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Contents

Siliceous materials in high-quality source rocks at the bottom of the Cambrian: study on the relationship between genesis and sedimentary environment and source rock development

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Abstract

The shale of the early Cambrian Niutitang Formation is rich in organic matter and is a high-quality marine source rock, and many progress has been made in the research of the Niutitang Formation Formation, but the siliceous materials in the process of organic matter enrichment or preservation is not understood, and there is a lack of fine comparative research between siliceous rock and siliceous shale. A total of 68 pieces of 3.2m thick siliceous rock system at the bottom of the Cambrian Niutitang Formation Formation in the Yangtiao Profile in the Kaili Majiang area of Guizhou Province were sampled layer by layer at high resolution, and according to the idea of sedimentary environment-biological composition-source rock formation, elemental geochemistry, petrology, organic petrology, etc. were used as theoretical guidance, and the identification and analysis under optical microscope and scanning electron microscopy, combined with organic carbon content, main elements, and silicon isotopes and other analysis and testing methods. The biological composition and TOC content of organic carbon were analyzed in detail, the relationship between sedimentary environment and

source rock development was discussed, and siliceous rocks and siliceous shales were compared and studied. The results showed that benthic algae were main source of organic matters in siliceous rock system, and a large number of grid-like and hive-like benthic algae were often found in siliceous rocks, and the biological composition of the profile was diverse, including planktonic algae, benthic macroalgae, doubtful origins, sponge spicules, wrist worms, etc., and could be summarized into three major categories of biological microfacies: planktonic algae, benthic algae, and other biological types. The TOC content of source rocks of different biomicrofacies was different, including benthic algae (average 3.50%)> planktonic algae (average 1.46%) > other organisms (average < 1.0%) (Fig 1). The discovery of sponges and sponge spicules, a small number of circular radiolarian fossils, indicates the presence of siliceous organisms. Studies have shown that sponges are more resistant to dissolution than radiolarians, with a preservation rate of 45.2±27.4% in sediment and 6.8±10.1% in radiolarians. Therefore, it is believed that the conservation mechanism of siliceous organisms in the Majiang Yangtiao Niutitang Formation is considered to be more contributed, and sponge spicules contributed more.

A large number of sponge spicules and wrist worms were found in the siliceous rock samples of this profile, indicating that the source rocks of the Cambrian bottom Niutitang Formation were repeatedly affected by hydrothermal activity during the formation process. Sponge biomicrofacies and wrist microphase samples strongly affected by hydrothermal events had the lowest TOC. It was indicated that hydrothermal activity may have certain adverse effects on the development of source rocks in this profile.

By analyzing the correlation between organic carbon content and principal element characteristics, the results show that there is no obvious linear relationship between SiO_2, SiO_2 excess, Al_2O_3 content and TOC. The correlation analysis of SiO_2 debris, SiO_2 hydrothermal and SiO_2 organisms and TOC calculated according to the simulation method will be carried out (Fig 2). It was indicated that the input of terrestrial debris would have many effects on the enrichment of organic matter in shale, and the dilution of hydrothermal fluid was also an important factor affecting the enrichment of organic matter in marine shale, and biosilicon was positively correlated with organic matter. In order to explore the influence mechanism of siliceous on the potential of organic hydrocarbon generation, further simulation studies should be carried out.

