

Campanian age of the rudist *vautrinia syriaca*: paleogeographic implications; syria

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Abstract

The Rudist *Vautrinia syriaca* (VAUTRIN) was considered so far as characteristic of the Maastrichtian of the northern margin of the Arabian platform, but new research shows that it is not possible to retain this consideration. Indeed, in both types localities (J. Abd Al Aziz and Yeyla) this rudist is present in breccia. The biostratigraphic analysis of the environment in the first locality can assign a Campanian age or precampanien age.

The study demonstrated also that the presence of the Rudist *Vautrinia syriaca* (VAUTRIN) within breccia and conglomeratic sediments above the ophiolitic complex in the north-west of Syria (Al Bassite - Yella hill) shows that the ophiolite emplacement along the northern Arabian Platform has happened in the Campanian time or in Precampanian time and not during the Maastrichtian time.

The presence of huge blocks of ophiolite on the surface of the Turonian limestone layers near Saarinjek village in Afrin Mountains (Kurdag) confirmed that the ophiolitic complex emplaced on the edge of the Arabian Platform at the end of the Turonian / early Coniacian, and not during the Maastrichtian.

The obduction of the ophiolitic complex explains the big marine transgression on the Arabian Platform since the beginning of Senonian.

Keywords : *Cretaceous, Rudist, Ophiolite Vautrinia syriaca, Syria*

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عمر الكامبانيان للروديست *Vautrinia syriaca*:

مضامين باليوغرافية؛ سورية

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الملخص

عُدَّت المستحاثَة *Vautrinia syriaca* مميزة لطابق الماستريختيان في منطقة الحافة الشمالية للسطيحة العربية. غير أن بحوثاً جديدة أظهرت أنه من غير الممكن اعتماد هذا التاريخ. فهذه المستحاثَة في موقعها الأصليين (جبل عبد العزيز وهضبة يابلا) موجودة بصورة منقحة ضمن رسوبات بريشية-كونغلوميراتية. وقد بينت التحاليل البيوستراتغرافية لبيئة الموقع الأول أنها عائدة إلى عمر الكامبانيان أو إلى عمر ما قبل الكامبانيان وليس إلى عمر الماستريختيان.

كما بينت الدراسة أن وجود المستحاثَة *Vautrinia syriaca* ضمن توضعات بريشية كونغلوميراتية تعلو المعقد الأفيوليتي في الشمال الغربي من سورية (منطقة البسيط- تلة بيلا) يدل على أن زحف المعقد الأفيوليتي إلى شمال السطيحة العربية قد حدث في زمن الكامبانيان أو زمن ما قبل الكامبانيان وليس في زمن الماستريختيان. وقد أكد وجود كتل ضخمة من المعقد الأفيوليتي على سطح طبقات التورونيان الكلسية بالقرب من قرية سعرنجيك في منطقة جبال عفرين (الكرداغ) أن هذا المعقد الأفيوليتي قد استقر في موقعه على حافة السطيحة العربية في نهاية التورونيان/ بداية الكونياسيان وليس في الماستريختيان. ويفسر هذا الزحف الأفيوليتي التجاوز البحري الهائل على السطيحة العربية منذ بداية السينونيان.

الكلمات المفتاحية: كريتاسي، روديسنات، أفيوليت، سورية، *Vautrinia syriaca*

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I. Introduction

The rudists of the Cretaceous of Syria have been the subject of various studies since the beginning of last century: Parona (1909), Vautrin (1933), and Keller (1933). The species described or cited of the Albian (*Eoradiolites lyratus* CONRAD) Turonian (*Hippurites resuctus*) were found since in many parts of Syria (Palmyrides, Hermon, Kurd Dagh) and even in neighboring countries: Lebanon, Jordan, Palestine, Turkey.

