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GEOMORPHOLOGICAL AND STRATIGRAPHIC ANALYSES AT THE ARCHAEOLOGICAL EXCAVATION IN THE MEGAPARK, NYÍREGYHÁZA-OROS

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Abstract

The aim of our morphological and stratigraphic investigations at the archaeological excavation in the area of the Megapark at Nyíregyháza–Oros is to make the reconstruction of the Aeolian development of the study area more accurate. The excavation is located between the remnants of two abandoned river beds in a wind-blown sand area near the crossing of main roads 4 and 41 East of Nyíregyháza–Oros. Eight boreholes were drilled in the site of the excavation. The cores were sampled in order to perform the sedimentological analysis of the penetrated strata. Strata of the sand dune are divided by a fossil soil horizon in which a cemetery from the age of the Hungarian conquest was found. Underneath the cemetery findings from the imperial age and urn graves from the Bronze Age were excavated. This suggests that wind-blown sand covered the soil horizon in a thickness of 1-1.5 m by the age of the conquest. The 3-4 m thick wind-blown sand excavated from the findings indicates sand accumulation following the 10th century.

Keywords: Geomorphology, archaeological excavation, stratigraphic and sedimentological analyses

INTRODUCTION

Studying the development of wind-blown sand areas in Hungary dates back to a century, however, accurate determination of the age of wind-blown sand formation by methods such as ^{14}C, OSL, archaeology has become possible only recently. (Kiss et al. 2006, Nyári et al. 2006). The formation of the Nyírség was outlined first in the publication of Nagy J. (1908) and then in that of Cholnoky J. (1910), however, a still accepted explanation for the development of the Nyírség was presented by Sümeghy J. (1944) who, based on the geological data of boreholes figured out that the Nyírség is the alluvial fan of rivers arriving from the Carpathians. Wind-blown sand was produced from the fluvial sediments deposited by the rivers.

Borsy Z. in his book on the Nyírség (1961) dates the formation of the dunes to the dry Boreal period (9000-7500 years) of the Holocene. By the 1980s fossil soils found in wind-blown sand could be dated by radiocarbon analyses (Borsy et al. 1981, Lóki et al.1993), which revealed that the first significant sand movements in the Nyírség took place in the Upper Plenniglacial period of the late Glacial (26000-20000 years BP). In the subsequent wet period the vegetation protected the surface until the next drier period of the Dryas (13000-11000 years BP) when wind became the dominant land forming process again.

Based on the field studies of the last decade, the aeolian transformation of the land was not completed in the Nyírség at the end of the Pleistocene (Kiss 2000, Lóki 2006, Lóki et al. 2008). Wetter and drier periods alternated in the Holocene as well and where vegetation was not protecting the surface wind was able to move the wind-blown sand deposited earlier. At present the surface forming activity of wind can be detected primarily in spring at the beginning of the growing season, however, it can be observed occasionally in winter as well (Lóki 1985). Detection of these "young" sand movements is helped greatly by archaeological excavations as findings (Lóki – Schweitzer 2001) and OSL age data (Nyári et al. 2006) make the age of land transformation more accurate.

The aim of the morphological and stratigraphic research performed in the area of the Megapark in Nyíregyháza-Oros was to contribute to the accurate reconstruction of the aeolian land development of the study area based on the age of the various archaeological findings and the data of sedimentological analyses.

MORPHOLOGICAL CONDITIONS IN THE SURROUNDINGS OF THE EXCAVATION

In this part of the Nyírség at the time of the accumulation of the alluvial fan the land was formed by the Ancient Tapoly-Ondava and the Laborc rivers arriving from the north until the middle of the Upper Plenniglacial (Borsy 1961). At this time the Bereg-Szatmár Plain and the Bodrogköz started to subside and as this subsidence was somewhat stronger at the northern part and the Tisza left the Ér valley at around 20000-22000 years ago and passed the Huszt Gate and going round the Beregovo Mountains turned to the NW towards the Bodrogköz. Simultaneously with the subsidence of the marginal areas the central part of the Nyírség uplifted and a dividing line developed along the Hajdúhadház–Nyírbátor–Vásárosnamény line.