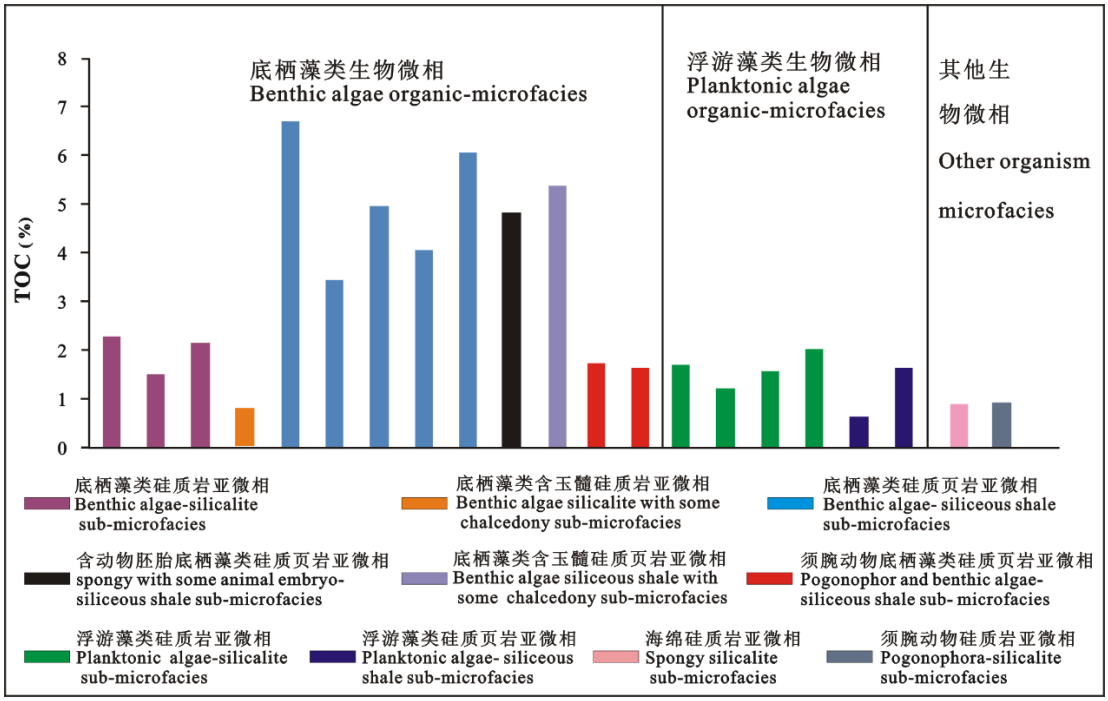

Fig.1 TOC content and biological composition of the siliceous rock series in The Yangtiao Niutitang Formation, Guizhou province

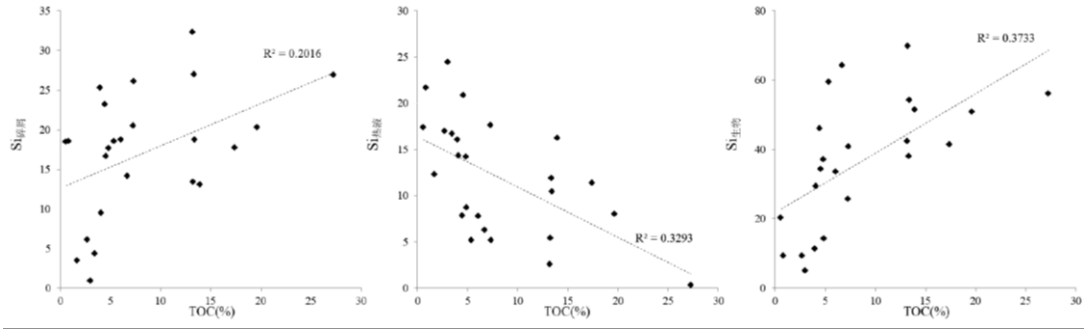

Figure.2 Correlation between TOC and SiO_2 debris, SiO_2 hydrothermal and SiO_2 organisms in The Yangtiao Nutitang Formation

Keywords: Niutitang Formation, sedimentary environment, siliceous origin, organic matter composition, organic matter preservation

Mixed Carbonate-Siliciclastic Sedimentation Characteristics in the Carboniferous to Permian, Southwestern Margin of the Tarim Basin, China

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Abstract

Mixed carbonate-siliciclastic deposits are widely developed in the Kunlun Mountain front area on the southwestern margin of the Tarim Basin during the Carboniferous to Permian period. Through the description of the actual measurements of five profiles and the microscopic observation of rock thin sections in the study area, it is believed that there are 2 types of mixed carbonate rocks and 2 types of mixed clastic rocks, and 4 types of mixed sedimentary layers developed in the study area. Three kinds of mixed sedimentary environment systems are distributed from shoreline to carbonate platform, from delta to carbonate platform, and from slope to shelf in the study area. Guided by sedimentological principles, the combined sedimentary model of Carboniferous to Permian system and the influencing factors of mixed deposition in the Kunlun fore-mountains area in the southwest margin of Tarim Basin are summarized. The study on the mixed sedimentary model of Carboniferous to Permian system in the southwest margin of Tarim Basin is helpful to understand the local paleosedimentary environment and paleogeological background, and has certain geological significance for future exploration and development.