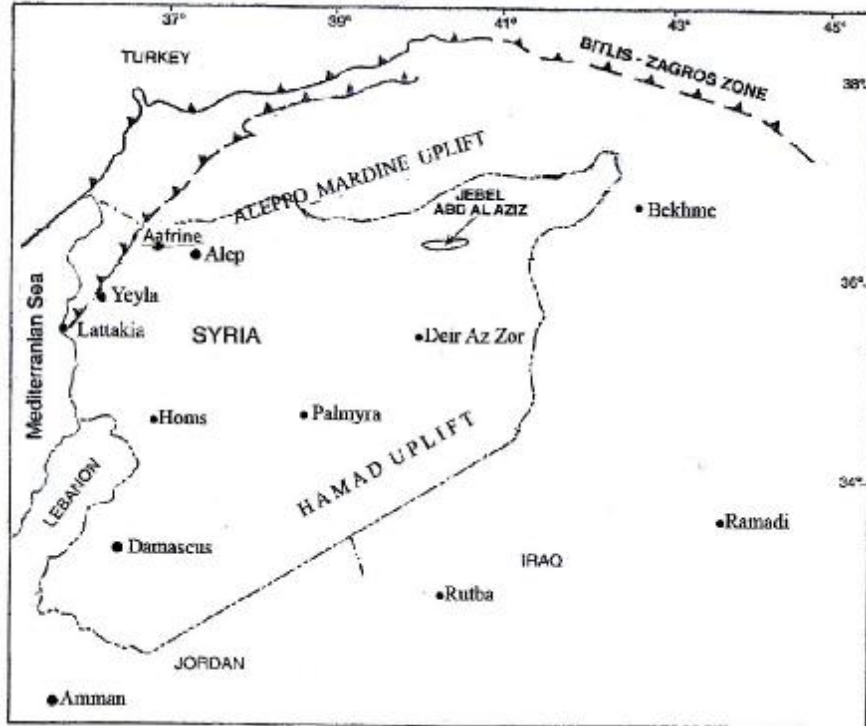


Fig. 1. Geographical situation of studied areas

In contrast, the Maastrichtian species *Vautrinia syriaca* (VAUTRIN), described by VAUTRIN (1933) and named by him as *Lapeirousia syriaca* VAUTRIN has so far never been found outside its two type-localities that correspond to two outcrops (occurrences) (**Fig.1**): one in the core of Jabal Abdul Aziz, near Garrah village (NE Syria), the other in the Yeyla hill, located 10 km to the east of Kassab, estival village of

NW Syria. The material studied by Vautrin was collected earlier by Dubertret in 1933 who suggested a Maastrichtian age for the beds that contain *Lapeirousia syriaca* VAUTRIN.

The revision of the Garrah sedimentary section, and the reinterpretation of the Yeyla section can conduct to determine the precise age of *Vautrinia syriaca* (VAUTRIN) which conventionally accepted by the authors (Dubertret, 1933, 1966, 1975; Ponikarov 1966).

II. Revision of the sections in the type locality of *Vautrina syriaca*

The revision of the stratigraphic position of the Rudist *Vautrinia syriaca* (VAUTRIN) in both type localities: Garrah village in Jabal Abdul Aziz and Yeyla Hill leads to question the age of the species attributed to the Maastrichtian by Vautrin (1933), Dubertret (1933) and Ozer S. (1991). Recall that this Rudist *Vautrinia syriaca* (VAUTRIN) contained in breccia sediments in these two type localities.

A) - Yeyla Hill

In this locality Dubertret (1933, 1966) described above the nappe of ophiolite and radiolarites, from bottom to top (**Fig. 2**):

