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Carpathian-Crimean paleogeography in Hauterivian-Aptian

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Abstract. The main features of the Early Cretaceous paleogeography at the Carpathian-Black sea region are outlined. Hauterivian-Aptian sediments accumulated in the internal and external basins separated by an island arch. In the internal basin terrigenous shallow marine and alluvial sedimentation dominated. Clastic influx realized by rivers, wich were controlled by regional faults. Carbonate, carbonate-clay silts were formed in the external basin, while carbonates of Urgonian type – at the Moesian plate.

Key words: Carpathian-Crimean, paleogeography, hauterivian-aptian, shelf, river)

Basal layers of Cretaceous in Carpathian-Crimean region are the carbonate and clastic sequence with several meters (Carpathian region) to about 600 m (Crimea and adjacent areas) in thickness. Depending on the section setting it consists of different grained sandstones, siltstones with conglomerates, claystones, limestones interlayers or of limestones with various content of clay, clastic and biogenic material.

At the most part of the investigated area between Lower Cretaceous and Paleozoic-Mezozoic basement the depositional hiatus existed. Lower Cretaceous deposits with local unconformity are covered by glauconitic Aptian-Albian deposits.

Studied basal layers have different age: Late Hauterivian-Early Barremian (southern part of the Crimean lowland, Carpathian region); Late Barremian-Early Aptian (central part of the Crimean lowland, Predobrougean depression); Aptian (North Foreshore of the Black Sea, central zones and slopes of Carkinitian, Calamitian, Middle Azovian uplifts) and Late Hauterivian-Early Aptian (Scythian and Moesian plates).

In the Moesian plate limits these deposits are a part of united Lower-Middle Cretaceous complex.

Taking into consideration sequence correlation of the main lithological components (sandstones, siltstones, claystones, limestones), according to quantitative method of the facial analysis (Kiseliov & Kulchytskyi, 1983), five lithologic complexes from three series have been revealed. There are: psammitic and carbonate-psammitic complexes of psammitic series; silt-claystone complex from claystone series; also carbonate and carbonate with sandstone and claystone intercalations complexes of carbonate series.

Psammitic and carbonate complexes are most developed in the limits of the Carpatian-Crimean region (Fig. 1). Hauterivian-Aptian sediments in Carpathian-Crimean segment of Mezo-Tethys accumulated in epi-mezopelagic depositional environments in two major basins (internal and external) separated one from the other by an island arch. The latter consisted of sub- and overmarine uplifts. Santa Crist, Dobrougean and Crimea islands were the largest among them (Fig. 2)[1].

In the internal basin (separated from the open ocean) there occurred alluvian-deltaic and shallow marine sedimentation. The continental margin marine basins were divided into two major regions – Roztockij and Predobrougean-Black sea. The depocentre of the first region was located in the western part of the margin; the depocentre of the second one – in the eastern part of the Carpathian-Crimea continental margin (Michajlov depression). Through the narrow straits both basins were connected with the open ocean: Roztockij – with the Carpathian trough; Predobrougean-Crimea – through the strait between Dobrougean and Calamitskij islands with the West-Black sea trough.

In both basins, clastic-carbonate sedimentation (carbonate-clay muds, thin layers of quartz-feldspar, quartz, carbonate sands and silts) dominated. Sedimentation rate did not exceed 5–10 mm/1000 years. Organogenic carbonate sedimentation was depressed by the intense clastic influx. Biogenic and carbonate detrital deposits were formed in local areas only.

Clastic material was provided by five main river systems flowing from the Feno-Sarmatian highland. These river valleys were fixed by elongated areas of coarse grained quartz and quartz-feldspar sands with kaolinite (meander facies) development (sedimentary rate about 100–150 mm/1000 y). Southward these facies were changed by fine grained deltaic sands and silts, and then – by silts and carbonate-clay muds of the external basin. This facies association are ended by oceanic floor fans. In lateral direction sandy meander facies were changed by

[1] Lithological map and paleogeographic model are constructed using geological data of Romania and Bulgaria (e.g. Atanasov, 1983. Costea, Vinogradov, Comsa, & Bonig, 1981).

