Australia's National Science Agency

SURFACE AND GROUNDWATER

GISERA | Gas Industry Social and Environmental Research Alliance

Baseline seismic monitoring in the Canning Basin, Western Australia

This project will characterise the current natural seismic activity and cultural seismic noise within the Canning Basin, Western Australia. This baseline will identify any potential increase in seismic activity due to planned gas extraction operations.

Key points

- There is a significant information gap about the background seismic activity of the Canning Basin in Western Australia.
- The Independent Scientific Panel Inquiry into Hydraulic Fracture Stimulation in Western Australia (2018), recommends a baseline of natural seismic activity be established prior to unconventional gas extraction development.
- This project will establish data processing platforms for baseline seismic monitoring before the start of hydraulic fracturing.
- It will improve discrimination between natural sources such as earthquakes and human activities.

Canning Basin

The Canning Basin is in northwest Western Australia, approximately 1,500 kilometres northeast of Perth. It is the largest sedimentary basin in Western Australia with an onshore area of about 530,000 square kilometres.

It contains potential opportunities for developing shale and unconventional gas. The small towns of Broome and Derby provide shipping, air support and services for the Canning Basin.

Knowledge gap about seismic activity

The western and north-western margins of the Australian continent show a moderate amount of long-term natural seismic activity, with most of the events lying close to the offshore edge of the continental crust. Particularly notable was the cluster of earthquakes off Broome in 2019, which produced the magnitude 6.6 and was felt as far away as Perth.

The origin of the natural seismicity in the Canning Basin is associated with the ongoing deformation of the crust at the north-eastern margin of the basin. However, measuring seismic activity within the basin is limited due to the lack of seismic monitoring stations in the region; currently, only four permanent stations exist within the basin.

This sparse network of stations cannot detect and locate events less than magnitude 2.5, which is critical for identifying baseline activity patterns. Geoscience Australia (GA) in Canberra only reports events with magnitudes greater than 2, as detected on the Australian National Seismic Network (ANSN).

As outlined by the Independent Scientific Panel Inquiry into Hydraulic Fracture Stimulation in Western Australia (2018), it is important to establish a baseline of natural seismic activity before unconventional gas extraction activities begin. To accurately form this baseline, the ability to detect seismic events with a magnitude as low as 1.5 will be needed.

Fitzroy River sedimentary rockface.
Photo courtesy Anne Crawford.

CSIRO | Australia Pacific LNG | QGC | origin | Santos | NSW Government | Australian Government Department of Industry, Science, Energy and Resources | Supported by Government of South Australia | Queensland Government | Northern Territory Government

Canning Basin escarpment. Photo Courtesy of Arthur Mory, WA Geological Survey and Resource Strategy Division.

Collaborating to close the information gap

The Geological Survey of Western Australia (GSWA) plan to install and operate a dense seismic monitoring array of 14 new stations in the basin in 2021. Telemetry systems will feed real-time data directly into the ANSN. These stations will be established in a section of the Canning Basin adjacent to a series of permits for oil and gas exploration, including experimental licenses.

The proposed seismic network is expected to have a sensitivity detection range for magnitudes as low as 1 and potentially lower. This will greatly increase the potential for detecting much smaller seismic events in the basin.

CSIRO has the expertise to set up the necessary software and algorithms to produce timely reports of seismic activity recorded by the seismic network, as well as evaluate the data.

CSIRO's GISERA project will integrate the data generated from GSWA's new seismic stations and four existing stations to provide the first baseline data for any naturally occurring seismic activity in the region. CSIRO will process and share this data on a regular basis.

More information

- Read more about the project
  Baseline seismic monitoring of the Canning Basin, WA
- Find out about
  other GISERA projects in Western Australia

Project activities

The scope of this project includes:

- identifying potential sources of seismic activity using existing datasets and maps within a desktop study
- developing and applying state-of-the-art algorithms for detecting and discriminating smaller natural and induced seismic events
- developing a platform to publish a catalogue of seismic activity and generating seismicity maps of smaller events in the Canning Basin, and relating these to geological features or surface infrastructure
- increasing the geological knowledge of the Canning Basin through further seismological research to understand and interpret seismic activity.

Outcomes

This project will provide important information to the community and regulators of the baseline seismic activity in the Canning Basin in a way that is transparent and available to the public.

It will improve discrimination of seismic sources, such as earthquakes, versus human activities, such as quarry blasting. It will also record additional seismic activities caused by new industrial activities.

Further information | 1300 363 400 | gisera@gisera.org.au | gisera.csiro.au

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