Gravity displacement of sediment masses in the Mesozoic-Cenozoic basins of the Northeastern Caucasus

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Three stages of intensive sediment gravity displacement spanning Toarcian-Aalenian, Campanian-Danian, and Oligocene-Miocene intervals are detected in the NE Caucasus (Mountain Dagestan). Morphology of slumping bodies was largely controlled by siliciclastic (sandy-clayey) or biogenic (calcareous or siliceous-calcareous) sedimentary types.

In the Toarcian-Aalenian, a wide river delta drained southern Russian Platform and adjacent areas resulting in formation of more than 6 km thick siliciclastic deltaic complex in the NE Caucasus basin. This deltaic system stretches ~250 km SE-NW and ~100 km NE-SW directions. Deltaic activity was affected by different factors, where intensive punctuated subsidence of the basin floor played the main role. Position of sandy bodies at the sloping surface of avandelta was unstable that could cause clastic flows or slumping with chaotic sediment mixing. However, relatively slow slumping of 10-15 m thick and few kilometers in size sandy plates on the avandelta slope was one of the most frequent types of gravity displacement. Internal architecture of sandy plates remained undisturbed, but they led to deformation, mixing and grinding of underlying sediments, which become lost of initial sedimentary features, homogenized and embedding sandy bodies of bizarre shape. Intensity of homogenization depended on both distance of sandy plate displacement and lithification of underlying sediments prior to beginning of plate movement. In the terminal Aalenian, as a result of transgression, delta migrated northward for few hundred km that resulted in reorganization of sedimentary regime and large-scale gravity displacement of sedimentary masses in this part of the basin interrupted.

Late Cretaceous to Danian time span was characterized by calcareous and siliceous-calcareous sedimentation in the NE Caucasus. Beginning in Campanian, large roughly trending to Caucasian NW-SE stretching syndepositional folds rose. Their formation was evidently caused by northward movement of Arabian Plate. Anticline buildup caused destabilization of sediment arrangement at their flanks and wide occurrence of slumping. Many horizons featured by submarine slumping deformations can be observed in the Campanian to Danian or even to Eocene sediments in some areas. Character of these deformations can be substantially different from complete grinding and homogenization to formation of large lying folds with good-preserved beds forming their curves and limbs. Calcareous beds underwent the major destruction during slumping deformation, while siliceous-calcareous sediments kept initial bedding and showed plastic deformations frequently forming thrust structures. Thickness of slumping horizons reaches several dozens of meters and they quite often associate with channels formed by mudflows and incised into slumping sediments. Enrichment in organic matter provides the development of slumping processes. The landslide structures are found in the sediments super posing the bed corresponding to OAE2 which contain high Corg values.

In the Oligocene-Miocene, Great Caucasus island rose. High seismic activity of its eastern part and sea-level fluctuations, destabilized sediments at the slope and led to formation of a series of large olistoliths built-up of pre-Oligocene deposits. Frequent middle Miocene earthquakes enabled not only slumping of soft sediments, but also complex fracturing of lithified clayey sediments allowing formation of numerous neptunic dikes.

Comparison of deformed structures occurred as a result of gravity displacement of sediment masses at the paleo-slopes of time-transgressive basins of the NE Caucasus shows significant differences among them caused by their different nature and composition of involved to slumping sediments.

Acknowledgements: RFBR Project no. 12-05-01138-a.