Turning of the Tisza towards the NW resulted in that the rivers arriving from the N were unable to reach the Nyírség. During the cold, dry climate of the Upper Plenniglacial only sparse steppe vegetation covered the fluvial sediments on the surface (Borsy 1961). This vegetation was unable to provide sufficient protection against strong

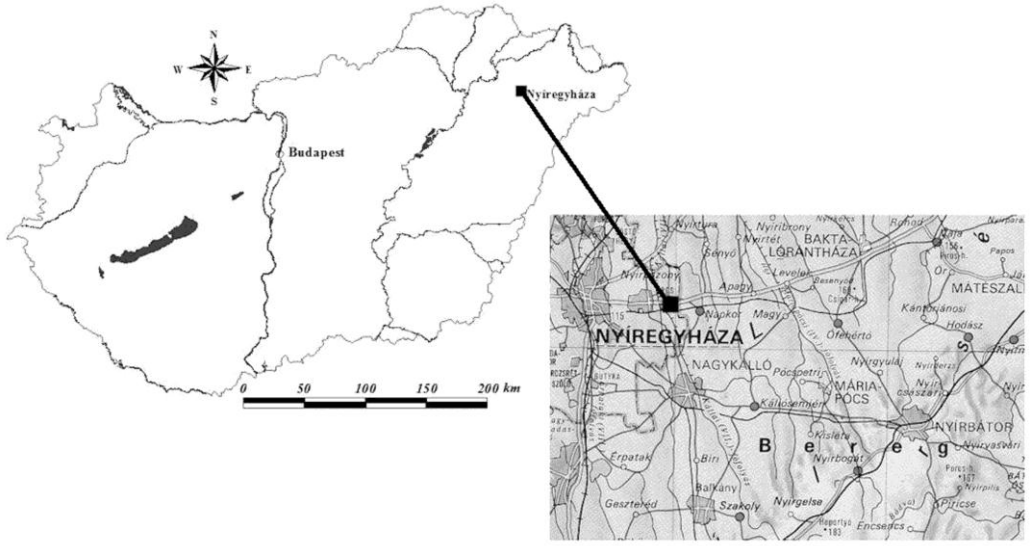

Fig. 1 The researcher area near Nyíregyháza (Dot marks the study area)

