

South Australian update Future Energy Exports CRC Conference

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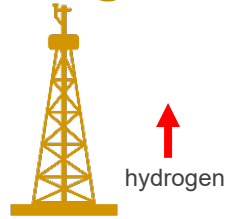


Hydrogen legislative framework

Petroleum & Geothermal Energy Act 2000

- single window into government for natural hydrogen.
- includes underground storage and pipeline transport for all 'colours' of hydrogen.

Natural (gold, white) hydrogen



Hydrogen and Renewable Energy Act

- Single window into government for all manufactured/generated hydrogen.
- Consultation closed 10 Feb 2023, the Bill is being prepared to introduce into Parliament soon.

Petroleum and Geothermal Energy Act 2000

South Australian Petroleum and Geothermal Energy Act 2000 (PGE Act):

- Proclaimed in September 2000 has been kept 'evergreen' via amendments as required;
- Objective/risk based regulatory framework;
- Covers licensing and regulation of exploration and exploitation of:
 - Petroleum and other prescribed regulated substances*;
 - Deep geothermal energy;
 - Gas storage reservoirs for regulated substances; and
 - Transmission pipelines for regulated substances.

***In February 2021 changes to the Regulations added hydrogen as a 'regulated substance' – joining petroleum, CO₂, H₂S, He, N and substances produced with petroleum.**



Hydrogen storage licensing and approval process



Stage 1 – Licensing

Provides resource access and property rights.

Stage 2 - Environmental Assessment and establishing approval conditions

Measurable environmental objectives: Environmental Impact Report (EIR) to address environmental risks (natural/social/economic) and how risks will be managed to ALARP, AND Statement of Environmental Objectives (SEO) to address EIR risks and environmental objectives to be achieved and measured.

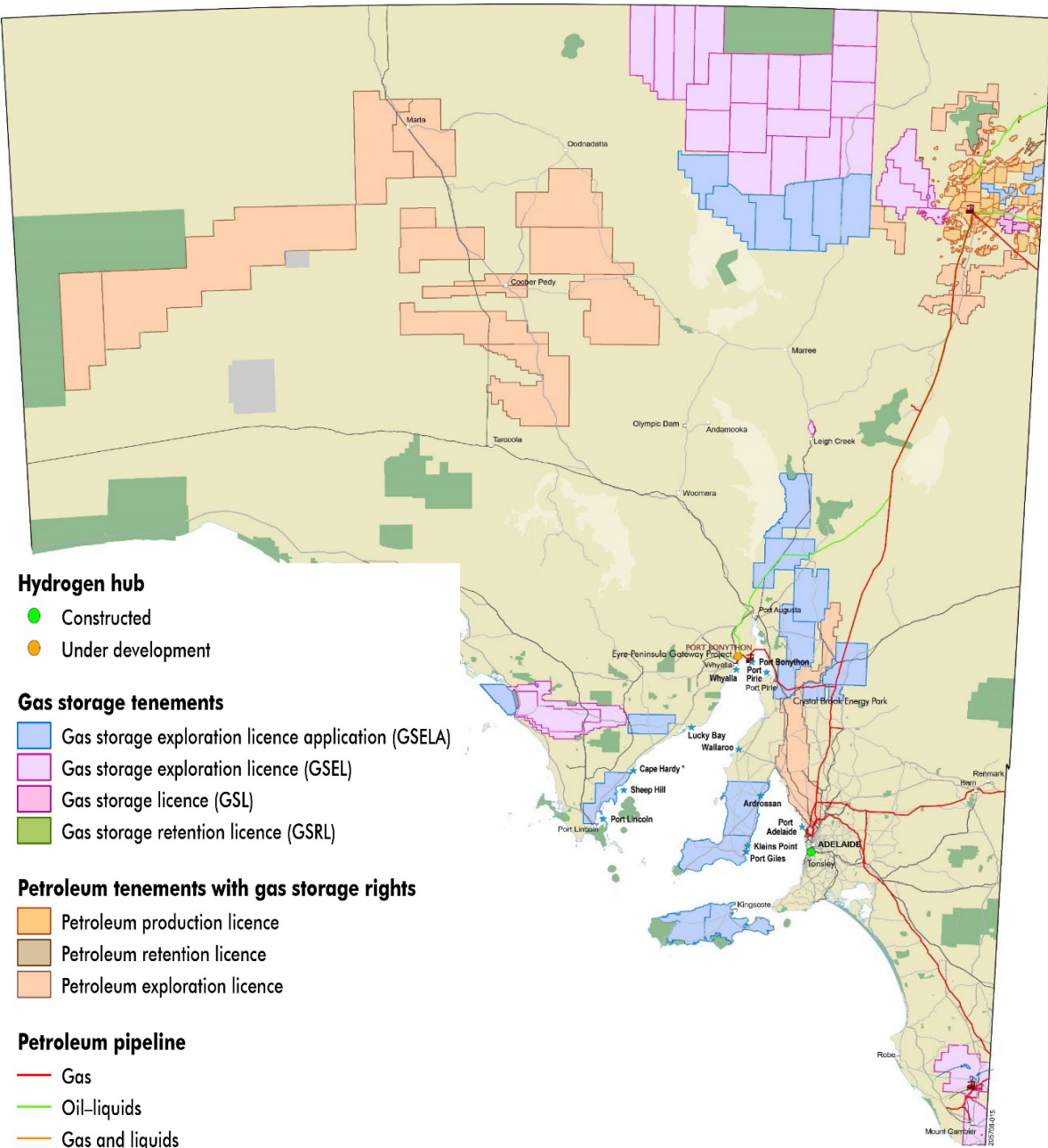
Stage 3 - Activity Notification and Approval

