

Stratigraphy of the Holocene sediments of the western part of the Ajdemir Lowland, Silistra District

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Д. Ангелова — Стратиграфия голоценовых отложений в западной части Айдемирской низменности Силистринского района. Голоценовые отложения западной части Айдемирской низменности объединены в две официальные литостратиграфические единицы: Тодоранскую глинистую свиту (новая свита) для болотных отложений и Тырликскую щебнево-песчано-глинистую свиту (новая свита) для аллювиальных отложений. Они отложились на маленьких блоках с различной динамикой и оформляют наложенные, вложенные и прислоненные несогласия. Отложения Тодоранской глинистой свиты сформировались в болотной среде в условиях непрерывного погружения, тогда как отложения Тырликской щебнево-песчано-глинистой свиты сформировались в речной среде при изменяющихся литодинамических условиях — от условий слабой тектонической активности и состояния динамического равновесия до условий продолжительного погружения при негативных тектонических движениях. Нижней границей служит ясная эрозионная поверхность разнообразной по литологическому составу и по возрасту подошвы.

Abstract. The Holocene sediments in the western part of the Ajdemir Lowland are covered by two formal lithostratigraphic units: Todoranka clayey Formation (new formation) for the swampy sediments and Târlica pebble-sandy-clayey Formation (new formation) for the alluvial sediments. They are deposited over small blocks of different dynamics and form superimposed, interbedded and contiguous discordances. The Todoranka Clayey Formation sediments are formed in swampy environment under conditions of constant sinking, while those of the Târlica Pebble-Sandy-Clayey Formation are formed in lacustrine environment under changing lithodynamic conditions — from slow tectonic activity and dynamic balance to continuous sinking resulting from negative tectonic movements. The lower boundary represents a distinguished erosional washout over various lithological basement of different age.

Introduction

The Holocene sediments in Ajdemir Lowland have not been subjected to detailed geological studies. They are vaguely mentioned in the works of Б о ж и л о в а et al. (1985) and Ф и л и п о в, М и к о в а (1986). The swampy sediments of the Srebârna Lake are palinologically studied by Б о ж и л о в а et al. (1985) and Л а з а р о в а (1990). They cover discordantly karstic Barremian-Aptian limestones, Albian siltstones (Н и к о л о в, 1969), Neogene sediments pertaining to the Ajdemir Formation (П о п о в, 1993) and Quaternary sediments of Pleistocene age. The thickness varies from 4 to 30 m (Fig. 1, B).

Holocene sediment characteristics

According to the origin, the Holocene sediments studied are alluvial and swampy. They are covered by two formal lithostratigraphic units, introduced herewith for the first time (Fig. 1, A).

