Natural hydrogen exploration in South Australia

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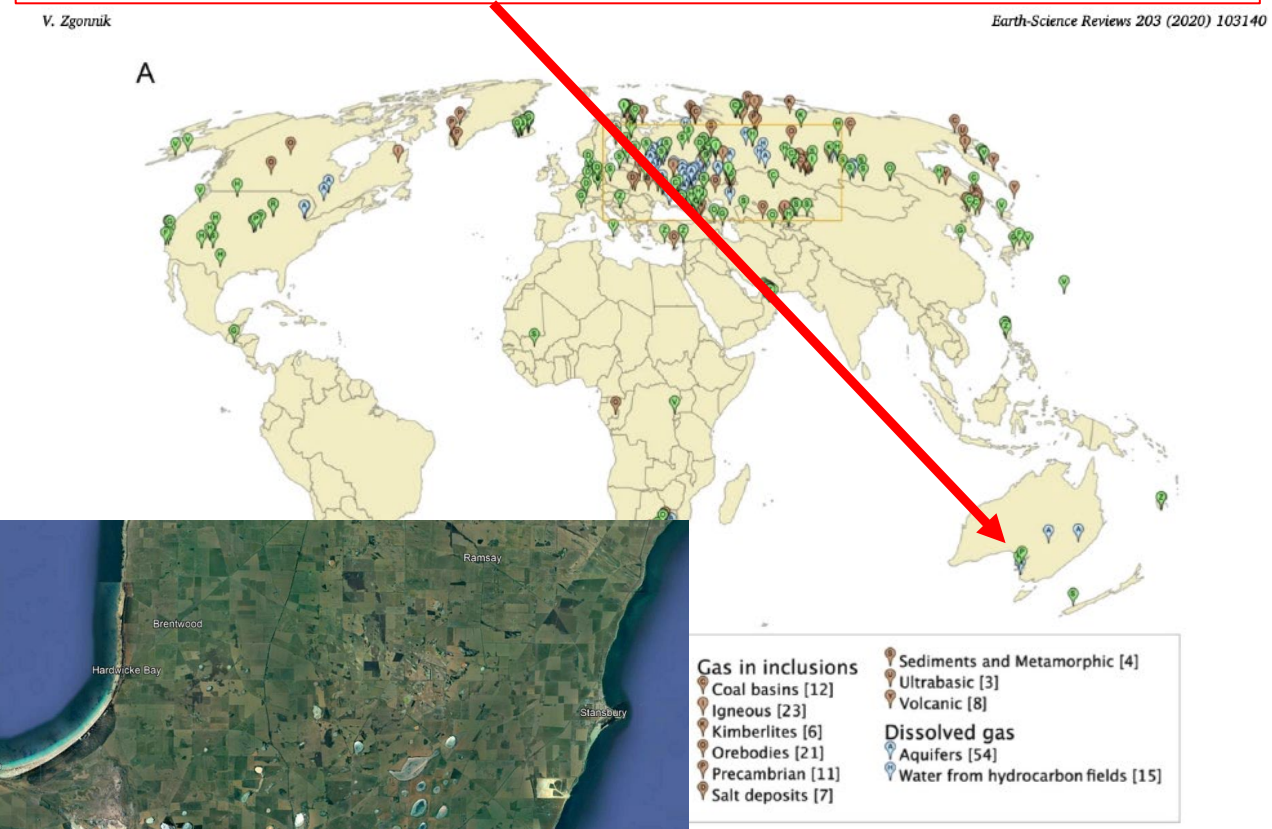
Why South Australia?

1. Zgonnik (2020) First drew attention to natural hydrogen indications in Australia.



***2.** Moretti et al. (March 2021) drew attention to potential seeps.*

1. Zgonnik found online SARIG records revealing significant hydrogen contents from Government analyses of gas samples taken from three historic drillholes:

1915 – Robe 1 (25.4% hydrogen)

1921 – American Beach Oil 1 (64.4-80% hydrogen)

1931 – Ramsay Oil Bore 1 (51.3-84% hydrogen)

2. *Moretti et al., 2021* postulated that salt lakes on Yorke Peninsula and Kangaroo Island were natural hydrogen seeps, formerly know as ‘fairy circles’.

3. Natural hydrogen exploration become possible in in SA in February 2021 when changes to the *Petroleum and Geothermal Energy Regulations 2013* added hydrogen as a ‘regulated substance. This enabled grant of exploration licenses targeting natural hydrogen.

