

Oligosteginid assemblages of basinal limestone succession in Ismael Awa section, Kurdistan Region, North Iraq.

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Abstract

Oligosteginid (calcspheres) assemblages which found in Dokan Formation, Erbil Governorate, Kurdistan Region, have a stratigraphic distribution similar to that found in Bangestan Group (Albian-Campanian) of Lurestan Province, Iran. Ten rock samples were collected from Ismael Awa section, Dokan formation and 20 thin sections were made and studied under microscope. There are five oligosteginid species found in Dokan Formation and all these species are of Late Albian, the depositional environment of the formation is tropical to subtropical, warm water 30-32 °C on the continental slope to abyssal zone and paleosalinity between 34-37 ‰.

key words: oligosteginid, calcsphere, Albian, Dokan.

تجمعات الاوليجوستجد لتتابع الحجر الجيري الحوضي في مقطع اسماعيل آوه، اقليم كردستان، شمال

العراق

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Salah Ali Hussain

الخلاصة

ان تجمعات الاوليجوستجنيد (الكاليسيفير) التي وجدت في تكوين دوكان، محافظة اربيل، اقليم كردستان لها توزيع طباعي مماثل لتلك الموجودة في مجموعة تكوينات بانجستان (الالبان-الكامبانيان) في اقليم لورستان، ايران. عشرة نماذج قد اخذت من مقطع اسماعيل آوه، تكوين دوكان حيث تم عمل 20 شريحة صخرية ودراستها تحت المجهر، هنالك خمسة انواع من الاوليجوستجنيد وجدت في تكوين دوكان وكلها ذات عمر الالبان المتأخر. ان البيئة الترسيبية للتكوين هي استوائية الى شبه استوائية وذات مياه دافئة تتراوح بين (30-32 درجة مئوية) تمتد من المنحدر القاري الى البيئة الحوضية وملوحة تتراوح بي (34-37 جزء بالالف).

الكلمات المفتاحية: الاوليجوستجنيد، الكاليسيفير، الالبان، دوكان

Introduction

In the third edition of dictionary of earth sciences edited by [1], calcispheres are defined as small calcite spheres, up to 500 μm in diameter, commonly found in Palaeozoic limestones and believed to be of algal origin. They consist of a micrite wall enclosing an interior which is hollow or filled with sparry-calcite (sparite). The Dokan Formation crops out along the High Folded Zone, NE Iraq, it's lithology consist of grayish brown, thick bedded, recrystallized limestone, the upper contact is conformable with Gulneri Formation and the Lower contact is unconformable with Upper Qamchuqa Formation [2]. The formation was deposited in tropical to subtropical, warm water 30-32 °C on the continental slope to abyssal zone and paleosalinity between 34-37 ‰ [2]. The oligosteginid assemblages is well distributed along Dokan Formation, and these assemblages was already dated as Late Albian because of their association with other foraminiferal genera, [2]. These mini calcareous spheres (clacispheres) regarded as algae by [3] who indicating that they are commonly found in lagoonal limestone successions from the Devonian onwards. He indicates that calcispheres are best to study in thin sections or peels. The section under study is located in the valley near the water well in Ismail Awa village near Degala Town, Erbil Governorate, NE Iraq. The coordinates of the section are (44° 26' 23" Longitude), (36° 12' 43" Latitude), figure 1.

Oligosteginid assemblages of basinal limestone succession in Ismael Awa section, Kurdistan Region, North Iraq.

Salah Ali Hussain

Materials and methods

Ten rock samples are collected from an outcrop of Dokan Formation which were 20 thin sections prepared in order to examine their contents under microscope, the calcispheres are photographed and classified using polarized microscope. All samples are stored in the department of Petroleum Geology and Minerals, College of Science, University of Diyala under the name DO 7-16.

