A NEW RECORD OF RADIOLARIAN SPECIES (*Dictyomitra multicostata*) INDICATING THE EARLY BERRIASIAN STAGE WITHIN THE CHIA GARA FORMATION, IN SULAIMANIYAH, NORTHEAST IRAQ

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Key words: Chia Gara Formation, Berriasian, Radiolaria, Surdash anticline

ABSTRACT

The Late Tithonian – Berriasian radiolarians of Chia Gara Formation were identified by studying 9 samples from outcrop section (KO/74/690) in the northeastern limb of Surdash Anticline at north of Sulaimaniyah city, northeast Iraq. The samples collected by the filed geologists of GEOSURV during 2008. Three formations are exposed in the section, (from bottom to top) Barsarin Formation; composed of fine crystalline dolomite rich with algal srtomatolites, Chia Gara Formation; composed of radiolarian clayey limestone, and Balambo Formation; composed of highly dolomitized limestone. An important Berriasian species of Radiolaria (*Dictyomitra multicostata* Zittli) was found and recorded for the first time within the Chia Gara Formation marking the beginning of the Early Cretaceous Epoch. Abundant Radiolarias in the studied samples indicate basinal marine environment; also the presence of Radiolaria and chert horizons in the formation represent the close relation with the Qulqula Radiolarian Series.

تسجيل نوع جديد من الراديولاريا (*Dictyomitra multicostata*) كدالة لعمر البرياسيان المبكر من تكوين الجياگارا في السليمانية، شمال شرق العراق

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المستخلص

تمت دراسة الراديولاريا في تكوين الجياگارا من عمر التيثونيان – البرياسيان من خلال 9 نماذج للمقطع KO/74/690 الواقع في الجناح الشمالي الشرقي لطية سورداش المحدبة، شمال مدينة السليمانية، شمال شرق العراق. جمعت النماذج من قبل جيولوجين الشركة العامة للمسح الجيولوجي والتعدين التي أجرت مسح جيولوجي تفصيلي للمنطقة للفترة 2008 - 2009، حيث ان الدراسات السابقة في المنطقة قديمة وقليلة جداً، ولم تجرى دراسات حديثة في المناطق المجاورة سوى دراسة واحدة والتي أجراها معلة وآخرون (2004) شمال شرق مدينة السليمانية.

تظهر في المقطع المدروس ثلاث تكوينات وهي من الأقدم الى الأحدث: بارسرين، جياگارا وبالمبو. يتكون تكوين بارسرين من صخور دولومايتية ناعمة التبلور غنية بالطحالب ويتكون تكوين جياگارا من صخور جيرية طينية مليئة بالراديولاريا أما تكوين بالمبو يتكون من صخور جيرية عالية التدلمت. وتم العثور على نوع مهم جداً من الراديولاريا (*Dictyomitra multicostata* Zittli) والذي يحدد عمر البرياسيان المبكر لأول مرة فى تكوين الجياگارا. ان كثرة وجود الراديولاريا وحجر الصوان هما دليلان على ان الترسيب حدث في بيئة بحرية عميقة متأثرة بمجموعة القلقولة الراديولاري.

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INTRODUCTION

The Chia Gara Formation was first described by Bellen *et al*. (1959), from its type locality in south of Amadiya, north Iraq, and believed to be of Middle Tithonian – Berriasian in age, with species of *Psuedocyclammina kelleri* Henson, and abundant ammonite species. Lithologically, the formation consists of thinly bedded limestone and shale. The same age is given by Spath (1950) in Bellen *et al*. (1959) and based his findings on ammonite species. No detailed study was carried out on the Radiolarian assemblages in the studied area and near surroundings. Al-Dulaimi (2007) studied Radiolaria from Karimia Formation; in north Iraq from subsurface section (Kirkuk Well No.109) and indicated the age of the formation. In this study, the Radiolaria from Chia Gara Formation was studied from 9 outcrop samples collected from outcrop section KO/74/690, which were collected by GEOSURV geologists, during execution of detalid geological mapping in west of Sulaimaniyah in 2008 – 2009.

LOCATION

The studied section is located in the northeastern limb of Surdash Anticline at north of Sulaimaniyah city, northeast Iraq, at Latitude 35º 50', Longitude 45º 10' (Fig.1).

AIM

The aim of this study is to indicate the age of the Chia Gara Formation, more precisely as compared to the previous works.