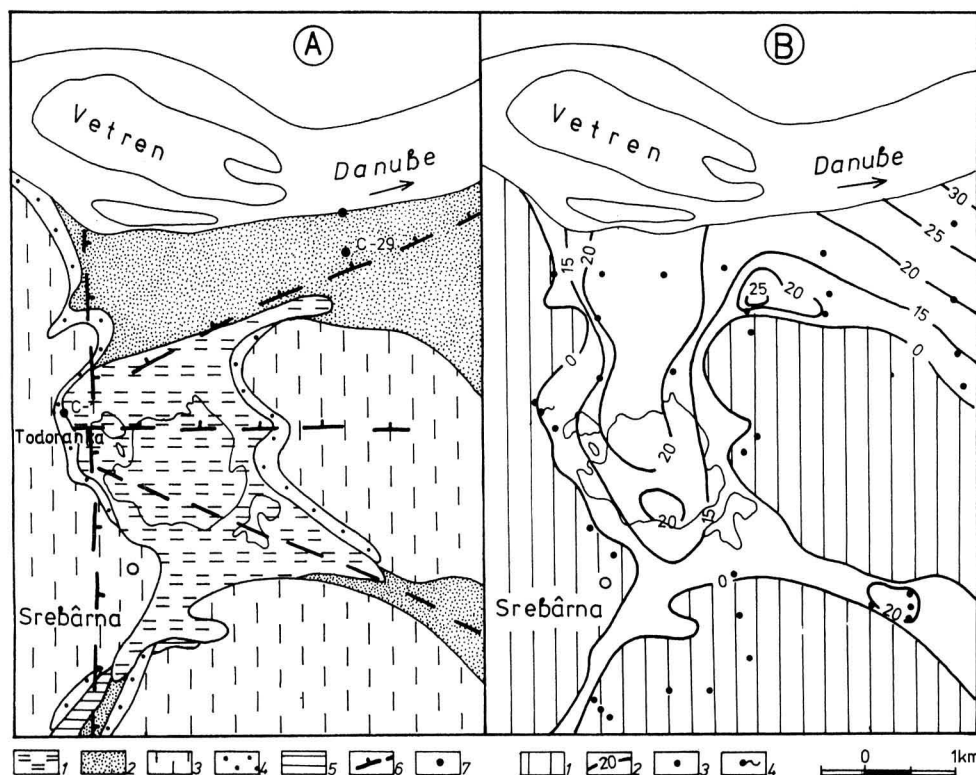


Fig. 1. A. Geological map of the western part of the Ajdemir Lowland

1 — Todoranka Formation (swampy sediments); 2 — Târlica Formation (alluvial sediments); 3 — loess; 4 — Neogene sediments; 5 — Cretaceous sediments; 6 — faults; 7 — holostratotype sections

B. Map of the Holocene sediment thickness

1 — pre-Holocene rock complexes; 2 — isolines; 3 — wells; 4 — spring

Swampy sediments

Todoranka Clayey Formation (Тодоранска глинеста свита) (new formation)

Nomenclature. It is called by the name of Todoranka spring, situated at 1 km to the north of Srebârna Lake, Silistra District, in the western part of the lake (Fig. 1, A and B).

Defining Features. The formation is determined by fine dense clays.

Type section. Corresponds to the 0-8.50 m interval from the core well Nr. 1 of Energoproekt (Божилова et al., 1985) (fig. 1, A, 2), located at 400 m to the north-west of the Todoranka spring.

6. (0-0.50 m). Soil, swamp clays (0.50 m.).

5. (0.50-1.0 m). Clay, dark-brown, compact with plant roots (0.50 m).

4. (1.0-2.0 m). Peat, black with manganese and iron concretions and bands, humus clays (1.0 m).

3. (2.0-7.30 m). Clay, greyish-blue, rich in humus substances (5.30 m).

2. (7.30-8.50 m). Yellow sands and pebbles of alluvial and delluvial origin and clay with rusty-yellow spots (1.20 m).

erosional washout

Basement. Ajdemir Formation, Dacian (Попов, 1993)

1. (8.50-12.50 m) Clayey sand (1.50 m).

B o u n d a r i e s. The lower boundary is with Neogene sediments (Ajdemir Formation) or directly with karstic Lower Cretaceous limestones (Ruse Formation) or marls (Trambeš Formation), while the upper boundary is with alluvial sediments of the Târlica Formation.

L i t h o l o g i c a l c h a r a c t e r i s t i c s. The formation is represented by vertical alternation of clays with different colour, dense, fine, oily, with organic matter.

I n t e r r e l a t i o n s. The formation lies over Neogene sediments or directly over Barremian-Aptian limestones and Albian marls. It is covered by swampy soil formed above in most of the area studied. Alluvial sediments and sandy clays with thickness of 5-6 m are spread over it with erosional washout to the north, within the low bay terrace of the River Danube. The formation is connected laterally with the Cretaceous or Neogene sediments with erosional or tectonic contact.

D i s t r i b u t i o n. The formation covers a considerable area in the western part of the Ajdemir Lowland (Fig. 1, A). It is more limited to the east from the area studied and is followed along the River Danube bay terrace.

T h i c k n e s s. From 4 to 20 m (fig. 1, B).

A g e. According to the data from the spore-pollen analysis (Божилова et al, 1985) (Fig. 2) it is a Holocene Formation, which corresponds to the age determined by morphostratigraphic analogues 10000-11000 years.

P a l e o g e o g r a p h y a n d c h r o n o l o g y o f t h e s w a m p y s e d i m e n t s

The spore-pollen range-chart (Fig. 2) reflects the grassy communities prevalence in the beginning of Holocene. The oak forests predominated the climatic optimum (8000 BP), while the beech ones had occurred about 6500 BP. The Upper Holocene (subatlantic and subboreal climatic periods) is characterised by decrease of the wood types amounts and increase of the grassy types. The water species were constantly present. The amount of cultivated grassy types related with the Bronze Age increases in the beginning of the subboreal age (4800+200 BP). Dating with C^{14} was accomplished in the well, proving the age of humus accumulation (after 2600+100 BP), i. e., in the first half of the subatlantic period under the conditions of humid climate (Божилова et al., 1985; Лазарова, 1990). The sediments studied have been formed in swampy environment, under the conditions of constant sinking. Income of coarse to fine grained gravels of deluvial origin is established in the swamp peripheral parts at the beginning of its formation (fig. 2).

