

STRATIGRAPHY, AGE CONSTRAINTS AND PALEOENVIRONMENTAL INTERPRETATIONS OF THE UPPER JURASSIC – LOWER CRETACEOUS SEDIMENTS IN THE AREA OF LAKE HAZEN, ELLESMERE ISLAND, CANADIAN ARCTIC

Christo Pimpirev, Polina Pavlishina

Department of Geology and Palaeontology, Sofia University “St. Kliment Ohridski”
1504 Sofia, Bulgaria; e-mails: polar@gea.uni-sofia.bg; polina@gea.uni-sofia.bg

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Introduction

The sediments exposed in the area of Lake Hazen (northeastern Ellesmere Island) have not been studied in details so far. The scope of the present contribution is to give new stratigraphical and sedimentological data, and to present in particular, palynological evidence for the Upper Jurassic-Lower Cretaceous age of the succession cropping out along the northeastern shore of Lake Hazen (Fig. 1).

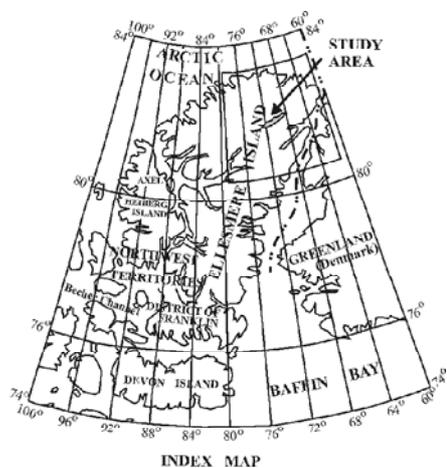
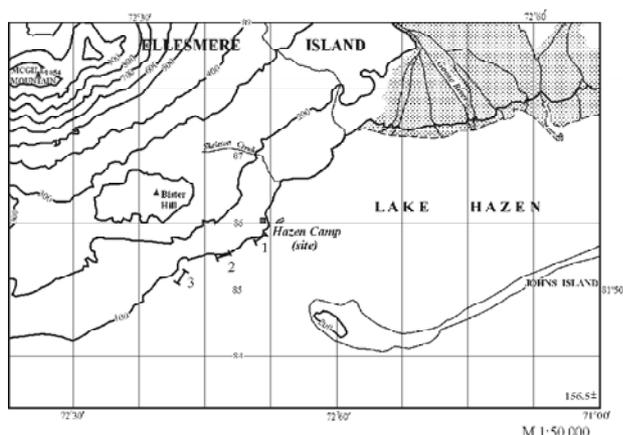


Fig. 1. Location of the study area

The sediments containing age diagnostic dinocysts assemblages, spores and pollen are exposed from Hazen Camp to 1.5 km southeast along the Hazen Lake shore. They were studied in three lithological sections. The lower part of the succession (section 3) is presented by 40 m thick sequence showing thinning upward trends (Fig. 2). It consists of mudstones alternating with very fine grained thin- to medium-bedded sandstones and siltstones with horizontal bedding. Two packets of amalgamated very fine grained sandstones (lower 1.5 m thick and upper 3m thick) were mentioned. Poorly preserved cephalopod was found at 12 m level.

The middle part of the sedimentary succession (section 2) consists predominantly of thick and very thick beds of weakly consolidated fine to medium grained sandstones (Fig. 2). Some sandstone beds are cross-bedded. Coal seams and lenses are common. In the lowermost part of the section (sample 2c) spores and pollen are abundant. The uppermost 14 m thick part of the section consists of weakly consolidated mudstones intercalated with thin fine to medium grained weakly consolidated sandstones. One sample from the top of the sequence (sample 2 at the 56 m level) contains very rich, well preserved dinocyst association.

The upper part of the sedimentary succession (section 1) consists predominantly of weakly consolidated mudstones intercalated with fine grained thin- to medium-bedded sandstones. One 2.5 m thick massive fine grained sandstone occurs in the base and one 0.5 m thick coarse to very coarse sandstone bed crops out in the upper part (Fig. 2). Three samples of the measured lithological section contain rich, well preserved and age diagnostic dinocyst assemblages.

Dinocyst associations and age assessment

Dinoflagellate cyst assemblages were obtained from most of the studied samples. They are comparatively