Specific technical information demonstrating how SEO will be achieved, focusing on recognized industry standards, equipment fitness for purpose assessments and capture, transport and storage including Monitoring, Reporting and Verification as well as details of process management systems.

Stage 4 – Post Closure Liability

At end of storage project life the licensee can apply to relinquish the licence and for long term liability to be either limited or excluded – residual risks will be assessed and the Minister may grant such approval with/without conditions.

Gas Storage Licencing framework



- The following licences provide the rights to store regulated substances, including hydrogen:
 - **Gas Storage Exploration licences (up to 2,500km²)** - exploration and operations to establish the nature, extent and feasibility of underground storage.
 - **Gas Storage Retention Licenses (up to 1,000km²)** - provides an GSEL holder with security of title over currently non-commercial storage sites for a reasonable period of time until they become commercial.
 - **Gas Storage Licences (up to 1,000km²)** - when a storage site is proven, the licensee is entitled to a Gas Storage Licence.
- **Pipeline Licence (PL)**
Pipeline licences (PLs) allow construction and operation of a transmission pipeline for carrying a regulated substance.



Underground hydrogen storage

Potential hydrogen storage 'plays':

- **depleted petroleum fields** –
 - Depleted oil and gas fields in the Cooper and Otway basins have potential as storage reservoirs suitable for CCS and hydrogen storage.
 - For another example see *Rami and Goldie Divko, 2023 Preliminary investigation of the hydrogen storage potential in the Port Campbell Embayment, Otway Basin, Victoria, Australia.**
- **salt** –
 - see Bradshaw et al. 2023 *Australian salt basins – options for underground hydrogen storage.**
 - For another example see Feitz et al., 2022. *Feasibility of underground hydrogen storage in a salt cavern in the offshore Polda Basin. In: Czarnota, K. (ed.) Exploring for the Future: Extended Abstracts, Geoscience Australia, Canberra, <https://dx.doi.org/10.26186/146501>*
- **aquifers,**
- **coal seams and**
- **abandoned underground mines.**

(*to be presented at the APPEA 2023 Conference next week).



Australian companies explore hydrogen in underground caves

by ANITA BROWN | 10 FEBRUARY 2022

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Hydrogen exploration: The next big thing?

