



Mineralogy and geochemistry of isolated sedimentary fabric in seep carbonates from Shenhu area, South China Sea

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Active methane seeps in Shenhu area promoted the precipitation of abundant authigenic seep carbonates which archived the seep activity. We try to trace the activity by the sedimentary fabric of seep carbonates.

Common components (Cc) of the samples were composed by coarse grain of silicates cemented by carbonate microcrystalline. Locations of special isolated components (Ic) are scattered in Cc and appear darker than Cc. The irregularly shaped Ic look like clot with sizes ranging from 200 to 700 μm . In-situ X-ray diffraction (XRD) analysis and scanning electron microscopy observation show that minerals in Ic are similar to those in Cc, which are quartz, feldspar, and clay cemented by micritic carbonate minerals. However, the Ic do not contain coarse and transparent quartz and feldspar. Their quartz and feldspar contents are lower than those of Cc, whereas clay content is higher. As the components surrounding Ic is not pure carbonates, such as aragonite, but coarse silicates and clay minerals cemented by micritic carbonates, the Ic was possible not incorporated after transport but formed autochthonously in the sediments. The actual formation mechanism is still uncertain. It could be pores before, such as seep tunnels or burrows by organism, and finally filled by micritic carbonate cementing clay minerals and fine quartz grains which were brought up by seeps, resulting in the Ic components. Thus, carbonates in the Ic could represent a later precipitation stage.

We made 5 continuous thin sections from one sample. Several Ic are found in each slice. But the shapes in corresponding locations are different. May be quite amount of thickness were consumed in the process of making thin sections. The carbonates in and surround the Ic were studied by electron probe microanalysis and in-situ XRD. The Mg/Ca (mole ratio) are overall slightly higher in Cc than in Ic in the first to fourth slice, but the trend is reversed in the fifth slice. Both the carbonates in Cc and Ic are dolomite accompanied with some minor phases of low-Mg calcite (LMC). The structure features of dolomites are almost the same, with d_{104} values around 2.906 Å. The d_{104} values of LMC vary from 3.007 to 3.025. Previously, we suggest that the contents and MgCO_3 contents of seep carbonates are positively related with the intensity and duration of sulfate-driven anaerobic oxidation of methane (SD-AOM). The similar MgCO_3 contents and structure of seep carbonates within and surround Ic possibly indicate that both of them were precipitated under extensive SD-AOM, implying a quite long duration of seep activity.