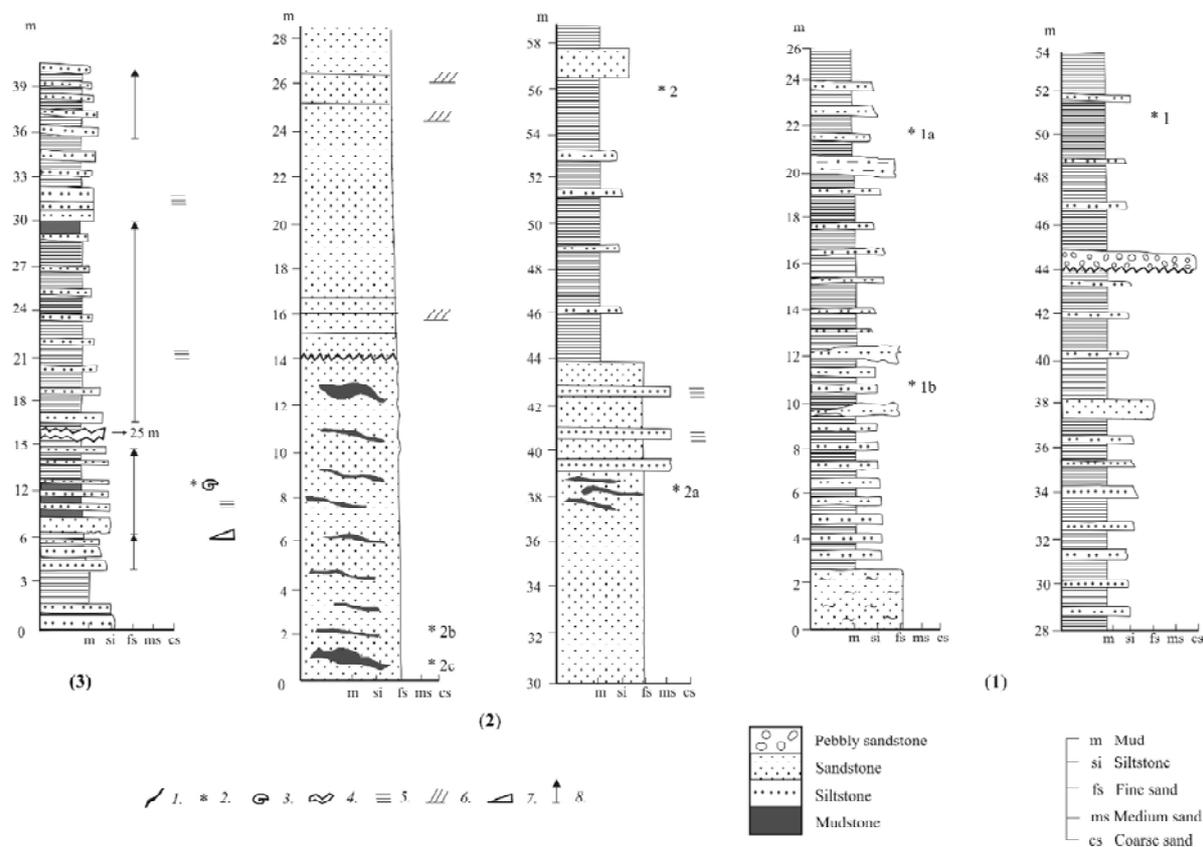


Fig. 2. Sedimentological sections: 1. (300 m SW from Hazen Camp); 2. (1 km SW from Hazen Camp); 3. (1.5 km SW from Hazen Camp).

1. coal seams; 2. palynological samples; 3. macrofossils; 4. lack of outcrop; 5. horizontal bedding; 6. cross bedding; 7. flute casts; 8. thinning upward sequences.

well preserved and the range of diversity is relatively high. Two distinct dinocyst associations have been recognized in the studied sections based on overall composition. They are termed the *Gonyalacysta dualis* - *Gonyaulacysta jurassica* Association and the *Tanyosphaeridium magneticum* Association.

The *Gonyalacysta dualis* - *Gonyaulacysta jurassica* Association is recorded in section 2, samples 2, 2a. The most profuse and characteristic species within this association are *Gonyalacysta dualis*, *G. jurassica*, *G. eisenacki*, *Nannoceratopsis pellucida*, *Sirmodium grossi* and *Glomodium zabrum*. Other relatively common species are: *Paraevansia brachythelis*, *Valvaeodinium groenlandicum*, *Pareodinia prolongata*, *Sentusidinium villersense*, *Sirmidiniopsis orbis* and *Chytroeisphaeridia chytrooides*. *Compositosphaeridium polonicum* is represented by single specimens in the slides.

The *Tanyosphaeridium magneticum* Association is recognized in section 1, samples 1b, 1a and 1. It is characterized by the common presence of

Tanyosphaeridium magneticum. The association is marked also by an influx of chorate species such as *Oligosphaeridium complex*, *O. diluculum* and *O. albertense*. *Lithodinia stoveri*, *Circulodinium distinctum* and *C. brevispinatum* are rare constituents of this association.

The associations are correlated with the existing dinocyst zonation for the Arctic, Boreal and Tethyan Realms. Based on this correlation the *Gonyalacysta dualis* - *Gonyaulacysta jurassica* Association indicates the *Stephanelytron redcliffense* Oppel Zone of Davies (1983) defined in the Sverdrup basin, Arctic Canada and might be correlated to the DSJ 23-27 Zone of Poulsen & Riding (2003) in Subboreal Northwest Europe. The association defines Oxfordian age for the middle part of the succession (section 2) along the northeastern shore of Lake Hazen.