Article in Preview · November 2022
DOI: 10.1080/14432471.2022.2129799

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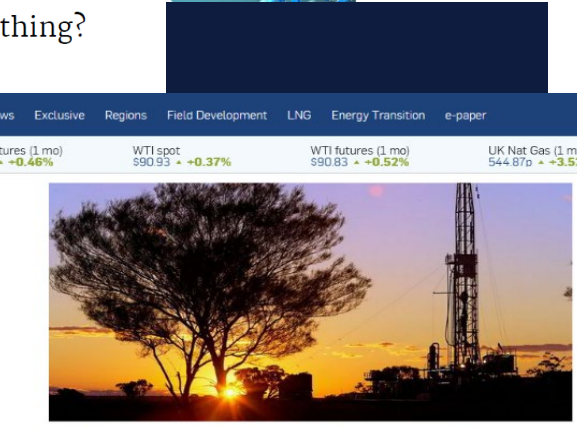
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HYDROGEN

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

ROSEMARY PETRABBS | 8 FEBRUARY 2022



Will natural hydrogen be Australia's next gold rush?

...ing interest — and significant investment —

... gold rush, which could prove as exciting as back in discovered shimmering flecks in a waterhole near ing interest from domestic and international miners

... as a novel 21st century focus with players targeting

Companies · Hydrogen 17 08 2022 by Tim Daiss

Gold hydrogen takes to the stage in Australia, but questions remain

Gold hydrogen is garnering attention in Australia as a potential competitor to blue and even green hydrogen, but critics say that gold hydrogen comes with considerable methane emissions and may not be volumetrically significant.



A presentation on May 19 by **Geoscience Australia** on gold hydrogen was named **winner** of the best technical presentation at this year's Australian Petroleum Production & Exploration Association (APPEA) conference in Brisbane.

[magazine.com/2022/02/02/natural-hydrogen-exploration-boom-snaps-up-one-third-of-south-australia/](https://www.enr.com/magazine.com/2022/02/02/natural-hydrogen-exploration-boom-snaps-up-one-third-of-south-australia/)

Natural hydrogen exploration 'boom' snaps up one third of South Australia

South Australia has found itself at the heart of a 21st-century gold rush, though this time for naturally occurring hydrogen. Since February 2021, 18 exploration licenses have been granted or applied for in the state by six different companies searching for natural hydrogen.

FEBRUARY 2, 2022 **BELLA PEACOCK**

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Underground salt caverns (pictured) have been posited as a potential place to store hydrogen, but it seems hydrogen may already be abundant in gas form under our feet. Explorations companies are newly scrambling to find out.

Image: Guilhem Vellut, flickr

South Australia's new 'gold' rush is hydrogen

— Exclusive

South Australia's new 'gold' rush is hydrogen



Angela Macdonald-Smith
Senior resources writer
Jan 31, 2022 - 5.00am

Acreege 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.

INNOVATION



ANALYSIS | Will natural hydrogen extracted from the ground be the next global gold rush?

The existence of naturally occurring H2 has been known about, but not well understood, for centuries — but this could be about to change, writes Rystad Energy Hydrogen Research

RELATED NEWS
7 November 2022 11:06 GMT | UPDATED: 7 November 2022 11:33 GMT
Brazilian green steel? Scandinavian metals firms
By Rystad Energy Hydrogen Research

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%.



Future Of Energy > Hydrogen
07 December 2021

Out in the dry of the state, there could be a best estimate prospective resource of 1.3 billion kilos of hydrogen (1.3 million tonnes), based on a basement interval of 86 metres and is currently being appraised by a new company which suggests if converted to electricity could power one million homes for 40 years.

Comments

Natural, or native, hydrogen is the latest buzzword picking up steam in the Australian energy industry, though as yet commercial concentrations are yet to be found. However, since February, the state government has awarded 18 petroleum licenses for six companies looking

Natural hydrogen exploration update

SA was put on the map of natural hydrogen occurrences in 2019-21 scientific papers (e.g. Zgonnik's comprehensive global review in 2020, Moretti et al. 2021) as a result of shows in drillholes and possible 'fairy circles'.

Regulatory changes to enable natural hydrogen exploration, hydrogen storage and transmission by pipelines have also attracted national and global interest.

Mali - Bourabougou Field is the world's only hydrogen producer – used for local electricity generation over the last 7 years.