Alluvial sediments

They are widely spread within the area studied and form an alluvial formation (Fig. 1, A).

Târlica pebble-sandy-clayey Formation (Търлишка чакълно-песъчливо-глинеста свита) (new formation)

N o m e n c l a t u r e. It is called by the name of Târlica locality, situated at 2 km to the north-east of the Srebârna Lake, Silistra District (fig. 1, A).

D e f i n i n g f e a t u r e s. The formation is characterized by sandy clays and fine grained gravels in the form of interbeds and lens of flood river facies and riverbed facies.

T y p e s e c t i o n. The top levels of the formation are followed in the banks of the low bay terrace of the River Danube, at 2.5 km to the north-east of the Srebârna Lake, Silistra District towards its recent river bed (fig. 1, A).

3. (0.0-20 m). Soil, dark brown, with plant roots (0.20 m).

2. (0.20-2.0 m). Clay, dark grey, dense (1.8 m).

1. (2.0-4.0 m). Clay, grey, sandy, with rusty spots (2.0 m).

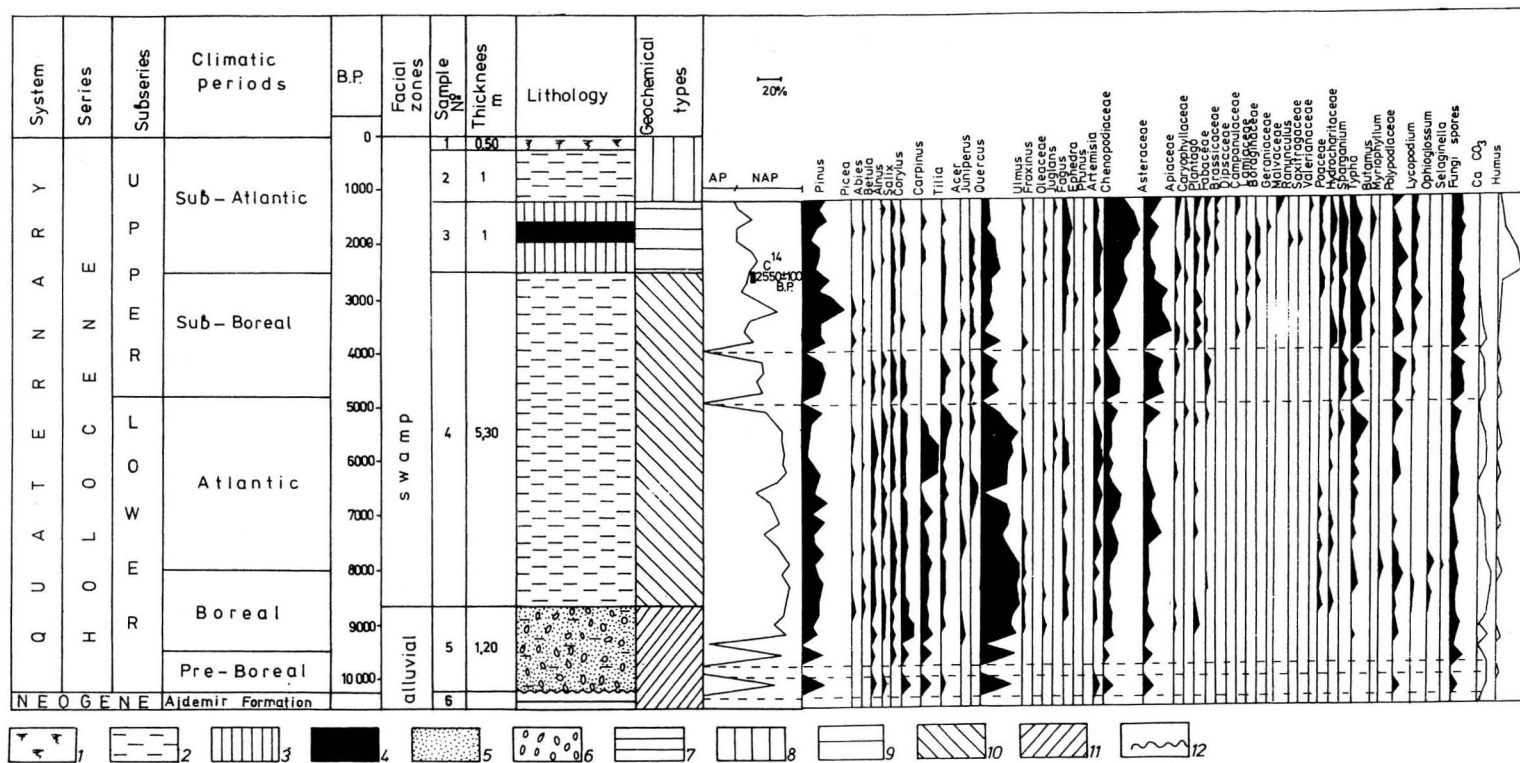


Fig. 2. Holostratotype of Todoranka Formation

Lithological characteristics (1-7): 1 – soil, 2 – clays, 3 – peat, 4 – goethite, 5 – sands, 6 – pebble, 7 – Ajdemiş Formation; **geochemical rock types (8-11):** 8 – brown, 9 – black, 10 – greyish-blue, 11 – yellow and yellowish-brown, 12 – washout

