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Biostratigraphy correlation, of Cretaceous successions in Kuh-e-Rahmat and Kuh-e-Sabz sections, NE Shiraz, Zagros (SW Iran)

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Abstract

Two stratigraphic sections (Kuh-e-Rahmat and Kuh-e-Sabz) of Upper Cretaceous strata in the Interior Fars region (SW of Iran) were selected. Lower Cretaceous succession of Kuh-e-Rahmat was consisted of Dariyan, Kazhdumi Sarvak and Ilam Formations. The lower contact of the Sarvak Formation with Kazhdumi Formation is described as a transitional type whereas the upper contact of Sarvak Formation was not clear. Stratigraphic distribution of microfossils reveals three biozones in this section: 1: *Palorbitolina lenticularis* (Aptian), 2: *Orbitolina concava* and *Hemicyclamina sigali* (late Albian-early Cenomanian), 3: *Stomiosphaera conoidea* (Late Cenomanian-Early Turonian). Kuh-e-Sabz lithologic aspect consists of two rock units such as: Sarvak Formation and thin-bedded limestone of lower part of Ilam Formation. The lower contact of the Sarvak Formation was not clear whereas the upper contact with Ilam Fm. was exposed as an erosional disconformity including oxidized zone. Vertical distribution of investigated taxa supports three biozones: 1: *Taberina bingistani* zone (middle Cenomanian), 2: *Praelveolina cretacea* zone (late Cenomanian), 3: *Dicyclina schlumbergeri* zone (Santonian-Campanian). The Sarvak Formation of Kuh-e-Rahmat was deposited in an inner shelf paleoenvironment (as open marine facies) because of well distributed of pelagic fauna, while Kuh-e-Sabz section mostly shows reef facies (back reef-fore) along the platform including agglutinated and porcelaneous foraminifera which reflects an inner shallow platform (0-50m).

Keywords: *Biostratigraphy, Foraminifer, Cretaceous, Zagros*

1. Introduction

Kuh-e-Rahmat section with following geographical coordinates: N: 29° 57’ 30.9" and E: 52° 55’ 36.2" is in Fars area (Northeast of Shiraz). Kuh-e-Sabz section is located north of Shiraz. The geographical coordination of the mentioned section N: 29° 51’ 48.4" and E: 52° 44’ 43.7"(Fig 1). Zagros structural zone (length nearly 1500 km and width was 100 to 300 km) was one of the most important tectonic units in Iran with NW-SE trend. Actually, it was recognized from Southeast of Turkey towards Hormoz Strait and considered as a part of Alpian- Himalayan Orogenic belt. The Zagros was divided into three main zones: Simply Folded, Imbricated and Metamorphic zones (Alavi 2004). Due to the presence of petroleum reservoirs, Zagros basin has attracted the attention of many petroleum geologists from long time ago. For the first time, stratigraphy of the Zagros area was studied by James and Wynd (1965). By the study, the Zagros was divided into four zones - Khuzestan, Lorestan, Coastal and Interior Fars zones. (Kalantari 1976) documented sub-surface biostratigraphic data which were mainly concerned with Cretaceous faunal assemblage of the Interior Fars region. Khosrow Tehrani and Fonooni (1994) established the Cenomanian biostratigraphy of the Zagros. The present research has been focused on biostratigraphy of Sarvak Formation.

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In addition vertical distribution of microfossils was the main body of this work. According to (Wynd 1965, Caron 1985, Husinec et al. 2000, Aguilera- Franco 2003, Premoli Silva and Verga 2004, Sari 2006, Afghah and Dookh 2014, Afghah and Fadaei 2014, Haftlang 2016), foraminifers and other microfossils were identified.

2. Stratigraphy

As mentioned before, three rock units (Dariyan, Kazhdumi and Sarvak Formations) are well exposed in Kuh-e Rahmat (Fig 2). 122 samples were collected from both Dariyan (Aptian) and Kazhdumi Formations (Albian) of the mentioned studied section, (48m thickness).The lithologic characteristic of the Dariyan was consisted of gray *Orbitolinid* sandy limestone whereas the Kazhdumi Formation was comprised of thin-bedded marly limestone with gray to light green color and gray thin-bedded marly limestone which is composed of fossil fragments (bivalves, gastropods).

The lower contact of Kazhdumi Formation was marked by gray thin-bedded limestone with an oxidized zone which is occurred between both Dariyan and Kazhdumi Formations whereas the upper contact was described by light gray marly thin-bedded limestone of Kazhdumi Formation which is gradually changed to gray medium and thick-bedded limestone of Sarvak Formation. It is necessary to note that, an oxidized zone is distinguished in the mentioned contact zone (lower most lithostratigraphic limit).

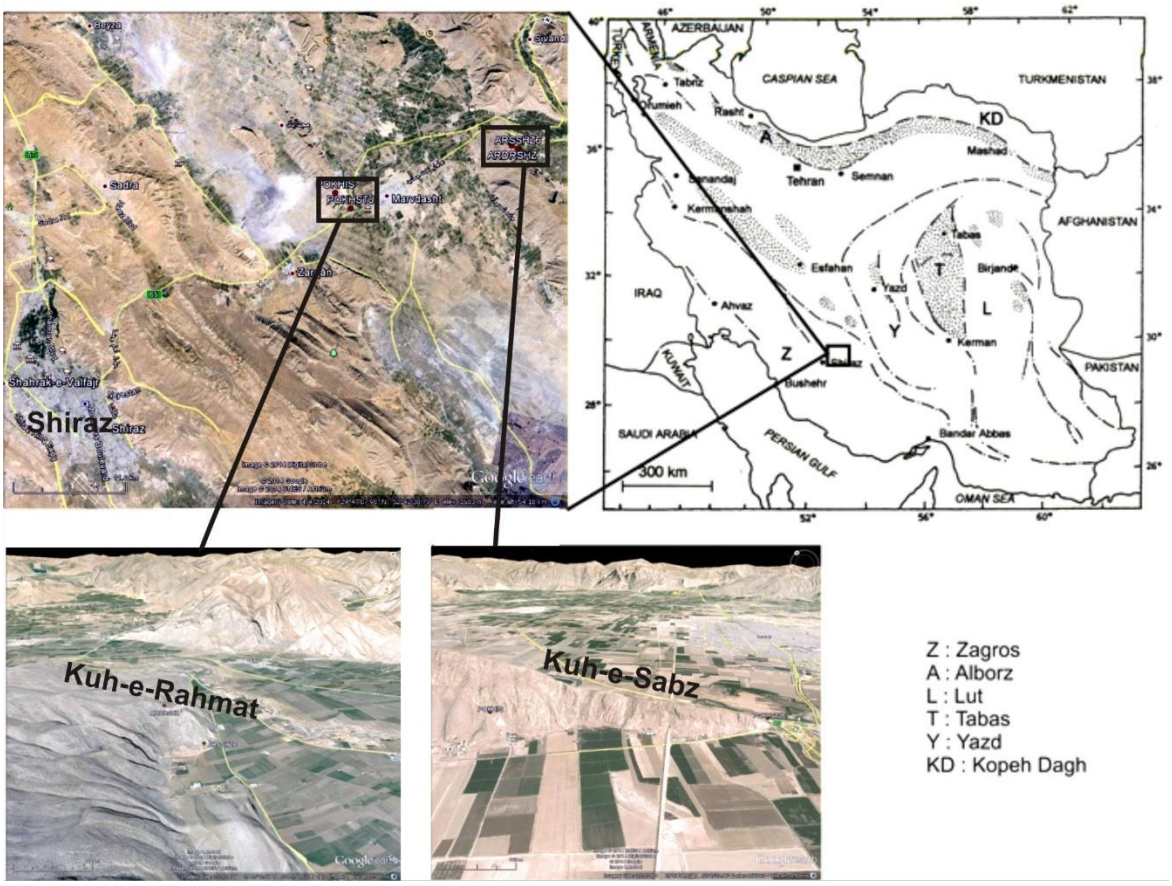

Fig 1. The geographical location of the studied sections (Kuh-e-Rahmat and Kuh-e-Sabz) and satellite photos of studied area.

