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BRIEF COMMUNICATIONS

The Crimean Eocene Nummulite Bank

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INTRODUCTION

Eocene nummulitic limestones represent potential reservoir rocks for oil accumulations in Central Asia, North Africa, and the Mediterranean region. Examination of their lithology and sedimentation settings is of great practical significance. This communication is dedicated to the characteristics of carbonate facies with Early–Middle Eocene nummulites developed in the Mountainous Crimea. Their best outcrops, which form a narrow band extending W–E, occur in the Mount Inkerman, Krasnyi Mak Settlement, Mount Suvlu-Kaya, Skalistoe Settlement, Simferopol City, Litvinenkovo Settlement (Zuya River), Mount Ak-Kaya, Prolom Settlement, and Nasypnoe Settlement (Feodosiya City) areas (Fig. 1). The rocks were examined with the unaided eye and under a microscope in thin sections. Their petrophysical properties were determined by analytical methods. Classification of carbonate rocks based on their primary sedimentary textures after R.J. Dunham was used when describing the rocks under the microscope [Wilson, 1980].

Based on nannofossils and foraminifers, the nummulite limestones constituting the Simferopol Formation are estimated to be late Ypreasian–early Lutetian in age [Zakrevskaya, 1993].

HABITAT ENVIRONMENTS OF RECENT LARGER FORAMINIFERS

Recent larger foraminifers are confined to areas washed by oligotrophic water masses. The occurrence of nummulitids representing this foraminif group in rocks indicates usually sedimentation depths of <130 m. They prefer warm (~25°C) shallow water (<120 m) of the euphotic zone. The distribution of larger foraminifers depends on different factors such as illumination, salinity, nutrients, and substrate. Nummulitids usually populate oozy carbonate substrate with sea grass developed on the slopes of positive morphological structures of the seafloor. During their entire life cycle, these organisms are characterized either by a sessile or almost immobile habit of life, being attached to algae, or move slowly using pseudopodia [Zernetskii, 1980]. Forms with strong thick-walled shells prefer shallow-water environments with high-energy hydrodynamics, while taxa with fragile flattened shells usually populate deeper-water areas. The concentrations of calcium dissolved in water determine the ornamentation of tests: the higher is this concentration, the more granulation is developed [Nemkov, 1962].

LITHOGICAL PROPERTIES OF CRIMEAN NUMMULITIC LIMESTONES

In paleogeographic terms, the facies of nummulite limestones developed in the Crimean Mountains is characteristic of a nummulite bank (Fig. 2). Sections in the Ak-Kaya and Prolom Settlement areas indicate the shallowest setting: a shoal in the central part of the bank with paleodepths of 10–30 m. The shoal is confined to the eastern limb of the Simferopol Uplift and to the southern continuation of the Novoe Selo Uplift. Prior to the Eocene, this area experienced differentiated uplifting [Shutskaya, 1970]. Approximately 500 m of sediments could have been eroded there by the Eocene. The sections consist there of loose nummulite packstone

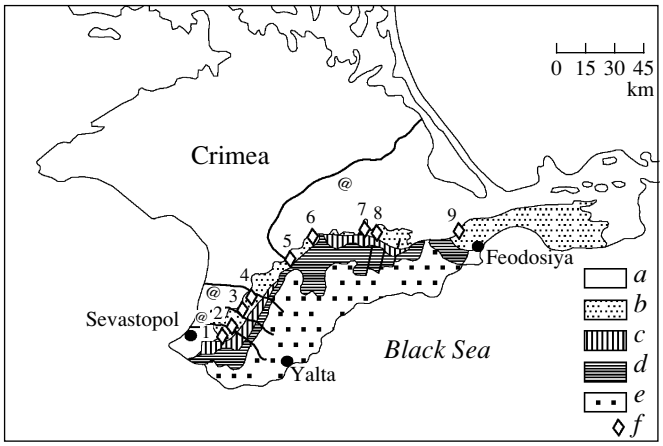

Fig. 1. Schematic geological map of the Crimea Peninsula and location of Eocene sections. (*a*–*e*) sediments: (*a*), Neogene, (*b*), Paleogene, (*c*), Upper Cretaceous, (*d*), Lower Cretaceous, (*e*), Upper Triassic–Jurassic; (*f*), Eocene sections: (1) Mount Inkerman, (2) Krasnyi Mak Settlement, (3) Mount Suvlu-Kaya, (4) Skalistoe Settlement, (5) Simferopol, (6) Litvinenkovo Settlement, (7) Mount Ak-Kaya, (8) Prolom Settlement, (9) Nasypnoe Settlement.