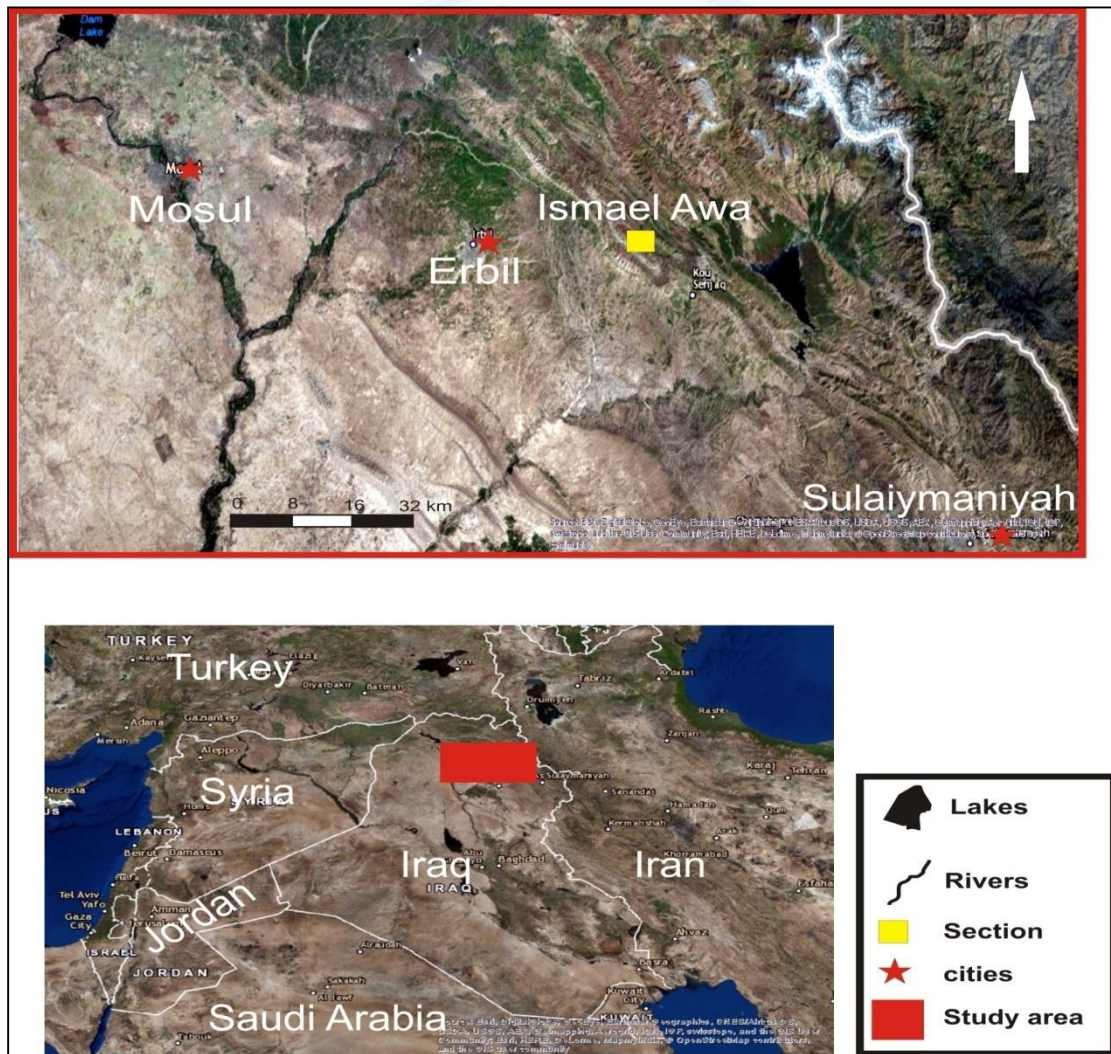


Figure 1. Satellite image showing location of the study area

Oligosteginid assemblages of basinal limestone succession in Ismael Awa section, Kurdistan Region, North Iraq.

Salah Ali Hussain

Systematic Description

The classification in the present work depends on the work of [4], [5] and others listed below; the reader can find them in the references.

Kingdom Chromista Cavalier-Smith, 1981

Phylum Cavalier-Smith 1987

Subphylum Cavalier-Smith & Chao 2004.