PREVIOUS WORKS

The Chia Gara Formation was introduced by Wetzel (1950) in Bellen *et al*. (1959) from Chia Gara Anticline of the High Folded Zone, south of Amadiya, north Iraq. They described the formation as unbroken succession of thinly-bedded limestone and shales, containing rich ammonite fauna and grading upwards into yellowish marly limestone and shales and give the age Late Jurassic – Early Cretaceous for the formation. In Rania area, Bolton (1958a) recorded thinly-bedded platy limestone, dark brown shale and dolomitic marls in the formation and claimed Tithonian – Berriasian age for the formation. From Sirwan – Halabja areas Bolton (1958b) recorded a sequence of black and brown shales, with soft marly dolomites and thinly bedded limestone and give the age Tithonian – Berriasian for the formation. From Halabja – Sayid Sadak area (Hawar, Giryaun, Kani Askan and Birri Dairo) localities, Buday and Suk (1978) described the formation as grey to dark thinly bedded argillaceous limestone; alternating with shale containing chert nodules and bands and give the age Tithonian – Berriasian for the formation. In Bekhme section, NE Iraq, Karim and Salman (1992) described the formation as silicified micritic limestone; sometimes thinly bedded and rich with macro and micro fauna and plant imprints and give the formation Late Jurassic – Early Cretaceous. Isho (1997) described the formation from Key Hole 12 in North Himreen Anticline, southeast Tikrit city as brown argillaceous limestone alternating with shale and dolomitic limestone and gives the age Tithonian – Berriasian for the formation.

METHOD OF STUDY

Nine samples were collected from outcrop section, NW of Sulaimaniyah. Thin sections were studied by means of binocular microscope. Radiolarian species were identified to interpret the exact age of the upper part of the Chia Gara formation.