Potential natural hydrogen sources

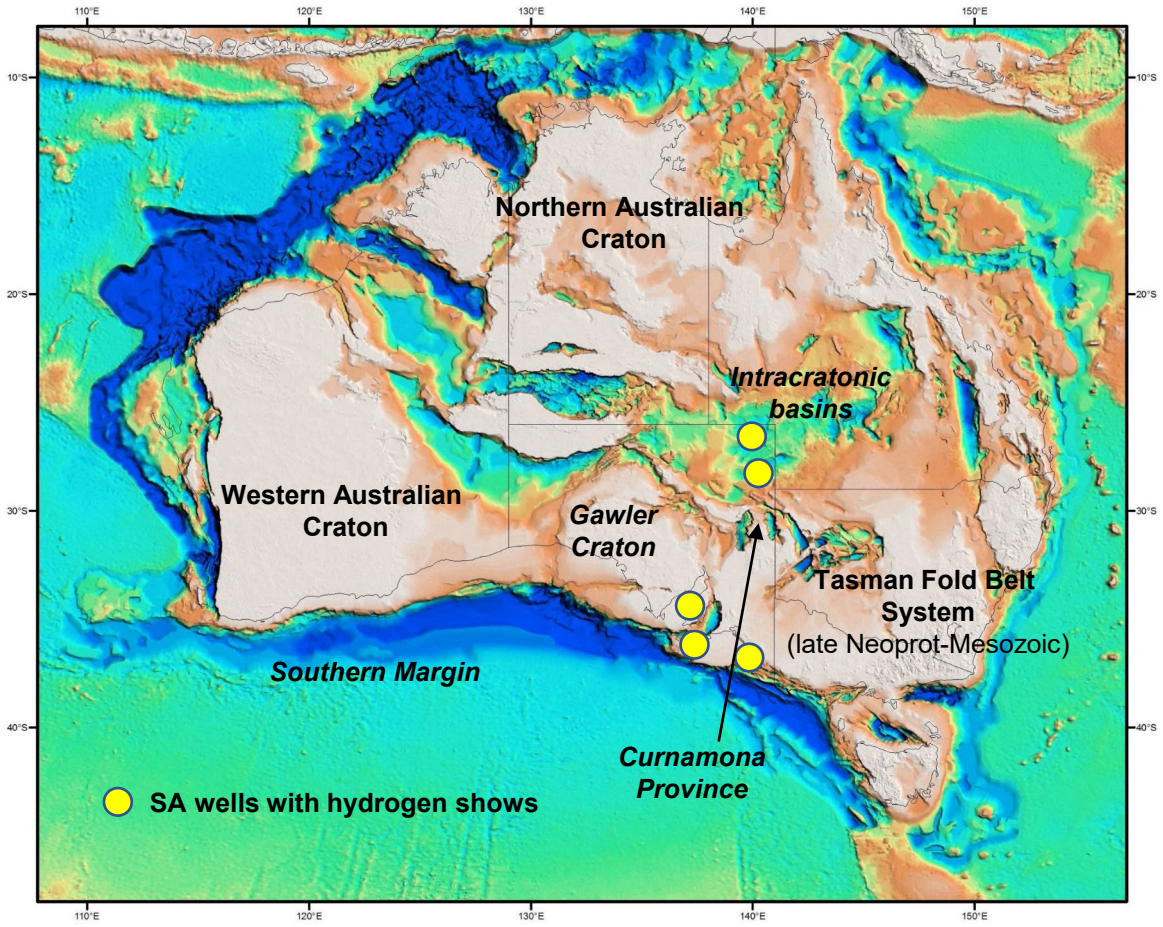