Class Dinophyceae Fritsch 1927

Order Peridiniales Haeckel 1894

Family Calcisphaerulidae Bonet, 1956

Genus *Calcisphaerula* Bonet, 1956

***Calcisphaerula innominata lata* Adams, Khalili and Said**

Figure 3 a, b

Calcisphaerula innominata lata new subspecies [6], p. 56, pl. 1, fig. 2a; [7], p. 1175, pl. 10, fig. 19.

Description:

Simple test, spherical, unilocular; the wall is thin, imperforate, laminated, composed of radially arranged calcite; this subspecies can be recognized in thin sections by watching that the wall looks like separated from the central body by a dark zone. Aperture not present.

Dimensions:

Diameter 60-130 μm , wall thickness 14-18 μm .

Age: Late Albian.

Discussion:

This subspecies is composed of, imperforate, radially laminated hyaline calcite wall, it is first described by [6] from the Coniacian to Turonian rocks in Iran and thought to be an evolutionary trend of *Calcisphaerula innominata*, there is no difference between the Iraqi and Iranian subspecies except the stratigraphic age (Late Albian) which found by the author, figure 2. *Calcisphaerula innominata lata* is described in Gurpi Formation (Maastrichtian) from Well 10

Oligosteginid assemblages of basinal limestone succession in Ismael Awa section, Kurdistan Region, North Iraq.

Salah Ali Hussain

at the Hendijan oil field, Northwest of Arabian Gulf, Iran by [7] and this subspecies is similar to the Iraqi one.

Calcisphaerula innominata Bonet

Figures 3 c, d

Lagena sphaerica Kaufmann, 1865 (pars), p. 196, text-figs. 104-106, in: [6].

Oligostegina sp. Kaufmann, [8], p. 21, pl. 4, fig. 2.

Calcisphaerula innominata [4], p. 57, pls. 22, 24, 27; [6], p. 56, pl. 1, fig. 1a, 3b; [7], p. 1168, pl. 4, fig. 7.

Description:

Simple test, spherical, unilocular; the wall is thick, imperforate, laminated, composed of radially arranged calcite; no aperture present.

Dimensions:

Diameter 30-130 μm , wall thickness 40-90 μm .

Age: Late Albian.

Discussion:

In the lowest strata, the thickness of the wall of this species is still in the same range mentioned above but it is become narrower in the middle and upper part of the Dokan Formation and the wall is more thick than the oldest species. This species is similar to that found by [6] in Bangestan Group of western Iran form the age Albian-Early Cenomanian. and similar to that which found by [9] in Sarvak Formation (Late Albian-Late Cenomanian) from Tang-e-Chenarbashi, Southwest Ilam, Eastern Iran. *Calcisphaerula innominata* was discriminated by [10] in Cupido Formation (Albian-Cenomanian) from Northeast Mexico, and have a similar outline morphology.

Oligosteginid assemblages of basinal limestone succession in Ismael Awa section, Kurdistan Region, North Iraq.

