

Evidence for deltaic palaeoenvironments in the lowermost part of the Miers Bluff Formation, Livingston Island, Antarctica

Доказателства за делтови палеобстановки от най-долните части на свитата Майерс Блъф, остров Ливингстън, Антарктида

Christo Pimpirev, Polina Pavlishina, Yavor Stefanov
Христо Пимпирев, Полина Павлишина, Явор Стефанов

Sofia University “St. Kliment Ohridski”, 15 Tzar Osoboditel Blvd., 1504 Sofia, Bulgaria; E-mail: polar@gea.uni-sofia.bg; polina@gea.uni-sofia.bg; yavor@gea.uni-sofia.bg

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The sedimentary sequences of the Miers Bluff Formation have been interpreted as deposited in marine palaeoenvironments (Arche et al., 1992; Pimpirev et al., 2006). For the siliciclastic rock sequences from the lowermost part of the Miers Bluff Formation (Fig. 1) could be proposed for the first time deposition in deltaic sedimentary environments.

Sedimentological data

The reasons for such assertion as deposition in deltaic sedimentary environments are as follow: well-marked coarsening-upward trend in the section; presence of abundant plant fragments; various sedimentary structures – depositional, erosional and deformational;

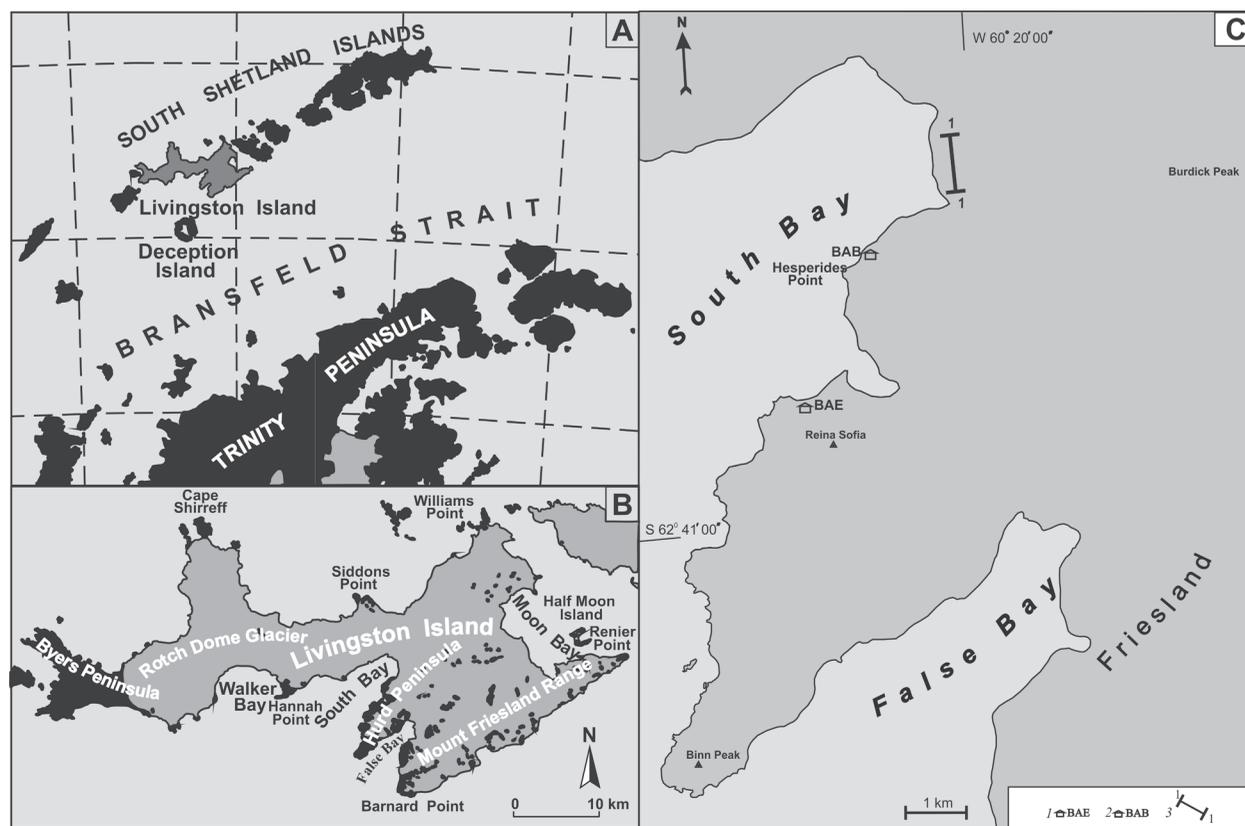


Fig. 1. Location of the studied area (Pimpirev et al., 2006): A, South Shetland Islands; B, Livingston Islands; C, Hurd Peninsula
1 – BAE – Spanish Antarctic Base; 2 – BAB – Bulgarian Antarctic Base; 3 – location of the studied sediments

moderate sorting and immature nature of the psammitic clastic rocks. Because of modern glacial covering as well as big number of fold and fault structures description of individual facies is very complicated. Nevertheless, it could be made some brief conclusions regarding definite sedimentary paleoenvironments within the ancient deltaic system.

The siliciclastic rock sequences formed in delta front environments are recorded in studied section by relatively thick alternations of shales with thin- to medium-bedded, cross- and evenly-laminated sandstones. A special feature is gradual increasing of psammitic clastic sediments upward in the section with commonly presented erosive surfaces (scours and channels) and large scale cross-bedding. Most likely, such a trend suggests for formation of subaqueous bar finger sand bodies which testifies for progradation of deltaic system.

Another distinctive sedimentary sequence in the section is comprised by dark, massive shales with abundant plant fragments, which likely were formed in marshes developed in interdistributary areas on delta plain. Commonly shales are interbedded by massive, poorly sorted, gravel-rich sandstones with large scale cross-bedding (planar and trough), high amplitude erosive surfaces and load structures. Most likely, latter psammitic sediments were deposited in distributary channels on delta plain.

