Authigenic pyrites and implication for AOM in early diagenesis of sediments, northern South China Sea

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Several sediment intervals rich in authigenic pyrites were identified in the recovered shallow sediment cores, northern South China Sea, where the gas hydrates were sampled first time in 2007. By analysis of the pyrite crystal morphologies by SEM, the pyrite distributions and the stable sulfur isotopes measured both by the chromium reducibel sulfur (CRS) and by the individual pyrites handpicked out under the binocular microscope, as well as the core dating by the AMS 14C of foraminifera and the TOC of sediments, we recognized that the pyrites aggregated mainly in the forms of rod, sheet-like masses and the foraminifera-infilling with the octahedral microcrystals in diameters from 3 to 30 μm. Several sediment intervals in Site 4B are dominated in authigenic pyrites especiall below the depth of 95 cmbsf. There seems no clear correlation between the pyrite enrichment and the TOC of sediments, indicating the microbially sulfate reduction of sedimentary organic matter (SOM) not the main sulfur sources needed for the pyrite precipitation. The $\delta^{34}S$ of pyrites varies from -41.69‰ to -49.16‰ VCDT by the measurement of individual pyrites handpicked out under the binocular microscopes and from -42.7‰ to -48.3‰ VCDT by the CRS, indicating the joint contributions of the bacterial sulfate reductions, the disproportional sulfur processes and/or the slow sulfate reaction rates leading to these extremely negative values of pyrite $\delta^{34}S$. At least five pyrite-rich intervals having the synchronous fluctuations of $\delta^{34}S$ were recognized in Site 4B. We thus propose that the anaerobic oxidation of methane (AOM) might play the key role in pyrite enrichments and the sulfur isotopic fractionation in Site 4B during the LGM-sealevel circulation in northern South China Sea. The pyrite-riched sediment intervals might record the excursions of the paleo-SMT zones affected sensitively by the upward methane flux in gas hydrate geosystem.

[1] Xie *et al* (2013) *Science in China*: D **56**, 541-548. [2] Aharon & Fu (2000) *GCA* **64**, 233-246.