Fig 2. Lower Cretaceous succession of Kuh-e Rahmat [*Orbitolinid* sandy limestone of Dariyan (Aptian), marls of Kazhdumi (Albian) and massive limestone of Sarvak (Cenomanian)] Formations.

The Sarvak Formation in Kuh-e-Rahmat section was extended approximately 412 meters and. comprised of thin-bedded gray limestone, and in some parts massive limestone interbedded with marly layers. The contact between Kazhdumi and Sarvak Formations was marked by an oxidized zone (Figs 3, 4, 5 and 6).

In addition, the Sarvak Formation can be divided into following parts (from the base to the top):

1) 81m light gray medium- to thickly-bedded limestone, interbedded with light brownish yellow thinly bedded marly layers.

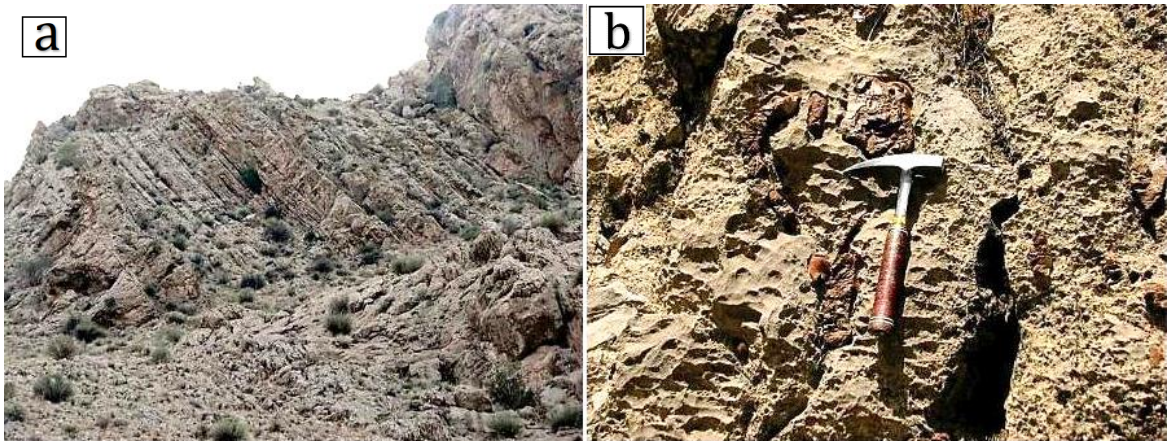

Fig 3. Mark as a) thin to medium-bedded limestone of Sarvak Formation, and b) Iron oxide nodules (oxidized zone) in thick-bedded limestone.

Fig 4. Overview of Sarvak Formation of Kuh- e- Rahmat.

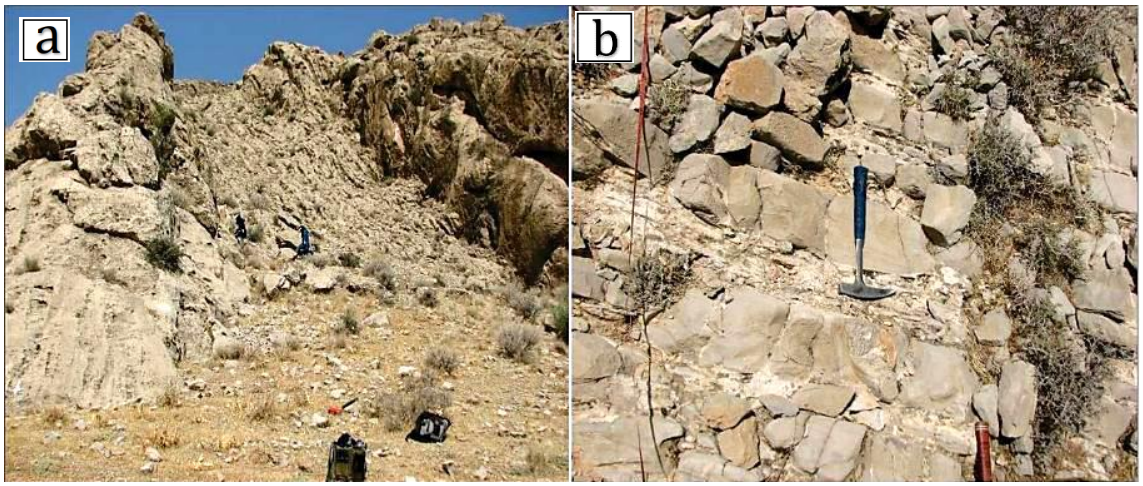

Fig 5. a) Thin to very thin- bedded limestone in Sarvak Formation, b) The marl among argillaceous limestone of Sarvak Formation.

2) 145m light gray to light brownish yellow medium-bedded limestone and gray thin-bedded marly limestone with calcite veins.
3) 74m light gray medium-bedded to massive limestone.
4) 112m light gray thin to medium-bedded limestone interbedded with gray to light green color thin-layered marly limestone.

The studied section of Kuh-e-Sabz was located in the Northeast of Marvdasht town and was 20 Km away from

Kuh-e-Rahmat section. Lithological characteristic of Sarvak Formation was Kuh-e-Sabz section is described as: the Sarvak Formation was comprised of gray limestone, very thin- bedded to massive, interbedded with marly beds. The Sarvak Formation thickness was measured approximately 284m. Additionally, 307 samples were collected both Sarvak and Ilam Formations. The upper part of Sarvak Formation was marked by an oxidized zone and light gray thin-bedded limestone of Ilam Formation with weathered gray color and gray on fresh surface which was occurred as an erosional disconformity (Figs 7,8,9,10,11 and 12). Sarvak Formation, in this section was divided into three parts (from the base to the top):

1) 95m light gray to light brownish yellow thin and medium- bedded limestone, in some parts with common calcite veins.

2) 58m light to dark gray medium-bedded to gray massive disturbed limestone bearing calcite and aragonite veins.

3)131 m light brownish yellow limestone and gray thin-bedded limestone yields fragments of rudist.