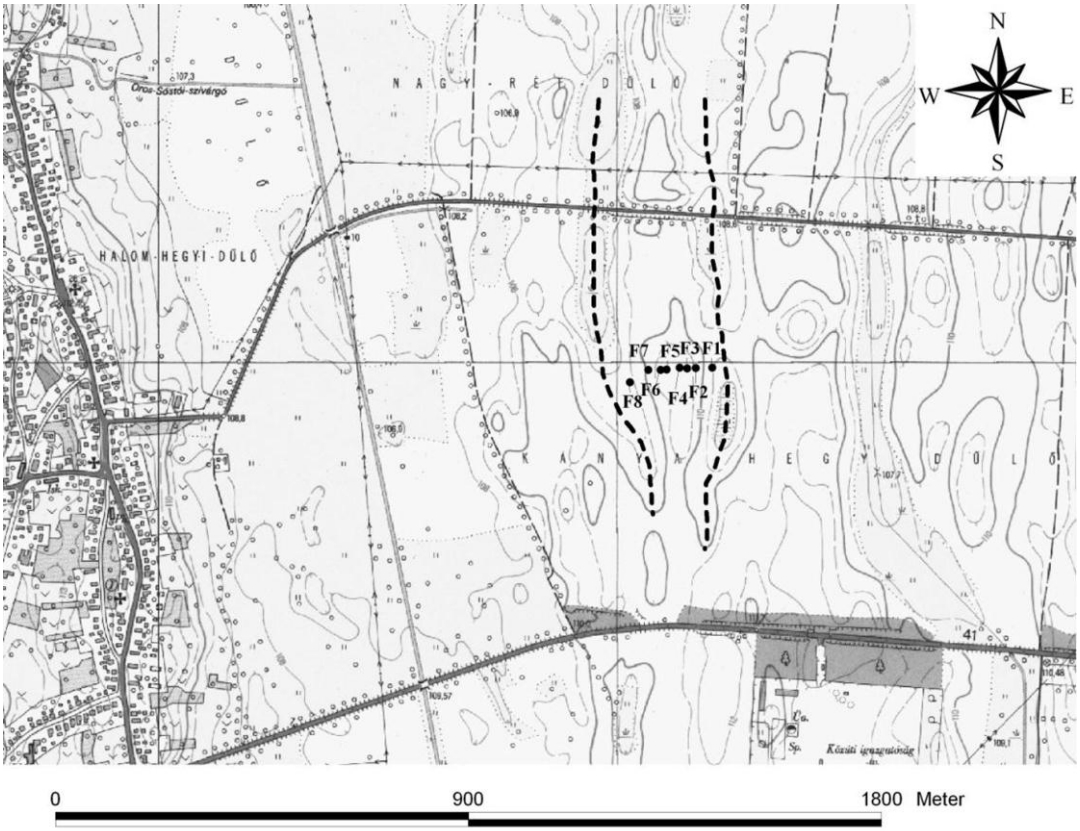

Fig. 2 Area of the excavation on a 1:10000 topographic map (Former river channels are indicated by dashed lines)

winds thus wind-blown sand landforms started to develop. During the transformation of the land wind filled the abandoned river channels by sand at several places. This explains that sections of different length of abandoned river beds can be observed in the Nyírség today.

The archaeological excavation at the junction of routes 4 and 41 east of Nyíregyháza–Oros lies between two river channel remnants (*Fig. 2*). Maps of the second military survey (*Fig. 3*) indicate a sand dune elevating

from its environment, which could provide shelter to people settling down here.

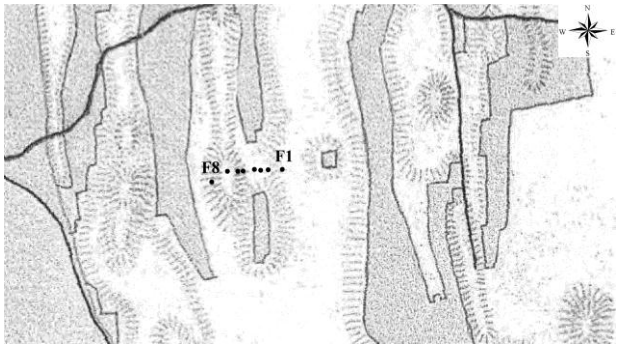

Fig. 3 Area of the excavation on the map of the Second Military survey
(Dots mark the sites of boreholes)

Strata in the sand dune were divided by a fossil soil layer suggesting that the formation of the dune lasted over at least two dry periods and a wetter period between them when the soil layer was formed. Thickness (50-60 cm) of the soil suggests that the wetter period lasted for several thousand years.

MATERIALS AND METHODS

Colleagues of the Jósa András Museum carried out detailed geodetic measurements on the original and the excavated surface prior to securing the findings. As we received access to their database the three dimension visualization of the excavated surface was possible using the software SURFER (*Fig. 4*).

Wind-blown sand layer was removed from the original surface down to the fossil soil layer. Stratigraphic research was started on the humus containing surface between the two abandoned river beds. Eight boreholes were drilled down to the groundwater table in this area (*Fig. 2*) using a hand driller. Samples were taken from the cores from each stratum in order to perform sedimentological analyses.

Samples were analysed in the sedimentological laboratory of the Institute of Earth Sciences, University of Debrecen. Grain-size distribution, humus and $CaCO_3$ content and pH of the samples were determined. Grain-size distribution was determined by Köhn pipette and dry sieving. $CaCO_3$ content was measured by a Scheibler type calcimeter. Humus content was determined based on the Tyurin method while pH was measured electronically. Softwares Microsoft Excel and Surfer8 were applied.