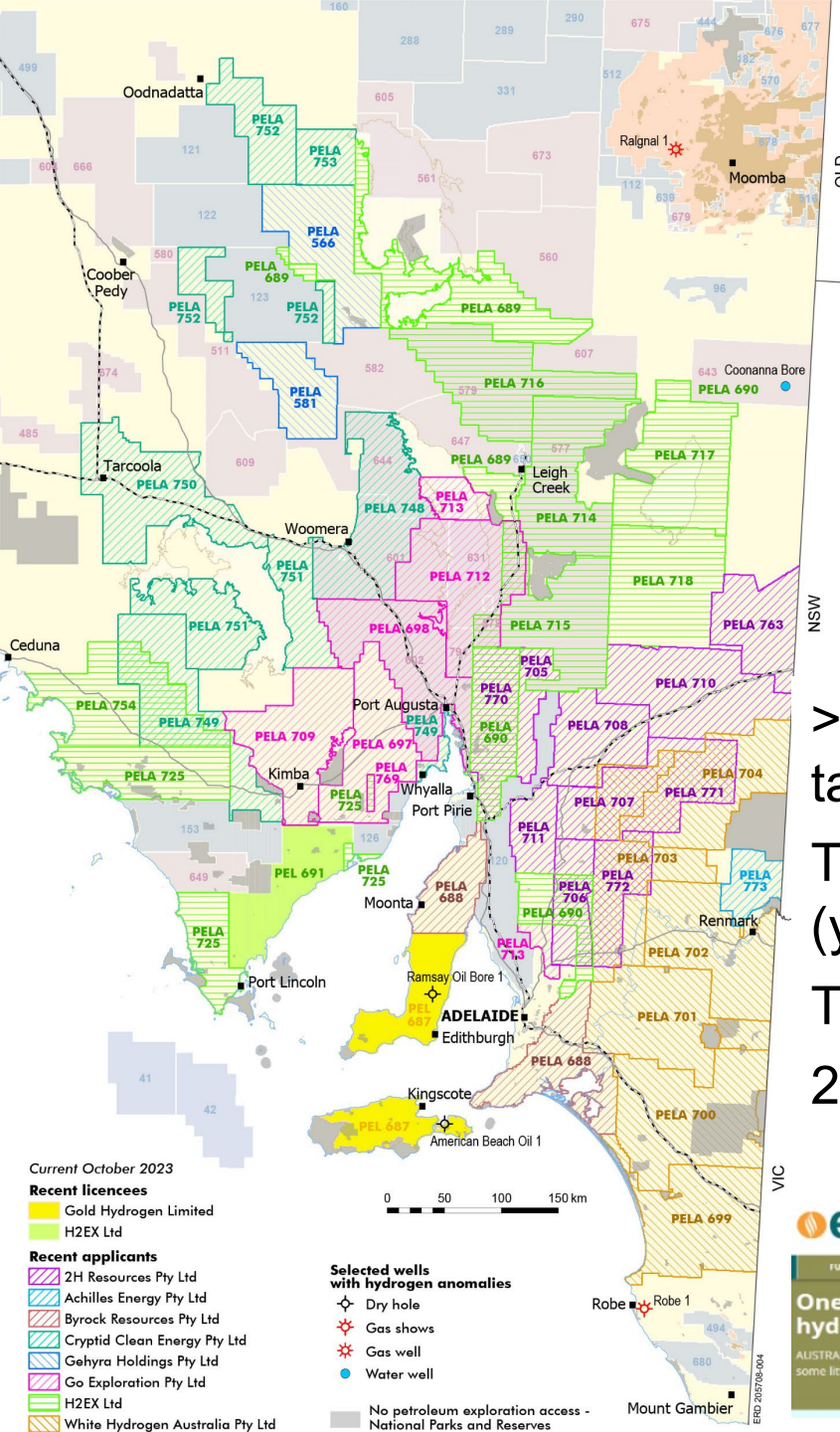


