Diagenesis of Oolitic Dolostone in Second Feixianguan Member, Lower Trassic, Yudongzi outcrop, Jiangyou, Sichuan, China

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Introduction

Yudongzi outcrop, about 5km away from Erlangmiao county of Jiangyou city, locates in southern Tianjingshan anticline in northwestern Sichuan basin. The section is about 240m in length and is dissected into 3 continuous profiles namely A, B and C. The outcrop is dominated by Feixianguan Formation which is subdivided into four units, the lower lower Feixianguan(T_1f^{1-1}), the upper lower Feixianguan(T_1f^{1-2}), the middle Feixianguan(T_1f^2) and the upper Feixianguan(T_1f^3) (Fig.1). The Feixianguan Formation is underlain by the Permian reef of the Changxing Formation.

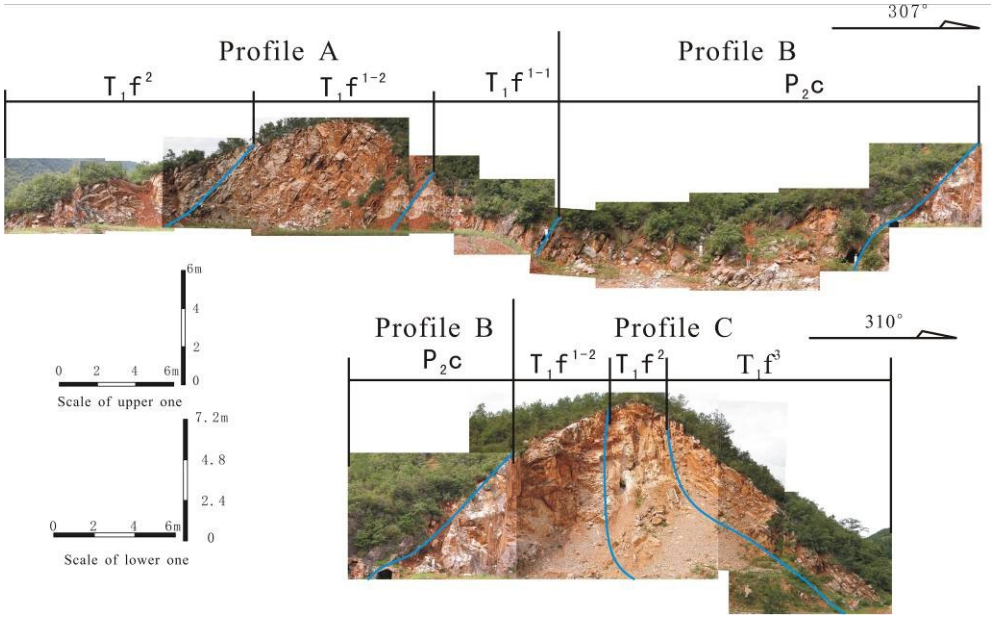


Fig.1 Yudongzi ourcrop, Erlangmiao county, Jiangyou city, Sichuan

Previous investigations indicate that oolitic dolostones of second Feixianguan member (T_1f^2) is favorable reservoir rocks in Sicuan basin. In Yudongzi outcrop, oolitic dolostones have high porosity (reaching 23.71% in some intervals) and low permeability(from 0.0126 up to

15.2752md). This paper focuses on diagenesis in second Feixianguan member (T_1f^2) to disclose the formation of the potential dolostone reservoir.

Petrology

The second Feixianguan formation is 7.5m in thickness in vertical profile A. Intraclastic limestone, bird-eye oolite-bearing dolostone and striped dolostone locate at the bottom （Fig.2）. These typical features imply that they are formed in tidal falt environment. There are three transitions from limestone to dolomstone stacking in the top of the middle Feixianguan formation. Generally, the size and content of oolites grains increase upward followed by the obvious dolomite increasment. Most oolites lose their cores leaving intragrain porosity alone. These infer that water level declines for 3 times and the sediments are formed propabably in exposed oolitic shoal in platform margin.