Key words: Southwest Tarim Basin, Carboniferous, Permian, Mixed carbonate-siliciclastic deposits

Development Characteristics of Neogene Microbial Carbonate Rocks in the Qaidam Basin, China

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Abstract

As an important type of carbonate rock, microbialites are widely distributed globally, with external morphology and internal structure. The research of microbialites has always been a hot topic in sedimentology. The Qaidam Basin, with an area of 121,000 km2, is a Mesozoic and Cenozoic intermountain- basin situated in the northern Qinghai-Tibet Plateau. Influenced by the uplift of the Qinghai-Tibet Plateau, a large salt lake developed in the western Qaidam Basin during Oligocene to Miocene, and microbialites of saline lacustrine were deposited. To clarify the sedimentary characteristics and distribution of Cenozoic microbialites in the western Qaidam Basin, based on the data of outcrops, cores, and thin-sections, the classification, and characteristics of microbialites were carried out to study the differential distribution of different types of microbialites. The results showed that there are four types of Cenozoic microbialites in the western Qaidam Basin, including stromatolite, thrombolite, oncolite, and biogenic grainstone. The lacustrine microbialites in the western Qaidam basin are mainly developed in the basin margin and shallow water environment, and their distribution is controlled by the combined impact of palaeogeomorphology, sedimentary environment, climate, and hydrological conditions. Based on the analysis of palaeogeomorphology and sedimentary environment, six sedimentary models of

microbialites can be established in high energy coastal zone, high energy steep slope zone, low energy deep water zone, low energy fault zone, low energy gentle slope zone, and low energy deep water uplifts zone in the western Qaidam Basin. Influenced by the changes in the sedimentary environment, the microbialites in the western Qaidam Basin are developed in different strata, which are relatively independent. In addition, the thickness of each stratum is relatively thin, and the distribution of microbialites has obvious migration characteristics. We found that intercrystalline pores, dissolution pores, and fractures constitute the main reservoir space of the microbialites in the western Qaidam Basin, which are mostly characterized by medium-high porosity and permeability. And they are vertically interbedded with lacustrine source rocks, which can form a high-quality source rock and reservoir assemblage, which will be an important exploration field in the western Qaidam Basin.

Keywords: Qaidam Basin; Microbialites; Classification; Differential distribution

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A lacustrine carbonate record of climate fluctuation: mixed siliciclastic-microbial carbonate sediments in the Lower Cretaceous Junggar Basin

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Abstract

The climate controls the formation of lacustrine carbonates which tend to form in an arid and evaporative climate. To unravel the paleoclimate and paleoenvironment in the Lower Cretaceous Junggar Basin, we conducted an optical, cathodoluminescence, fluorescence, quantitative evaluation of minerals by scanning electron microscopy, Raman spectroscopy, carbon, oxygen, and sulfur isotopes in the Lower Cretaceous in the Junggar Basin. Lacustrine oncoids, ooids, thrombolitic clots, and thin-layered gypsums are mixed with terrigenous clasts. Some oncoids exhibit alternating dark organic carbon-rich micrites and light sparry calcite laminae with unequal thicknesses and binding structures of microbiota. Some ooids display a celebroid structure. The carbon isotopes of the carbonates are more positive compared to published data in coeval nearby regions. These lines of evidence suggest the existence of microbial-induced sediments. The sulfur isotopes of the gypsums are as negative as an average of -21.72‰, suggesting the sulfate-reducing bacteria occur in the lake. A mixing model of mixed siliciclastic-microbial carbonate sediments was established. During highstand periods, oncoidal bafflestones and thrombolites grew in the shallow lake with a relatively inadequate sediment supply, some of which were eroded and torn up by the lake wave or storm. These intraclasts, oncoids, calcite spherulites, botryoidal grains, cortoids, ostracodes, and ooids autochthonously mixed with the terrigenous clasts in an

agitated lakeshore environment rapidly and accumulated as oncoidal, ooidal, or ostracodal grainstones. Sparry carbonate cortices were peeled off from the oncoids and densely packed as intraclast wackstones in a shallow lake environment, with laminated or massive lime mudstone. The oxygen isotopes of the carbonates are generally close to their counterpart in the Late Cretaceous lacustrine carbonates that were deposited in an evaporative and arid environment. The lacustrine carbonate and episodic thin-layered gypsums are both related to short-term arid and evaporative climate fluctuation in a semi-humid setting after the aridification in the Late Jurassic.

Keywords: oncoid; thormbolite; botryoidal grains; mixed siliciclastic-carbonate sediment