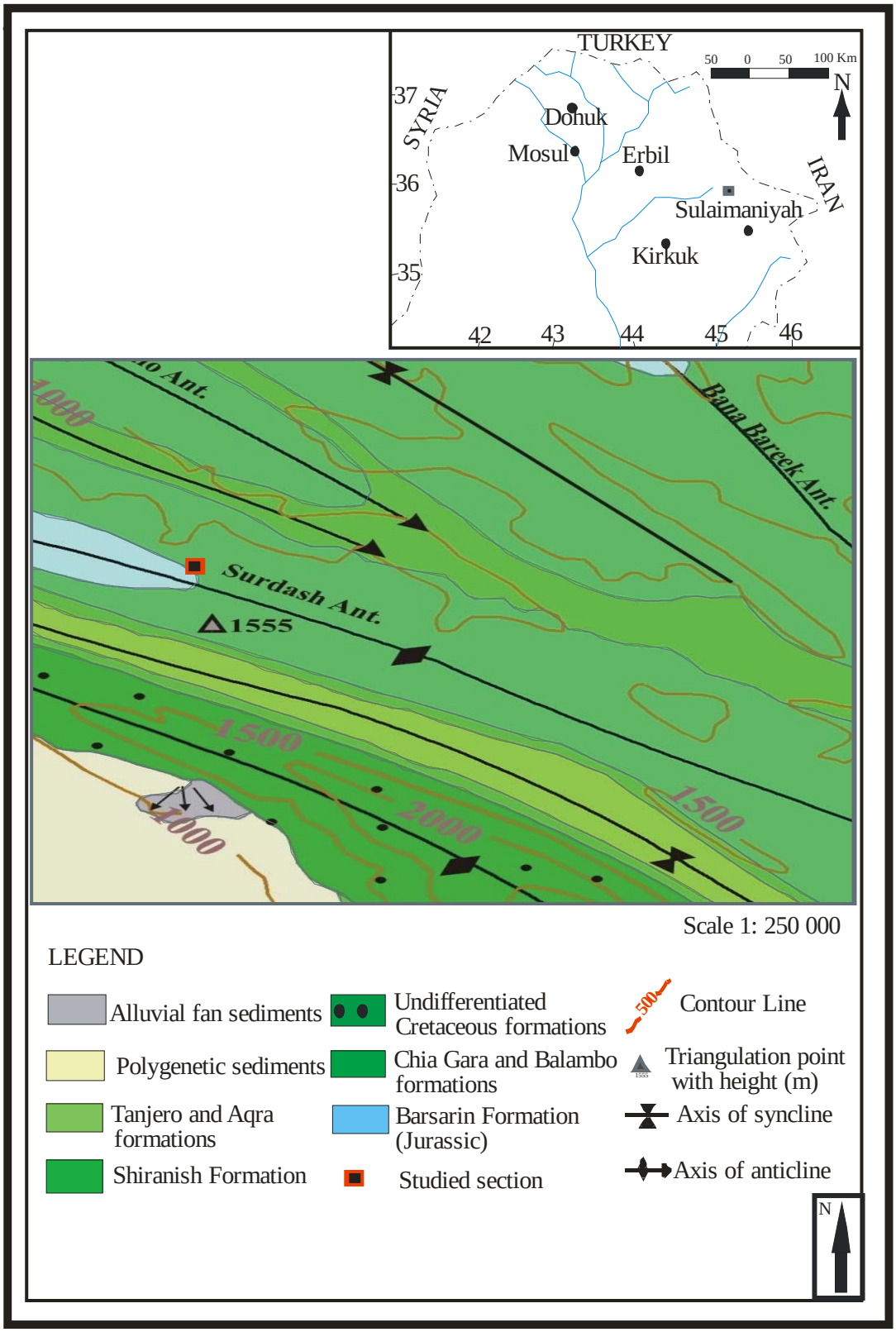

Fig.1: Geological map of the studied area (modified from Ma'ala, 2007)

LIST OF FOSSILS

The following fossils were identified in the studied samples

Radiolaria: *Dictyomitra multicostata* Zittli (Fig.3.1), *Styladictya* cf. *haeckel* Campbell and Clark, *Styladictya rotulata* Campbell and Clark (Fig.3.2), *Williriedellum crystaillinum* Dumitrica, *Paronella ewinge* Pissagno (Fig.3.3), *Paronella* sp., (Fig.3.4a), *Patwlibracchium* sp., (Fig.3.4b and Fig.4.1), *Cryptamphorella concara* Forman (Fig.4.2), *Coccodiscus* sp., *Porodiscus* cf. *cretaceous* Campbell and Clark, *Staurolonchidium* sp., *Dorydictyum* sp., (Fig.4.3), *Dorydictyum simplex* Hind (Fig.4.4a), *Stylosphaera* sp., (Fig.4.4b), *Trithysetta* sp., (Fig.5.1), *Palaeacantus* sp., *Spongodiscus* sp., (Fig.5.2), Radiolarian capsule (Fig.5.3) and Spines capsule of Radiolarias (Fig.5.4).

Foraminifera: *Rotalipora* sp. and *Protoglobigerina* sp.

LITHOSTRATIGRAPHIC DESCRIPTION

The section is described from bottom to top (Fig.2). The lower two samples represent the Barsarin Formation, which is composed of fine crystalline dolomite, rich with algal stromatolites, indicating Sabkha environment, characterizing the formation (Pesl, 1976 and Buday and Suk, 1978). The contact between the Chia Gara and Barsarin formations is marked by brecciated limestone (sample no.3). The Chia Gara Formation is represented by samples no.4, 5, 6 and 7. It is composed of radiolarian clayey limestone; with abundant Radiolaria and rare *Protoglobigerina* sp. The upper contact of the Chia Gara Formation with the overlying Balambo Formation is marked by phosphatic intraclastic dolomitic limestone (sample no.8). The uppermost sample of the section belongs to Balambo Formation, which is composed of highly dolomitized rock with abundant ghost of *Rotalipora* spp. of Cenomanian age.

BIOSTRATIGRAPHY

The upper part of the Chia Gara Formation (samples no.6 and 7) contain abundant radiolaria. The most important species marks its first appearance is *Dictyomitra multicostata* Zittli (Fig.4.1) indicating the start of the basal part of Berriasian (Early Cretaceous age) within the Chia Gara Formation. Abundant Radiolarian species of Cretaceous age, like *Parodiscus* sp., *Stylodictya* sp., *Stylosphaera* sp., *Dorydictyum simplex* Hind, and *Staurodictya* cf. *rotulata* Campbell and Clark. These fauna are documented from Early Cretaceous of Middle California by Campbell and Clark (1944), from California Coast (Blake Bahama Basin) by Pessagno (1971), from equatorial Atlantic by Erbacher (1998), and from France by Danellian *et al*. (2006). The presences of *Dictyomitra multicostata* Zittli within the Chia Gara Formation indicates a continuous sedimentation of the formation from Late Tithonian – Berriasian and this species marks its first appearance at the base of the Cretaceous Epoch.