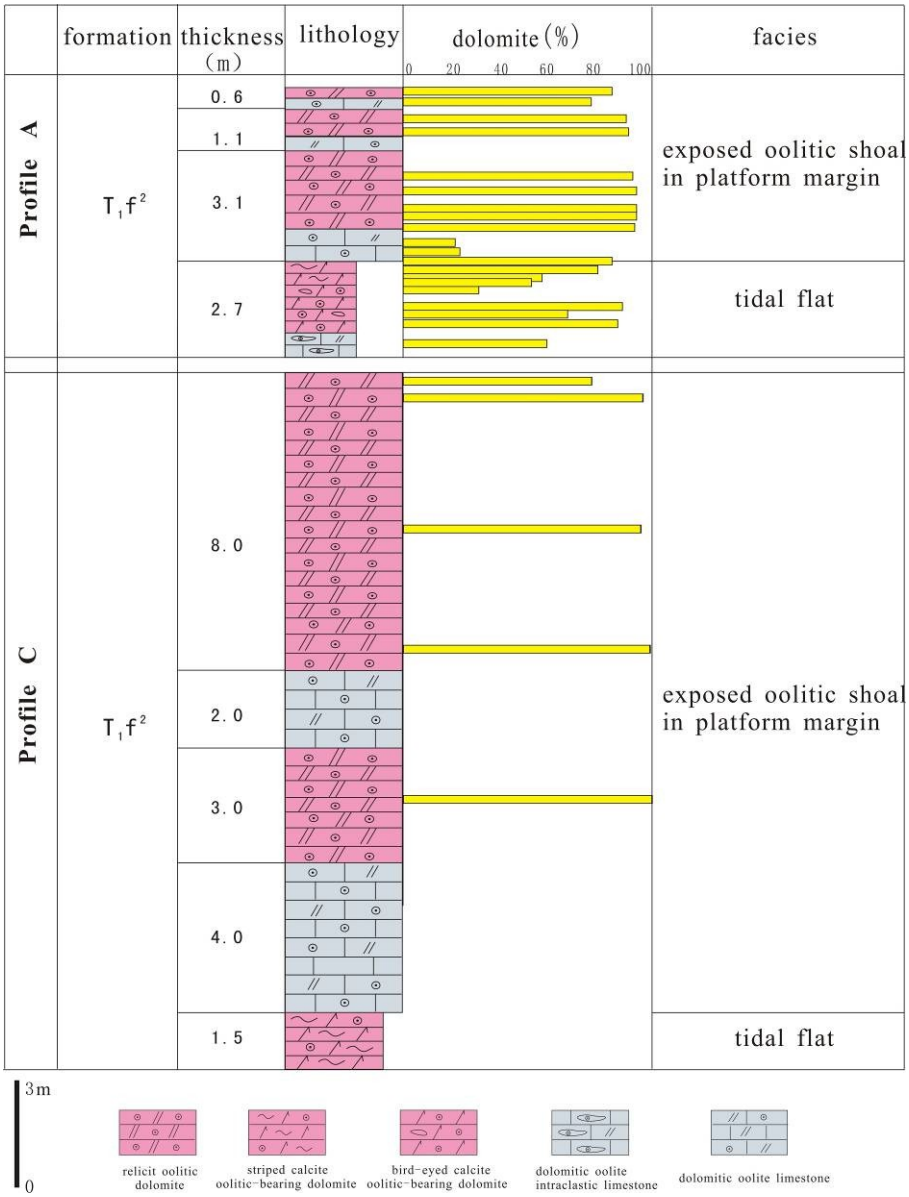


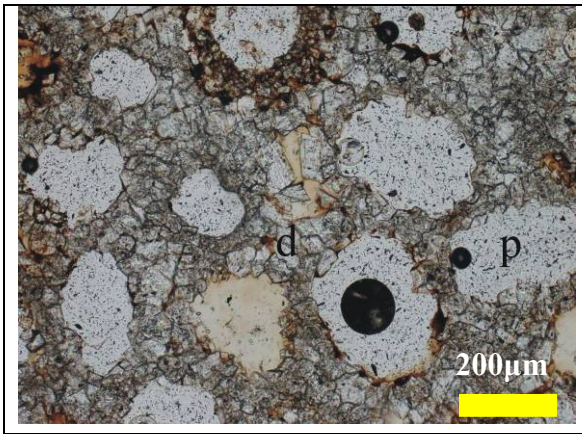
Fig.2 vertical lithology characteristics of middle Feixianguan Formation in profile A and C

The rocks compostions and textures variation in profile C is similar to profile A. In this profile, the second Feixianguan member are composed of tidal flat sediments below dominated by striped oolite-bearing dolomites and periodic oolite shoals above with interbedded oolite limestone and dolostone.

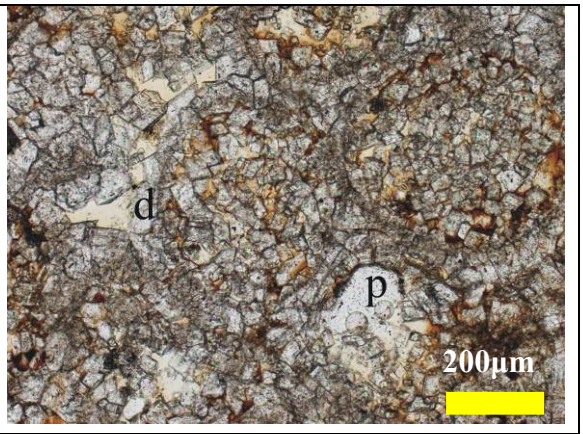
Diagenesis and diagenetic sequence

Dolomitization, dissolution, cementation and oil-filling are the 4 main diagenesis types in the outcrop. Based on the X-ray diffraction analysis of 99 samples, it shows that dolomite content of 36 samples is above 50%. 11 samples dolomite content is 100% and they all locate in the exposed oolite shoal of platform margin.