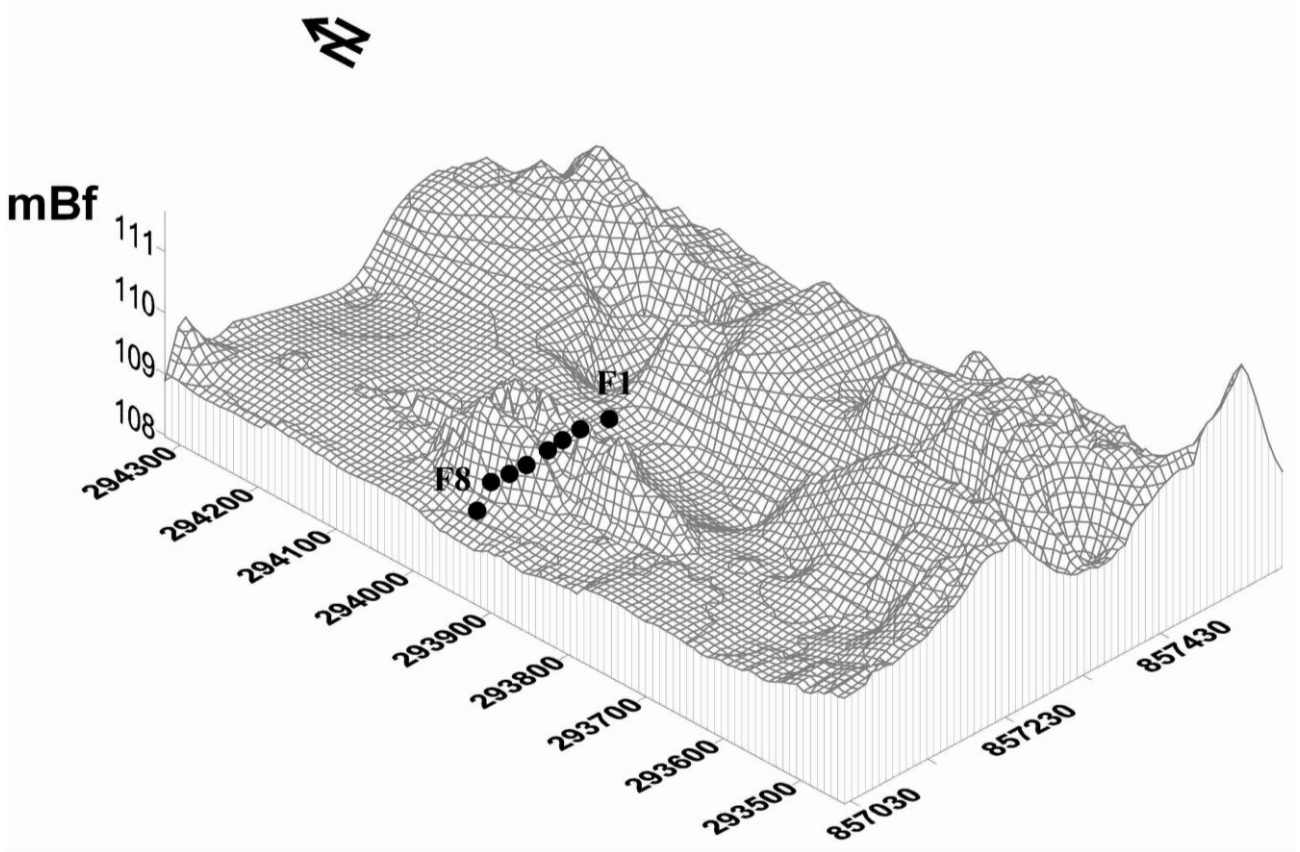

Fig. 4 Digital elevation model the excavated surface Co-ordinate system: Hungarian EOV (Dots mark the sites of boreholes)

RESULTS

Sedimentological results

Considering the composition of the samples, ratios of the coarser and finer fractions are generally small, the sand fraction dominates the grain-size distribution. Particles between 0.2 and 0.02 mm are dominant in the samples (*Fig. 5*).

Based on the grain-size distribution, the strata of the excavation are composed of wind-blown sand. Samples are slightly and moderately calcareous and their pH measured by water and KCl dissolution is slightly basic. These data are characteristic for the Nyírség.