DEPOSITIONAL ENVIRONMENT

The Chia Gara Formation with its abundant Radiolaria and *Protoglobigerina* sp. indicate an open marine condition of bathyal depth (more than 250 m) affected by the Qulqula Radiolarian Series (Buday and Suk, 1978).

CONCLUSION

The presence of *Dictyomitra multicostata* Zittli within the Chia Gara Formation indicates a continuous sedimentation of the formation from Late Tithonian – Early Cretaceous Period and its appearance marks the basal part of the Berriasian Stage (Early Cretaceous).

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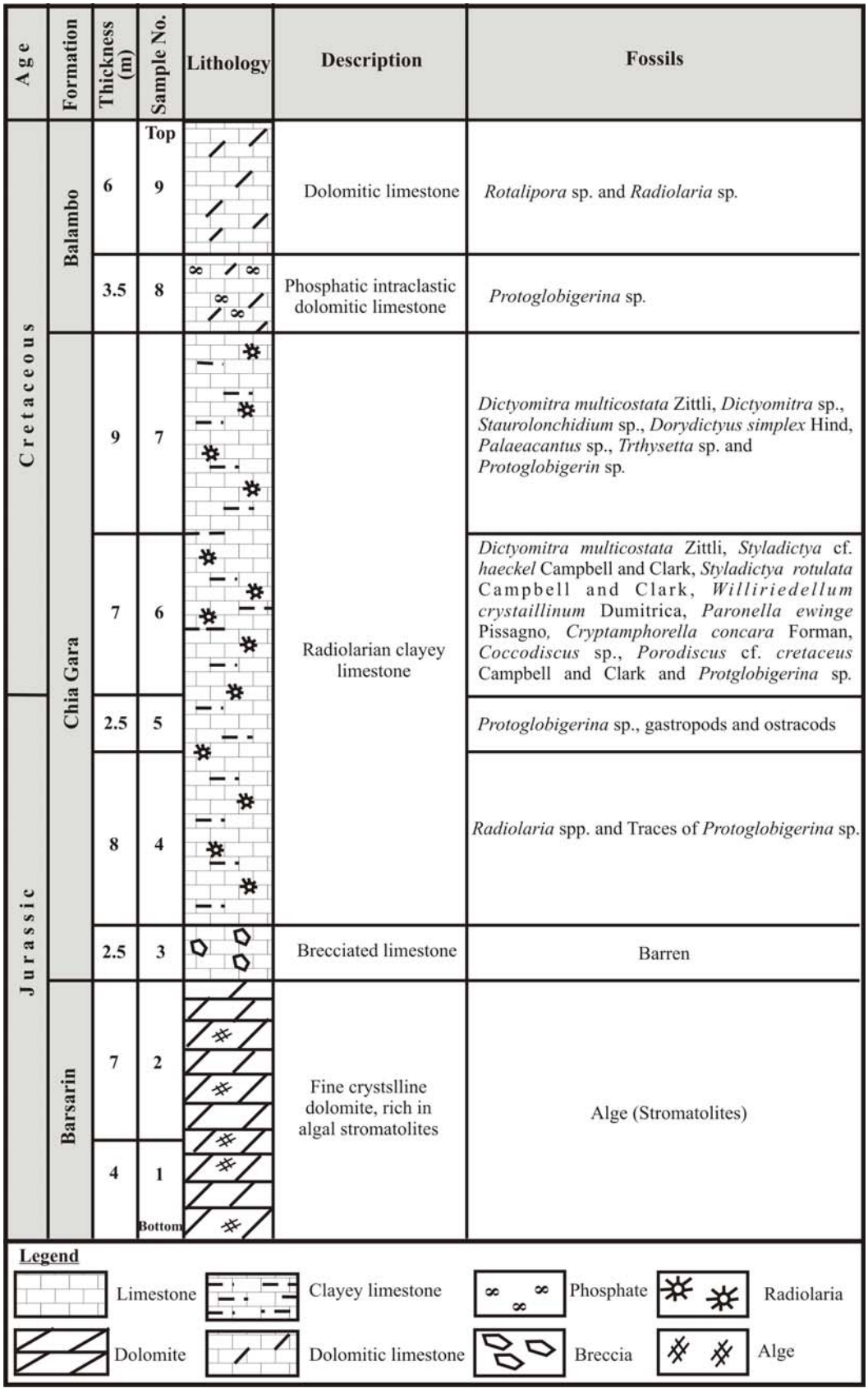