Remark: The range-chart between grassy and wood types and the CaCO_3 and humus amounts is according to Б о ж и л о в а et al. (1985, fig. 4) and Л а з а р о в а (1990, fig. 1)

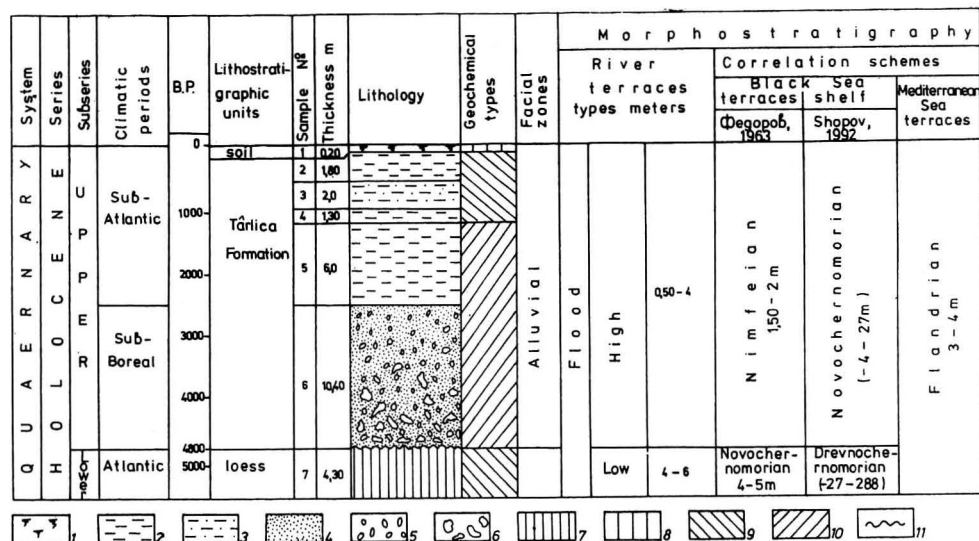


Fig. 3. Correlation between Târlica Formation and continental and marine morphostratigraphic units lithological characteristics (1-7): 1 — soil, 2 — clays, 3 — sandy clay, 4 — sands, 5 — pebbles, 6 — valoons, 7 — redeposited loess; geochemical rock types (8-10): 8 — brown, 9 — grey-blue, 10 — yellow and yellowish-brown, 11 — washout

Additionally we point out C-29 of Energoproekt (Б о ж и л о в а et al., 1985) (fig. 3), which is more complete in comparison with the holostatotype.

Cover. Recent soil.

7. (0-0.20 m). Soil, dark-brown with plant roots (0.20 m)
6. (0.20-2.0 m). Clay, greyish-blue with calcareous concretions (1.80 m); grain-size content: 2.0-0.05 mm — 11%, 0.05-0.005 mm — 55% and <0.005 mm — 34%.
5. (2.0-4.0 m). Clay, grey, sandy with rusty spots (2.0 m); grain-size content: up to 2 mm — 12%, 2.0-0.05 mm — 17%, 0.05-0.005 mm — 44% and <0.005 mm — 27%.
4. (4.0-5.30 m). Clay, dark grey, with blue spots, thick (1.30 m)
3. (5.30-11.30 m). Clay, light yellow, thick (6.0 m)
2. (11.30-21.70 m). Gravels and valloons in the bottom of the packet, middle- to finegrained quartz sand (10.40 m).

erosional washout

Basement. Redeposited loess clay. Lower Holocene

1. (21.7-25.0 m). Redeposited grey, loess dusty clay (4.3 m).