The change of humus content indicates well the buried soil layer. Humus content of the upper part of the generally 60 cm thick soil layer reached 6 % and this decreases gradually downwards. Humus content is around 1.3 % in the wind-blown sand below. In boreholes F1 and F8 (*Fig. 5*) – drilled in the former beds – humus content varies between 2 and 5 % from the bottom of the borehole to the top. This can be explained by buried vegetation on the wet surface. In the 2-4 m thick excavated wind-blown sand above the fossil soil no further soil layers were found by the archaeologists.

There was another thin humus layer at 120-140 cm (*Fig. 5*). This suggests that the climate was wetter at the time of the formation of this layer, however, these conditions were short lived as subsequent wind-blown sand movement impeded the further development of the thin soil layer.

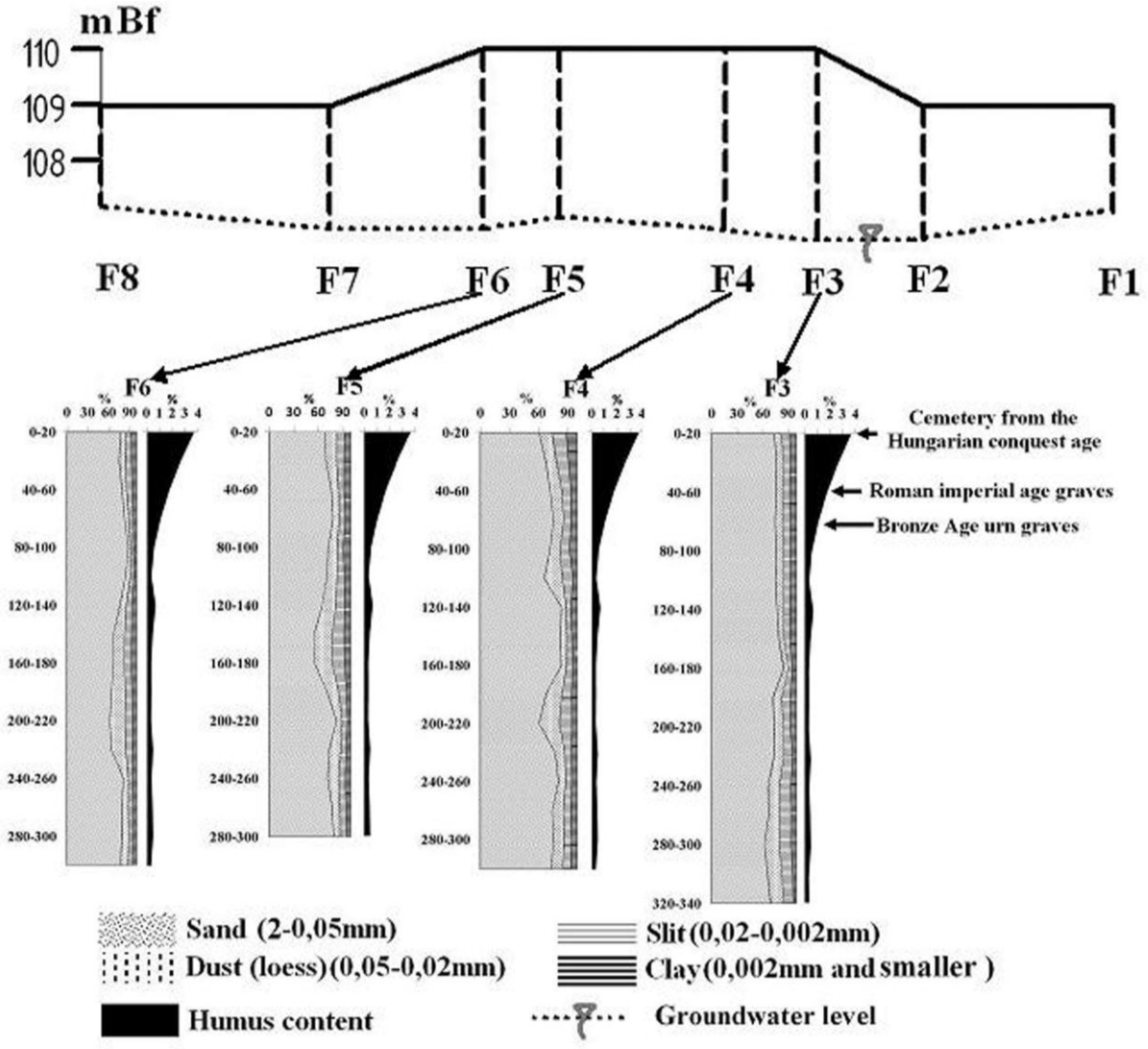

Fig. 5 General cross-section of the dune and the grain-size distribution of the strata and humus content of the material in the boreholes