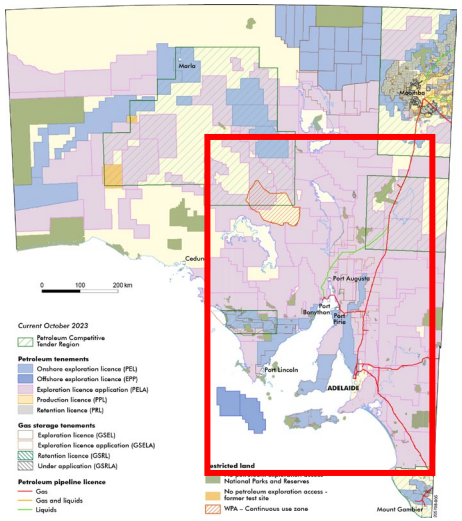
Image - OZSEEBASE 2021 (Geognostics)
https://www.geognostics.com/oz-seebase-2021

- ☑ **Hydrogen indications in drillholes**
- ☑ **Ancient basement complexes which contain iron and/or uranium rich rocks** e.g. Archaean greenstone and Precambrian basement terranes, 'hot' granites' - may generate hydrogen via:
  - radiolytic processes (radioactive decay breaks bonds in water) &
  - oxidation of Fe^{2+}rich minerals (serpentinization).
- ☑ **fractured and seismically active source areas** - deep-seated faults can both channel migrating hydrogen up from deep sources to surface and introduce water downward for further chemical reaction with exposed iron-rich rocks.
- ☑ Sedimentary cover may reservoir and trap migrating hydrogen particularly if **aquifer systems and /or seal rocks like salt** are present (see Bradshaw et al. 2023).
- ☑ Thermogenic **decomposition of organic matter** (e.g. over-mature source rocks, Boreham et al. 2023).

Surficial hydrogen seeps? Seeps can be blind or coincident with visible sub-circular topographic depressions on the metre to kilometre scale (formerly 'fairy circles').

Hydrogen exploration status





Natural hydrogen E&P is regulated under the Energy Resources Act 2023.
A Petroleum Exploration Licence (PEL) is required to explore for natural hydrogen.

>40 ‘over the counter’ applications have been lodged for PELs targeting natural hydrogen since February 2021.

The first PEL was granted in July 2021 to Gold Hydrogen Pty Ltd (yellow).

The second was granted to H2EX in June 2022 (green).

2H Resources is the first mover in 6 PEL applications.


ENB energy news bulletin

One third of South Australia pegged for native hydrogen exploration

AUSTRALIA'S government is pushing hard to get the cost of hydrogen down to A$2 per kilo by 2030 but some little known frontiersmen in South Australia believe they can cut that by 75%.


THEFIFTHESTATE

So there's a hydrogen gold rush in South Australia – here's what we know so far

ROSE MARY PETRASS 8 FEBRUARY 2022


Exclusive

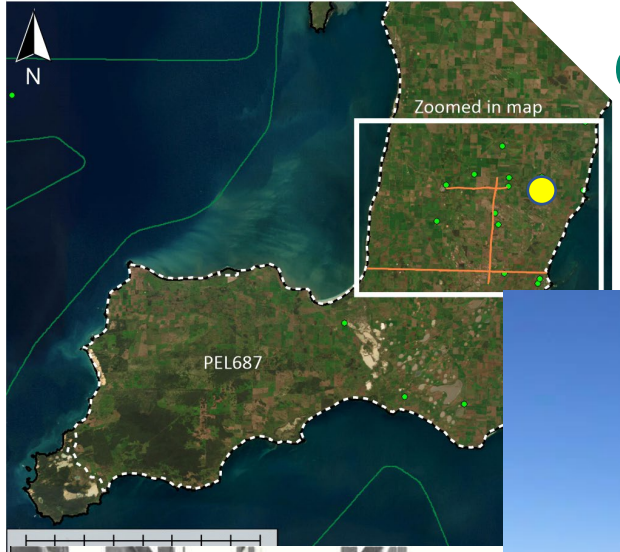
South Australia's new 'gold' rush is hydrogen

Angela Macdonald-Smith
Senior resources writer

Acreage covering almost a third of South Australia has been snatched up by entrepreneurial explorers in search of "gold" hydrogen deposits that they believe could easily undercut the cost of manufacturing the clean fuel.

In less than 12 months, six companies have taken up or applied for 18 exploration licences targeting so-called "gold" hydrogen, named for its natural occurrence and sustainable profile, covering 32 per cent of the entire state, according to consultancy EnergyQuest.

Gold Hydrogen Ramsay drilling update



- Ramsay 1 (Australia's 1st natural hydrogen exploration well) was drilled in October 2023, TD 1,005 metres.
- On 31 Oct 2023 Gold Hydrogen reported *"Testing and laboratory results measured air-corrected hydrogen at 73.3% at 240m, consistent with the 76% air-corrected concentration of hydrogen reported in the Ramsay Oil Bore 1 in 1931." …..*

