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An Algal-foraminifera Reef of Carboniferous in Qinling, China

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There is a considerably good reef of Carboniferous in Sanlixia, Xunyang, Shaanxi Province on the eastern part of Qinling. The reef is built up the carbonate continental shelf of shallow sea by foraminifera and varied algae as the sedimentary basin is becoming small gradually. There are lot of fusulinids in the reef such as *Quasifusulina*, *Triticites* and *Pugosfusulina* etc., therefore the stratigraphic horizon correspond to the *Pseudoschuchergina* Zone (Ding, Y. J. 1992).

The reef is about 40m high, and the morphology almost stretch from north to south on the plan. Three parts can be observed on the field, namely base, core and lateral facies. The reef rock consists of limestone as follows; foraminifera-algal bindstone is made up by tubular foraminifera and varied calcareous aglae with skeleton and blue green aglae without skeleton binding mud and clasts; bafflestone is made up by *Dasycladus* baffling mud and clasts; sparite grainstone, which occurs in the reef base, is made up by varied bioclasts and intraclasts; crystalgal mud-limestone occurs in the reef back. There are a great deal of brachiopods in the mud-limestone. These organisms with varying size occur in collecting together and keeping original state of life.

The studied area is nearly the coast environment with higher power where there are large scale distribution of bioclasts, thus, the bioclast banks are developed well. Because of the influenced by Hercynian movement, the sedimentary basin became deeper and then varied algal moved toward the high place for living on the bioclast banks. At first *Dasycladus* fixed on the bank under assisting by the binding algae and developed to baffling framework. Afterwards a lot of tubular foraminifera with red algae and blue-green algae developed fast to form the large scale bindstone, and the reef is built up. Meanwhile, the lateral facies are formed.

After checking both reefs in the geosyncline and platform, we discover that they are very similar in many respects such as the reef morphology, scale, type of reef rocks, structure, organic content, building function and model. It is such a result that the fluence is little to the process of building reef by organisms under the different tectonic background. We think builders may be suitable well to the crustal movement, and builders can balance the fluence producing by crustal movement through adjusting the velocity of build up by organisms. On the other hand, the both of range and velocity of crustal movement are also a little comparing with growth of organic framework so the organisms may not feel the change. The distributing characteristics of the reef from north to south may also give some indication that the shape of Qinling basin in Carboniferous inherits the characteristics extending from north to south in Devonian.

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DOLOSTONES OF THE ORDOVICIAN MAJIAGOU GROUP OF ORDOS, NORTH CHINA

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The Ordos area is in the west of the North China Platform, and is 320,000km². The Ordovician Majiagou Group is mainly composed of limestones and dolostones. The dolostones are the well-known reservoir rocks of the Ordos Gas Field. There are many types of dolostones, and the major two types are mud sized to fine-silt sized crystalline dolostones (type I) and coarse-silt sized to fine-sand crystalline dolostones (type II).

Type I dolostones are earthy yellow to gray. They are thinly bedded. Laminar and wavy stromatolites, bird's eye structures and gypsum pseudomorphs are common. They are commonly associated with shales and gypsum. Their cathodoluminescence colours are dark brown to dark red. The average $\delta^{13}\text{C}$ is -0.09‰ (PDB), and the average $\delta^{18}\text{O}$ is -1.55‰ (PDB), being relatively high. The ordering degree is 0.61, being relatively low. The molar concentration of CaCO_3 is 52%, and the dolomite is Ca-rich. These characteristics show that such dolostones is Sabkha type dolostones.

Type II dolostones are the so-called saccharoid dolostones. They are gray to dark gray, and are commonly mottled. Ghosts of biograins, sandclasts and ooids are commonly observed. They are thickly bedded to massive, and are commonly associated with undolomitized limestones. Stylolites are developed, and the dolomite commonly concentrates along them. From coarse-silt sized dolomite to fine-sand sized dolomite, the average ordering degree increases from 0.77 to 0.90; the average molar concentration of CaCO_3 decreases from 51.8% to 50.4%; the average $\delta^{13}\text{C}$ decreases from 0.69‰ to 0.57‰, varying little; the average $\delta^{18}\text{O}$ decreases from -6.92‰ to -7.26‰. In fine-sand sized dolomite (major constituent of type II dolostones), the homogenization temperature is 104-350°C. These characteristics show that such dolostones were formed in deep burial environments by Mg^{2+} -rich hot water dolomitization.

