The fragmentation, dynamics, and chemistry of eight dense and cold clumps

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The aims of this work are to explore the habitats of massive clumps and the fragmentation process at different wavelengths and scales, and study the chemical evolution in extreme cold dense conditions. Eight massive precluster clumps (G18.17, G18.21, G23.97N, G23.98, G23.44, G23.97S, G25.38, and G25.71) were selected from the SCUBA Massive Pre/Protocluster core Survey at 850 and 450 μm. VLA D-configuration at 1.3 cm, PbBI BCD-configuration at 3.5 and 1.3 mm, APEX at 870 μm observations were followed up, and archival infrared data at 4.5, 8.0, 24, 70 μm were combined to study the fragmentation of these eight clumps. The spectral line include NH3 (1,1) & (2,2), NH2D, H13CN, HC15N, and C18O, which were used to study the dynamics, and chemistry. Most of their subfragmentation seen in high spatial resolutions interferometer observations are starless or prestellar cores without corresponding mid-infrared emission. Many condensations have masses larger than 8 M_□ with R_eff □ 0.02 pc. Their core formation efficiency ranges from 12% to 53%, and their core mass spectrum is ΔN/ΔM = M^−0.91±0.08 between 4 and 20 M_□ at a scale of R_eff □ 0.02 pc. The NH2D emission peaks far offset from the continuum and NH3 cores, as suggests that the NH2D may trace the thick envelope with very low temperature and high density. There are obvious velocity gradient for the clumps seen from NH3 dynamical distribution. We obtained high degree of deuteration of around 1. The C18O is strongly depleted and frozen onto the dust grains. The star formation in these eight clumps may be triggered by UC H II regions nearby. There exists probably a hierarchical evolutionary sequence from the evolved UCHII regions nearby to infrared sources, and then to prestellar cores. The derived flatter slope of the core mass spectrum may be indicative of turbulent dominated fragmentation.