Gas sources and concentrations in Surat Basin shallow aquifers: Methane concentration method comparison, and isotopic study

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Background

The Surat Basin hosts various industries that extract groundwater including coal seam gas (CSG), feedlots and agriculture. Gas has been observed in some bores drawing groundwater from different aquifers across the Basin. While methane can occur naturally in aquifers, biogenic CSG has been extracted from the Walloon Coal Measures, raising questions on the *sources* of gas in overlying aquifers. Current standard monitoring uses a direct fill approach to measure dissolved methane concentrations in vials, however, this approach *may lose gas to atmosphere when* present above solubility levels.

Figure 1: Sampling water bores in the Surat Basin. Showing the Terra Sana gas-water separator. Isoflask, and vial containers used for sampling methane.

Methods

- Water and gas sampling of bores in the Springbok, Gubberamunda, Mooga, Hutton, and Precipice sandstones, the Orallo Formation, and the Condamine Alluvium. Water bores and CSG production wells from the Walloon Coal Measures were also sampled. We compared the standard direct fill "vial" method to a closed sampling method using an Isoflask for dissolved gas (Fig. 1). The TerraSana gas-water separator was used for sampling the total free and dissolved gas in sumner canisters (Fig. 1).
- Methane concentrations measured at ALS and Stratum Reservoir. Stable isotopes of methane, CO_2, water, and dissolved inorganic carbon (DIC) measured at The University of Queensland's Stable Isotope Geochemistry Laboratory. Waters analysed for cations, anions, alkalinity, Sr isotopes, ^{14}C, ^{36}Cl, ^{3}H, and metals (not discussed here).

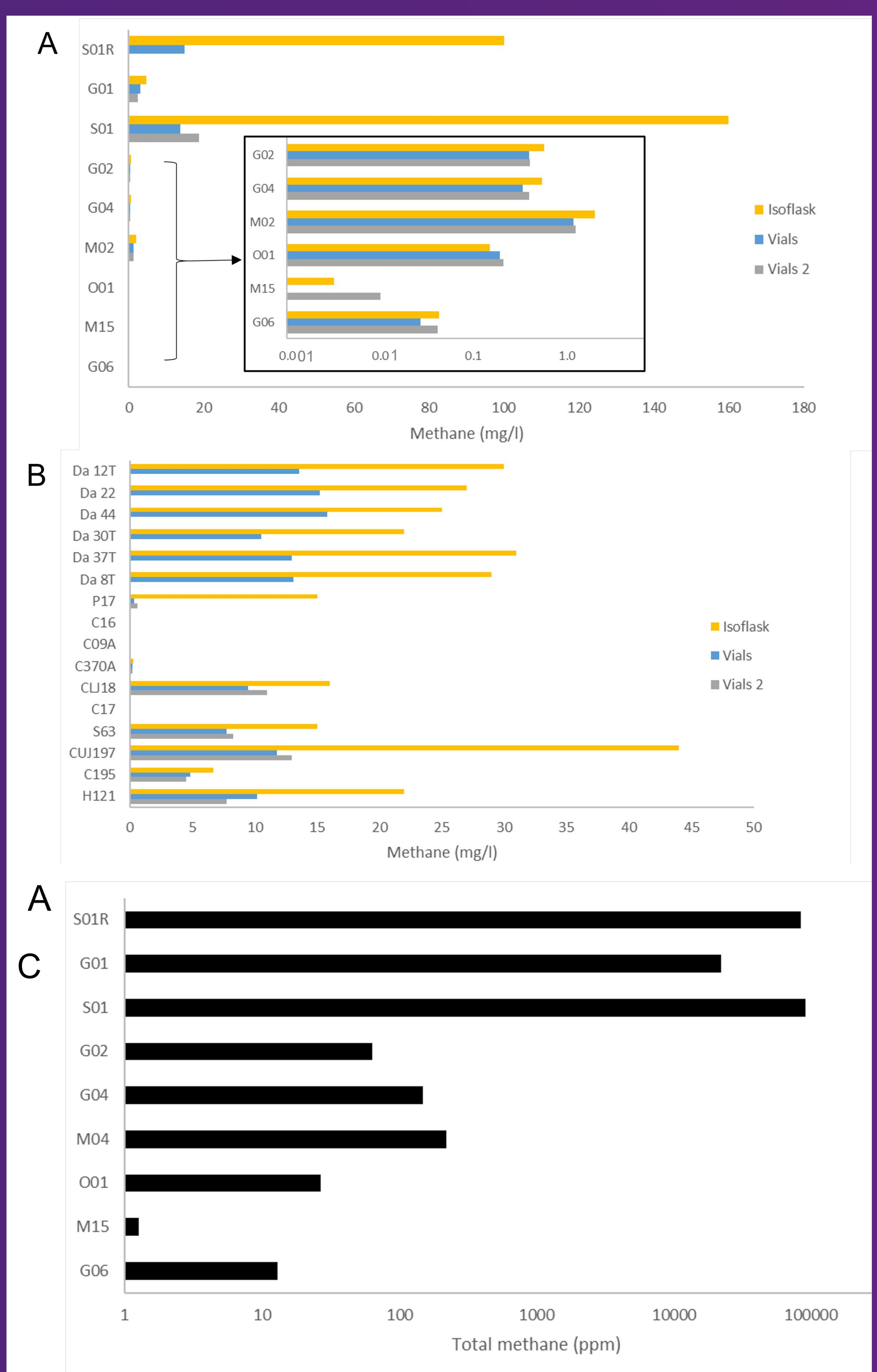

Figure 2: A) and B) Methane concentrations from water bores and CSG wells measured by vials and Isoflasks. C) Total methane measured by the gas water separator. In gassy bores open vial sampling is losing gas and underestimating concentrations.