Type I dolostones are the major reservoir rocks of the Ordos Gas Field at present. Type II dolostones with ghosts of biograins, sandclasts and ooids, i.e. the saccharoid dolostones whose precursor is limestones of bank facies, are relatively high in porosity, and are the best potential reservoir rocks of the Ordos Gas Field.

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ORIGIN OF WHEAT-SHAPED DOLOSTONES IN THE ORDOVICIAN MAJIAGOU FORMATION IV OF THE ORDOS, NORTH CHINA

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The massive dolostones in Majiagou Formation IV of the Ordos can be divided into the normal-shaped crystalline dolostones which are dominant and the wheat-shaped crystalline dolostones which are limited to the southeast margin of the Ordos Basin according to the crystal shape.

The wheat-shaped dolostones are a kind of mottled dolostones. The dolomite mottles are irregular belts that are almost always parallel to bedding planes in outcrops. Under the microscope, the dolomite crystals are wheat-shaped rhombs, and the size of the crystals is from 0.05mm to 0.5mm. The ratio of length to width is commonly between 2.0 to 3.0, and the long axes are unoriented. This is very similar to the arrangement of gypsum crystals. The measurement of optical axis showed that the long side is vertical to C axis of the crystal. The dolomites display weak red colour under cathodoluminescence. The studies on petrology, oxygen-carbon isotope and fluid inclusions of the main crystals show that the normal-shaped crystalline dolostones resulted from burial hot water dolomitization, and so are the wheat-shaped dolostones. But why are the crystals like wheat grains? We give following interpretation: The rocks of Majiagou Formation IV at the east part of the Central Paleorise is composed of penecontemporaneous gypsiferous dolostones and gypsum interlayers. Gypsum was dissolved at epidiagenetic stage. It made the interstitial water rich in magnesium ions and a lot of sulfate ions. Sulfate ions can restrict the growth of dolomite crystals and make the dolomite crystallization like gypsum. So the wheat-shaped dolostones are the result of the dolomitization in hot water rich in magnesium ions and sulfate ions in burial environment.

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AGES AND INTEGRATED CHEMOSTRATIGRAPHY OF NEOPROTEROZOIC CARBONATE ROCKS FROM SOUTH AMERICA

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The $^{87}\text{Sr}/^{86}\text{Sr}$ ratio of around .70740 obtained on limestones from the chronocorrelated Bambui Group (MG) and Una Group (Ba) reveal that the sedimentary basins were connected for a certain period. This value is compatible with the Vendian (610-570 Ma) and an age of ca. 595 Ma can be inferred from the secular variation curve recently proposed by Kaufman and collaborators. In both Bambui and Una Groups, the $\delta^{13}\text{C}$ values increase toward the top of the formations from ca. -4‰ (PDB) to values higher than +6‰, similar to the observed situation in the post-Varanger carbonates of Svalbard, East Greenland, Namibia and others.

A similar $^{87}\text{Sr}/^{86}\text{Sr}$ value (.70746) was found for the Araras Formation (MT) limestones taken up to now as coeval with the Corumbá Group (MT). However, the $^{87}\text{Sr}/^{86}\text{Sr}$ ratio for this last group, together with its equivalent Camba Jopho Formation in Paraguai, is very different, around .7085. This indicates that both units can be younger than the already mentioned Bambui Group and their ages can be estimated as 560+/-10Ma, a fact which is supported by the presence of Ediacaran-like fauna (590-550Ma). In contrast, the Loma Negra Formation of the Tinta Group in Argentina seems to be appreciably older, than the Bambui Group, because of the very low value of the $^{87}\text{Sr}/^{86}\text{Sr}$ ratio of ~.7060, which could indicate an age within the 900-780 Ma interval. This low ratio is close to that found in the I 6 level on Adrar limestones of Mauritania (890-874 Ma), deposited during the "Mantle" event defined by Veizer and others in 1983.