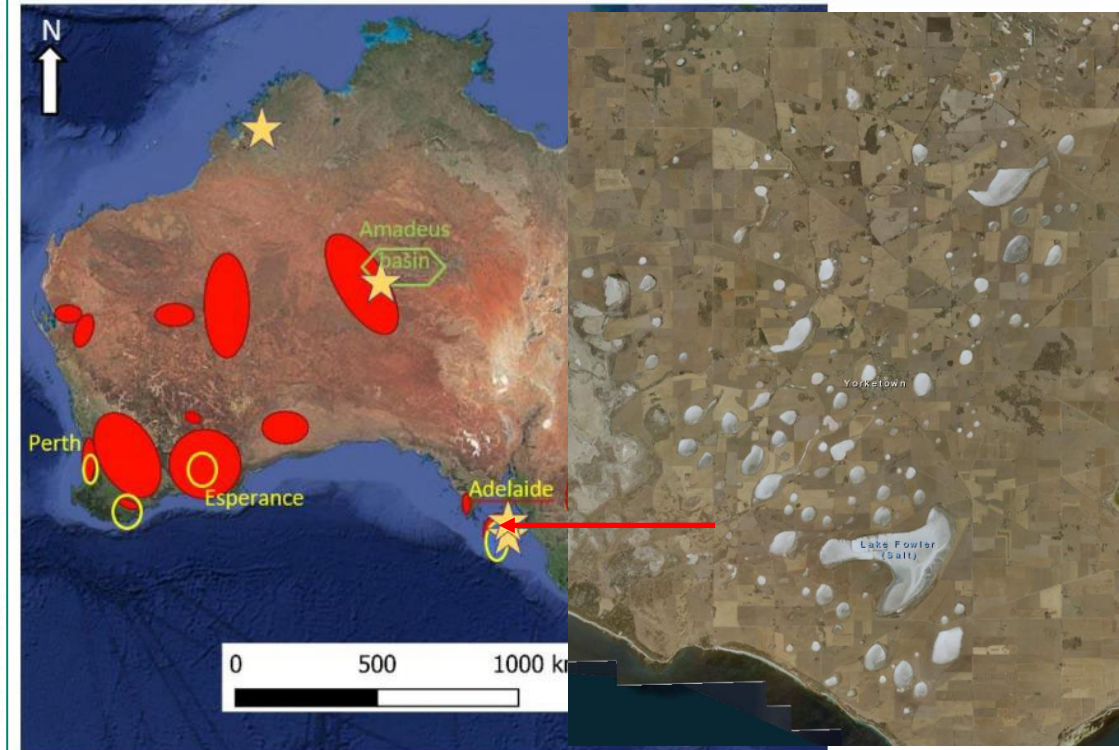
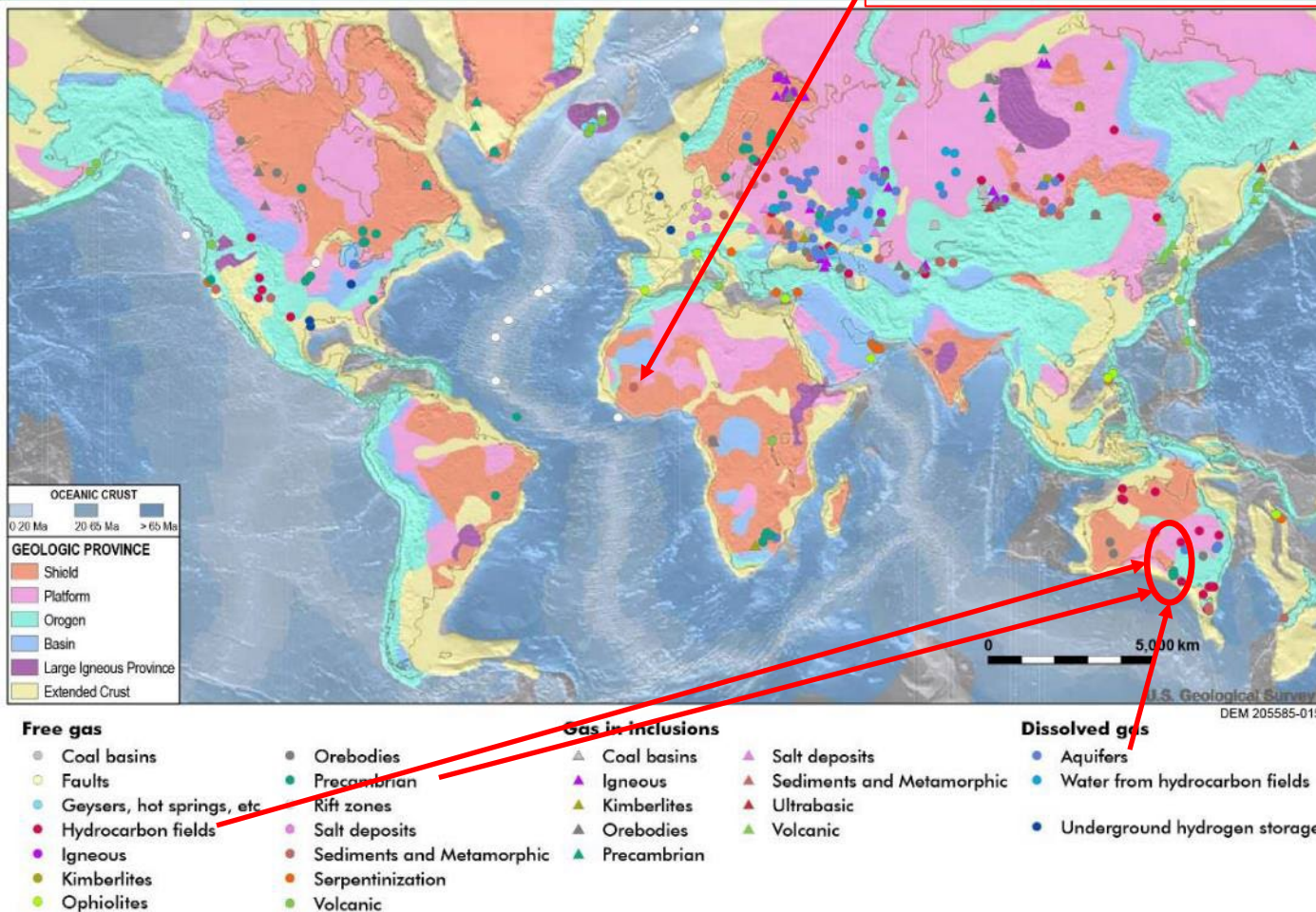