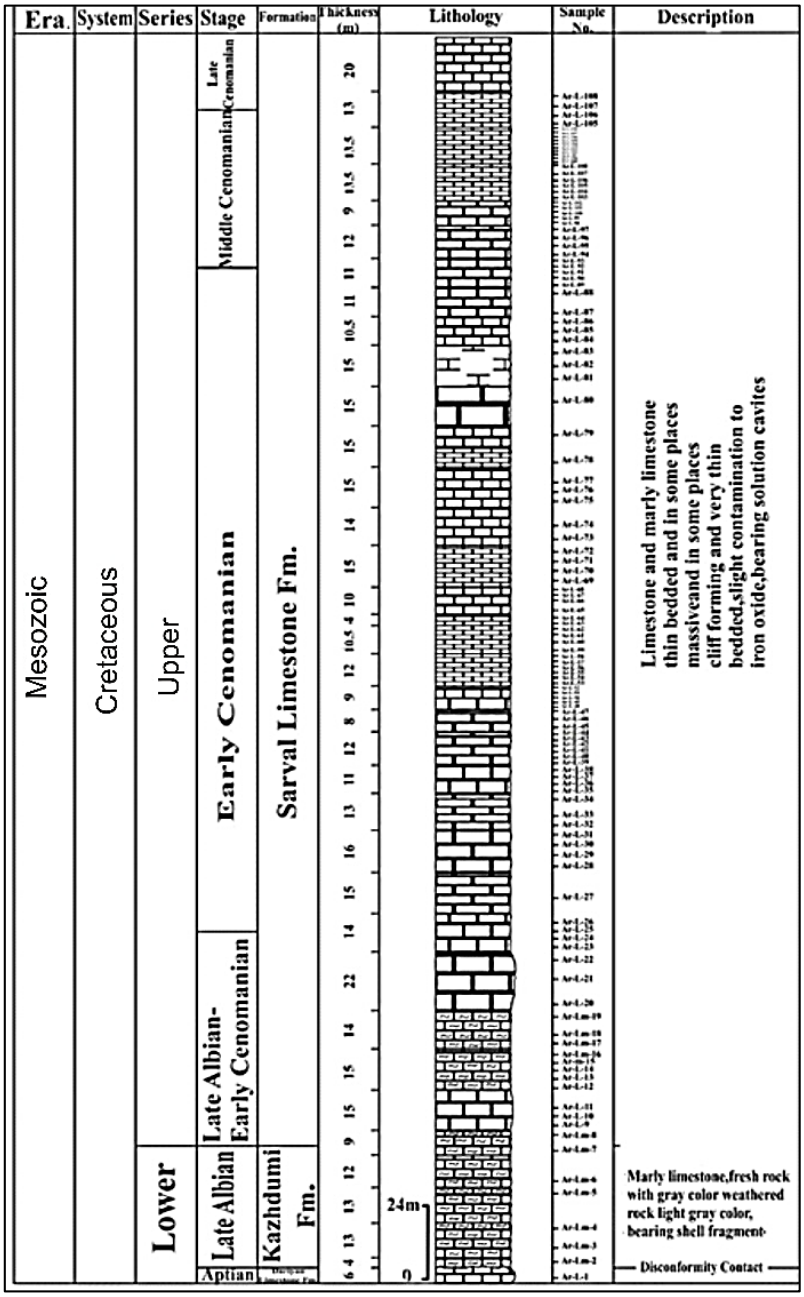

Fig 6. Lithostratigraphic column of Kuh-e-Rahmat Section.

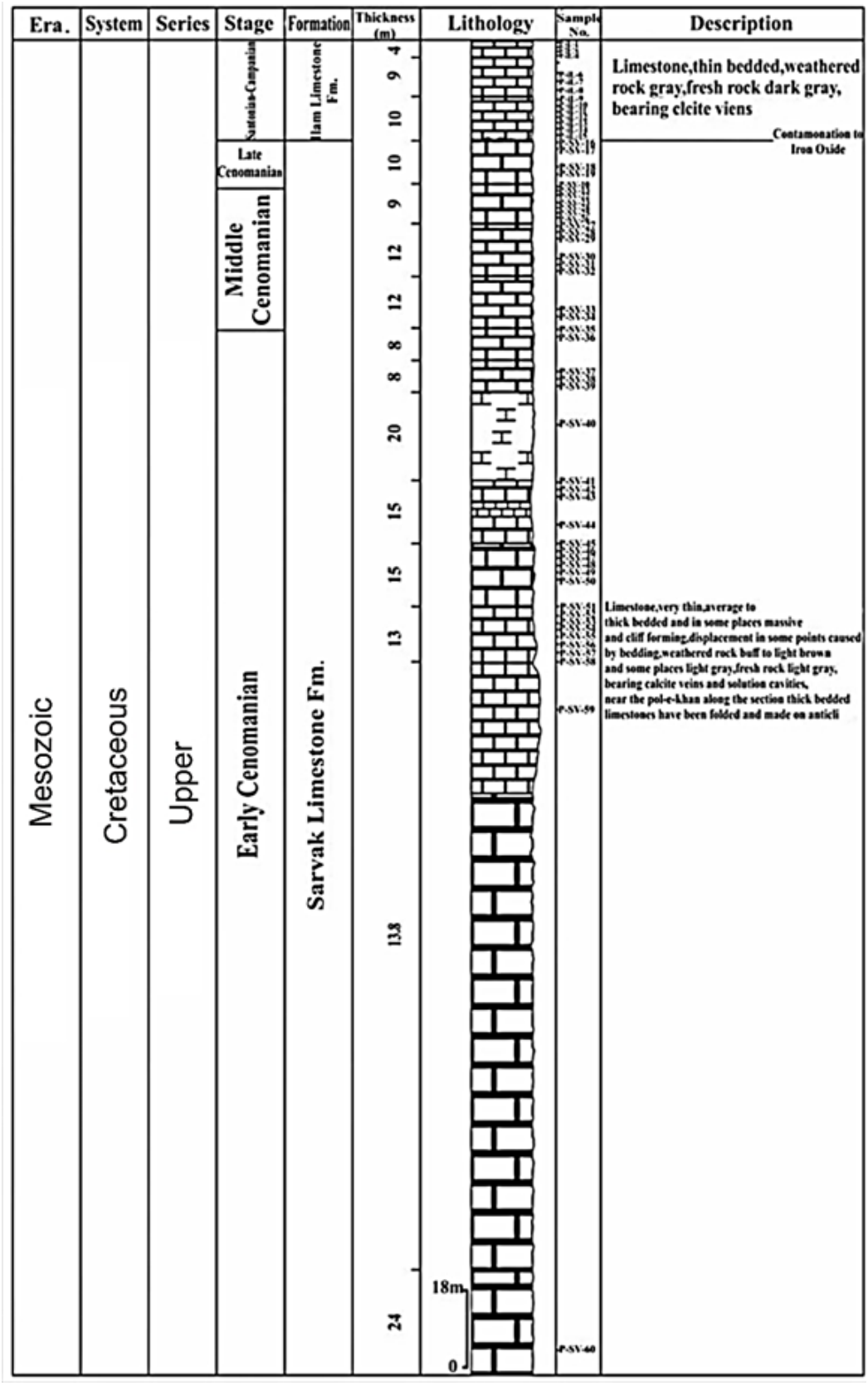

Fig 7. Lithologic aspect of Kuh- e- Sabz section.

Fig 8. The lower contact of Sarvak Formation has no outcrops in Kuh- e- Sabz section, this section begins at the side of Shiraz-Esfahan road with light gray to greyish brown limestone

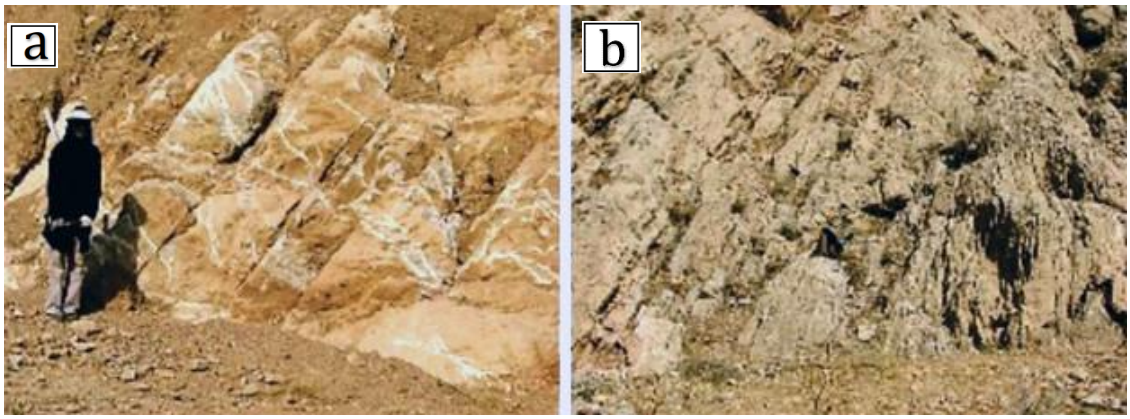

Fig 9. a) Gray medium- layered limestones of Sarvak Formation (eastern ridge of syncline at the begining of the section), b) thin- layered limeston of Sarvak Formation.

Fig 10. Extension of limestones related to Sarvak Formation in Kuh- e- Sabz section.

Fig 11. The outcrop of Sarvak and Ilam Formations in Kuh- e- Sabz section.

Fig 12. a) Train tunnel through rock making thick- bedded to massive limestones of Sarvak Formation, b) Contact between Sarvak and Ilam Formations as a depositional disconformity.

3. Biostratigraphy

Microscopic investigation of Kuh-e-Rahmat confirms the presence of 16 genus and 9 species of plankton Foraminifera, 22 genus and 10 species of benthic Foraminifera and three biozones were described (Fig 13, whereas Kuh-e-Sabz section was consisted of one genus of plankton Foraminifera, 26 genus and 13 species of benthic Foraminifera and eventually, three biozones were recognized (Fig 14).