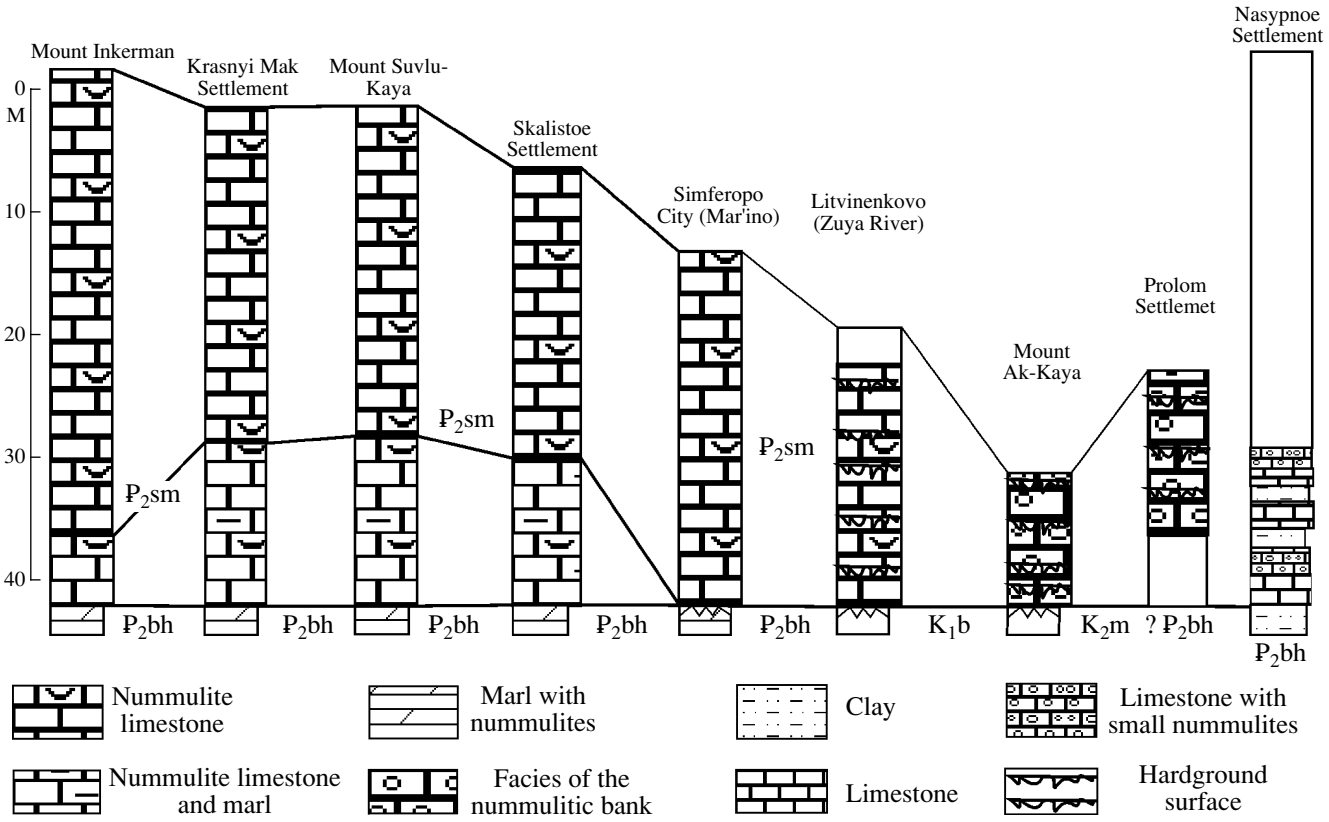

Fig. 2. Facies profile of Eocene sediments in the piedmonts of the Crimean Mountains.

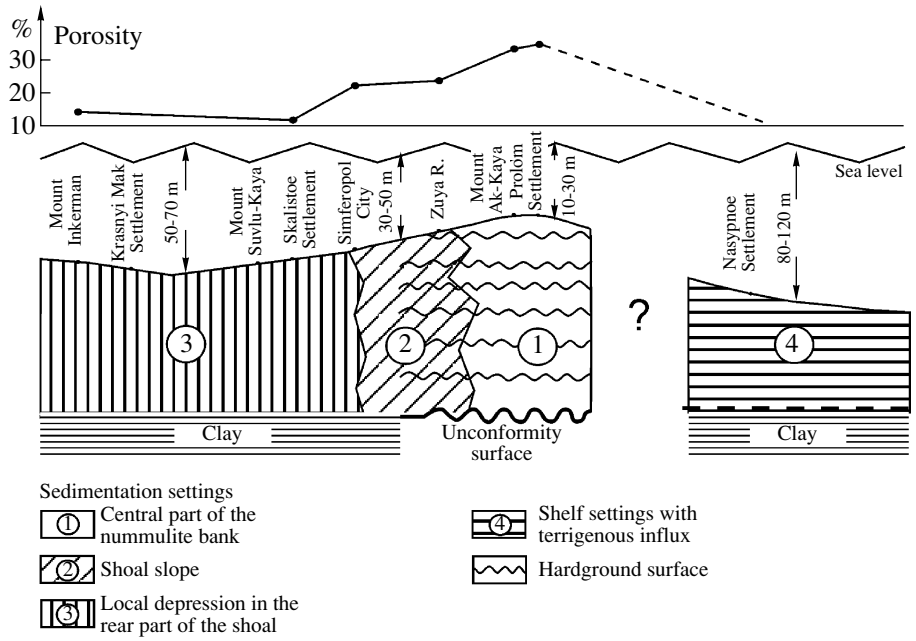

Fig. 3. Paleogeographic profile of Eocene sediments in the piedmonts of the Crimean Mountains.