Salah Ali Hussain

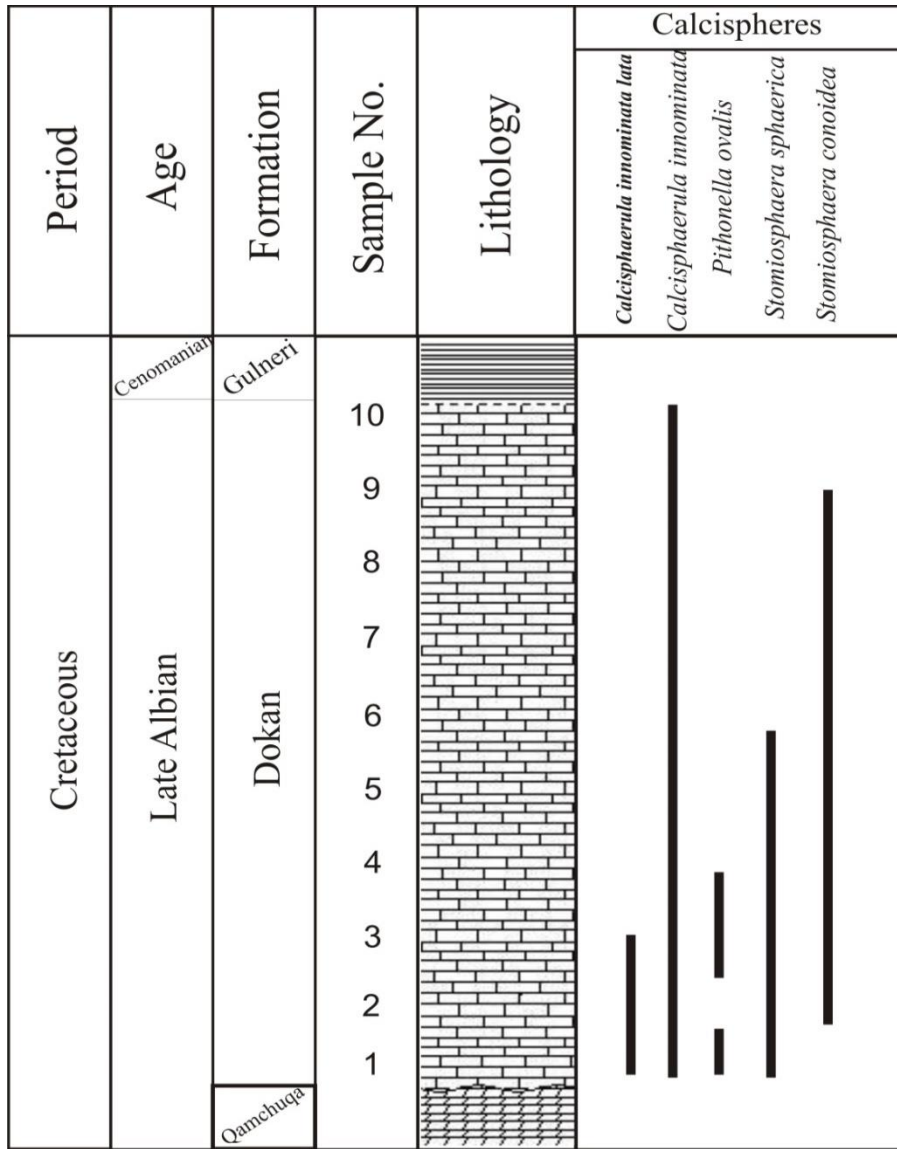


Figure 2. Stratigraphic range chart of calcispheres in Ismael Awa section

Oligosteginid assemblages of basinal limestone succession in Ismael Awa section, Kurdistan Region, North Iraq.

Salah Ali Hussain

According to [11] the systematic position of the pithonellids is:

Division Dinoflagellata (Butschli, 1885) Fensome *et al.*, 1993

Subdivision Dinokaryota Fensome *et al.*, 1993

Class Dinophyceae Pascher, 1914

Subclass Peridiniphycidae Fensome *et al.*, 1993

Order Peridinales, Haeckel, 1894

Suborder Peridiniineae Autonym

Family Thoracosphaeracea Schiller, 1930

Genus *Pithonella* Lorenz, 1902

Pithonella ovalis (Kaufmann)

Figures 3 e, f

Lagena ovalis Kaufmann, 1865, p. 191, text-figs. 104, 107a-b; in: [11].

Oligostegina sp. Kaufmann. [8], p. 21, pl. 4, fig. 2.

Pithonella ovalis (Kaufmann). [4], p. 50, pls. 22-23, 25-26; [6], p. 58, pl.1, fig. 3a, 6b.

Description:

Test simple, unilocular, elongate oval, circular in transverse section; extremities rounded; wall laminated, imperforate, composed of radially arranged calcite; aperture simple, small, located at one extremity of the test.

Dimensions:

Length 60-110 μm , width 35-60 μm , wall thickness 10-20 μm .

Age: Late Albian.

Discussion:

The Iraqi species is slightly different from the Iranian one due to have less wall thickness and being more ovate, this species is occur just in the lower part of Dokan Formation and disappear in middle and upper parts of the formation which indicate a short stratigraphic range, while [6] described *P. ovalis* from the Albian to Late Turonian.