4. Kuh-e-Rahmat biozones

Biozone No.1: *Palorbitolina lenticularis* Taxon Range zone

This biozone was extended approzimately 8 m which included contact zone of Dariyan and Kazhdumi Formations. This zone is described by the first occurrence of *Paleorbitolina lenticularis* (Blumenbach). It should be noted that this taxon was recorded from Lower Aptian sequence of Coastal Fars area by (Schroeder et al. 2010). Afghah and Shaabanpour Haghighi (2014) reported the mention taxon from Lower through Upper Aptian of Interior Fars. Therefore discrepancy of stratigraphic range was recognizable between two zones of Coastal and Interior Fars regions. However, the upper limit of this zone was marked by disappearance of the mentioned taxon which is coeval with the first presence of *Orbitolina concava* (Lamarck) and *Hemicyclammina sigali* Maync. Actually, the most foraminifers among it's coexist community were Cyclaminids, *Pseudocyclammina* sp., *Orbitolina* sp. and *Nautiloculina oolithica* Mohler. The age of this biozone, with respect to its recognized faunal assemblage, is proposed Aptian (Fig 15a).

Biozone No.2: *Orbitolina concava* and *Hemicyclammina sigali* Assemblage zone .

The present biozone was extended over 90 m and it included total of Kazhdumi Formation and Lower part of Sarvak Formation. It is observed in the samples No. Ar-LM- 2 to No. Ar- LM- 19. This biozone is marked by the first occurrence of *Orbitolina concava* Lamark and

Hemicyclammina sigali Myanc. Faunal assemblage of this biozone is comprised of: *Gaudryina* sp., *Pseudocyclammina* sp., *Rotalipora* sp., *Stomiosphaera sphaerica* Kaufmann, *Ticinella madecassiana* Sigal, *Muricohedbergella* sp., *Pithonella ovalis* Kaufmann, and calcareous algae such as: *Salpingoporella* sp. Actually *Hemicyclammina sigali* Myanc has been previously known as endemic taxon whereas *Orbitolina concava* Lamark recorded from other regions of Tethyan realm from early Cenomanian (Haftlang 2016). It is necessary to note that this species co-occur with *Hemicyclammina sigali* Myanc. Other biostratigraphic data base confirms age determination of *Orbitolina concava* Lamark as Cenomanian Orbitolinid (e.g. Bozorgnia 1964; Simmons et al. 2000) whereas (Schroeder et al. 2010) documented this species as Albian taxon.

Both *Stomiosphaera sphaerica* Kaufmann and *Pithonella ovalis* Kaufmann were previously reported from upper Albian sediments of Central Iran by (Yazdi et al. 2009). *Ticinella madecassiana* Sigal is documented from late Albian sediments of Devon (England) by (Boudagher-Fadel 2015). According to identified foraminifers and other microfossils, the age of this biozone is assigned to late Albian- early Cenomanian. Similar data has been previously recorded by (Afghah and Yaghmour 2014) (Fig 15b,c).

Biozone No. 3: *Stomiosphaera conoidea*.

The established biozone is measured over 309m. In thickness. It includes the upper part of Sarvak Formation in the studied section. Actually the *Stomiosphaera conoidea* Bonet is occurred in the samples from Ar- LM-20 to Ar- LM- 121. Microscopic study reveals microfossils and planktic foraminifers which are consisted of *Ticienlla madecassiana* Sigal, *Ticienlla roberti* (Gandolfi), *Calcisphaerula innominata* Bonet, *Whiteinella praehelvetica* (Trujillo), *Wheiteinella* sp., *Heterohelix reussi* (Cushman), *Heterohelix moremani* (Cushman), *Rotalipora baleraensis* (Gandolfi). (Omaña et al. 2014) recorded *Stomiosphaera conoidea* Bonet from Cenomaian strata of Central Mexico. Both investigated Ticinellids [*Ticienlla madecassiana* Sigal, *Ticienlla roberti* (Gandolfi)], *Heterohelix moremani* (Cushman), *Rotalipora baleraensis* (Gandolfi) were identified as Albian-Cenomaian taxa Permoli Silva and Verga (2004). The both *Whiteinella praehelvetica* (Trujillo) and *Heterohelix reussi* (Cushman) were recorded as Cenomanian- Turonian age (Permoli Silva and Verga 2004, Caron et al. 2006, Omaña et al. 2014).

This faunal assemblage is co-occurred with crushed rudist fragments. Similar biostratighraphic data were previously documented by (Afghah and Yaghmour 2014, Afghah and Dookh 2014, Afghah and Fadaeie 2014). Regards to plankton association and other identified microfossils, the Late Cenomanian-Early Turonian age (Haftlang 2016), of this biozone is acceptable (Fig 15d).

5. Kuh-e-Sabz biozones

Biozonation of the studied Sarvak Formation limestone in Kuh-e-Sabz section allows vertical distribution of various microfossils and foraminifers. As mentioned before three biozones are established along this section which are assigned to Sarvak Formation. However these biozones are described as: *Tabrina bingistani* taxon range zone, *Praealveolina cretacea* taxon range zone and *Dicyclina shlumbergeri* taxon range zone.

Biozone No. 1: *Taberina bingistani* taxon range zone

This biozone is extended over 240 m. It contains lower and middle parts of Sarvak Formation in this section and it has been also observed in the limit of the obtained samples (P- SV- 34 to P- SV- 60). Among it's coexist microfossil and foraminifer association, common foraminifers are referred to *Praealveolina* sp. and *Taberina bingistani* Henson.

According the investigated foraminifers and other recognized microfossils, the suggested age similar established biozone of the Sarvak Formation was determined mid Cenomanian Afghah and Fadaei (2014). Also by the Afghah and Fadaei (2014) the mentioned taxon which is co-occur with other early to mid Cenomanian taxa (e.g. *Cuneolina parva* Henson, *Praealveolina tenuis* Reichel) from early to mid Ceomanian age from Interior Fars area. Moreover other previous biostratigraphic data confirm determined age of this biozone (e.g. Afghah and Yaghmour 2014, Afghah and Dookh 2014). Eventually the age determination of this biozone is referred to middle Cenomanian. (Fig 15e).

Biozone No. 2: *Praealveolina cretacea* taxon range zone

Its thickness is measured approximately 30 m. The biozone includes the upper part of Sarvak Formation in the studied section (samples: P- SV- 20 to P- SV- 33). The first appearance of *Praealveolina cretacea* (d' archiac) which is coeval with last presence of *Praealveolina* sp. and *Taberina bingistani* Henson. The upper limit of this biozone is marked by the first appearance of *Dicyclina schlumbergeri* Munier-Chalmas which is synchronous with the last presence of *Praealveolina cretacea* (d' archiac). Microscopic investigation shows occurrence of *Marginotrancana* sp., and *Lnticulina* sp. as common foraminifers of this biozone. The age of this biozone, with respect to foraminiferal association is recommended late Cenomanian which is corresponded with (Orabi et al. 2012; Afghah and Yaghmour 2014). (Fig 15f).

Biozone No. 3: *Dicyclina schlumbergeri* taxon range zone

The present biozone is extended about 20 m. This biozone is referred to the upper part of Sarvak Formation and lower part of Ilam Formation in the studied section (samples: P- SV- 9 to P- SV- 19).