The cements between oolites are coarse dolomite crystals which are bright and pure forming the first cementation generation. These cements grow perpendicular to the surface of oolite grains(Fig.3). The dolomites are probably formed in fresh water phreatic environment. Some oolite shells are composed of dolomites which are different from the dolomite cements in texture. The crystals are comparatively smaller and dirtier. They are fromed later than the fresh water dissolution, but earlier than the dolomite cementation in fresh water phreatic environment. Therefore, we surmise that the dolomites form in depositional mixed water environment. The ordering degree of the oolite shoal range from 0.57-0.92 and average is 0.74.



A.sample YA-B-5,thin section，×10，single polarized light



B.sample YA-B-12，thin section，×10，single polarized light

Fig.3 relicit oolitic dolostone in exposed oolite shoal of platform margin.
d:dolomite，p:porosity

There are two types of dissolution: fresh water dissolution and burial dissolution. The previous mainly appear in the oolites grains in exposed oolite shoal and exhibit obvious selection. Only oolite grains are dissolved. When grains are sedimented for a short time, they are exposed to the surface before cementation and then suffer from fresh water leaching. Hence, the oolites form intragrain pores which are mostly filled by later cements. Burial dissolution also exists in the area. The acid solutions produced by organic matter evolution and decarboxylation are the main factor leading to dissolution of carbonates and formation of secondary porosity such as intercrystal pores and intergrain pores. These pores are considerably bigger than cement grains.

Two cementation generations develop in the second Feixianguan formation. The first generation are pectinate crystal grained dolomite cements. The cements are perpendicular to

the surface of grains and fill in the original porosity as euhedral crystals. The cements are common in exposed oolite shoals. The second generation cements fill in the left pores by the first generation. They are pure and bright and cement as coarse-grained mosaic structure. The cements are easy to be dissolved into pores.

Enormous oil-filling phenomenons are observed not only in the outcrop but also under the microscope work. Some pores between oolites and intragrains are totally filled by bitumen. Most pore boundaries or minerals boundaries show the distribution of residual bitumen.

Sediments in the exposed oolitic shoal experience these diagenetic environments: fresh water--mixed water--shallow burial--deep burial（fig.4）. During the entire evolution process, diagenesis near surface is strong such as fresh water dissolution and mixed water dolomitization are strong.

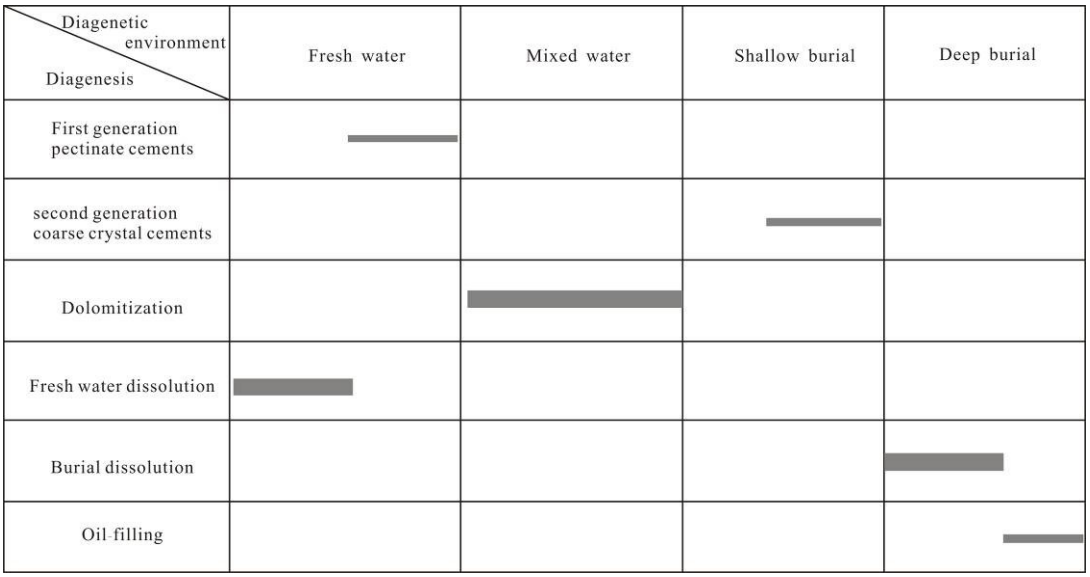


Fig.4 diagenetic sequence of second Feixianguan formation in Yudongzi outcrop