and grainstone consisting of nummulite shell fragments and lacking micritic matrix and cement. The rocks are characterized by excellent porosity properties (Fig. 3), which make organnic edifices good reservoirs for hydrocarbons. The sequence of organic-detrital limestones encloses abundant hardgrounds with crustacean

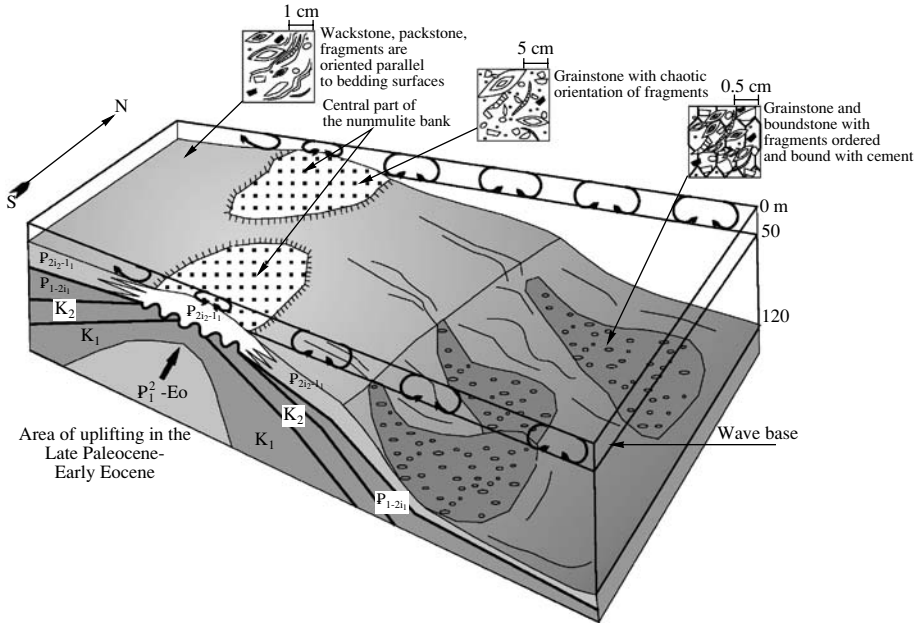

Fig. 4. Model of the Crimean Eocene nummulite bank.

tracks left by thalassinid crustaceans. Accumulations of large foraminiferal tests up to 8–10 cm across are confined to the upper surfaces of hardgrounds. These starved sedimentary sections are stratigraphically complete, being however substantially thinner compared to other successions (up to 10 m in the Mount Ak-Kaya area). The mature hardgrounds were formed on shoals under the influence of strong currents.

Relatively deeper-water facies distributed west of this shoal were recorded in the Litvinenkovo Settlement area and in the Simferopol section. The former are similar to sections described above: well-developed hardgrounds alternate with beds of loose nummulite packstone and packstones–grainstone. At the same time, the section is three times thicker there. The section in the Simferopol area consists of alternating nummulite wackstone–packstone beds and hard nummulite packstone with abundant foraminifer shells. These sediments accumulated in shallow-water settings of the shoal slope at a depth of approximately 50 m at the most where intermittent currents washed them.

The Skalistoe Settlement, Mont Suvlu-Kaya, Krasnyi Mak Settlement, and Mount Inkerman sections are located farther west and largely consist of wackstones enclosing lenses of packstone and mudstone containing rare nummulite tests and carbonate matrix. The rocks are characterized by thin bedding reflected in alternating hard (wackstone–packstone) and less compact (wackstone and mudstone) varieties. The sediments characterize relatively deeper parts of the shelf with depths exceeding 50 m. The bedding is determined by bottom currents.

In the Feodosiya area, the Eocene section consists of alternating compact pinkish limestone (grainstone, boundstone) and carbonate clay with nummulites. The accumulation depth of these sediments can reach 120 m (Figs. 3, 4) i.e., the maximal value for such facies, which correspond to deep slope settings of the nummulite bank.

CONCLUSIONS

The nummulite facies is characteristic of Eocene sections occurring along the piedmonts of the Crimean Mountains. They comprise sediments accumulated in the central part of the nummulite bank, on its shoal (Mount Ak-Kaya, Prolom Settlement) and slope (Litvinenkovo Settlement, Simferopol City), the relatively deep shelf (the eastern part of the Crimean Mountains piedmonts between the Krasnyi Mak and Skalistoe settlements), and the deep slope of the nummulite bank.

Organic-detrital nummulite limestones are characterized by excellent reservoir properties. This is particularly true of facies confined to the central part of the nummulitic bank. This feature makes the rocks in question promising with respect to hydrocarbon accumulations.

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