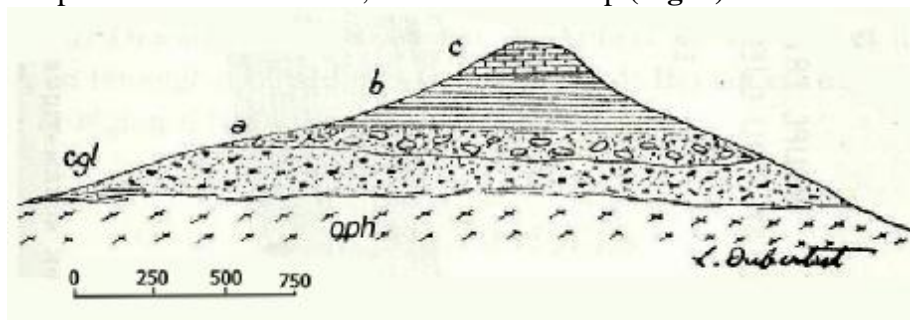


Fig. 2. Geological cross-section of the Cretaceous in Yeyla Hill.(after Dubertret)

-cgl) Conglomerates with pebbles of ophiolite; radiolarites beds at the base.

-a)-Calcareous breccia with clasts of ophiolites and debris of Rudists whole, (*Vautrinia syriaca* (VAUTRIN), *Hippurites syriaca* and *vaccinates syriaca*), and whole specimens occasionally, and rare benthic foraminifera (*Siderolites calcitrapoides*) (Maastrichtian).

- Clastic and glauconitic limestone devoid of rudists, but with many *Siderolites calcitrapoides* and *Omphalocyclus macroporus* of Upper Maastrichtien.

-b) Chalky marl.

-c) Nummulitic limestone.

Ozer S. (1991) cites that the Rudistid fauna in Yeyla consists of *Vautrinia syriaca* (VAUTRIN), *Pseudopolyconites cf. ovalis*, *Hatayia spinosus*, *Dictyoptychus sp.*, *Sabina sp.*, *Hyppurites syriaca*, *Vaccinites (Pironaea) syriaca*. According to his opinion this association indicates Maastrichtian age.

The presence of clasts and whole Rudist in the breccias is indeed indicative for alterations and reworking of earlier rocks. Their presence in the sediments that underlie Maastrichtian sediments is not sufficient to substantiate a Maastrichtien age.

B)- Jabal Abd Al Aziz

The sandstones beds with *Vaccinites aff. inaequicostatus*, reported by Dubertret (1933), to Turonian up to Lower Senonian, are unconformably overlain by 15m breccia with *Vautrinia syriaca* (VAUTRIN) attributed by him to Maastrichtian. This age determination was based on a mere comparison he conducted with *Vautrinia syriaca*-breccia outcrop in Yeyla hill. Since then, Dubertret has considered the 200 m of chalk with sandstone and limestone intercalations also *Vautrinia syriaca* (VAUTRIN), Orbitoidae and Globotruncanidae (*Globotruncana linneana*) to be of Maastrichtien age.

Through this study the same locality of Garrah village, in the core of Jabal Abdul Aziz has been remapped and the following sequence (from bottom to top) has been established (**Fig. 3**):

a) Reddish silty claystone

b) 16 m Limestone, light-grey, microcrystalline, fossiliferous, with *Heteraster syriacus* VAUTRIN-KELLER, *Palorbitolina lenticularis* (BLUMENBACH), *Choffatella decipiens* SHLUMBERGER, *Hensonella dinarica* (RADOICIC), *Pseudocyclammina sp.*, *Permocalculus sp.*, of Upper Barremian – Lower Aptian.

c) 4 m of polygenic conglomerate with calcareous cement, without sedimentary features, elements poorly sorted, subangular to

subrounded, pebbles to cobbles (centimetric to decimetric). Calcareous sandstone at the top, with large Ostreidae, Sponges spicules, Gastropods, Annelids. These sediments facies yielded no characteristic fossils, they are assigned to the Albian age based on their stratigraphic position.

d) 20 m. Marl and marly limestone, light-grey, with planktonic foraminifera: *Rosita fornicata* PLUMMER, *R. marginata* (REUSS), *Marginotruncana coronata* (BOLLI), *M. arca* (CUSHMAN), *Globigerinelloides* sp., *Hedbergella* sp and benthic foraminifera which indicates Campanian age.

e) 3.50 m Sandy dolomitic limestone beds with big pellets

f) 23 m. Sandy dolomitic limestone beds with angular pellets of sandy limestone overlying the uppermost beds that contain rudist debris, reported by Dubertret (1933). We believe that the Rudist *vaccinites aff. inaequicostatus* and the Foraminifera *Orbitoides media* D'ARCH. detected through this study indicate a Campanian age.

