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General investigation into Upper Paleozoic sedimentary environment in southern Central Iran

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Abstract

A thick sequence of Paleozoic rocks in Central Iran with special characteristics has been investigated. This corresponds to some other regions in Iran. The aim of this research is to investigate several facies of the Paleozoic in the southern part of Central Iran containing supertidal, intertidal and lagoon facies carbonates that are found in arid climate, similar to the southern Persian Gulf and west Australian coast and sandstone, black and red shale, siltstone and conglomerate of terrigenous facies. Based on widely extended sandstone layers and the existence of dolomitic layers in the top of terrigenous sequence, we suggest the existence of a littoral environment with slow subsidence for formation of these layers. Black shales are found in the end of delta environments and small islands existing between braded channels .With increase of energy, siltstones and sandstones were formed between black shale's layers. Red shales accompanied with siltstones and tiny to grainy sandstones indicate continental tropical weather. The conglomerate layer on the paleorelief represents an off lap stage and an orogenic phase. In the sedimentary environment of the above mentioned sequence, based on the existence of different fauna, special lithologic and sedimentary structures, there can be recognized marine facies, containing littoral, intertidal, lagoon, bioclastic bar, reef and sandy bar, and continental facies, containing braided river channels and point bar.

This study demonstrates that Upper Devonian sediments were laid above the sandstone and quartzite layers, like in other regions in Central Iran, and were deposited chronologically at the Pre-Middle Frasnian.

Key words: middle Frasnian, carbonate facies, terrigenous facies, fauna.

بررسی عمومی محیط رسوبی پالئوزوئیک فوقانی در جنوب ایران مرکزی

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چکیده

توالی ضخیمی از رسوبات پالئوزوئیک در ایران مرکزی با ویژگی‌های خاص و مشابه با دیگر نقاط ایران مورد مطالعه قرارگرفتند. هدف از این تحقیق بررّسی رخساره‌های پالئوزوئیک در جنوب ایران مرکزی می‌باشد. رخساره‌های کربناته شامل رخساره‌های اینترتایدال، سوپرتایدال و لاگون می‌باشند که در مناطق خشک مانند جنوب خلیج‌فارس و غرب سواحل استرالیا یافت می‌شوند. رخساره‌های تخریبی شامل ماسه‌سنگ، شیل‌های قرمز و سیاه، سیلتستون و کنگلومرا می‌باشند. بر اساس امتداد دار بودن و گستردگی لایه‌های ماسه‌سنگ همراه با دولومیت در بخش فوقانی سکانس تخریبی، وجود یک محیط لیتورال همراه با فرونشینی آرام برای تشکیل این لایه‌ها، پیشنهاد می‌گردد.

شیل‌های تیره، در انتهای محیط‌های دلتایی و جزایر کوچکی که بعداً در بین رودهای بریده بریده به‌وجود می‌آیند، یافت می‌گردند. شیل‌های قرمز همراه با سیلتستون و ماسه‌سنگ‌های دانه‌درشت تا دانه‌ریز بیانگرمحیطی قاره‌ای با آب و هوای گرم هستند. لایه‌ی کنگلومرایی در ناهمواری قدیمی یا ناهمواری فسیل بیانگر یک مرحله بالاآمدگی و یک فاز کوهزایی می‌باشد.

بر اساس وجود فونای مختلف، لیتولوژی ویژه و ساخت‌های رسوبی در این سکانس، دو نوع رخساره‌ی دریایی شامل لیتورال، اینترتایدال، لاگون، سدّ بیوکلاستیکی، ریف، سدّ ماسه‌ای و رخساره‌ی قاره‌ای شامل رودخانه‌های بریده بریده و پوینت بار قابل تشخیص هستند.

این مطالعه ثابت می‌کند که رسوبات دونین فوقانی همانند سایر نواحی دیگر ایران مرکزی بر روی رسوبات ماسه‌سنگی وکوارتزیتی قرار می‌گیرند که همگی از نظر زمانی قبل از فرازنین میانی نهشته شده‌اند.

واژه‌های کلیدی: فراسنین میانی، رخساره های کربناته، رخساره‌های تخریبی، فون.

