

## Factors influencing methane-derived authigenic carbonate formation at cold seep from southwestern Dongsha area in the northern South China Sea

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The mineral and geochemical studies are carried out on a profile through a diagenetic methane-derived authigenic carbonate sample which was collected from southwestern Dongsha area of the northern South China Sea. The five samples located in the cross-sectional middle mainly consists of dolomite and quartz, and two samples close to surface show small amounts of Mg-calcite. The  $\delta^{13}\text{C}$ ,  $\delta^{18}\text{O}$  and  $\delta^{44/40}\text{Ca}$  values of the samples range  $-30.59\text{‰}$ ~ $-0.30\text{‰}$  VPDB,  $3.07\text{‰}$ ~ $3.59\text{‰}$  VPDB and  $1.35\text{‰}$ ~ $1.47\text{‰}$  SRM915a, respectively, indicating a clear contribution of methane oxidation to the carbon pool from which the authigenic carbonates precipitated from. From the isotope signals alone it can not be distinguished if the carbon source is rather thermogenic gas or a mixture of biogenic methane and marine dissolved inorganic carbon (DIC). The  $\delta^{18}\text{O}$  values are in general consistent with dolomite precipitation from a fluid similar to present seawater. The observed small variability might be related to fluid oxygen isotope composition. The relative small range in calcium isotope values indicates relatively constant growth conditions and precipitation from seawater like fluid. The central part of the carbonate nodule formed under the strong influence of methane seepage, and the external part is less influenced by methane, either due to reduced methane flux to the surface or caused by erosional exhumation of the carbonate nodule from greater depth to the sediment surface.

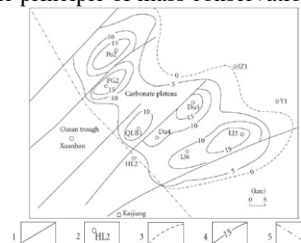
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## A Prediction Model of Oil Cracked Gas Resources and Its Application in NE Sichuan Basin, SW China

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The prediction of oil cracked gas resources is necessary and urgent in the gas exploration of these basins at high to over stage in China. A marine crude oil sample was pyrolyzed using sealed gold tubes system in our study. The pyrolysates including gas, liquid, and solid were quantitatively analyzed. Based on the pyrolysis data and kinetic calculation, the yield correlativity among gas, liquid, and solid products was regressed with high correlative coefficients to establish a prediction model suitable for the resource estimation of oil cracked gas. The verification formula for this model was also established on the principle of mass conservation.



1. Fault
2. Well
3. Boundary of sedimentary facies
4. Content contour of solid bitumen in reservoir (%)
5. Distribution area of solid bitumen in reservoir

Fig1. Content contour of solid bitumen in reservoir in NE Sichuan Basin

The affecting factors and the application preconditions of this model were discussed. Finally the model was extrapolated to the prediction of oil cracked gas resources of Feixianguan formation in NE Sichuan basin, SW China[1]. The prediction value of oil cracked resources is about  $6.84 \times 10^{12} \text{m}^3$ , and generation intensity of oil cracked gas is about  $97.5 \times 10^8 \text{m}^3/\text{km}^2$ , and the paleo-oil reserves is about  $97 \times 10^8 \text{t}$ . The verifying value for this prediction is approximately equal to 1, indicating the model is reliable in the resource estimation of oil cracked gas.

It is the first attempt to evaluate oil cracked gas resources through analyzing the increase or decrease of gas, liquid, and solid products in crude oil pyrolysis and the correlativity among the three yields.

Some new ideas are provided for the estimation of natural gas resources and the restoration of paleo-oil accumulations in the areas with high and overmature marine source rocks in south China. It is significant for the decision-making of natural gas exploration in China.