Conclusions

- Current monitoring methods using open vial sampling for methane may be underestimating methane concentrations above ~10 to 13 mg/l in gassy bores
- Combination of isotopic techniques can distinguish methane sources and inter-aquifer disconnectivity in the majority of cases
- Measurable difference between methane and CO_2 stable isotopic signatures of CSG and the majority of aquifer and alluvium water bores sampled here overlying the Walloons coal seams. This indicates that the methane in these bores is likely generated in situ.
- A few e.g. gassy Springbok bore could not be distinguished from CSG, gas sources are unknown – more research needed!

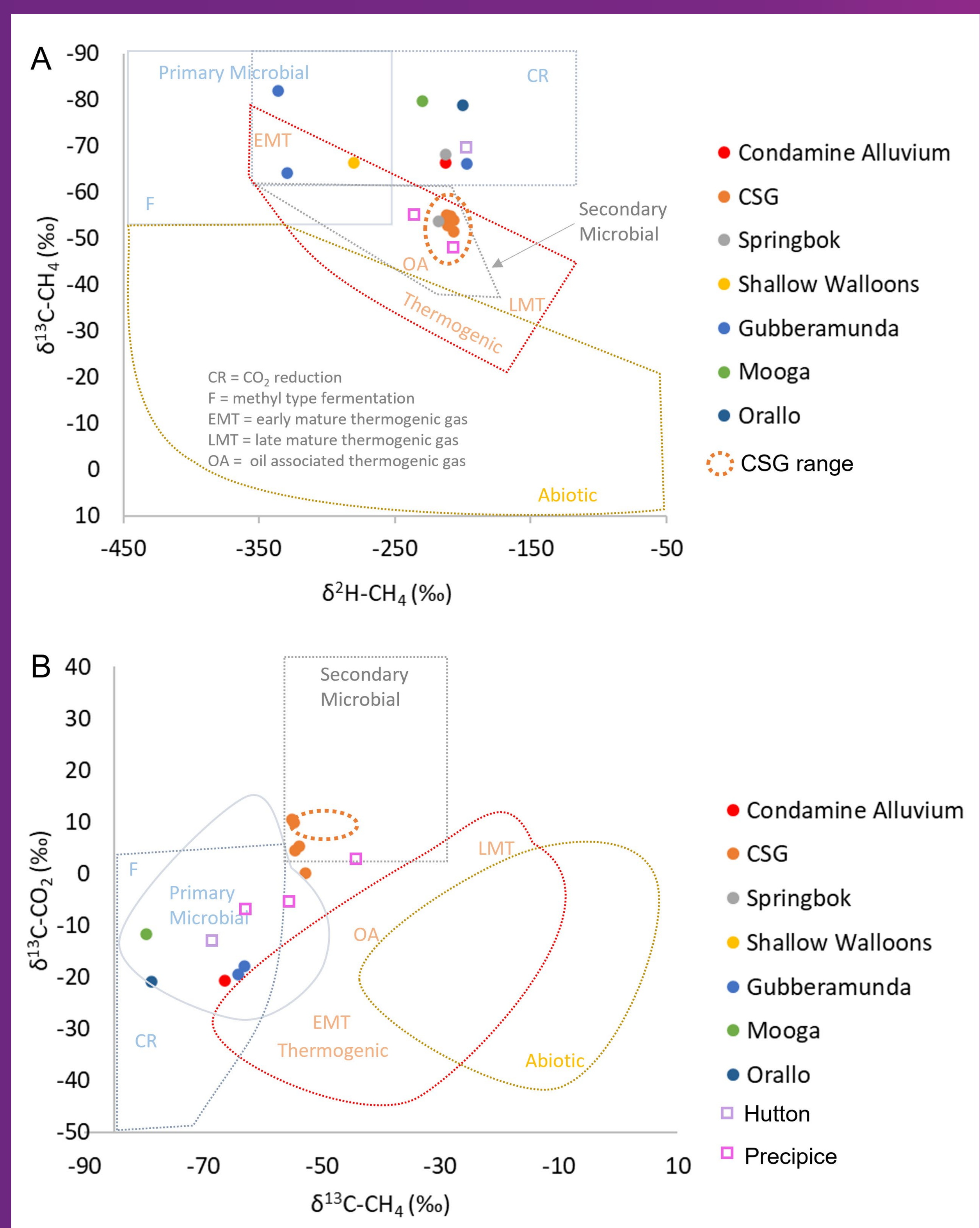

Figure 3: A) and B) Stable isotopes of methane and carbon dioxide. CSG has a secondary microbial signature. Majority of aquifers bore signatures are distinct – supports in situ methane production not leakage. A few samples including the gassy Springbok bore could not be distinguished from CSG, so the gas sources are currently unknown.

Now in press: Pearce et al., 2022. Methane in aquifers and alluvium overlying a coal seam gas region: Gas concentrations and isotopic differentiation, Science of the Total Environment https://doi.org/10.1016/j.scitotenv.2022.160639

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Acknowledgements

This research has been conducted with the support of the UQ Centre for Natural Gas, which is currently funded by The University of Queensland and the industry members – APLNG, Arrow Energy, and Santos. National Energy Resources Australia (NERA) also provided funding for this research. Landholders and CSG companies are also thanked for assistance in the field and for providing data and information.

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