1. Introduction

In description geological events and paleogeographic characteristics of Iran in Caledonian orogenic cycle, has been observed that since Assintic orogenic in late Precambrian, an extensive basement including: Iran, Arabia, Iraq, south of Turkey, Pakistan and central Afghanistan had consolidated. This basement had formed an extensive craton which was covered by a shallow marine.

Therefore this extensive region of Middle East converted to stable consolidated continental platform and during this cycle an extension phase with Silurian magmatism governed to region. In Silurian phase large portion of Iran lands including: major parts of Alborz, Azerbaijan, Zagros and parts of central Iran has been converted to continental environment.

Naturally in such as area, we can not find traces of marine sediments in early upper Paleozoic. But there are also areas that in early Hercynian cycle (late Paleozoic), kept marine environment of late Caledonian cycle (early Paleozoic).In these areas, marine sedimentation were shallow marine, like terrigenous–carbonate sediments which were deposited in platforms (Khosrotehrani 1989).

2- Results and Discussion

The studied area is in south of central Iran (Fig. 1). In this area there are extensive outcrops of Paleozoic rocks. Sedimentary environment of studied sequences is investigated based on occurrence of different fauna (vertebrates like fish, invertebrates and conodont), lithologic terms, sedimentary structures and different sedimentary environments selected for these areas. These environments are marine facies including: tidal flat, lagoon, bioclastic bar, reef and sandy bar that is limited to wave effects (Figs 2, 3).

Continental facies of studied profiles includes: truncated river channels, point bar or sedimentary bars of the river. According to thin sections studies of these sequences, we described the most important sequences in several thin sections and specified their facies as follows: (Facies classification and suggestion of sedimentary model is generally based on Lasemi & Carozzi 1981 and Carozzi 1989 method). In this section type genus are Brachiopods, Corals, Tentacolites, Plecypods, Fish fossils and Conodonts which contains:

Conodonts species: *Icriodus sp., Icriodus deformatus deformatus,* Han 1987, *Icriodus cornatus,* Sannemann 1955, *Icriodus xenium,* Nazarova 1997, *Icriodus iowaensis,* Youngquist & Peterson 1947, *Pelekysgnathus indinatus,* Thomas 1949.

2.1. Laminated dol mudstone-mudstone facies

Mentioned facies has thin – bedded. Secondary dolomite was not found in this facies (Fig. 4). Such characteristics like laminated fabrics, Fenestral vesicle and evaporate mineral casts, specify their formatting in arid climates in superatidal regions.

These regions with these characteristics recently are placed in south Persian Gulf coast (sabkha), superatidal of Florida in west of Androze Island in Bahamas (Lasemi et al. 1989).

2.2. Dolomitize stromatolite boundstone facies

This medium bedded facies have yellow and brown to grey color. Stromatolite has been expanded in form of planar. Microscopic studies of this facies reveal that dolomite crystals are small to large in size.

Fenestral fabric (Fig. 5) and lamination has been clearly observed in some samples. Lamination possibly made of bitumen bearing material.

Fenestral fabric specifies super tidal environment (Shinn 1983 & Lasemi 1995). Stromatolite has been observed in inter tidal environment in recent arid climates like south Persian Gulf coast (Purser 1973).

Figure 1. View of area (Z: Zagoon, P: Padeha, S: Sibzar, B: Bahram Formations)

