Complex gas hydrate systems on the north slope of South China Sea

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Five targeted drilling expeditions (GMGS1- GMGS-5) have been conducted to confirm and characterize the occurrence of gas hydrates in the different basins of South China Sea. The first offshore production test was also successfully conducted in 2017. In addition, researchers have collected three-dimensional (3-D) seismic data, which can be used to infer geological controls on the distribution of gas hydrate within various parts of the reservoir. Three distinct classes of bottom simulating reflectors (BSRs) have been identified from the 3D seismic data. These include continuous BSRs, discontinuous BSRs and pluming BSRs. Double BSRs also occur in some places, an effect of different hydrate stability fields for gases of different compositions. The exposed gas hydrate, carbonate and flourishing chemosynthetic communities are detected using ROV with a high amplitude seismic reflection at the east of the gas hydrate drilling expedition GMGS2. Active and inactive cold seeps indicate the different activity stages of seepage. Three drilling expeditions (GMGS3&4) were conducted in the Pearl River Mouth Basin, where the BSRs occur at depths inconsistent with predicted pressure-temperature conditions due to the complex processes of sedimentation, erosion and slope failures of migrating canyons. BSRs also shoal in some places, perturbed by the upward migration of fluids. The drilling expedition indicates that gas hydrate was identified from the chimney zone where mass transport deposits are widely developed. The chimney structures with pull-up reflections were caused by high velocity of the occurrence of gas hydrate in the sediments. However, the gas hydrate systems show different geological controls and geophysical anomalies identified from the well log data and seismic data.