Authigenic Carbonates from MC 118 (Gulf of Mexico) and Their Possible Relation to Gas Hydrate Destabilization

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The occurrence of authigenic carbonate has been documented at gas hydrate sites worldwide, suggesting that the precipitation of this carbonate may be related to the formation and decomposition of gas hydrates. However, the relationship of this hydrate-carbonate association has not been well established. Here, we present data from carbonate phases that are intercalated with gas hydrates in uppermost 50 cm of sediments from the Mississippi Canyon lease block 118 (MC 118), Gulf of Mexico (GOM). The site was discovered using the Johnson Sea Link research submersible in 2002. The carbonates collected are present as nodules, slabs, and blocks. X-ray diffraction (XRD) investigation shows that these carbonate are mainly composed of high-Mg calcite, with minor amount of aragonite and dolomite. All carbonates are moderately depleted in ^{13}C ($\delta^{13}C$= -29.8 to -18.5‰ PDB) indicating that the carbon source is derived mainly from thermogenic methane or high molecular weight hydrocarbon gases, which is consistent with the dominance of structure II gas hydrates at the sampling site. The oxygen isotopic composition of carbonates ranges from +3.4 +5.8‰ PDB. On the basis of the oxygen isotopic compositions and mineralogy of carbonates, and present in-situ ambient bottom-water temperature, we show that the some of these carbonates precipitated in or near equilibrium with bottom water. On the other hand, carbonates with more enriched in ^{18}O (up to 2 ‰ PDB) are interpreted to have precipitated from ^{18}O-rich fluids probably originates from hydrate water released during gas-hydrate destabilization. Age estimates based on ^{14}C dating of shell fragments is going on and which will be used to constrain the factors controlling the destabilization of gas hydrates. The trigger of the decomposition of gas hydrate, e.g. nearby salt movement and related brines, temperature changes of the surrounding water column, and long-term sea level change will be also discussed. Overall, our results show that the massive gas-hydrate deposits at MC 118 of the GOM have indeed undergone periods of destabilization, and that the carbonate phases now associated with these deposits have recorded such destabilization.