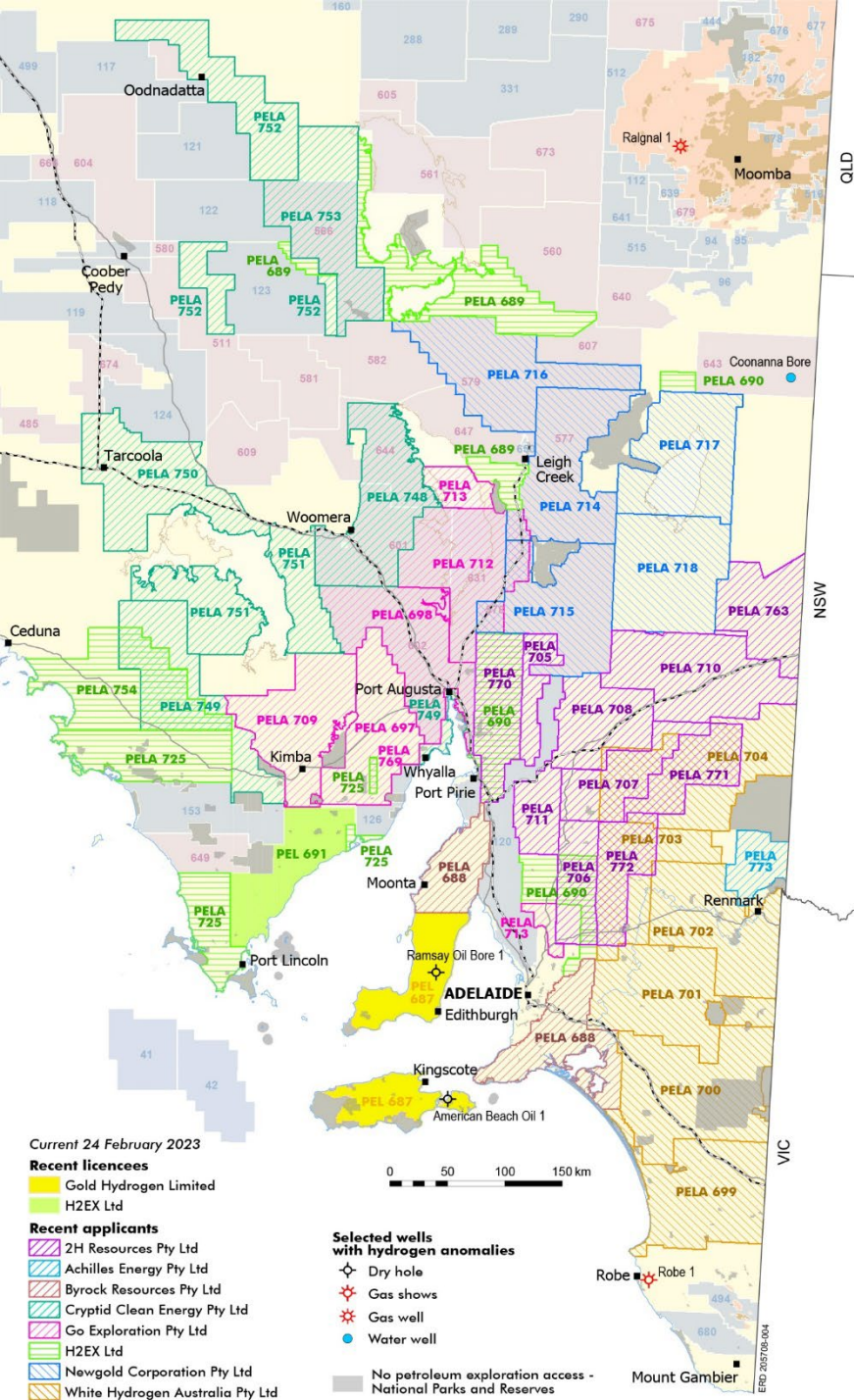