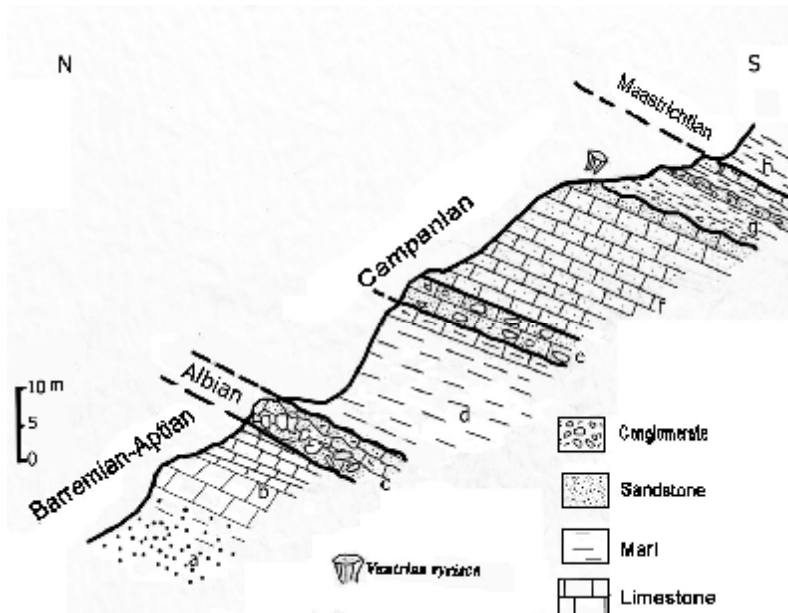


Fig. 3 . Geological cross-section of the Cretaceous in. Jabal Abd Al Aziz

g) 8 m. Marl and chalky marly limestone with dolomitic sandstone pebbles, and large rudist (up to 15cm long) including whole or fragmented and dispersed *Vautrinia syriaca* (VAUTRIN). This level is overlain by a limestone and marly limestone alternation ended by thin medium to coarse sandstone beds whose top surface is bioturbated. The Microfauna is very rich in planktonic foraminifera: *Globotruncanita calcarata* (RZEHAKE), *G. linneiana* (d'ORBIGNY), *G. rosetta* (CARSEY), *G. elevata* (BROTZEN), *G. marginata* (REUSS), *G. stuartiformis* (DALBIEZ), *G. conica* WHITE, *Rosita fornicata* PLUMMER, *Marginotruncana renzi* GANDOLFI, *Archeoglobigerina cretacea*, (d'ORBIGNY), *A. angusticarinata* (GANDOLFI), *Orbitoides media*. D'ARCH, *Globotruncanella* sp., which indicates an Upper Campanian age.



Fig. 3a. Panoramic view of the Cretaceous Formation section in Jabal Abd Al Aziz

h) about 150 m thick whitish marl with micro conglomerate lenses (pebbles 1cm in average), and planktonic foraminifera: *Rosita fornicata*, *Globotruncanita stuartiformis*, *G. falsosuarti*, *G. havanensis* VOORWIJK, *Rugotruncana subcircumdofera* (GANDOLFI), *R. subrugosa rugosa*, *R. globulosa*, *R. bahijia*, *Heterohelix pulchra*, *H. globulosa*,

Pseudogumbelina costulata (CUSHMAN), *Neoflabellina* sp, which indicate a Lower Maastrichtian (**Fig.4**).