Fig.2: Stratigraphic column of the studied section
(Scale 1 cm = 2 m)

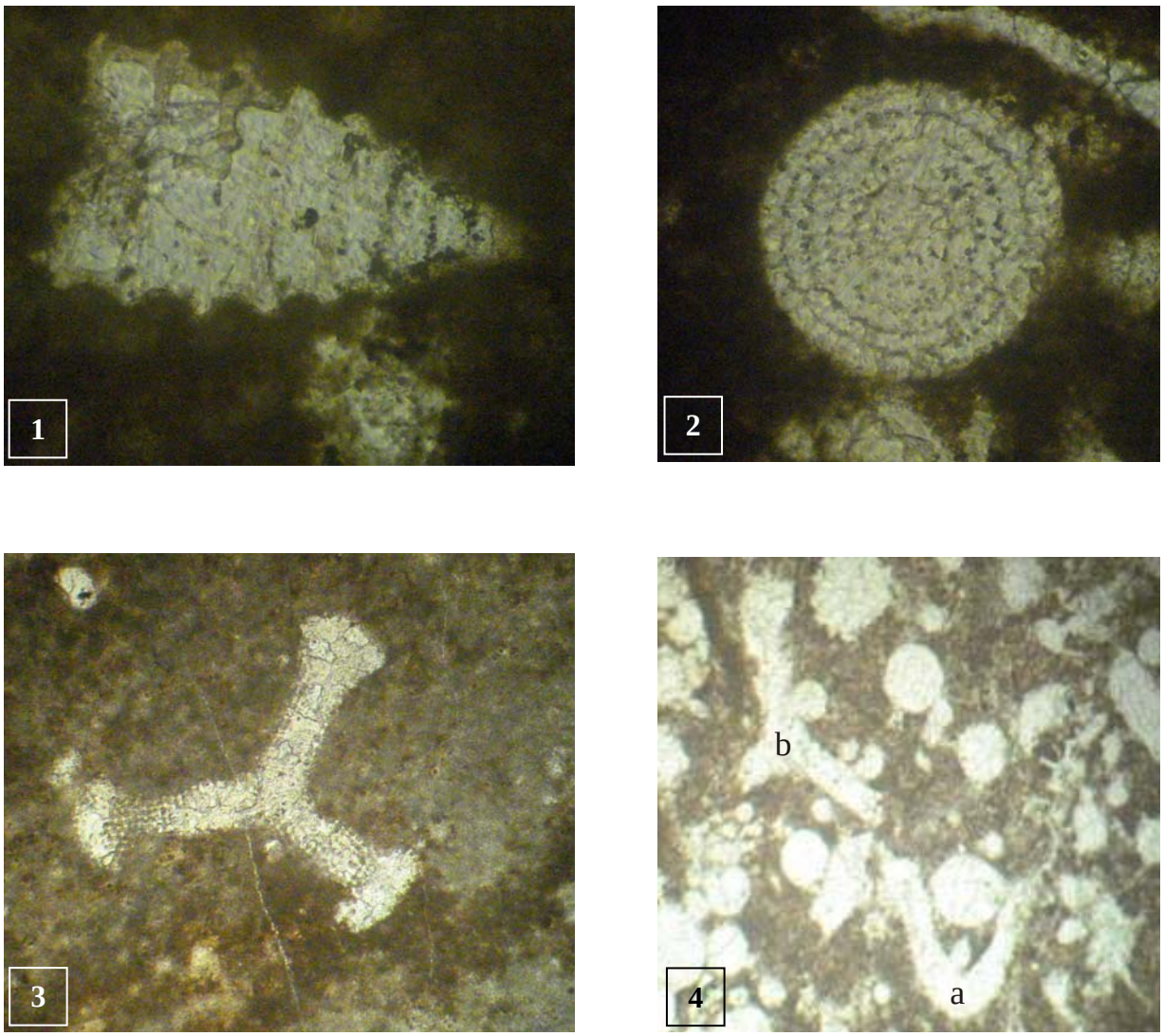

Fig.3:
1-*Dictyomitra multicostata* Zittli, Sample No.7, X400
2-*Stuarodictya rotulata* Campbell and Clark, Sample No.6, X400
3-*Paronella ewinge* Pissagno, Sample No.7, X400
4- a- *Paronella* sp., Sample No.6, X400
b- *Patwlibracchium* sp., Sample No.6, X400

