Organic Matter of Oligocene-Miocene Sediments of the Caspian-Kuban Region

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This paper presents the results of geochemical investigations of the organic matter of the Oligocene-Miocene sediments of the Caspian-Kuban region between the Kusarchay and Gil'ginchay Rivers. Determinations were made of the bitumens, their component composition, humic acids, organic carbon, and total nitrogen; as well as petrographic and physical chemical analyses for the purpose of clarifying the conditions and character of the medium of sedimentation of the rocks of the Oligocene-Miocene complex. A study was made of 15 sections of the Maykop formation, Chokrak, Karagan, and Koun horizons, and the Sarmatian stage in natural outcrops along the Tertiary monocline; and also of cores from structural-exploration and prospecting wells. See Fig. 1.

The bitumen was extracted from the rocks by chloroform. The component composition was studied by the method of Markusson-Sakhnov. The organic matter was determined in a Wurtz-Sntroleyn apparatus after extraction of the bitumen. The quantity of humic acids was determined calorimetrically after their extraction by 2-percent KOH. Nitrogen was determined by the Kheldahl method.

The section of the upper Maykop of the northwest part of the area with a thickness of 40-60 m consists of alternating beds of dark gray, chocolate brown, thin-bedded sandy clays with incrustations of jarosite and thin sandy beds. In the southeast of the region the thickness of the Maykop sediments increases, and sandy-clayey rocks predominate in the section. Beds and lenses of marls, dolomites, and locally siderite are observed. Farther to the southeast the section of the Maykop again changes to clayey sediments. The average carbonate content of the rocks is 9%.

The amount of disseminated bitumen in the rocks of the Maykop formation ranges from 0.01 to 0.86%. To the southeast up to the Turzhunchay River there is a regular decrease in the content of bitumen from average values of 0.08 to 0.01%. We note that the rocks of the Maykop section along the Chagadzhukchay and Turzhunchay Rivers are on the whole non-bituminous. Farther on, in the areas of Amirkhanly, Saadan, and Chandagar-Zorat, the bitumen again increases and reaches a maximum up to 0.16% (Saadan); this can be explained by an increase in the role of clays in these sections. See Table 1. Further, as our investigations have shown, the sediments of the same age studied in natural exposure and in wells yielded different results. As a rule, the samples of rocks from outcrops contain less bitumen than rocks recovered from wells due to the weathering of the organic matter. For example, the maximum content of bitumens in the Maykop sediments studied in outcrops does not exceed 0.18%, whereas its reaches 0.86% in core samples. The average value of bitumen for the Caspian-Kuban area is 0.09%.

The average C_{org} content for the Maykop sediments in the area under study is 1.30%; the maximum C_{org} is found in rocks of the Maykop formation in the Saadan and Chandagar-Zorat areas (0.50-3.57%), the average being 2.0%. In well 6 of the Tengialty area, the C_{org} content in the shales reaches 9.78% (6). In this connection, the average value of C_{org} increases with stratigraphic depth. The indexes in the rocks of the Maykop are relatively less along the Turzhunchay River where the amount of C_{org} is more than 2.0% only in two samples of the upper part of the section. See Fig. 2.

The Maykop sediments are characterized on the whole by a small content of humic acid from 0.01 to 0.03%, rarely reaching 0.04-0.08% (Zeyvachay). Humic acids are largely absent in the section of the Maykop along the Turzhunchay River; only four samples with 0.01 to 0.02% were found. A higher content of humus was recorded in the Maykop in the Saadan area where the content has a broad range from 0.02 to 0.29% with an average of 0.11%. In addition there is a systematic increase in the content of humic acids downward along the section.

Of the Oligocene-Miocene sediments, the rocks of the Maykop formation are the most enriched in nitrogen, the average being 0.061%. In this connection, considerable concentration of nitrogen have been found in samples of rocks of the Maykop along the Kusarchay River (0.076-0.126%, average - 0.1%). The C/N ratio is 12.1. In the basin of the Turzhunchay River the average value for nitrogen does not exceed 0.052%.

The Chokrak horizon (middle Miocene) consists of dark gray, brownish black clays with beds of sand, argillites, marls, and dolomitized limestones with Spiralis. The sandy rocks are poorly sorted. In the southeast of the area the section has a more clayey character. The carbonate content is small, averaging 5-7%.

The rocks of the Chokrak horizon are characterized by a bitumen content of 0.0 to 0.29%, averaging 0.035%. In the section of the Chokrak along the Zeyvachay River the amount of disseminated bitumen in the rocks increases downward.

The content of C_{org} is very high in the rocks of the Chokrak section of the Zeyvachay River (1.02 to 6.63%, average - 2.24%). Also