In conclusion, the Rudist *Vautrinia syriaca* (VAUTRIN) and the conglomerate pebbles were reworked, packed in sandy dolomitic limestone and marl which redeposited in the basin. Accordingly, the Upper Campanian age of the marl should not any longer be taken as a criterion for Maastrichtian dating of *Vautrinia syriaca* as Vautrin, 1933; Dubertret, 1933 and 1966, considered them. The new data derived from this remapped section confirmed a Campanian or Pre-Campanien age for the Rudist *Vautrina syriaca*.

Level -e- and -f- represent a lithostratigraphic unit with reef shoal facies that could be correlated with some formations in Iraq as Bekhme Formation (Bellen et al., 1959) and in particular, Hartha Formation (Owen and Nasr, 1958) which contains the famous rudist *Vautrinia syriaca* (VAUTRIN). I propose for this Formation the name "Charabiine Formation " (ancient Assyrian name of Jabal Abd Al Aziz area).



Fig. 4. The Upper Campanian contact with *Globotruncanita calcarata* and the chalk marl of the Maastrichtian in the core of Jabal Abd Al Aziz

III. Rudist Dating of the ophiolite obduction onto the Arabian platform

The ophiolitic rocks encountered in northwest Syria (Bassit area-Yeyla) are overlain by 50 m thick sedimentary clastic rocks. The lower parts of which are either pudding stone consisting of ophiolitic rocks and radiolarite pebbles, or coarse limy breccias bearing large reworked rudists (*Vautrinia syrica*) and large foraminifera (*Siderolite*).

The upper parts of these clastic rocks are composed of clastic limestone devoid of rudists get rich in orbitoids (*Orbitoides media*). Dubertret, 1939 dated these clastic rocks as Maastrichtian.

Another ophiolitic rocks outcrop in the Arabian platform located in U.A.E. close to the U.A.E. Omani border is similarly overlain by sedimentary clastic rocks bearing rudists debris (*Vautrinia*) and remnants of large foraminifera (*Siderolite*, *Orbitoides media*). This series attains 250 m thickness and is given by Roger et al. (1989) an age of Maastrichtian also.

In Abd Al Aziz mountain in northeast Syria, the Campanian clastic limestone containing large foraminifera (*Orbitoides media*) is overlain by breccias bearing large reworked rudist (*Vautrinia*) alternated by 15 m thick of marl and sandstone beds, overlain in turn by 200 m thick of chalk and marls. Dubertret, 1939 gave the rudists-bearing breccias and chalk an age of Maastrichtian. Nevertheless recent investigations conducted by the auther in this site revealed that the rudists-remnants-bearing marl contains also pelagic foraminifera (*Globotruncanita calcarata*), a guide fossil for Campanian. Accordingly, *Vautrinia* must be referred to either Pre-Campanian or Lower Campanian, and not to Maastrichtian as it was dated heretofore.

Recent investigations in Saro "Saaranjak" in Kurd Dagh Chain in northwest Syria revealed the presence of ophiolitic rocks (**Fig.5,6**) overlies Turonian limestone and overlain by lower Senonian (Coniacian) pelagic marl (Al-Maleh, 1976). Geochemical analysis, especially trace elements, of this ophiolitic block, as established by Prof. Otaki, indicates an harzburgite rock, as are shown in Table 1. Below.



Fig. 5. Panoramic view of the Cretaceous Formation in the Aafrine Mountain (Saarinjek village) showing the contact Turonian – Coniacian.

Table No 1- Geochemical analysis of the ophiolitic rock established at Damascus University

Channel Compound	Al Al ₂ O ₃	Na Na ₂ O	Mg MgO	Si SiO ₂	P P ₂ O ₅	S SO ₃	K K ₂ O	Ca CaO	Ti TiO ₂	Mn Mn ₂ O ₃	Fe Fe ₂ O ₃
C	1.21	0.21	36.70	37.75	-0.04	0.09	0.00	0.75	0.01	0.08	8.45
Unit	%	%	%	%	%	%	%	%	%	%	%

From the aforementioned, it is concluded that the ophiolitic rocks obducted onto the Arabian platform during the Turonian end / Coniacian outset, and not during Upper Maastrichtian as it was long believed.

