 2009 A World First: 10 Blocks in 5 Basins

OFFSHORE PETROLEUM AND
GREENHOUSE GAS STORAGE ACT
2006

Previous Basin Studies at GA



For more information...

See www.ga.gov.au/ccs

Or contact ccs@ga.gov.au