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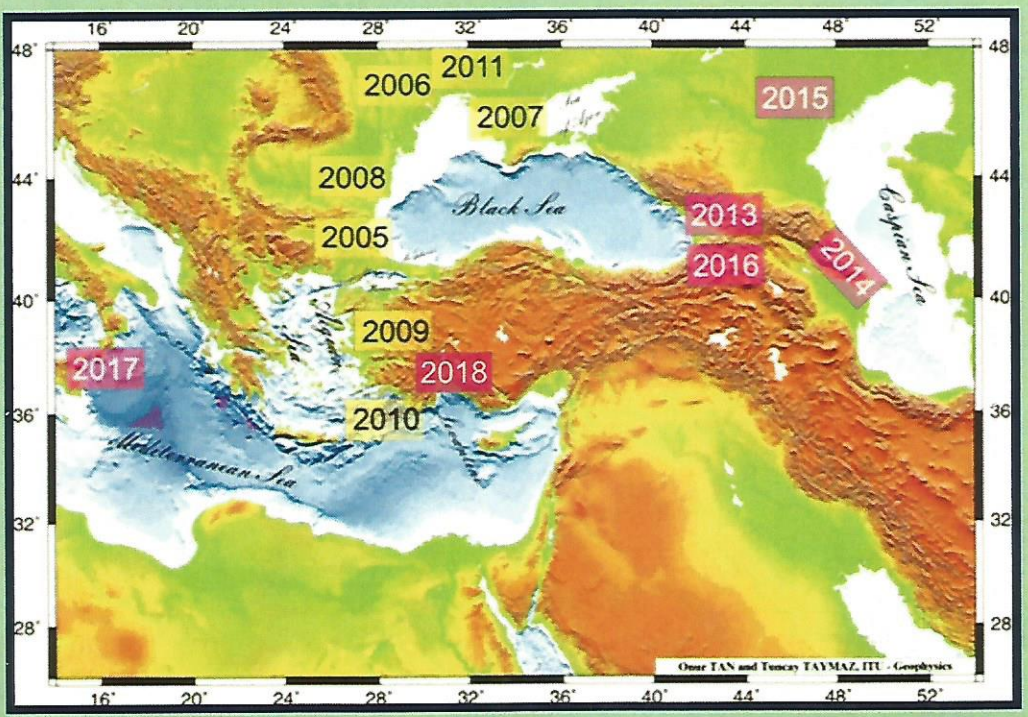

PROCEEDINGS

IGCP 610 "From the Caspian to Mediterranean: Environmental Change and Human Response during the Quaternary" (2013 - 2018)

INQUA IFG POCAS "Ponto-Caspian Stratigraphy and Geochronology" (2017-2020)

THE LOESS-SOIL SEQUENCES IN THE LOWER VOLGA AREA: STRATIGRAPHY, GEOCHRONOLOGY AND PALEOGEOGRAPHY

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Paleogeographic development of the Caspian Sea in the Late Pleisocene is characterized by alterna-tion of transgressive and regressive stages. Unlike transgressive periods, the paleogeographical environment during regressive periods is less understood. The main reason is the lack of paleon-tological and paleobotanical remains (fauna and pollen) in continental deposits of various genesis.

The longest period of a Caspian Sea low level stand in the Late Pleistocene is the Atelian regres-sion. During this period a thick sequence of continental deposits was formed. This formation is widespread within the Northern Caspian Depression and represented by subaqueous and subaerial deposits, including alluvial and aeolian. In the southern part of Lower Volga most of this strata is eroded by more active abrasion during Caspian sea minor transgressions of Hyrcanian time and the first part of Khvalynian period. But in the north, in the series of sections around the Volgograd city, Atelian strata reach up to 10-12 m in thickness. In this area continental sedimentation was longer, the abrasion during the high-stand of Early Khvalynian transgression was relatively small (~1-3 m, depending on the geomorphological position) due to very rapid sea-level rise in a short time (Kur-banov et al., 2018). Four sections reveal the structure of Atelian formation: Srednyaya Akhtuba, Leninsk and Batayevka on the left side of the Volga valley and Raigorod on the right side.