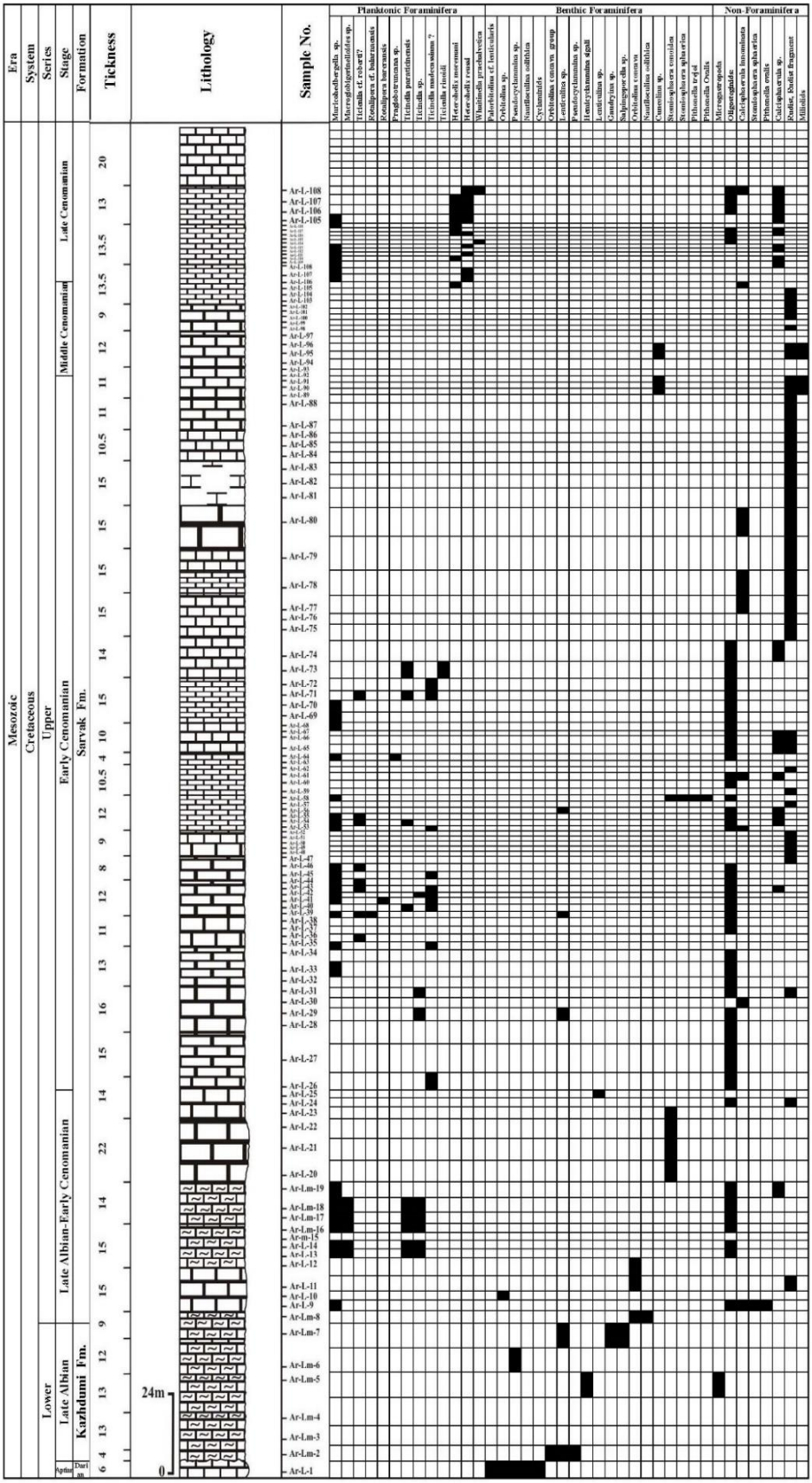

Fig 13. Biostratigraphical column of Kuh- e- Rahmat section

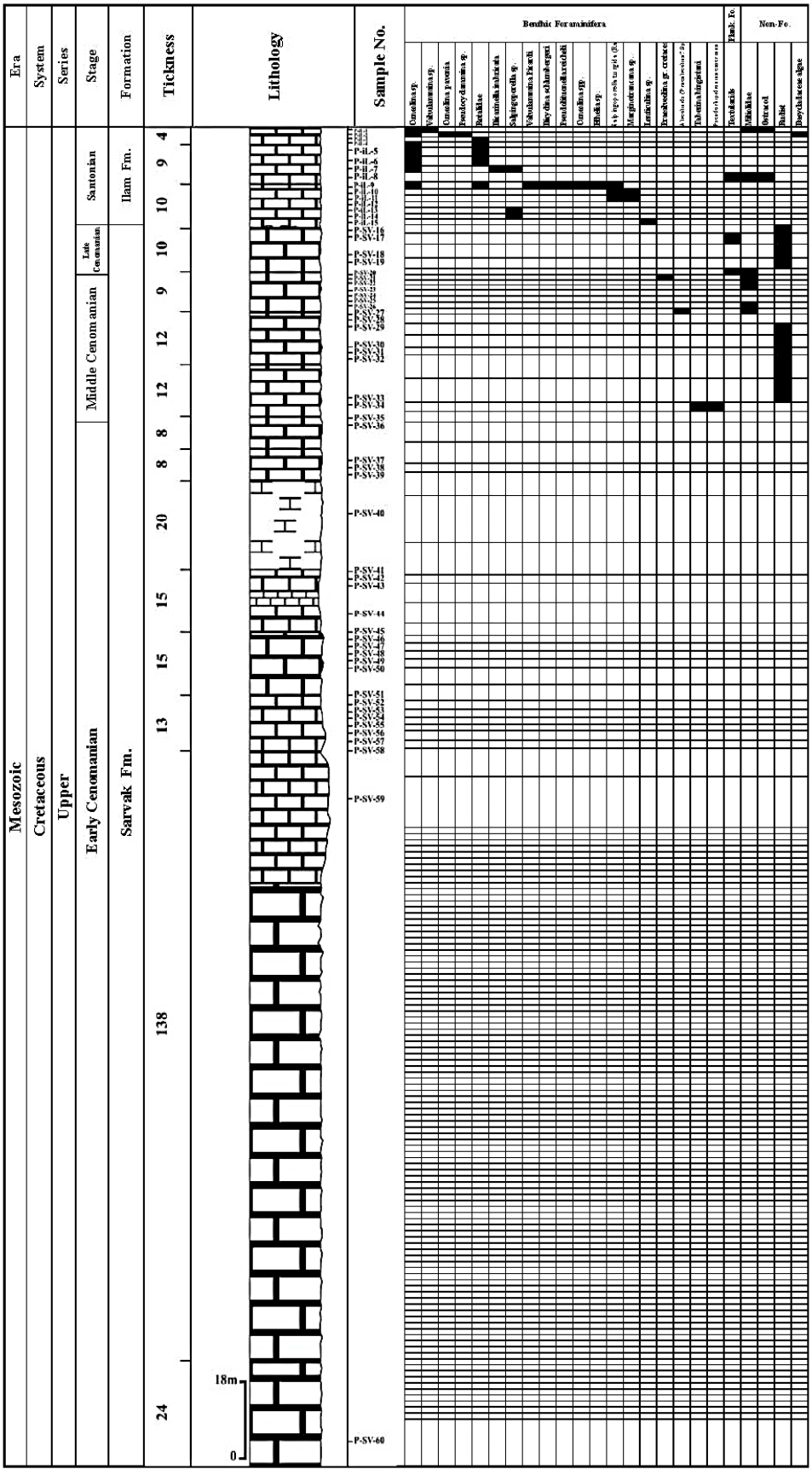

Fig 14. Biostratigraphical column of Kuh- e- Sabz section

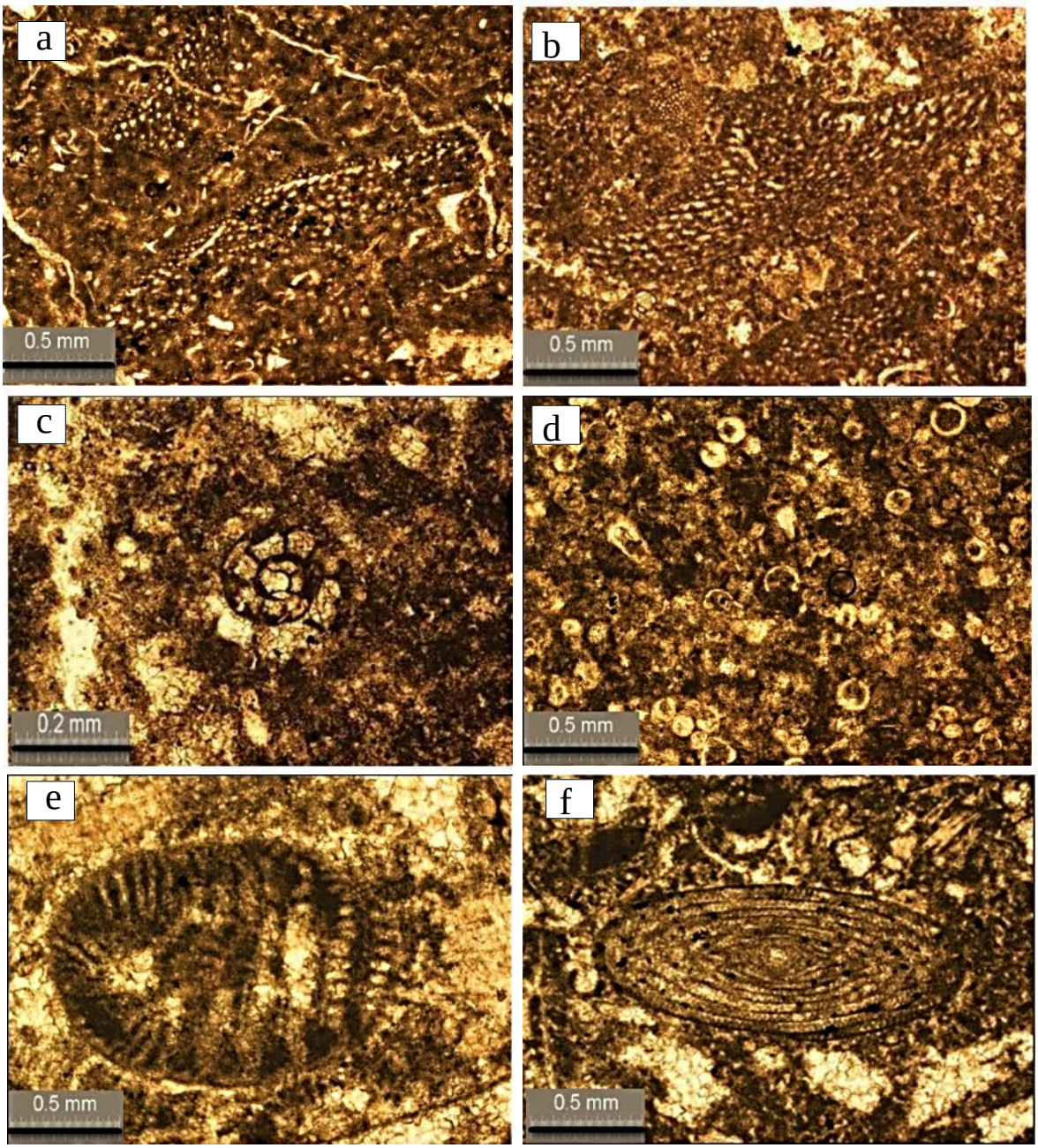

Fig15. a)*Palorbitolina lenticularis*, b) *Orbitolina concava*, c)*Hemicyclammina sigali*, d) *Stomiosphaera conoidea*, e) *Tabrina bingistani*, f) *Praealveolina cretacea*

Actually, this biozone is marked by the first through the last occurrence of *Dicyclina schlumbergeri* Munier-Chalmas. It is necessary to note that the mentioned taxon is known as long range taxon. It was previously recorded in shallow water facies of Maastrichtian strata of Interior Fars area, Afghah and Farhoudi (2012). Diagnosed foraminifers are comprised of *Cuneolina* cf. *Pavonia* d'Orbigny, *Cuneolina* sp., *Dicarinella imbricata* (Mornod). Regards to faunal assemblage of this biozone, Coniacian-Santonian age is approval (Haftlang 2016).

6. Discussion

Biocorrelation of studied sections reveals obvious variation faunal assemblage of both studied sections. Actually the section of Kuh-e-Rahmat is comprised of three segregated rock units (Dariyan, Kazhdumi and Sarvak Formations) whereas Kuh-e-Sabz section is consisted of Sarvak and Ilam Formation. The Sarvak Formation is recognizable in both studied sections. Foraminiferal and microfossil constituents of both Sarvak exposures support different faunal assemblage. Moreover the established biozones of the Sarvak Formation allows paleobathymetry condition. Suggested Kuh-e-Rahmat biozone of Sarvak Formation allows open marine paleoenvironment whereas the established biozones of the Kuh-e-Sabz confirm shallow water carbonate system of lagoon. Porcelaneous foraminifera is well distributed in Kuh-e-Sabz section which is index of lagoon environment (Afghah 2016). Therefore, there is obvious paleoenvironment variation between Cenomanian strata of Kuh-e-Sabz and Kuh-e-Rahmat sections. Biostratigraphic data of Kuh-e-Rahmat reveal shallow carbonate system during Aptian-Albian age. The presence of *Stomiosphaera conoidea* Bonet and other planktic foraminifera [e.g. *Ticienlla madecassiana* Sigal, *Ticienlla roberti* (Gandolfi), is acceptable proof of transgressive movement