B o u n d a r i e s. The lower boundary is washed out over Lower Holocene sediments (redeposited loess or alluvial sediments), or over karstic Lower Cretaceous limestones, while the upper boundary is gradual with recent alluvial soils (biogenic elluvium).

L i t h o l o g i c a l c h a r a c t e r i s t i c s. The formation represents alteration of pebbles, sands, sandy clays and clays of alluvial origin and oblique bedding. The formation cannot be established at parts in the profile. Income of delluvial materials is observed in the terrace periphery.

I n t e r r e l a t i o n s. The formation lies all over washed out surface of the Lower Holocene alluvial or alluvial-delluvial sediments or over karstic limestones of the Ruse Formation and is covered by recent soils. It is interrelated laterally with various levels of the Todoranka Clayey Formation or with alluvial and alluvial-delluvial sediments of the Lower Holocene.

D i s t r i b u t i o n. The formation covers a considerable area in the region studied building the low bay terrace of the River Danube and of its larger tributaries (fig. 1, A).

Thickness. Variable — from 1 to 30 m.

Age. The formation probably pertains to the Upper Holocene (4800-5000 BP) (according to morphostratigraphic analogues with the dated Todoranka clayey Formation).

Paleogeography of the alluvial sediments

The correlation scheme of the Târlăca pebble-sandy-clayey Formation (fig. 3) enclosed and the correlation done using approved schemes reveal the defined lithofacies GS: flood river facies, riverbed and old-meander facies, formed during the subatlantic and subboreal periods and transition from perstative dynamic phase to constrative dynamic phase.

Conclusions

The Holocene sediments formed in the western part of the Ajdemir Lowland result from the tectonic and geomorphological development. They are deposited over small blocks with different dynamics and form superimposed, interbedded and contiguous discordances. The lower boundary represents a clearly marked erosional washout over various lithological background of different age.

The climatic and hydrodynamic changes in the beginning and during the Holocene reflect the sedimentation forming clearly expressed cycles in both major lithofacial zones — the alluvial and the swampy ones.

The complex stratigraphic analysis of sediments and the correlation done restore the history of the geodynamic development of the region during the post-glacial history of Europe and represent background sections for Bulgaria.

The study has practical importance for preservation of the International biosphere reserve "Srebărna", protected by UNESCO, which is in environment crisis, and for the expected hydrotechnical construction as well.

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References

- Shorov, V. 1992. The Pleistocene — Holocene boundary in Black Sea Shelf. — *Geologica Balc.*, 22, 2; 91-95.
- Божилова, Е., Лазарова, М., Страшевска, К. 1985. Геоморфологические особенности и развитие растительности в районе озера Сребырна. — *Год. Соф. унив., Биол. фак.*, 79, 2; 99-109.
- Дончев, П., Евлогиев, Й., Минков, М. 1985. Границата неоген-кватернер и стратиграфия на кватернера в Русенско. — *Сп. Бълг. геол. д-во*, 46, 3; 325-334.
- Лазарова, М. 1990. Развитие растительности в районе озера Сребырна. — В: „Микрофоссилии в Болгарской стратиграфии“ (Николов, Т. edit.). С., Болг. геол. общество; 95-100.
- Николов, Т. 1969. Стратиграфия на долната креда в част от Североизточна България. — *Изв. Геол. инст., сер. стратигр. и литол.*, 18; 31-71.
- Попов, Н. 1993. Литостратиграфски единици на неогена в Силистренско. — *Сп. Бълг. геол. д-во*, 51, 1; 65-70.
- Федоров, П. В. 1963. Стратиграфия четвертичных отложений Крымско-Кавказского побережья и некоторые вопросы геологической истории Черного моря. — *Тр. ГИН АН СССР*, вып. 88; 1-197.
- Филипов, Л., Микова, Л. 1986. Кватернерните образувания в Лудогорието. — *Сп. Бълг. геол. д-во*, 47, 2; 140-149.