Oligosteginid assemblages of basinal limestone succession in Ismael Awa section, Kurdistan Region, North Iraq.

Salah Ali Hussain

A thick wall that measured 10-15 μm was observed by [12]. He said that the irregular internal part of the wall is difficult to see, but frequently an irregular fracture along the ellipse is distinguished. This species measured height 70 μm , width 35 μm , apertural diameter 7 μm , these characters was described in Cerritos in the western Valles–San Luis Potosi platform, Mexico from the Late Albian.

***Pithonella sphaerica* (Kaufmann)**

Figure 3 g, h

Stomiosphaera sphaerica (Kaufmann, 1865) [4], p. 64-66, pl. 23, figs. 1-2; [6], p.64, pl. 1, fig. 6a.

Pithonella sphaerica (Kaufmann, 1865) [13], p. 193, pl. 1, figs. 7a, b; [14], p. 340, pl. 18, figs. a b, c, d, pl. 19, c) Pl. 1, fig. 6; [12], pl. 10, a-b.

Description:

Test is simple, unilocular, spherical; the wall is thick, imperforate, laminated, composed of radially arranged calcite, aperture (if existed) single, simple.

Dimensions:

Diameter 65-130 μm , wall thickness 15- 20 μm .

Age: Late Albian.

Discussion:

The thickness of the wall is highly variable in the same sample and through the entire formation. The Iraqi species have a wall is similar to that found in Iranian specimen composed of imperforate, laminated, radially arranged hyaline calcite which described by [6] from the Upper Albian-Coniacian, while [4] described *P. sphaerica* from Mexico as having a granular and only partially lamellar calcite wall. On the other hand, [15] discriminated a radial hyaline wall structure in similar forms from the Paris Basin. [12] discriminated the Mexican species from Cenomanian-Early Turonian that has a wall measured 25 μm and formed by two concentric layers divided by dark lines. The diameter ranged from 70 to 100 μm for the analyzed specimens. This species is occur only at the lower to the middle part and disappear from the other part of Dokan Formation.

Oligosteginid assemblages of basinal limestone succession in Ismael Awa section, Kurdistan Region, North Iraq.

Salah Ali Hussain

Genus *Bonetocardiella* Dufour, 1968

Bonetocardiella conoidea Bonet

Figure 3 i

Stomiosphaera conoidea Bonet, 1956, p. 454, pl. XXII, figs. 1, 2; [6] p. 64, pl. 1, fig. 5a; Dufour, 1968 p. 2, pl. 1, fig. 4.

Bonetocardiella conoidea (Bonet, 1956) [16], p. 15, pl. 1, figs. 1, 2; [17], p. 822, pl. 7 figs. 1, 2, 3, 9, 10, 11, pl. 2, figs. 1, 2, 3, 7; [18], p. 155; [19], p. 362, pl. 2, fig. 9, pl. 3, fig. 5; [20], p. 186, pl. 1, figs. 13, 15; [14], p. 341, pl. 19, figs. b, c, e; [21], p. 240, pl. 6, fig. 9; [22], p. 90, pl. 1, fig. 5; [12], pl. a-d.

Description:

Simple test, subconical, unilocular, the outline is helmet-shaped, Aperture is present and simple found in the central lower part of the test, the aperture side of the wall is either concave or even.

Dimensions:

Dimensions: Height 70-110 μm , width 80-130 μm .

Age: Late Albian.

Discussion:

The Iraqi specimen is differing from that described by [6] in Bangestan Group of western Iran due to the shape side of the aperture which is concave or even in the Iraqi one and slightly convex in the Iranian specimen, also there is a wide difference in the stratigraphic range of the Iraqi specimen which have Late Albian while the Iranian is Albian-Cenomanian. *B. conoidea* is similar to Mexican one described by [12] that have a heart shape and a wall formed by calcite crystals oriented in linear rows.

Oligosteginid assemblages of basinal limestone succession in Ismael Awa section, Kurdistan Region, North Iraq.