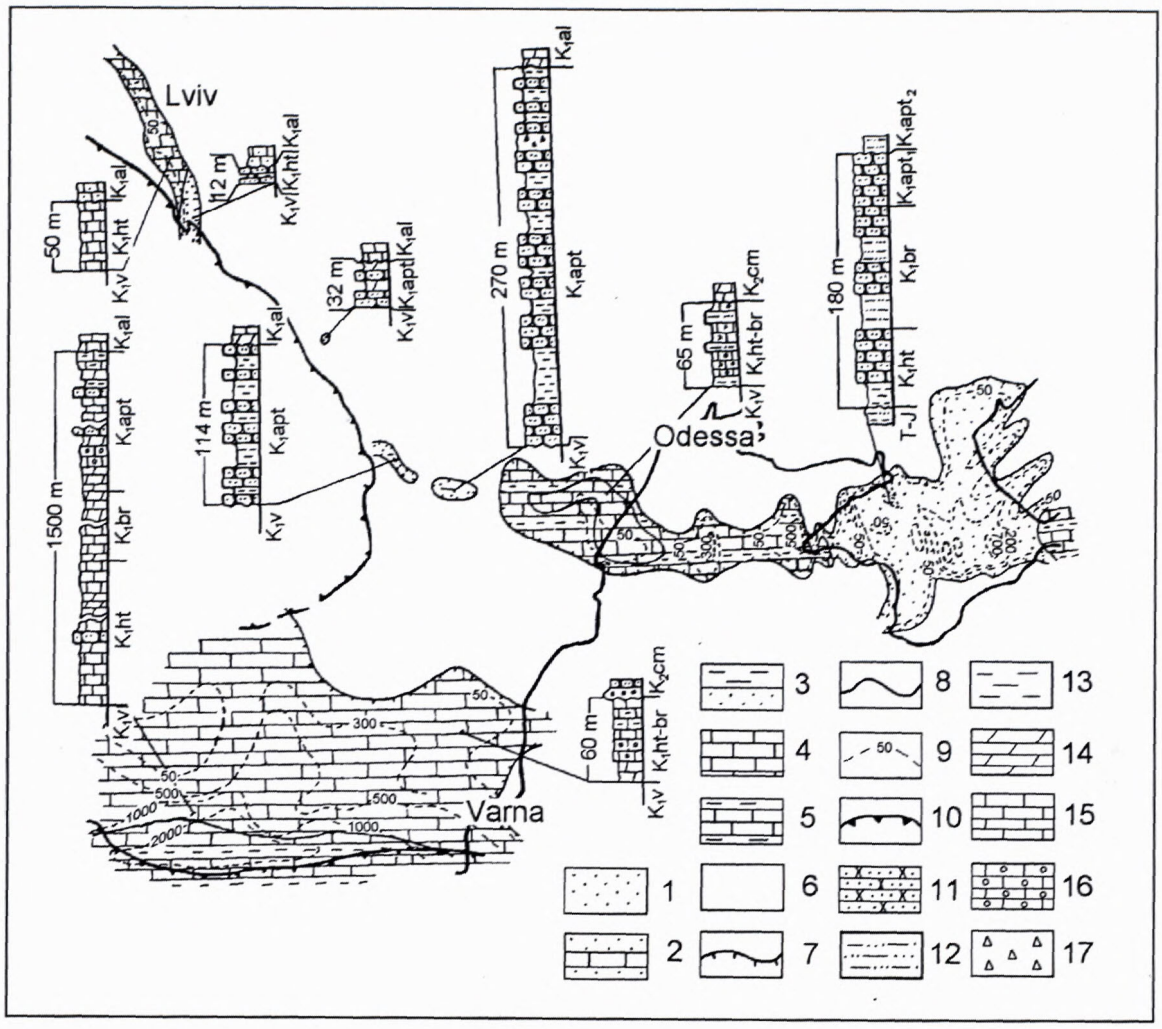

Fig. 1. Litological map of the Carpathian-Crimean region. Upper Hauterivian–Lower Aptian.
Litologic complexes: ***Psammitic series (1-2)****: 1 – psammitic complex (avarage content: gravelites 4%, sandstones 61%, siltstones 20%, claystones 13%, limestones 2%); 2 – carbonate-psammitic complex (gravelites 2%, sandstones 57%, siltstones 10%, claystones 12%, limestones 26%);* ***Claystone series****: 3 – siltstone-claystone complex (gravelites 0.2%, sandstones 8%, siltstones 29%, claystones 53%, limestones 10%);* ***Carbonate series (4-5):*** *4 – carbonate complex (sandstones 2%, siltstones 7%, claystones 10%, limestones 81%); 5 – carbonate with interlayers of sandstones and claystones complex (sandstones 8%, siltstones 10%, claystones 21%, limestones 61%). 6 – Land. 7 – Limits of the deposits spreading. 8 – Limits of the litologic complexes. 9 – isopachytes. 10 – thrust limits. 11 – sandstones, 12 – siltstones, 13 – claystones, 14 – maris, 15 – clay limestones, 16 – oolitic limestones, 17 – breccia.*

alluvial silts and muds; deltaic deposits were changed by clay-carbonate muds of the internal shelf. These major river systems formed up along fault zones. The Odesskij, Mykolaivskij, Krivorogsko-Eupatorijsko-Scadovskij, Salgir-Octiabrskij, Konksko-Bijlozerskij faults promoted terrigenous influx into the Black sea-Crimea basin, whereas the Teteriv and Bilotcerkivskij – into Carpathian basin.