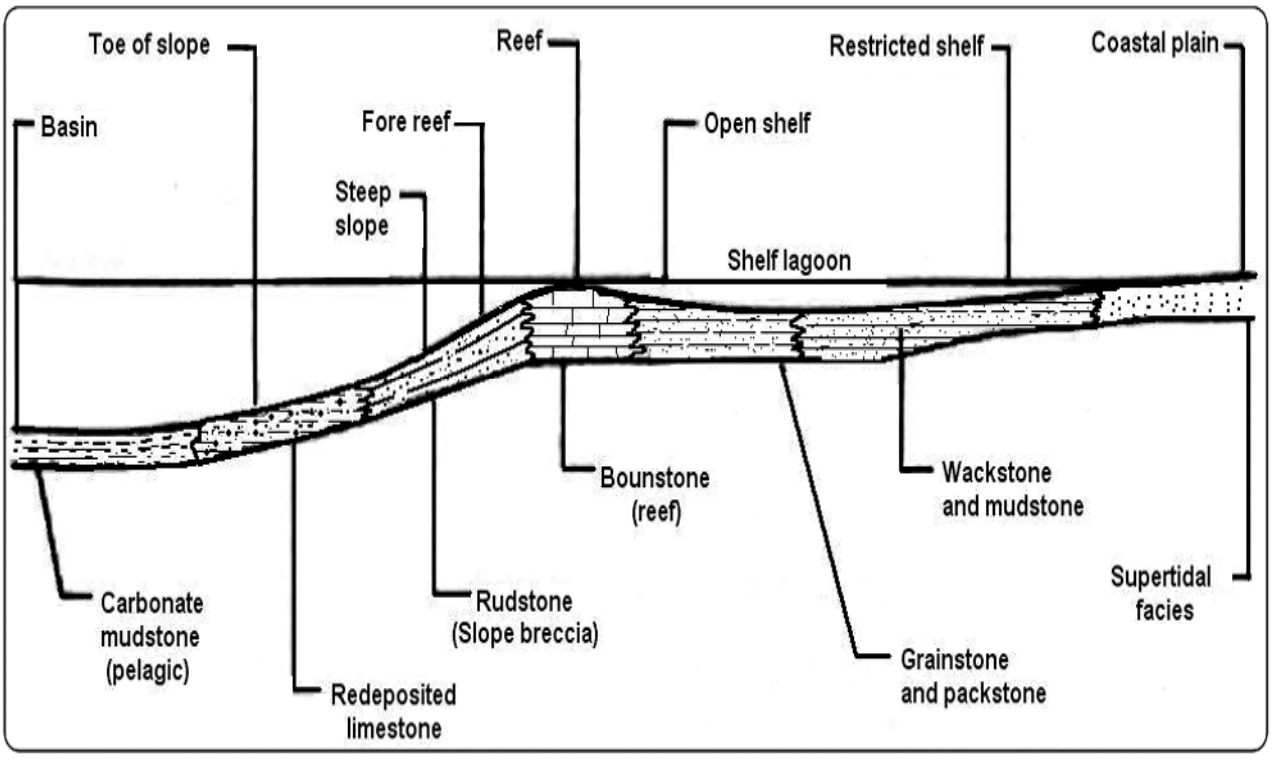

Figure 2. A profile of carbonate sees that was existed in Frasnian (Nichols 1999)