occurs of late Albian age which is recognizable in the basal part of Sarvak Formation. According to (Leckie 1987), the mentioned foraminifers are determined as shallow water (<100m) planktic foraminifers. Therefore stratigraphic distribution of microfossil taxa of Kuh-e-Rahmat represents outer ramp paleoenvironment whereas the biozones of the Kuh-e-Sabz is assigned to shallow water carbonate system of lagoon. The biozones of Kuh-e-Rahmat confirm transgression of sea-level during Aptian through late Albian time. Although Orbitolinids are well expand in Aptian strata Afghah and Shaabanpour (2014), the other Orbitolinids are extended in Albian sequence (Kazhdumi Formation), but in late Albian transgression of sea-level was occurred. The presence of Ticinellids and other plankton microfossils (e.g. *Calcisphaerula innominata* Benot and *Stomiosphaera conoidea* Benot) is an acceptable proof for transgressive movement occurrence which is detectable along Sarvak Formation of the mentioned section.

In the present discussion, temporal correlation and rock correlation are considered and on this basis Cenomanian deposit (Sarvak Formation) are compared with two sections: Kuh- e- Rahmat and Kuh- e- Sabz (Zagros basin). Based on vertical distribution of identified foraminifers and microfossils, the studied section are biostratigraphically correlated (Fig 16).

To compare sedimentary environment of Kuh-e-Rahmat and Kuh-e-Sabz sections, microscopic facies analysis is provided. According to mentioned study, it is obviously that the sedimentation in both sections is assigned to continental shelf. Facies analysis of Kuh- e- Sabz section supports well distributed benthic foraminifers and due to sea-level fluctuation along the platform during Cenomanian, the paleoenvironment is mostly consisted of back and fore reef which is referred to inner shallow platform environment (0- 50 m depth), while microscopic investigation of Kuh-e-Rahmat confirms the occurrence of plagic Foraminifera. According to (Dunham 1962) the Sarvak Formation are mostly comprised of packstone-wackestone and grainstone lithofacies, therefore the paleoenvironment is considered as inner shallow platform (inner shallow environment) and Open marine facies can be observed (Fig 17).