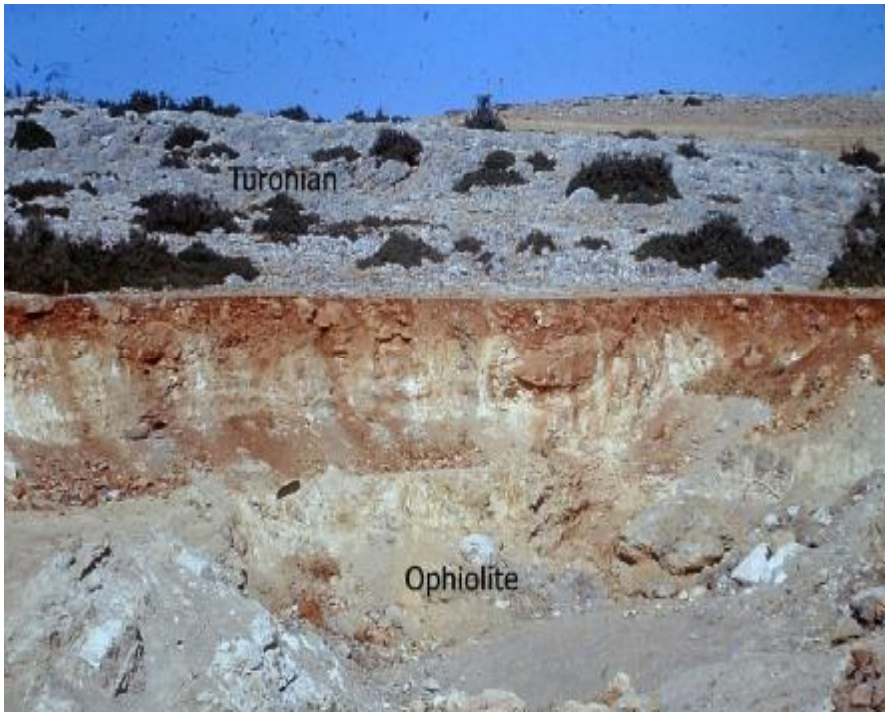


Fig. 6. Ophiolitic rocks at the surface of Turonian in Aafrine Mountain (Saarinjek village)

From afore mentioned, it is concluded that the ophiolitic complex obducted onto the NW of Arabian platform during the Turonian end / Coniacian outset time, not during Upper Maastrichtian time as it was long believed ((Dubertret, 1937 and 1966; Ponikarov, 1966; Al Maleh, 1976; Parrot, 1977; Al Maleh *et al.* 1992; Khatib, 2010).

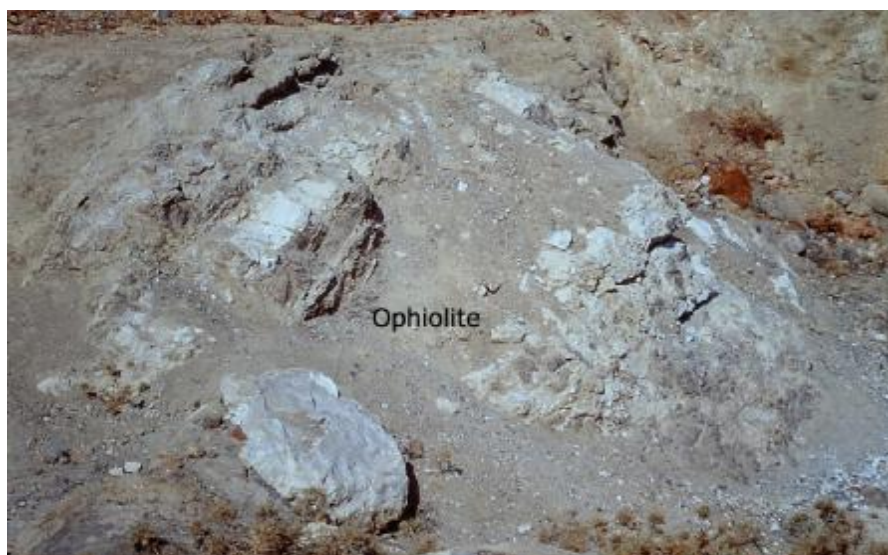


Fig. 6a. (Detail of fig. 6) Ophiolitic rocks at the surface of Turonian in Saarinjek village