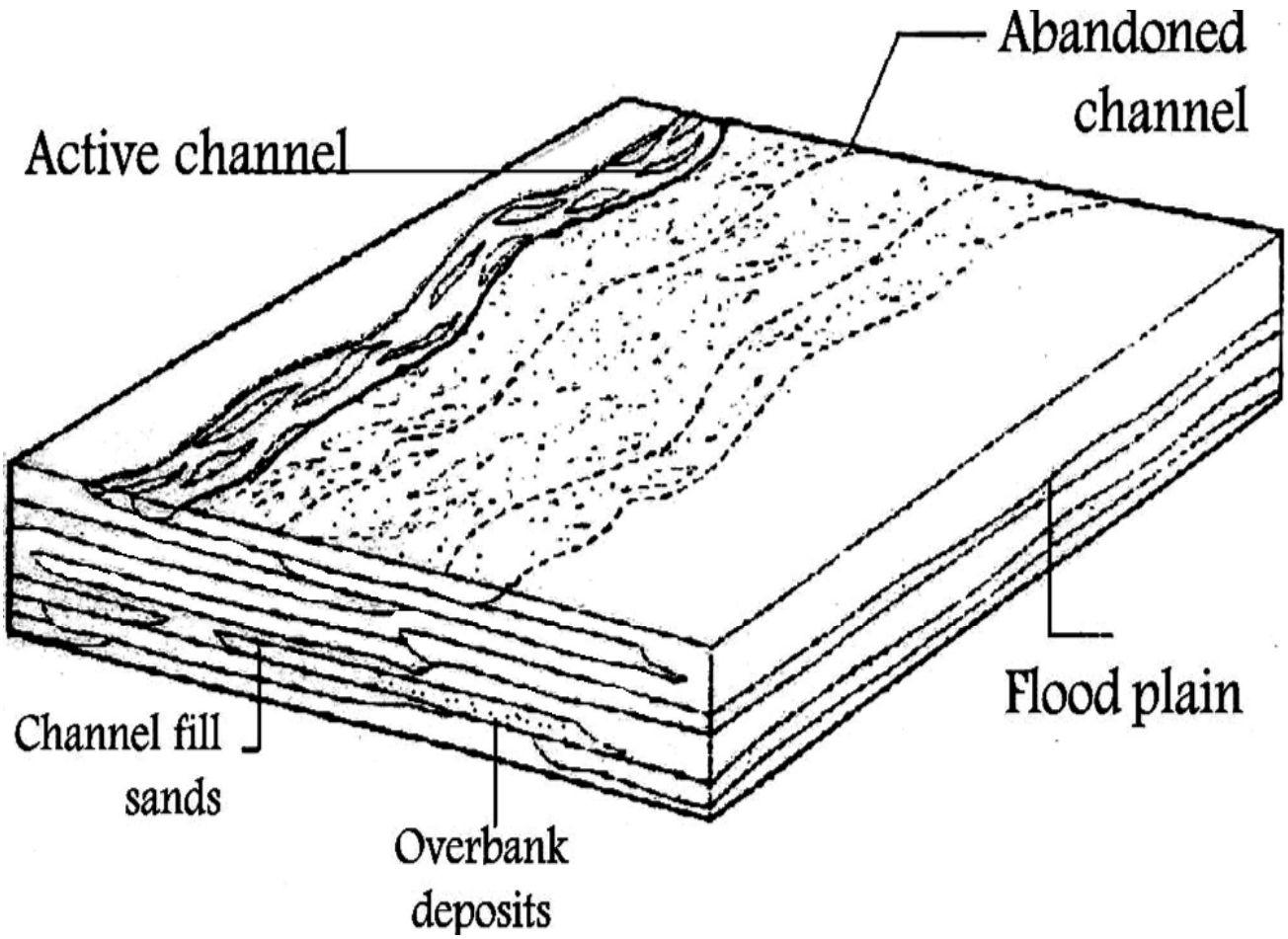

Figure 3. Difference environments coasts which are to effects waves (Nichols 1999)

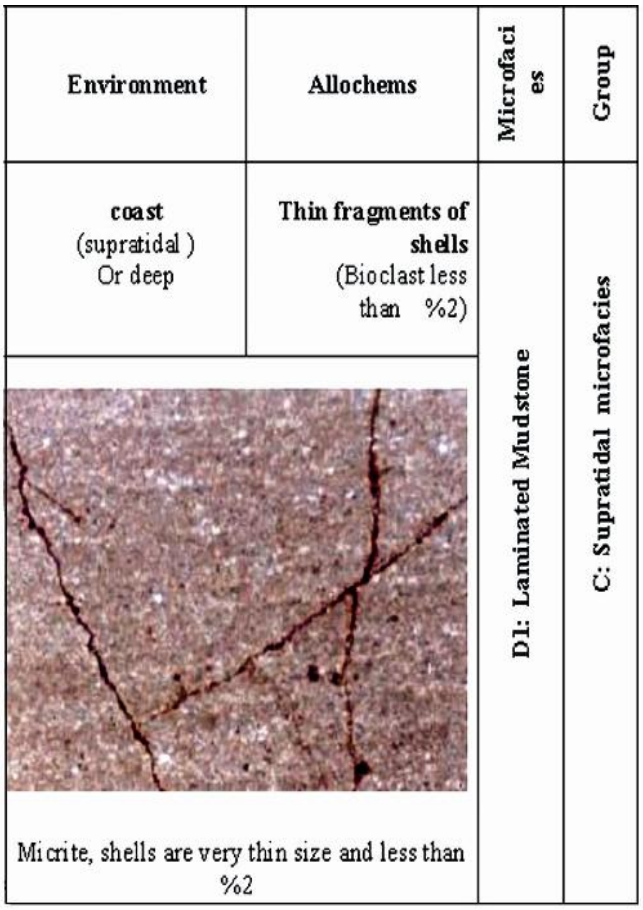

Figure 4. Mudstone laminated microfacies (×33)