The general stratigraphy of Atelian formation in these four outcrops differs. The existing strati-graphical framework is based on new series of luminescence dating results (Yanina et al., 2017). Srednyaya Akhtuba is characterized by three MIS-5 paleosols and thick horizon of MIS-4 loess. The uppermost soil (MIS-5a) is disturbed by distinct deep wedges, cracks and streaks with sedi-ment penetrating from the covering loess. These cryogenic features clearly illustrate cooling cli-mate conditions of the MIS-4 at Lower Volga and can be easily identified at most of the sections. The upper part of the sequence is represented by alternation of alluvial sand and weakly developed loess horizons with clear traces of pedogenesis in MIS-3, that are also influenced by cryoturbations.

Leninsk, located more to the South is characterized by two well-developed paleosols of MIS-5, again with clear frost wedges from the upper thick loess horizon and one level of pedogenesis at the top of MIS-3 stage (the upper part of the soil is eroded). The MIS-5a soil is disturbed by deep cracks filled by loess.

At Raigorod section the Atelian strata is based on thick horizon of alluvial sediments (floodplain facies). In these alluvial clays and silts we identified two levels of pedogenesis, represented by highly hydromorphic soils. This stage remains undated, the only idea about the age of the well-developped soil at the base of the section can be obtained from the published results of pollen anal-ysis – that indicates the Likhvin stage (MIS-9) of the Russian plain (Grichuk, 1954). On the top of this layer floodplain facies change to channel facies – clean well-sorted sands, on top of which weakly developed paleosol can be identified. This soil is disturbed by minor wedges – not very clear due to similarity of the lithology with the overlaying sands. The clean loess of MIS-4 stage with 2 layers of slightest evidence of pedogenesis passes to MIS-3 stage loess with pedocomplex containing two paleosols on the top of the sequence. This pedocomplex was partly eroded during Khvalynian transgression.

Most developed sequence of Atelian time can be found at the Batayevka location, 100 km to the SE from Leninsk. Batayevka section is located on the left side of the Lower Volga valley opposite to the reference section of Chernyy Yar on the right valley side. In this outcrop we were able to iden-tify three levels of pedogenesis of MIS-3 (in alluvial sands of the upper part of the section), well-developed pedocomplex of MIS-5, containing three combined paleosols, the top one with perma-frost features – cracks and wedges. Important difference of this section is that it contains another three older levels of pedogenesis – of unknown age (probably MIS-7 and MIS-9). The Atelian for-mation here developed on the alternating lagoon and lacustrine sands and silts.

Described stratigraphy and chronology of the loess-paleosol sequence of the Atelian formation al-lows us to better understand the main stages of environmental evolution of the Lower Volga region and the whole Northern Caspian lowland during the Late Quaternary.Shells of freshwater and con-tinental ecological groups of molluscs are found in these sediments, both with suppressed morphol-ogy. Mammal skeletal remains of the upper Paleolithic faunal complex are found, including a mammoth, a horse, a reindeer and other animals, giving evidence for the cold climate of the Atelian epoch. The same is indicated by the taiga spore and pollen spectra from the Atelian deposits (Grichuk, 1954; Moskvitin, 1962). The pollen assemblages of definitely periglacial character re-covered from the Atelian deposits from cores (Bolikhovskaya et al., 2017).

The Atelian paleosols of different degrees of development implies a multiple change of climatic conditions in the region with warming and increased humidity. By the end of the Atelian epoch, the climate became warmer. In the vegetation, the share of arboreal pollen increased; along with birch, pine and spruce, newly introduced elm, oak and linden appeared; in the herbaceous associations the importance of xerophytes decreased, while Gramineae and herbaceous vegetation were introduced. Steppe and forest-steppe environments became dominant.

Starting with the second early Valday cooling and lasting up to the Holocene, the center of the Rus-sian Plain was occupied by a variety of periglacial landscapes. At the beginning of the early Valday cooling maximum, the transgressive development of the Caspian was disrupted by the Atelian re-gression that reached the lowest level at the peak of cooling conditions, under a cold and dry cli-mate. Heterogeneity of climatic conditions, expressed as an alternation of stadials and interstadials, was reflected in the Atelian deposits by the

development of thick loess horizon during MIS-4 and paleosol horizons alternating with loess during MIS-5 and MIS-3 stages.

Acknowelegements

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