IV. Conclusion

The study of the *Vautrina syriaca* outcrop in Jabal Abd al Aziz shows clearly that this endemic rudist was colonizing a carbonate ramp on the northern margin of Arabian platform in Campanian rather than Maastrichtian.

The *Vautrina syriaca* presence in breccias sediment (Yeyla Hill) or in pelagic marl of Upper Campanian (Jabal abd Al Aziz) is due to reworking of the rudist-colonized carbonate ramp in Campanian time. This reworking is due to a succession of events at the end of the Cretaceous, which followed a generalized collapse of the carbonate platform with rudist at the Turonian /Coniacian boundary due to an extensional tectonics in Syria (Dubertret, 1937 and 1966; Ponikarov, 1966; Mouty, 1967; Al Maleh, 1976; Mouty and Saint Mark, 1982; Mouty et al. 2002). The collapse of the carbonate platform in the Upper Cretaceous was also recognized on the N-NE of the Arab platform edge by Cros et al., 1991 in Turkey, Bellen et al., 1959, Owen & Nasr, 1958; Buday, 1980 in northern Iraq.

These carbonate ramps along the Arabian platform margin are due to the Neothetys obduction on the Arabian platform.

It is worth mentioning, that no other Senonian rudist was reported elsewhere in the entire Syrian carbonate platform. The Campanian time sedimentation is generally represented throughout Syria by pelagic marl or mainly by hemipelagic sediments in relatively deep basin, and locally at sites, by calcareous phosphorite (Dubertret, 1933, 1966; Ponikarov, 1966).

The ophiolite outcrops in NE Iraq, Zagros and Oman are similarly overlain by sedimentary clastic rocks containing *Vautrina* Rudists debris and remnants along with large foraminifera (*Siderolites*, *Orbitoides media*) (Alsharhan, 1995). The emplacement of this vast ophiolite sheet along the Arabian Platform margin, which termed by Ricou (1971) “Peri-Arabian ophiolitic Belt”, must be similarly dated either Pre-Campanian or Early Campanian, probably at the beginning of the Senonian.

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Vautrinia syriaca (VAUTRIN)