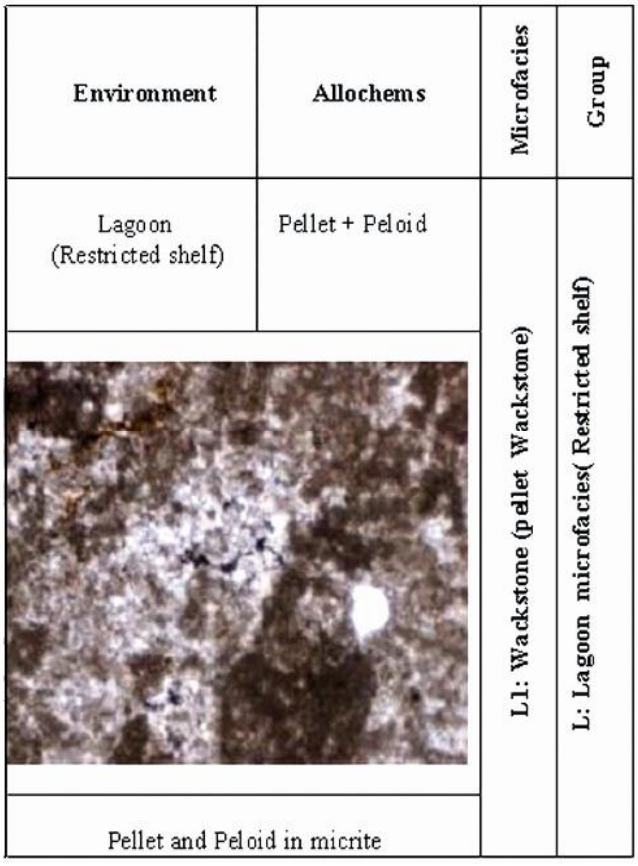

Figure 6. Wackstone Microfacies (×45)

2.3. Lagoon facies

A facies group and two carbonatic facies have been specified here.

L1: related to restricted shells that has wackstone to mudstone.

L2: related to open shelf whose carbonates in this condition is largely grainstone to packstone.

2. 3.1. Peloid wackstone- packstone

This facies has brown color with medium to thick bedded layers (Fig. 6). Dolomitization has been occurred inside this facies, pellet and Peloid amounts comprises %50 of total volume. Occasionally some of bioclasts like brachiopods comprises less than %5 of thin section.

2. 4. Sandstone facies

This medium to thick bedded facies has white, light, light yellow, light red color and includes:

-Quarts Arenite sub facies (Fig. 7)
- Litharenite sub facies (Fig. 8)
- Lithic Arkose sub facies
- Arkose sub facies (Fig. 9)

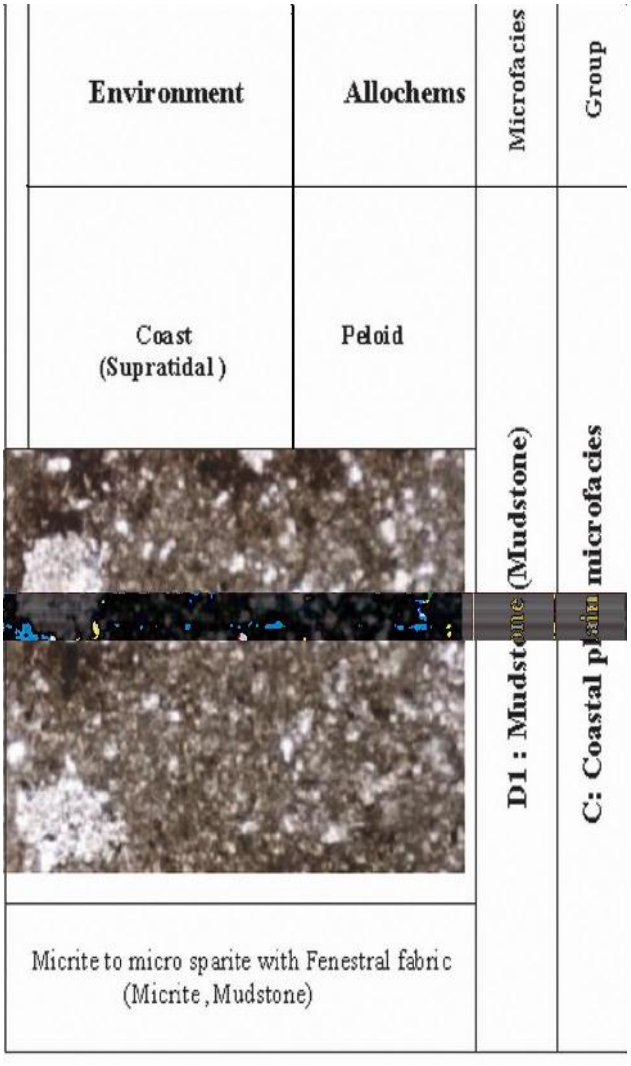

Figure 5. Wackstone Microfacies (X 33)

