Assessment of shallow subsea hydrocarbons as a proxy for leakage at offshore geologic CO2 storage sites

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Abstract

This study is part of a multi-phase effort to identify and characterize offshore geological carbon storage (GCS) potential along the Texas Gulf Coast. Previous efforts acquired a high-resolution 3D seismic dataset (P-cable™) and interpreted a seismically discontinuous zone as shallow gas pockets (<100 m below seafloor) associated with a vertical chimney structure. Our approach was to measure hydrocarbon concentrations and stable carbon isotopes near the seafloor to assess if gas migrated vertically from seismic anomalies. Deep-sourced thermogenic hydrocarbons would indicate that the structure is transmissive which could indicate an unacceptable risk for GCS at the site. Alternatively, hydrocarbons formed in-situ from biogenic processes would not preclude transmissivity of the structure but would add information to the risk assessment. Gases were extracted from 23 piston core samples recovered between 2.56 and 3.50 m subseafloor. Light hydrocarbons and stable carbon isotopes of methane were used for source attribution. The result was that geochemical signatures were consistent with typical background values observed within the first few meters of subsea sediment and therefore did not indicate leakage from depth. From our analysis, we offer insights into the use of hydrocarbon molecular and isotopic compositions at the seafloor for signal attribution as part of environmental assessments at geological CO_2 storage sites.