Salah Ali Hussain

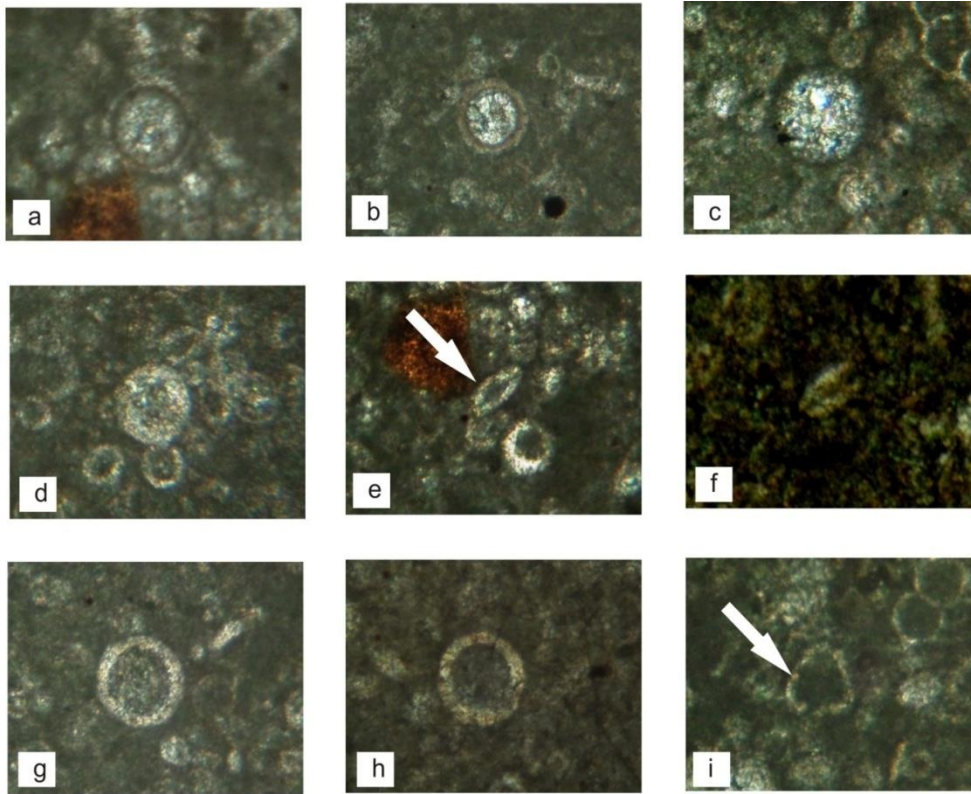


Figure 3. (a-b) *Calcisphaerula innominiata lata*; (c-d) *Calcisphaerula innominata*; (e-f) *Pithonella ovalis*; (g, h) *Pithonella sphaerica*; (i) *Bonetocardiella conoidea*

Conclusions

1- Five species are found in Dokan Formation, these are:

A- *Calcisphaerula innominata lata* Adams, Khalili and Said.

B- *Calcisphaerula innominata* Bonet.

C- *Pithonella ovalis* (Kaufmann).

D- *Pithonella sphaerica* (Kaufmann).

E- *Bonetocardiella conoidea* Bonet.

Oligosteginid assemblages of basinal limestone succession in Ismael Awa section, Kurdistan Region, North Iraq.

Salah Ali Hussain

- 2- These oligosteginids indicate a tropical to subtropical, warm water 30-32 °C on the continental slope to abyssal zone and paleosalinity between 34-37 ‰.
- 3- The oligosteginids in present work are of Late Albian.

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Oligosteginid assemblages of basinal limestone succession in Ismael Awa section, Kurdistan Region, North Iraq.

Salah Ali Hussain

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Oligosteginid assemblages of basinal limestone succession in Ismael Awa section, Kurdistan Region, North Iraq.

Salah Ali Hussain

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Oligosteginid assemblages of basinal limestone succession in Ismael Awa section, Kurdistan Region, North Iraq.

Salah Ali Hussain

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