Figure 5. Location of the areas with many circular depressions in Australia (red areas). The yellow stars are the location of the wells that found H₂, the yellow circles highlight the areas where depressions that look like fairy circles can be observed and where statistic has been done in this study.

Moretti et al. (March 2021)

Natural hydrogen exploration update



- South Australia has taken the lead nationally in enabling natural hydrogen exploration.
- 7 companies have lodged 40 applications for PELs targeting natural hydrogen since February 2021.
- The first licence (PEL 687) was granted to Gold Hydrogen Pty Ltd in July 2021. They have just completed roadside soil gas sampling with the CSIRO and an extensive airborne geophysical survey.
- The second licence (PEL 693) was granted to H2EX and they are conducting a soil gas survey with the CSIRO.
- Why the interest? 50-80% hydrogen content was measured in 1931 by the Mines Department in gas samples from wells drilled from 1915-1931 on Kangaroo Island, Yorke Peninsula and the Otway Basin.
- South Australia's iron-rich cratons and uranium-rich basement with deep seated faults in the Gawler Craton, Curnamona and Musgrave Block may be prospective for natural hydrogen.

Conclusions

- **Regulatory, licensing and investment frameworks are in place, enabling grant of Australia's first exploration licences targeting natural hydrogen, licences for underground storage of hydrogen and licences for the transmission of hydrogen in pipelines.**
- **Some natural hydrogen explorers have also applied for Gas Storage Exploration Licenses to provide the rights to store hydrogen.**
- **Upcoming company exploration activity in SA will test a diversity of natural hydrogen plays.**
- **It is expected that the *Hydrogen and Renewable Energy Act* and *Petroleum and Geothermal Energy Act 2000* amendments will be in place by the end of 2023.**

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