Archaeological results

Archaeologists of the Jósa András Museum, Nyíregyháza made preliminary excavations around Nyíregyháza-Oros between 21 April and 6 December 2011.

The area of 26 hectares was studied by the Cultural Heritage Protection Survey using excavation ditches. This revealed that practically the entire area is full of findings. More than 6000 objects were found during the 8 months of excavation.

As was expected a cemetery from the age of the Hungarian conquest in the 10th century was found in the north-west part of the area. This part is a sandy ridge of a hill extending from N to S in the central part of which two smaller elevations were located. The western one was slightly higher than the eastern one. In this latter area the 97 graves were found.

Another three graves – also belonging to this age – were found 80 m to the north from the cemetery. On the ridge of the hill, however, findings of two other archaeological periods were also excavated. According to archaeological interpretation prior to the cemetery a tell was located here in the Roman imperial period (2th-4th centuries AD) several buildings and more than 300 pits of which were explored in the north-west part of the excavation. A significant part of these was found beneath the cemetery that is why a few of the graves were unintentionally occupying some of the earlier pits. Five Bronze Age urn graves containing ashes were also excavated together with a few other pits probably from the same period as well. Age of the Bronze Age pits and graves is between 2800 BP and 800 BP. Now the area can be regarded as entirely excavated, no findings from earlier ages were found.

CONCLUSIONS

Archaeologists excavated a cemetery from the time of the Hungarian conquest, a tell from the Roman Imperial Age underneath and finally Bronze Age urn graves from the strata of a sand dune. People of various times utilized the natural conditions of the area. There was a stream in the vicinity of the natural elevation thus the area was optimal for settling even though on wind-blown sand.

Strata of the sand dune were divided by a fossil soil layer suggesting that the formation of the dune took place over at least two dry periods separated by a wetter period. Thickness of the soil indicates that the wetter period lasted for several thousand years. Peoples of different ages (Bronze Age, Imperial Age) settled in this wetter time period. Based on the position of the findings this 60 cm thick soil layer was formed between the imperial age and the Bronze Age. Following the imperial age the area was covered by wind-blown sand in the drier periods.

Graves were placed generally at a depth of 1-2 m. Most of the graves from the Hungarian conquest were found in the upper part of the fossil soil layer at around this depth. This indicates that by the time of the Hungarian conquest at least 1.5-2 m thick wind-blown sand covered the soil layer and the 1.5-2 m deep graves were emplaced in this wind-blown sand layer.

The fact that 3-4 m thick wind-blown sand was removed from the top of the fossil soil layer suggests that sand movements took place following the 10th century as well. Between the age of the Hungarian conquest and nowadays another 2 m of wind-blown sand accumulated.

Regarding the development of the area, wind-blown sand was accumulated by wind in the late Glacial from the fluvial sand material of the alluvial fan. On the surface of this sand soil developed in the wet periods of the Holocene. The dune rising above its vicinity was an excellent location for the Bronze Age people to settle. Since both the Bronze Age and the imperial age findings were excavated from beneath the graves of the Hungarian conquest age from the fossil soil layer no Aeolian land formation can be suggested in the area for this period. Following the Imperial Age – like in other sand areas of the Great Hungarian Plain – wind-blown sand was formed repeatedly in the dry periods. Meanwhile, in the age of the Hungarian conquest the area became inhabited again, however, climatic conditions and anthropogenic effects impeded the development of a soil horizon. Thus no soil layer divides the accumulated 3-4 m of wind-blown sand.

Acknowledgement

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