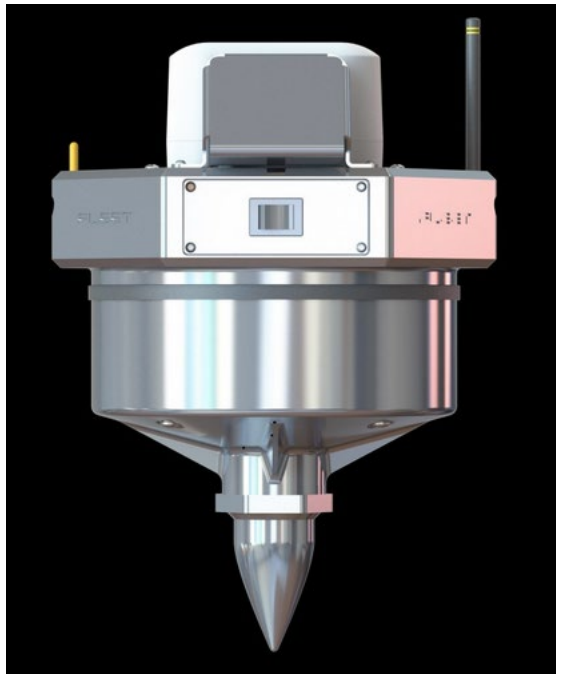
  "Helium was also detected with an air-corrected content of 3.6% at 892mMD depth."
- Ramsay 2 spudded ~0.5 km away on 17 Nov. 2023. **UPDATE** - hydrogen indications discovered in the Early Cambrian carbonates as per Ramsay 1. TD 1068 m.

The old and the new - Ramsay 1 and the 1931 Ramsay Oil Bore

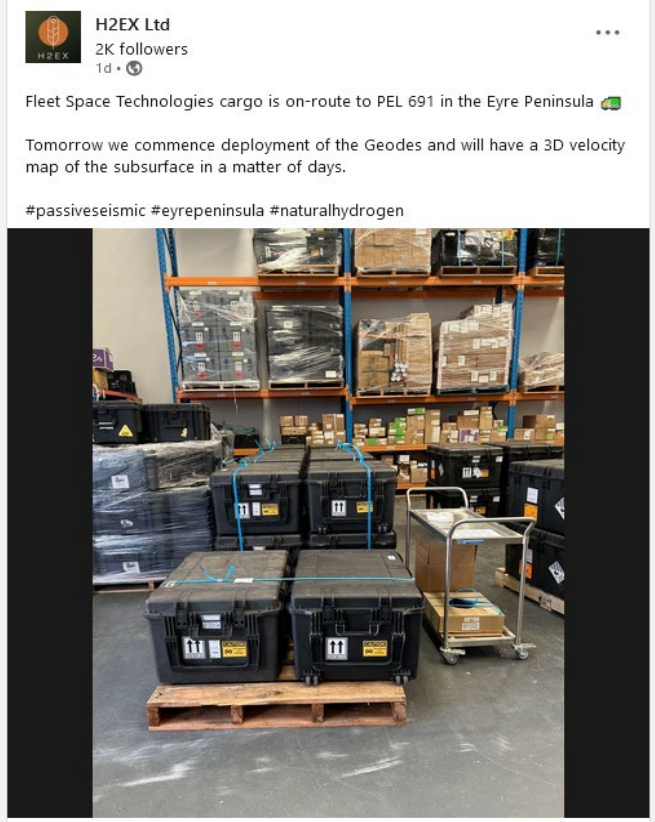
https://www.goldhydrogen.com.au/ramsay-project/

H2EX update

CSIRO team in the field on PEL 691 Apr-May 2023



https://fleetspace.com/mineral-exploration



- H2EX were the other early mover and announced hydrogen indications from a CSIRO soil gas survey earlier this year in PEL 691 on Eyre Peninsula.
- H2EX has been awarded a Federal Government Co-operative Research Council Project grant to "***Accelerate Exploration and Extraction of Renewable Natural Hydrogen".***
- The company commenced a low impact 3D Ambient Noise Tomography (ANT) survey utilising Adelaide-based Fleet Space Technologies in late November 2023.

https://h2ex.com.au/ Photos from H2EX

Conclusions

- South Australia's regulatory, licensing and investment frameworks are in place, enabling grant of Australia's first exploration licences targeting natural hydrogen back in 2021.
- 2023 has been an exciting year with on ground exploration by Gold Hydrogen and H2EX followed by Gold Hydrogen's announcement of hydrogen and helium indications in Ramsay 1 – Australia's first hydrogen exploration well. Ramsay 2 has also discovered hydrogen indications.
- Company exploration activity in SA is starting to test a diversity of natural hydrogen plays.
- Watch this space!
- If you have any questions please contact me: elinor.alexander@sa.gov.au
- For more information use the QR code: