



Australian Government



Geological and Bioregional Assessment Program

Fact sheet 23

Structural flow implications for unconventional gas resource exploration, Beetaloo Sub-basin case study (Northern Territory, Australia)

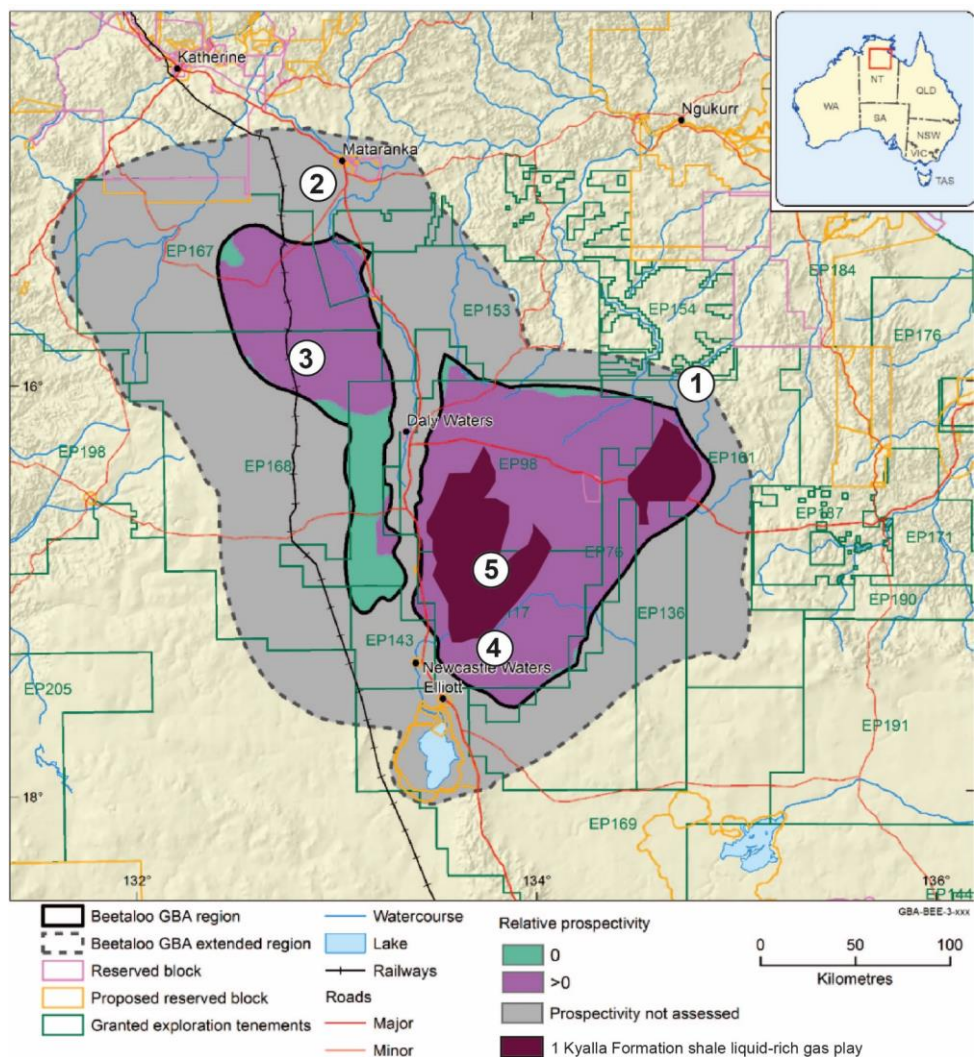
This study aims to assess the potential for natural connections between unconventional petroleum plays, aquifers and the surface at a basin-scale within the Beetaloo Sub-basin in the Northern Territory. To determine potential natural connectivity and paleo-leakage, present-day structures and potential active and paleo-leakage pathways are imaged with a new processing and interpretation of existing and newly acquired 2D seismic reflection profiles, electro-magnetic and magnetic datasets. Those data are discussed in terms of potential fluid and gas connectivity under the present-day stress regime, and with reference to both the current unconventional petroleum activity development scenario and the five to ten years development scenarios (Huddlestone-Holmes, 2020; Figure 1).

Reactivated strike-slip faults:

North to north-northwest trending strike-slip faults have been reactivated in the recent past and control present-day deposition at the edges of the Beetaloo Sub-basin. These faults are associated with 2 areas of active bubbling springs: Hot Spring Valley in the OT Downs sub-basin (1 in Figure 1) located 10 km north of the western sub-basin, and near Mataranka Springs (2 in Figure 1) located at the northern edge of the eastern Beetaloo Sub-basin. The strike-slip faults likely provide local connectivity between the shallow unconfined aquifer and a deeper gas or fluid source. The origin and flux of this deeper source is unknown and needs to be further investigated to assess if the input of gas is local or regional.

Figure 1 Petroleum relative prospectivity, and potential current and post-Cambrian paleo fluid flowpaths (1 to 5) associated with interpreted fault pathways

- 1) OT Downs fault zone, 2) Mataranka and Birdum Creek Fault, 3) western Beetaloo Sub-basin, 4) southern eastern Beetaloo Sub-basin, and 5) central eastern Beetaloo Sub-basin



Post-Cambrian faults: Few north-western trending post-Cambrian fault segments are interpreted within the boundaries of the Beetaloo Sub-basin (3 to 5 in Figure 1). These are interpreted as occurring in the prospective dry gas play zones in the Amungee member of the Velkerri formation (5 in Figure 1) (Geological and Bioregional Assessment Program, 2020). Generally, these fault segments are not related to the reviewed evidence of present-day leakage. However, fault segments located in the south of the eastern Beetaloo Sub-basin near Elliot (4 in Figure 1) may have been recently reactivated and could potentially act as open pathways for the migration of fluid and gas. However, data are sparse and of poor quality in these areas. Further field work and data acquisition is necessary to assess if such pathways are currently active.

The GBA Program

The \$35.4 million Geological and Bioregional Assessment (GBA) Program is assessing the potential impacts of shale and tight gas development on water and the environment to inform regulatory frameworks and appropriate management approaches. The geological and environmental knowledge, data and tools produced by the GBA Program will assist governments, industry, land users and the community by informing decision-making and enabling the coordinated management of potential impacts.

How to cite

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Find out more

- Journal paper: Frery E, Byrne C, Markov J, Evans T, Huddleston-Holmes C, Turnadge C, Crosbie R, Martinez J, Raiber M (in prep.) Structural flow implications for unconventional resources exploration, Beetaloo Sub-basin case study (Northern Territory, Australia).
- Orr ML, Bernardel G, Owens R, Hall LS, Skeers N, Reese B and Woods M (2020) Geology of the Beetaloo GBA region. Technical appendix for the Geological and Bioregional Assessment: Stage 2. Department of the Environment and Energy, Bureau of Meteorology, CSIRO and Geoscience Australia, Australia. Viewed 12 February 2021, https://www.bioregionalassessments.gov.au/sites/default/files/gba-bee-stage2-appendix_petroleumprospectivity_final.pdf.
- Huddleston-Holmes CR, Frery E, Wilkes P, Bailey AHE, Bernadel G, Brandon C, Buchanan S, Cook SB, Crosbie RS, Evans T, Golding L, Gonzalez D, Gunning ME, Hall LS, Henderson B, Herr A, Holland KL, Jarrett A, Kear J, Kirby J, Lech ME, Lewis S, Macfarlane C, Martinez J, Murray J, Northover S, O'Grady A, Orr ML, Owens R, Pavey C, Post D, Sundaram B, Rachakonda P, Raiber M, Ransley TR, Tetreault-Campbell S and Wang L (2020) Geological and environmental baseline assessment for the Beetaloo GBA region. Geological and Bioregional Assessment Program: Stage 2. Department of the Environment and Energy, Bureau of Meteorology, CSIRO and Geoscience Australia, Australia. Viewed 12 February 2021, <https://www.bioregionalassessments.gov.au/assessments/geological-and-bioregional-assessment-program/beetaloo-sub-basin/beetaloo-gba-region-stagetwo-report>.

Datasets that support this work are available at data.gov.au

- Geological and Bioregional Assessment Program (2020) [Shale gas prospectivity maps for the Kyalla Formation and Amungee Member of the Velkerri Formation, Beetaloo Sub-basin](#) [spatial].
- Geological and Bioregional Assessment Program (2021) [Spatial causal network for the Beetaloo GBA region](#). [data].

More information is available at bioregionalassessments.gov.au/gba.