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Vegetation and hydrological changes of the Shabla-Ezeretz lake system (northern Bulgarian Black Sea coast)

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Introduction Sites suitable for palynological studies are rare along the Bulgarian Black Sea coast. With regard to this results of investigations of coastal lakes are of great importance for palaeoecological recon-structions. There are good reasons which make the northernmost Bulgarian Black Sea coastal lake Shabla-Ezeretz an interesting site for palynological research. Its location along the coastal area of Southern Dobrudzha allows tracing out detailed information about environmental changes in the steppe area supposed by some Bulgarian botanists (Jordanov, 1936; Stojanov, 1941) to be of natural origin. The archaeological evidence of human occupation in the vicinity of the lake dates back to the Neolithic (Todorova, 1985). The origin of the lake and the oscillatory lake-sea connec-tion are of interest for reconstruction of sea-level changes during the Holocene. Methodology Two sediment cores Shabla-Ezeretz I (710 cm long) and Shabla-Ezeretz II (750 cm long) were taken from the northwestern coast of the lake at 30 and 80 cm water depth respectively with Streif and Dahnowsky core equipment. They were investigated by means of various biostratigraphic proxies (pollen, mollusks, diatoms, and radiocarbon dating). The samples for pollen analysis were processed according to standard method of Faegri & Iversen (1975). For the determination of ab-solute pollen frequency and pollen influx, two tablets of Lycopodium clavatum were added (Stock-marr, 1971). Eight samples of the core Shabla-Ezeretz II were dated at the Radiocarbon dating laboratory at Gif-sur-Yvette (France). The pollen sum for percentage calculation was based on AP+NAP-Local elements=100%. Results of pollen analysis are presented by Tilia and Tgview 2.0.2 programs. The local pollen assemblage zones were established by CONNISS cluster analysis (Grimm 1991, 2004).

Results The results are correlated with available archaeological data and enriched the information about the vegetation, climate, landscape, and hydrological changes, as well as about human econ-omy and occupation within the coastal area of Southern Dobrudzha (NE Bulgaria) since 11000ś500 BP onwards. According to the radiocarbon dates the accumulation of sediments rich in pollen started at about 6800ś110 BP/5630 cal. BC. Pollen analytical data give evidence that before that time pri-mary steppe vegetation dominated by heliophyllous herb taxa such as Artemisia, Chenopodiaceae, and Poaceae with scattered stands of deciduous trees: Quercus, Corylus, Carpinus betulus, and Ulmus had dominated the landscape around the lake. During the time span 5900ś100 BP/4850 cal. BC - 5650ś100 BP/4470 cal. BC a transition of steppe into forest-steppe communities dominated by Quercus with more thermophyllous taxa such as Tilia, Fagus, and Fraxinus excelsior occurred and suggested favorable climate conditions during the Late Atlantic. Mixed oak forests occurred only in favorable habitats with moisture conditions as well as on the Dobrudzha Plateau and Lu-dogorie Region situated westward from the area investigated. The subsequent change of natural vegetation and formation of secondary xerothermic herb communities was influenced not only by climate change at the beginning of the Subboreal, but by the increased human impact as well. Palynological record revealed three distinct stages of human activities as signaled by the sig-nificant values of cultivated species such as Cerealia-type, Triticum, and Hordeum and other an-thropogenic taxa: Plantago lanceolata, Polygonum aviculare, Centaurea cyanus and Urtica. These data testified to well developed agriculture and stock-breeding in the area during the Late Neolithic ca. 6800ś110 BP/5630 cal. BC, Eneolithic ca. 6200-5990ś100 BP/5070-4850 cal. BC, and after a Transitional period during the Bronze Age ca. 5000-3070ś100/3720-1400 cal. BC. The molluscan assemblages suggested the liman origin of the lake connected with the rise of the Black Sea level during the end of the Old Black Sea Transgression and revealed two stages of li-man sedimentation as well as the stages of interaction with the sea ca. 5400 BP and 4400 BP. The initial stage of the lake formation ranges between 6800ś110 BP/5630 cal. BC and 3700ś105 BP/2040 cal. BC. Layers of gyttja, peat and molluscan detritus of brackish water molluscan species such as Dreissena polymorpha and Theodoxus pallasi were formed. The significant values of pol-len of Typha/Sparganium and the lack of diatoms suggested a water-level lowering. At ca. 5400 BP and 4400 BP an increase of euryhalinous molluscan species and pollen of aquatic species Myrio-phyllum spicatum and M. verticillatum as well as benthic species of diatoms Paralia arenaria and Amphora ovalis confirmed the increase of water level and the interaction with the sea. During the time span 3600 BP and 2440ś95 BP/510 cal. BC a disconnection from the sea and formation a thick peat layer followed. Presumably the water level was lowered during the Fanagorian Regres-sion occurring at about the same time. The evolution of the liman continued after that event and the

second stage of liman sedimentation similar to the initial stage started.

Conclusions The liman origin of the lake and its formation at 6800 ś110 BP was related to the second phase of the Old Black Sea Transgression. The natural origin of steppe vegetation in the area was proved. The human influence during the late Neolithic, Eneolithic and Bronze Age was established.

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