

FORMATION CONDITIONS OF SOURCE ROCK POTENTIAL IN EOCENE DEPOSITS OF CAUCASIAN-SCYTHIAN REGION

Lilia R. DISTANOVA and Olga K. BAZHENOVA

Lomonosov Moscow State University, Moscow, 119992 Russia, liluha@rambler.ru

Establishing of formation conditions of OM from Eocene deposits, mainly Kuma formation (and its analogues) which is high-potential source rock in the Caucasian – Scythian region has been object of investigations. Research work included determination of distribution character and composition of OM at a basis of modern methods of organic geochemistry including GC, GC-MS, Rock-Eval pyrolysis.

Eocene samples (in particular Kuma formation) used in this study are obtained from the area of Western and Eastern Precaucasus (sequences at Heu, Pshish, Belaya rivers), outcrops on Caucasus, outcrops on Dagestan (Chirkey-HPS), Crimea region (Kazantash) and oil shales of the Boltysk field (Ukraine).

Eocene Kuma deposits are represented by dark-layered bituminous marls and carbonate clays with thin seams of sands and siltstones with thickness of about 80 m. TOC content in the studied marls of Precaucasus varies from 0,2 to 10,3% (average 2,0%). $(S_1+S_2)=0,4-30$ kg HC/t - from low up to excellent potential. HI=20-612 mg HC/g TOC - kerogen type I to III (mainly II type). The studied sequences are characterized by immature OM. Maturation level counted by $T_{max}=415-427^{\circ}C$.

Age analogue of Kuma formation on the western slope of Caucasus is Navagan formation represented by flysch of mainly carbonate-claystone composition with laminae of shales. TOC in carbonate samples in Sochi-Adler area changes from 0,78 up to 9,4%, $(S_1+S_2)=1,66-56,2$ kg HC/t; HI=160-790 mg HC/g TOC, consequently kerogen type I–II, i.e. these source rocks could be evaluated as highly potential. Tmax value is average 432°C, except exposures of Charkey - HPS (Dagestan) where Tmax = 442°, so we can assume probable maximal burying of the strata not less than on 2,8-3 km.

Distribution of n-alkanes on the western slope of Caucasus (area Sochi-Adler) based on GC data is bi-modal with maximum on C₁₆-C₁₈ and C₂₅-C₂₉. Pr/Ph=0,88-1,33. Increased values of Ki=1-4,2 testify on low maturation of OM, only in Western-Aphipsk area (the West-Kuban trough) Ki is 0,28 that is being evidence, alongside with other parameters, of higher OM maturation. Distribution of alkane HC's confirms marine origin of OM, partially with some input of higher plants and its accumulation in reducing conditions. Even sterane

distribution character ($C_{27}:C_{28}:C_{29}=32:31:36$) of OM also points on marine sedimentation conditions and mixed type of OM.

In marls of Kuma formation of Crimea (Kazantash) $TOC=1,57-8,1\%$ (average 4,2%), $(S_1 + S_2) = 11,5-20,6$ kg HC/t. $HI=167-250$ mg HC/g TOC - low quality of OM (kerogen type III); by $T_{max} = 415-420^\circ C$ OM has not reached level of the "oil window". Distribution of n-alkanes is bi-modal with maximum on $C_{16}-C_{17}$ and $C_{29}-C_{30}$, $Pr/Ph=0,57-0,58$. By sterane distribution character ($C_{27}:C_{28}:C_{29} - 31:16:51$) OM corresponds to mixed type of OM.

Thus, accumulation of Kuma formation deposits proceeded in rather shallow marine basin of Eastern Peritethys. Abundance of OM led to creation of reducing and sharply reducing near-bottom conditions. The studied sequences of Caucasus and Crimea regions corresponds to relatively coastal part of Kuma basin. Improvement of OM quality in southern direction is observed in sequences of Sochi-Adler area (HI up to 790 kg HC/t), due to reducing of terrestrial component. Samples from investigated areas of Precaucasian and Crimea have been studied by GC-MS in order to determine isorenieratene. Such structures have not been identified. Thus, Eocene basin has not experienced hydrosulfide infection.

Eocene oil shale deposits (Boltysk field) are filling the depression 600m deep in crystalline rocks of Ukrainian shield. OM is represented by the remainders of planktonic algae *Botryococcus*. $TOC=1,6-31,6\%$, $Ro=0,25-0,30\%$. $HI=780-950$ mg HC/g TOC that testifies on algal initial matter (kerogen type I). Deposits have not reached the level of the "oil window".

Geological conditions of Eocene potentially-source rocks formation are varying. Reasons for accumulation of the heightened concentrations of sapropelic OM in Eocene deposits are open to question. It could be explained by high biological productivity of the basin. The Pre-Kuma time is an epoch of transgressions, strengthening of the rift formation sources, stretching and the raised permeability of the earth crust, accompanied by intensive receipt into the World ocean of magmatic material that is evident due to heightened concentrations of Cr, Ni, As, V.

Thus, carbon-containing Eocene deposits are characterized by heightened and high source rock potential of OM which formation was caused by high-lipid algal planktonogenic initial organic matter with insignificant input of terrestrial OM. Increased potential of Eocene deposits, first of all Kuma formation and even-aged oil shales has been caused by a flash of phytoplankton bioproductivity stimulated by endogenous processes.