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Characteristics and Origin of Dawsonite in Songliao Basin, China: A natural analogues for CO₂ sequestration in deep-saline aquifers

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The Cretaceous dawsonite-bearing sandstone is locally distributed in Honggang and Gudian Gas Field, Songliao basin, China. Dawsonite, as a function of the role on 'CO₂ trace mineral' ^[1,2], with its existence can record that a large scale of CO₂ injected or resided in geological history. By using polarizing microscope, SEM(scanning electron microscope), INCA energy spectrum analysis, X-ray diffraction and stable isotope mass spectrometer etc., the petrology of dawsonite-bearing sandstones including framework composition, cements or authigenic minerals, diagenetic paragenesis and the origin of CO₂ forming dawsonite are investigated. The results show that dawsonite-bearing sandstones are mainly arkoses, feldspathic litharenite and lithic arkoses with medium to fine grained, poorly to moderately sorted. Dawsonite, as the important cement (the amount can be up to 17% in the sandstones), can either as cements, filling in the pores among the grains appearing as radial, bunchy, rosette, intricately trichoid and platy collective, or as replacement of feldspar and debris partly or on the whole, appeared like bunchiness or platy. The diagenetic paragenesis includes six discrete diagenetic processes in order of occurrence: (1) clay mineral coatings, quartz overgrowth, kaolinite; (2) petroleum charging; (3) CO₂ charging; (4) calcite (5) dawsonite; (6) ankerite. The $\delta^{13}\text{C}$ of dawsonite values are from -1.9 to +0.3‰PDB. The calculated $\delta^{13}\text{C}$ of CO₂ gas being in equilibrium with dawsonite range from -8.7 to -6.9‰PDB, which is in coincidence with $\delta^{13}\text{C}$ values (ranging from -9.76 to -5.74‰PDB) for CO₂ in Honggang and Gudian Gas Field. Combining with the fact that both dawsonite-bearing sandstones and CO₂ gas reservoir lie in the vicinity with deep fractures and basalt, a conclusion can be drawn as that the CO₂ for forming dawsonite and resource as gas reservoir belongs to mantle - magmatic type.

References:

- [1] Moore J et al. (2005) *Chemical Geology*, 217: 365-385
- [2] Worden R H (2006) *Marine and Petroleum Geology*, 23: 61-77