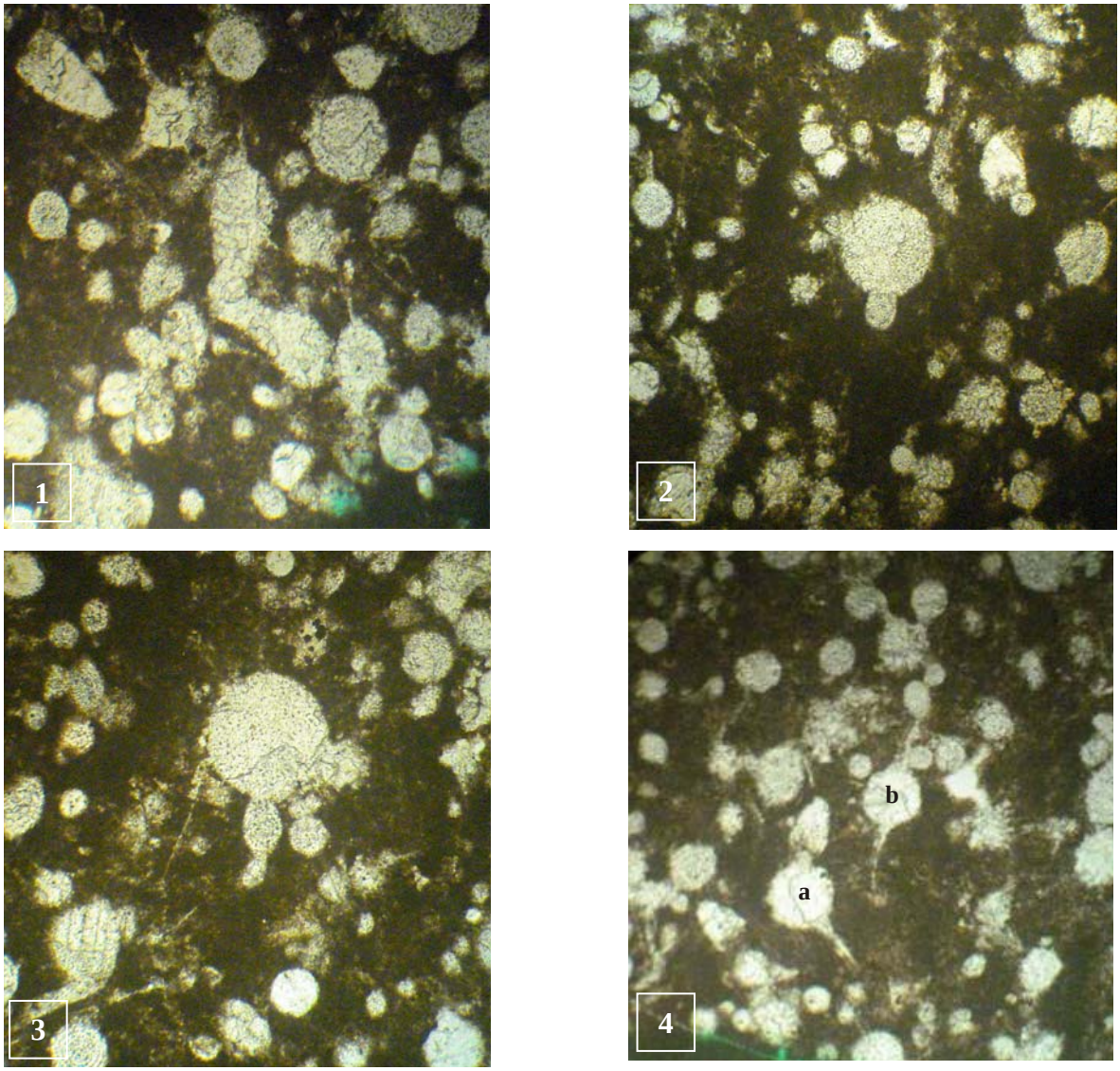

Fig.4:
1-*Patwlibracchium* sp., Sample No.6, X400
2-*Cryptamphorella conara* Foreman, Sample No.6, X400
3-*Dorydictyum* sp., Sample No.6, X400.
4- a - *Dorydictyum simplex* Hind, Sample No.6, X400
b- *Stylosphaera* sp., Sample No.6, X400