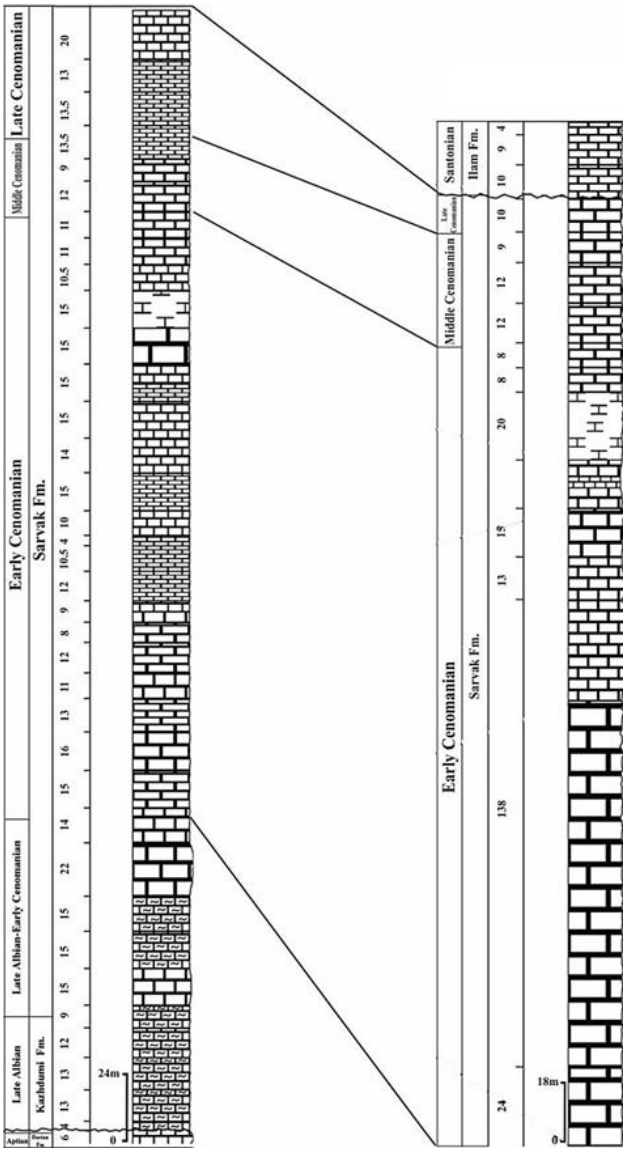

Fig 16. Biostratigraphic correlation of the Sarvak Formation (Kuh-e-Rahmat and Kuh-e-Sabz sections)

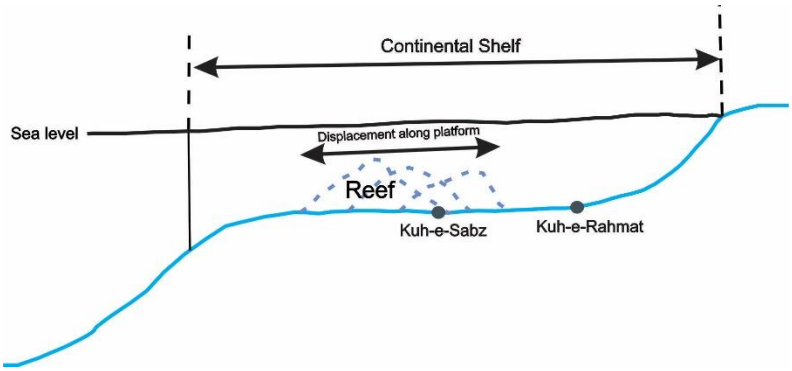

Fig 17. Schematic model of sedimentary environment of two studied Sarvak Formation sections in Interior Fars area.

7. Conclusion

Reconstruction of the Upper Cretaceous basin in Fars carbonate platform requires to collect biostratigraphic and petrographic data of other surface and sub-surface sections in Interior Fars area. Some part of these data was collected before (Afghah and Yaghmour 2014; Afghah and Dookh 2014; Afghah and Fadaei 2014). Since basement faults effects were recorded before along both Coastal and Interior Fars regions (Shaabanpour Haghighi 2014; Afghah and Yaghmour 2014; Afghah and Fadaei 2014; Afghah et al. 2016), therefore biostratigraphic and sedimentary environment studies are the major data which led us to reconstruct the lower Cretaceous sedimentary basin and biostratigraphic characterization.

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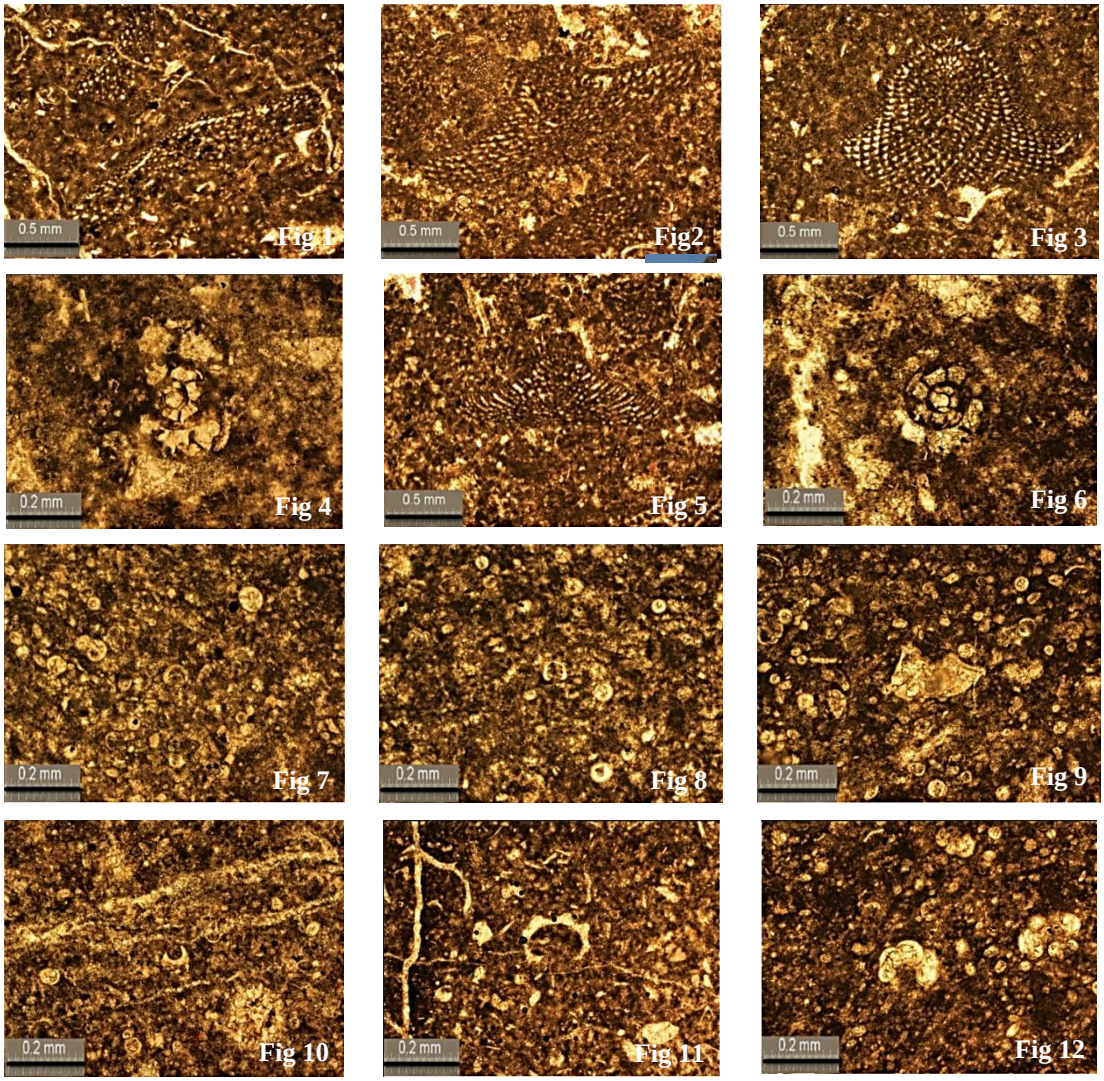

Plate 1."All figured specimens are Glauconitic sandylimestone, Equivalent Top Sarvak formation of from Kuh-e-Rahmat and kuh-e-sabz section.