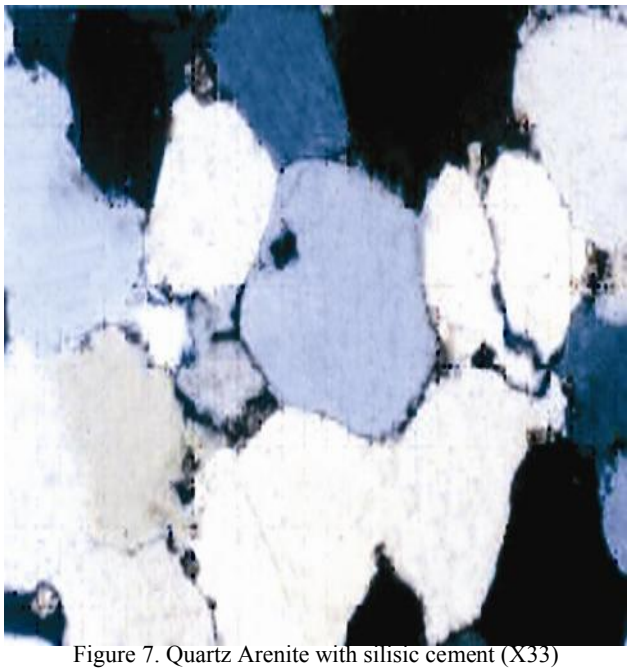

Figure 7. Quartz Arenite with silisic cement (X33)

Figure 8. Litharenite with silisic cement (X 33)

Comprising elements are generally (up to %90) mono crystal quartz that is rounded in quartz Arenite and in other facies is sub rounded to angular. Some times quartz fragments with metamorphic origin have been observed in some thin sections.

Forming cement are comprised of clay, silica, calcite to dolomite that is immature to mature relative to textural maturity and is sub mature to mature relative to mineralogy.

These sandstones have sedimentary structures like ripple mark in form symmetric or asymmetric and cross bedding. Based on sedimentary environment of this sandstone with respect of large distribution, layers continuity and dolomite paragenesis, it is a coast with low subsidence.

Figure 9. Arkosic wacke with clay cement (X 33)

2. 5. Dark shale facies

This facies is alternate with lower Frasnian carbonates, sometimes is interbedded with siltstone and sandstone. This facies is related to end part of delta and interdistributary bays. Increase in energy of environment had formed their siltstone and sandstone.

2.6. Red shale facies

This facies is with siltstones and sandstones with small to large grain size, the later is accompanied by calcrete with different thickness. These facies are related to continental environment with arid climate. Shale layers were frequently formed in flood plane and over Point bars which are some times accompanied with sandstone beds showing ripple mark, siltstone beds and laminated sandstone which is referred to flood planes.

2.7. Conglomerate facies

These beds are conglomerate to breccia – conglomerate which is laid in base of profile and overlain on Padeha dolomites. This facies has formed from thin beds of different carbonatic pebbles, separated mud fragments and basal sandstone. Erosion surface has been observed in button of these conglomerate beds.

