CO2 Storage and Hydrate Stability: A Comparison of Offshore Basaltic Reservoirs

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The U.S. Northeast Continental Shelf (Long Island Basin) and the Cascadia Basin are prospective areas for sequestering millions of tons of CO_2 into offshore basaltic reservoirs to help mitigate climate change. Carbon capture and storage removes anthropogenic CO_2 from the atmosphere and injects supercritical CO_2 fluid or dissolved CO_2 into reservoirs. Offshore geological well data from previous expeditions are available to investigate sub-seafloor basalt reservoirs for storage in these offshore areas. Carbon Dioxide clathrate exists at low temperatures (below 10°C) and a range of pressures and may serve as a trapping for injected CO_2. We utilized a software package from the Colorado School of Mines (CSMHYD) to determine the hydrate phase equilibrium for a given temperature and pressure, utilizing field data from local wells and hydrologic cruises. Our results indicate that the CO_2 hydrate stability is present at 260 m below sea level (BSL) and continues to 236 m below seafloor (BSF) through sediments in the Cascadia Basin; the hydrate stability zone is not present at the Long Island Basin due to high-temperature gradients. We also investigated the mixed-gas hydrate phase stability for N_2 and CO_2 injection because adding N2 to the system reduces the size and deepens the hydrate stability zone in the water column. In addition, using ArcGIS, we also performed a geographical analysis of each area. We collected data to depict the maritime boundaries, shipping lanes, renewable energy sources, and habitat areas of concern. These results show that the Long Island Basin area is near planned offshore wind energy lease blocks and is within United States Jurisdiction. The Cascadia Basin site is within Canadian Jurisdiction. Both sites are separated from habitat areas of concern and have access to shipping fairways lanes and zones. Insights from these analyses will help determine the potential for each region to provide successful and secure reservoirs for offshore carbon capture and storage.