REFERENCE

- AL-Maleh K. A. (1976). Etude stratigraphique, pétrographique, sédimentologique et géochimique du Crétacé du N.W. Syrien (Kurd Dagh et environ d'Afrine). Thèse, Paris, 620 p.
- Al-Maleh K.A., Delaune M., Mouty M. And Parrot J. F. (1992). Relation du front de la nappe ophiolitique du NW Syrien avec son substratum de part et d'autre de la faille du Levant: Baer-Bassit, Kurd Dagh *C.R. Acad. Sci., Paris*, V. 314, P. 1195-1202.
- Alsharhan A. S. (1995). Facies variation, diagenesis and exploration potential of the Cretaceous Rudist-bearing carbonates of the Arabian Gulf. *American Association of Petroleum Geologists Bulletin*. V. 79, p, 531 – 550.
- Alsharhan A. S. and Nairn A. E. M. (1990). A review of the Cretaceous formations in the Arabian Peninsula and Gulf. Part III. Upper Cretaceous (Aruma Group) Stratigraphy and Paleogeography. *Journal of Petroleum Geology*. v. 13, p. 247- 266.
- Bellen R. C. Van, Dunnington, H. V., Wetzel, R. And Morton, D. (1959). *Lexique Stratigraphique International, Asie, Iraq*. Intern. Geol. Congr. Comm. Stratigr., 3, Fasc. 10a, 333p.
- buday T. (1980). The regional geology of Iraq : stratigraphy and paleogeography. *State Organisation of Minerals Library*. Bagdad, Iraq, v. 1, 455 p.
- Cros P., Dercourt J., Gunay Y., Fourcade E., Bellier J. P., Lauer J. P., Manivit H. & Kozlu H. (1991). La plate-forme arabe en Turquie du Sud: une rampe carbonatée albo-turonienne effondrée au Sénonien. *Bull. Centre Rech. Explor.- Prod. Elf Aquitaine*, 15, 1, 215-237.
- Dubertret L. (1933). La tectonique de la Syrie septentrionale à la fin du Crétacé et au début du Tertiaire. –*Notes et Mém. Syrie-Liban*, I, 13-28.
- Dubertret L. (1937). Contribution à l'étude stratigraphique de la côte libano-syrienne. Le Crétacé. I. Le Massif Alaouite ou Djebel Ansariyeh. - *Notes et Mém. Syrie-Liban*, II, 9-42.
- Dubertret L. (1966). Liban, Syrie et bordure des pays voisins. 1ère partie, tableau stratigraphique avec carte géologique au millionième. –*Notes et Mém. Moyen-Orient*, 8, 251-358, 35 fig.
- Dubertret L. (1975). Introduction à la carte géologique à 1/50 000 du Liban. –*Notes et Mém. Moyen-Orient*, t. XIII.
- Keller A. (1933). Sur quelques rudistes du Djebel Ansaryeh et de l'Amanos (Syrie septentrionale). - *Notes et Mém. Syrie-Liban*, I, 45-52.
- Khatib M. (2010). Evolution tectonique du NW de la Plaque arabe en Syrie. Thèse, Université d'Alep & Université P&M Curie, Paris.
- Mouty M. (1967). Results of the stratigraphical study of the Alaouite Mountains. *Ministry of Petroleum, Damascus*, rapport inedit.
- Mouty M. & Saint Marc P. (1982). Le Crétacé moyen du Massif Alaouite (NW Syrie). *Cahiers de Micropaléontologie*, 3, 55-69.

- Mouty M., Al-Maleh A.K. And Abou Laban H. (2002). Le Crétacé Moyen de la chaîne des Palmyrides. *Geodiversitas, Mémoires du Museum National d'Histoire Naturelle*, Paris.
- Ozer S. (1991). Maastrichtian rudist fauna and biogeography of the Yayladagi-Hatay area (SE Anatolia). In *Ahmet Acr Geology Symposium (Proceedings)*. Cukurova Univ. Adana, Turkey.
- Owen R. M. S. And Nasr S. N. (1958). The Stratigraphy of Kuwait-Basrah area in. *Weeks J. L. (editor) Habitat of Oil Symposium. Am. Assoc. Petr. Geol., Tulsa.*
- Ponikarov V. P (1966). The Geology of Syria. *Ministry of Petroleum, Damascus.*
- Parona. (1909). *Radiolites liratus* CONR. *Apricardia notlingi* BLANCK. Nel Cretaceo superiore della Siria. *Atti della R. A. Sc., Torino, XL-IV.*
- Parrot J. F. (1977). Assemblage ophiolitique du Baer-Bassit et termes effusifs du volcan0-sédimentaire : Travaux et documents de l'O.R.S.T.O.M., 72.
- Ricou, L. E. (1971). Le croissant ophiolitique per-arabe, une ceinture de nappes mise en place au Cretace superieur. *Rev. Géogr. Phys. Géol. Dyn., v. 2, XIII, 4, p. 327-350.*
- Roger J., J-P. Platel, C. Cavalier And C. Boudillon-De-Grissac. (1989). Données nouvelles sur la stratigraphie et l'histoire géologique du Dhofar (Soltant d'Oman). *Bulletin de la Société Géologique de France (8), v.5, p. 265 - 277.*
- Vautrin H. (1933). Sur quelques formes nouvelles de Rudistes recueillies en Syrie septentrionale. *Notes et Mém. Syrie-Liban ,I, 29-43.*