Fig 1. *Palorbitolina lenticularis*
Sample No: Ar-L-1
Depositional environment: In a shallow water (Inner shelf environment)
Formation: Dariyan
Kuh-e-Rahmat section
Age:Aptian

Fig 2, 3. *Orbitolina* sp.
Depositional environment: (Inner shallow platform)
Sample No: Ar-L-11
Formation: Sarvak
Kuh-e-Rahmat section
Age: Upper Albian to Lower Cenomanian

Fig 4. *Pseudocyclammina* sp.
Depositional environment: In a shallow water (Inner shelf environment)
Sample No: Ar-LM-2
Formation: Kazhdumi
Kuh-e-Rahmat section
Age: Upper Albian

Fig 5. *Orbitolina concava*
Depositional environment: (Inner shallow platform)
Sample No: Ar-LM-8
Formation: Sarvak
Kuh-e-Rahmat section
Age: Upper Albian to Lower Cenomanian

Fig 6. *Hemicyclammina sigali*
Depositional environment: In a shallow water (Inner shelf environment)
Sample No: Ar-LM-5
Formation: Kazhdumi
Kuh-e-Rahmat section
Age: Upper Albian

Fig 7, 8. *Stomiosphaera sphaerica*
Depositional environment:Pelagic facies
Sample No: Ar-L-58
Formation: Sarvak
Kuh-e-Rahmat section
Age: Lower Cenomanian

Fig 9. *Rotalipora* sp.
Inner shallow platform (0 to 50 m):
Bio- pel Sparite
Sample No: p-il -15
Formation: Sarvak
Kuh- e- Sabz section
Age: Upper Cenomanian

Fig 10. Oligosteginids: *Pithonella ovalis*
Depositional environment: Pelagic facies
Sample No: Ar-L-58
Formation: Sarvak
Kuh-e-Rahmat section
Age: Lower Cenomanian

Fig 11. *Salpingoporella* sp.
Depositional environment: In a shallow water (Inner shelf environment)
Sample No: Ar-LM-7
Formation: Kazhdumi
Kuh-e-Rahmat section
Age: Upper Albian

Fig 12. *Muricohedbergella* spp.
Depositional environment: Open marine
Sample No:Ar-L-64
Formation:Sarvak
Kuh-e-Rahmat section
Age: Cenomanian

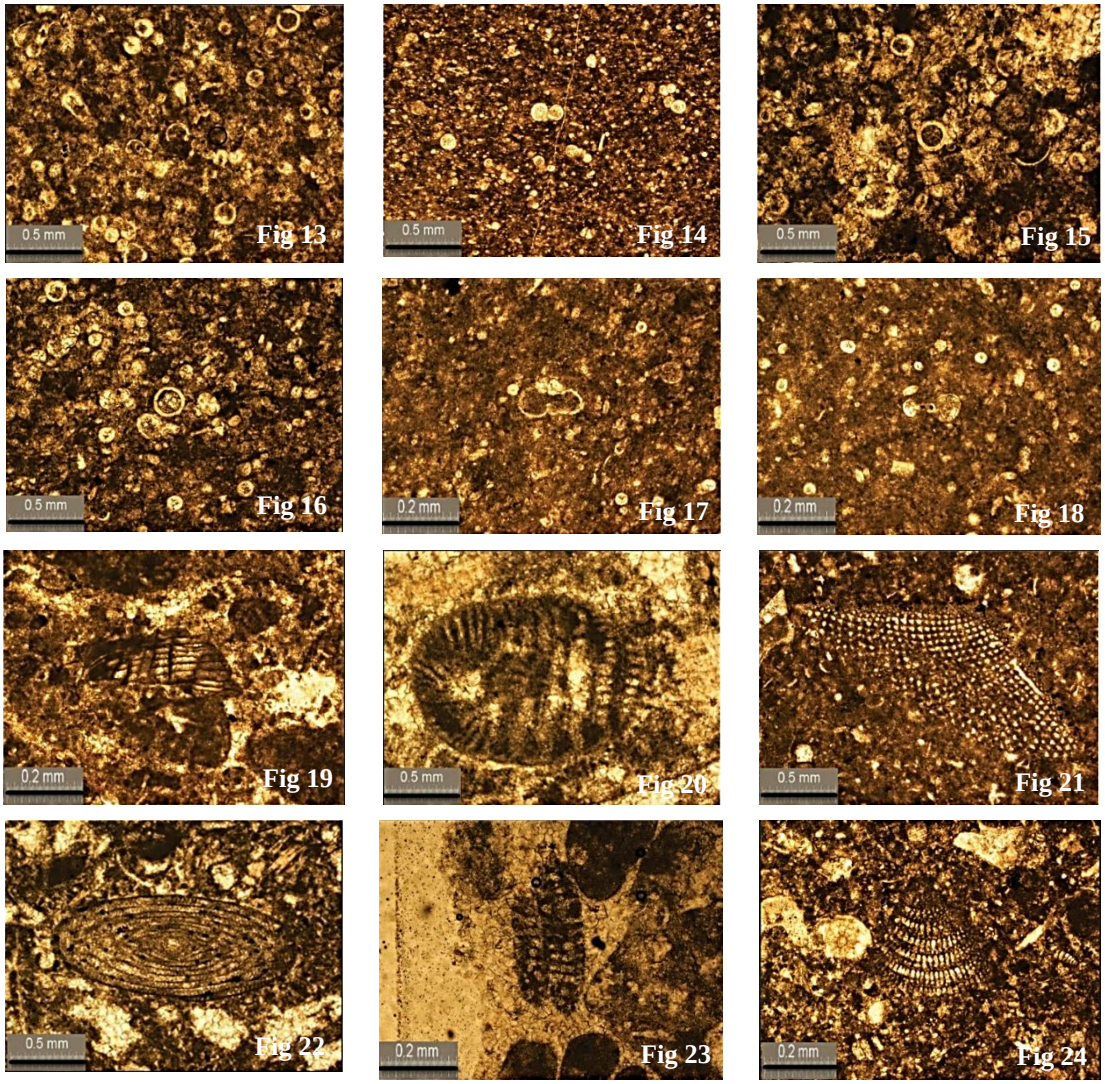

Plate 2."All figured specimens are Glauconitic sandylimestone, Equivalent Top Sarvak formation of from Kuh-e-Rahmat and kuh-e-sabz section.

Fig 13. *Stomiosphaera conoidea*
Depositional environment: Shallow water
Sample No: Ar-LM-20
Kuh-e-Rahmat section
Formation: Sarvak
Age: Late Cenomanian- Early Turonian

Fig 14. *Muricohedbergella* spp.
Depositional environment: Open marine
Sample No: Ar-L-13
Formation: Sarvak
Kuh-e-Rahmat section

Fig 15. Oligosteginids (*Calcisphaerula*)
Depositional environment: Pelagic facies
Sample No: Ar-L-56
Formation: Sarvak
Kuh-e-Rahmat section
Age: Lower Cenomanian

Fig 16. Oligosteginids: *Calcisphaerula innominata*
Depositional environment: Pelagic facies
Sample No: Ar-L-61
Formation: Sarvak
Kuh-e-Rahmat section
Age: Lower Cenomanian

Fig 17. *Muricohedbergella* sp.
Depositional environment: Open marine
Sample No: Ar-L-13
Formation: Sarvak
Kuh-e-Rahmat section
Age: Lower Cenomanian

Fig 18. *Ticenella madecassiana*
Depositional environment: Open marine facies
Sample No: Ar-L-26
Formation: Sarvak
Kuh-e-Rahmat section
Age: Lower Cenomanian

Fig 19. Rudist
Depositional environment: Pelagic facies
Sample No: Ar-L-57
Formation: Sarvak
Kuh-e-Rahmat section
Age: Lower Cenomanian

Fig 20. *Taberina bingistani*
Depositional environment: Inner shallow platform
Sample No: P-Sv-34
Formation: Sarvak
Kuh-e-Sabz section
Age: Middle Cenomanian

Fig 21. *Orbitolina* sp.
Depositional environment: Inner shallow platform
Sample No: Ar-L-11
Formation: Sarvak
Kuh-e-Rahmat section
Age: Upper Albian to Lower Cenomanian

Fig 22. *Praealveolina cretacea*
Depositional environment: (Southern Tethys) inner shallow Platform
Sample No: p-sv-20, 21
Formation: Sarvak
Kuh-e-Sabz section
Age: Middle Cenomanian

Fig 23, 24. *Cuneolina* sp.
Depositional environment: Inner shallow platform
Bio- pel sparite
Sample No: p-il-2
Formation: Ilam
Kuh-e-Sabz section
Age: Santonian