On the basis of mentioned above brief and preliminary results, siliciclastic rock successions from lowermost part of the Miers Bluff Formation could be considered as an ancient example of fluvial, Gilbert-type delta systems.

Palynofacies analysis

Palynofacies analysis describes the total acid-resistant organic matter content of sedimentary rocks within a specific depositional environment. The study of sedimentary organic matter involves the identification of palynomorphs, plant debris and amorphous organic particles, their relative proportions, size and preservation status. Palynofacies analysis provides clear signals for a specific set of environmental conditions as duration of transport, distance to coast line, depositional energy, water depth and nutrient availability, oxidizing conditions. Therefore, palynofacies patterns and Rock-Eval pyrolysis data are used herein to contribute paleoenvironmental interpretations.

The palynofacies parameters and ratios follow the classification of Tyson (1995). They are: 1) The ratio of continental to marine particles (CONT/MAR ratio); 2) the ratio of opaque to translucent phytoclasts

(OP/TR ratio); 3) the size and shape of opaque plant debris; 4) the relative proportion of amorphous organic matter (AOM).

In the present study, palynofacies of the lower part of the Miers Bluff Formation are characterized by a moderate abundance of translucent phytoclasts, including single finds of structured cuticles and gymnosperm pollen grains combined with moderate to high numbers of opaque particles. The values of the OP/TR ratio show higher content of the opaque particles. Opaque phytoclasts are larger than translucent ones. Their shape is mostly equidimensional suggesting short transportation in the basin. According to palynofacies analysis principles (Tyson, 1993, 1995) such composition of the sedimentary organic matter indicates proximal conditions of deposition with high input of terrestrial components for this part of the Miers Bluff Formation. The investigated phytoclast particles reveal a greater variety of particle sizes. They have been transported during a short period of time and have overtaken short oxidation close to the shore-line.

Palynofacies interpretations are in accordance with the Rock-Eval pyrolysis data already published by Markova et al. (2009) from this part of the Miers Bluff Formation. The authors identified mixed kerogen type II and III indicating marine as well as continental environments of deposition. The presence of kerogen type III gives clear signals for proximity of the coast line. It originates predominantly from higher continental plants and vegetal debris. Following Tyson (1995) most favorable for the deposition of this kerogen type are the oxidized near shore and deltaic environments.

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