External basin, which was open to the ocean sedimentary zone, was very narrow and developed southward, south-westward from Santa Crist-Crimean island arch. In the Moesian-West and East Pontides platforms, only this zone essentially widened. In these areas organogenic carbonate sedimentation dominated.

The Moesian carbonate platform was divided into three sedimentary zones (internal, external shelves an barrier zone). Inner shelf covered the largest part of the Moesian platform. There were deposited the foraminiferal and foraminiferal-oolitic carbonate, sometimes clay-carbonate muds with sedimentary rate about 20–30 mm/1000 y. The external shelf as a narrow zone surrounded the internal one. Within its limits, clay and carbonate-clay muds essential silt-size clastic admixture were deposited at the rate of about 50-60 mm/1000 y. In the barrier zone, which is routed in southern part of Moesian platform, carbonate bars and bioherms (Urgonian facies) were formed.

The paleoshelf edge in the Carpathian region supposedly occurred along the Transcarpathian fault zone, in the Moesian platform – to the south of the South Moesian thrust, in the Black sea-Crimea region the paleoshelf edge actually coincides with the present one.

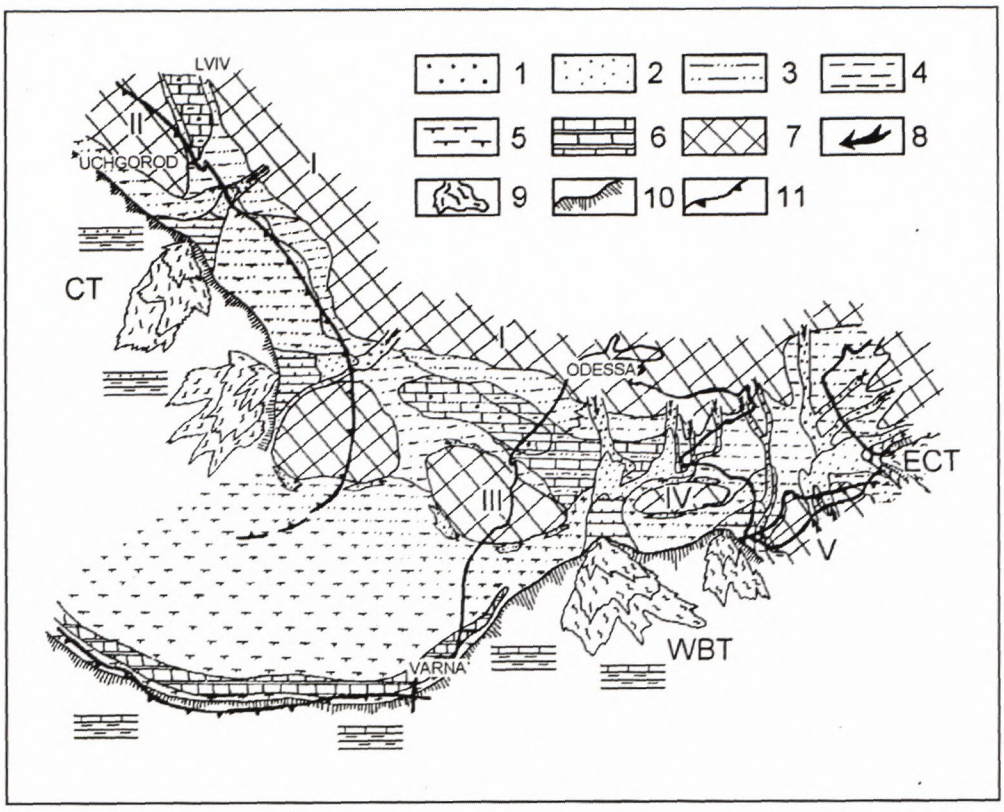

Fig. 2. Sedimentary model of the Carpathian-Crimean continental margin. Late Hauterivian–Lower Aptian.
1 – coarse grained sands, 2 – different grained sands, 3 – silts, 4 – clay muds, 5 – carbonate-clay muds, 6 – carbonate (detrital) and organogenic deposits, 7 – nondeposited area , 8 – directions of clastic influx, 9 – fans, 10 – shelf edge, 11 – thrust limits.I – Feno-Sarmatian land. Islands: II – Santa Christ: III – Dobrougean; IV – Calamitskian; V – Crimean. Trough: CT – Carpathian; WBT – West-Black sea; ECT – East-Caucasus.

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