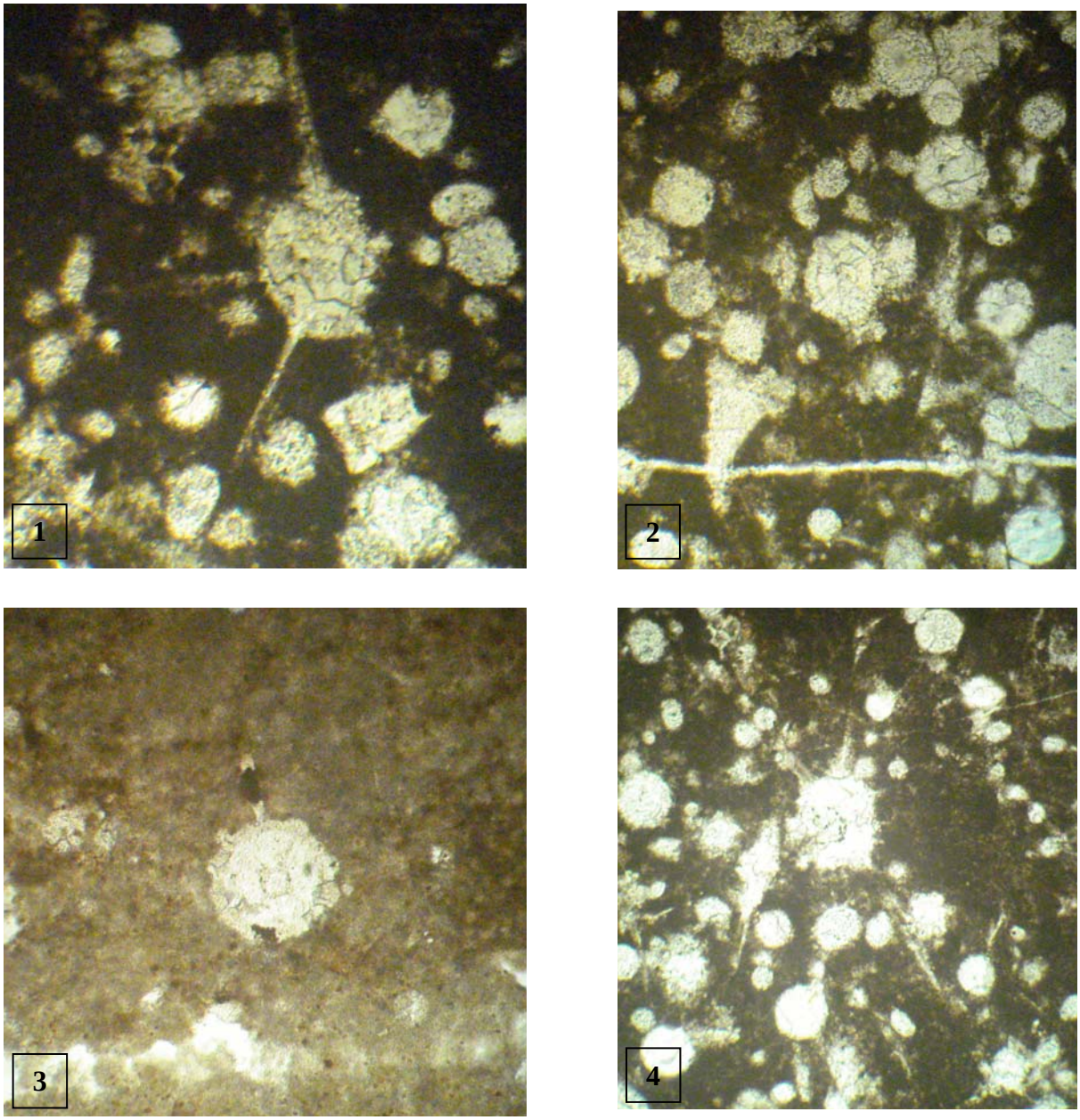

Fig.5:
1-*Trithysetta* sp. Sample No.6, X400
2-*Spongodiscus* sp., Sample No.7, X400
3-Radiolarian capsule, Sample No.7, X400
4-Spines capsule of Radiolarias, Sample No.6, X400

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