The *Tanyosphaeridium magneticum* Association indicates the *Tanyosphaeridium magneticum* Oppel Zone of Davies (1983) and correlates quite well to the *Spiniferites* spp. Zone and its *Tanyosphaeridium*

magneticum Subzone of Leereveld (1995) recognized in ammonite calibrated sections in SE Spain and the Tethyan Realm. The association defines Valanginian age for the upper part of the succession (section 1) along Lake Hazen.

Paleoenvironmental interpretations

The overall composition of the palynofacial content in this study is combined with the sedimentological data from the sections and gives good grounds for paleoenvironmental interpretations.

The sediments from the lower part of the succession were deposited in turbidite marine paleoenvironment with ammonite finding.

The sedimentation in the middle (Oxfordian) part started in continental paleoenvironment with abundant coal seams. The palynofacies is dominated by terrestrial material, represented by trilete spores (40-60%), gymnosperm pollen (20-40%), cuticle sheets and well preserved woody phytoclasts. Dinoflagellate cysts are completely lacking thus confirming the continental nature of this palynofacies. Upwards it changed to brackish and marine with rich and diverse dinocyst associations, but the ratio of non-marine to marine is approximately 1:1 within the palynofacies. The diverse dinocyst association is dominated by *Gonyaulacysta* representatives considered to be more typical of middle shelf environments with normal seawater salinity conditions. The input of terrestrial material, however, was high during the deposition of this unit.

The Valanginian part of the succession is characterized by more open marine neritic depositional environment. Marine elements are frequent in this palynofacies, being represented mainly by dinoflagellate cysts. The ratio of non-marine to marine palyno-

morphs is approximately 1:1 in most of the samples. The dinocyst association is dominated by *Oligosphaeridium* species. This genus has its highest abundance and suggests marine neritic paleoenvironments, but the supply of terrestrial material remained high during the deposition of this part of the sequence.

Conclusions

The proved age of the studied sedimentary succession along the northeastern shore of Lake Hazen extends from Late Jurassic (Oxfordian) to Early Cretaceous (Valanginian). Two distinct dinoflagellate cyst associations were recognized. The older, termed the *Gonyaulacysta dualis* – *Gonyaulacysta jurassica* defines Oxfordian age for the middle part of the succession, while the younger – the *Tanyosphaeridium magneticum* association suggests Valanginian age for its upper part. The Oxfordian interval in the section is characterized by continental to relatively shallow marine conditions with a high influx of terrestrial organic matter. The subsequent Valanginian interval is characterized by more open marine neritic depositional environment, but the terrestrial influx remained still high. The age of the middle part of the succession is Oxfordian and the upper one is Valanginian, which leads to the assumption that at the end of the Jurassic period an interruption of the sedimentation occurred in the depositional basin.

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НОВИ ДАННИ ЗА СТРАТИГРАФИЯТА, ВЪЗРАСТТА И ПАЛЕООБСТАНОВКИТЕ НА ГОРНОЮРСКИТЕ И ДОЛНОКРЕДНИ СЕДИМЕНТИ В ОБЛАСТТА НА ЕЗЕРОТО ХЕЙЗЪН, ОСТРОВ ЕЛСМЕЙР, КАНАДСКА АРКТИКА

Христо Пимпирев, Полина Павлишина

Целта на настоящата публикация е да представи нови стратиграфски и седиментоложки данни и особено нови палиноложки доказателства за оксфордската и валанжинска възраст на седиментните последователности североизточно от езерото Хейзън, остров Елсмейр, Канадска Арктика. Описани са три разреза в областта. Разграничени са диноцистните асоциации *Gonyaulacysta dualis* – *Gonyaulacysta jurassica* и *Tanyosphaeridium magneticum* и са корелирани с зоналните схеми за Арктика, Бореалната и Тетиска област.

Въз основа на тези корелации асоциацията *Gonyaulacysta dualis* – *Gonyaulacysta jurassica* определя оксфордска възраст за средната част от седиментната последователност (разрез 2), докато асоциацията *Tanyosphaeridium magneticum* доказва валанжинска възраст за нейната горна част (разрез 1).

Седиментоложките данни и цялостният състав на палиноложките ансамбли са съвместно анализирани в изследваните разреза. Направени са палеогеографски интерпретации, основани на отношението на морски и континентални елементи, както и на определените видове диноцисти. Оксфордският интервал в цялостната седиментна последователност се характеризира от континентални до относително плиткоморски условия на седиментация със значителен привнос на континентални палиноморфи и органична материя. Валанжинският интервал е представен от морски неритични палеообстановки с висок привнос на континентални елементи в тях. От доказаната оксфордска възраст на средната част от изследваната седиментна последователност и валанжинската на горната ѝ част може да се допусне прекъсване на утайконатрупването в седиментния басейн в края на юрския период.