3. Conclusion

The marine sediments of upper Devonian like other area of central Iran laid over sandstones and quartzite which all had deposited before middle Frasnian or older than *hassi* zone, but Padeha formation laid over zagoon formation with erosion plain. These sandstone beds are in alternate to sandy marl and gypsiferous marls and have no competent thickness in correlation with type section. These had deposited in coastal plain or sabkha with very low subsidence, but had formed by locally Transgression Sea, sandy dolomite and dolomite which are alternate to

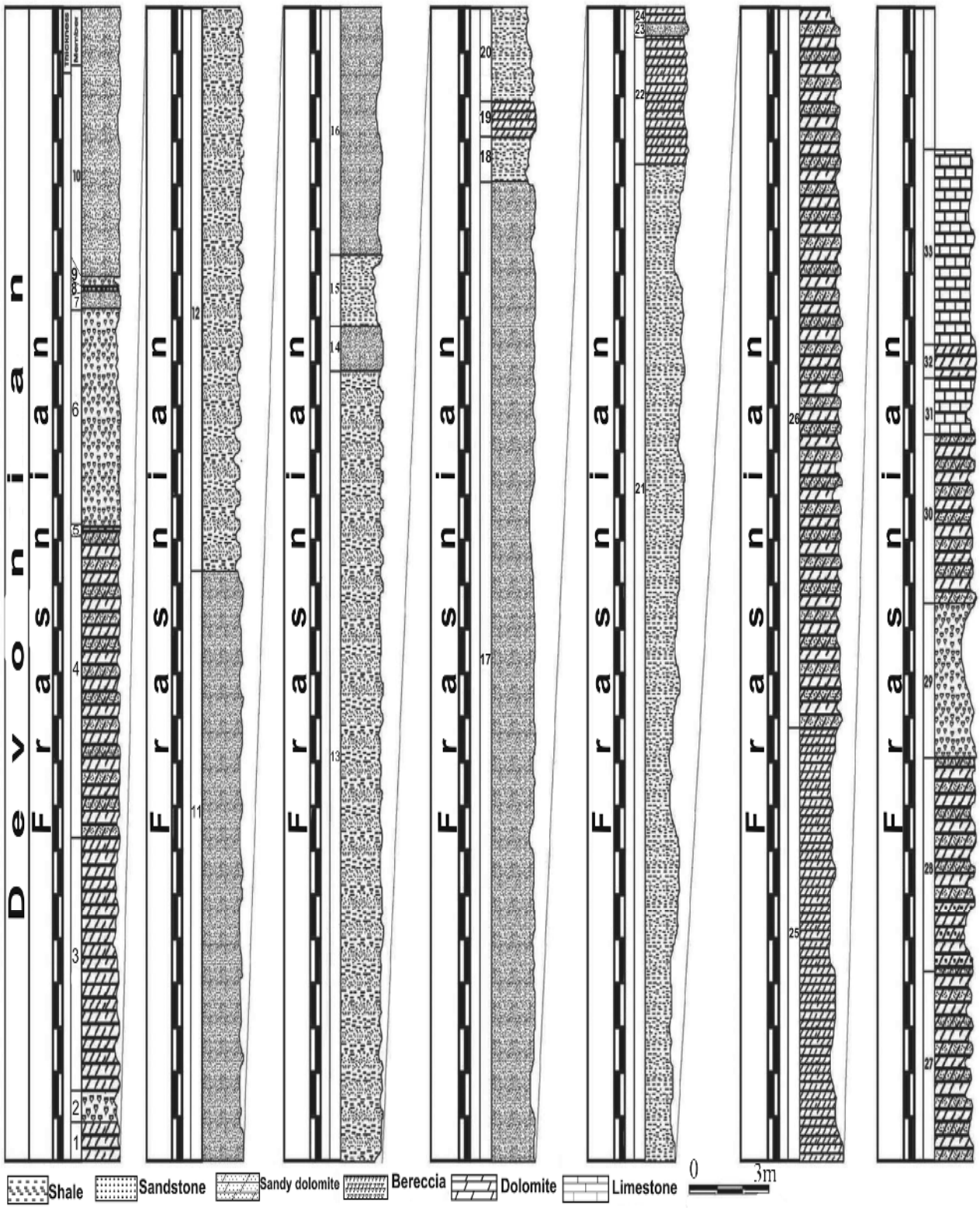

Figure 10. Columnar section of studied region

sandstones and observes in upper this member. Sea transgression had formed some conditions of shallow marine which distinguishes via forming dolomitic beds of Padeha. This transgression occurred in all regions of Iran over a coastal flat because it lacks missing elements terrigenous at base. Afterward, the continental and arid coastal conditions had occurred leading to formation of alternate terrigenous and evaporated sediments. Finally shallow sea transgression had occurred leading to the growing of coral reef.

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