PRELIMINARY RESULTS OF AN ARCHAEOMETRICAL STUDY OF THE ECSE-HALOM (KURGAN) IN HORTOBÁGY, HUNGARY

A HORTOBÁGYI ECSE-HALOM ARCHEOMETRIAI VIZSGÁLATÁNAK ELŐZETES EREDMÉNYEI

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Abstract

Ecse-halom is a kurgan in the Hortobágy region in Hungary that was built during the Late Copper Age/Early Bronze Age by eastern nomadic communities. It is located on the border between two modern settlements. A road of medieval origin runs along the body of the mound and separates it into two parts. Its southern half was ploughed and used as a rice field; later a military observation tower was built on the top of it. Despite of all the surface of the mound is in a fairly good condition and provides a home for regionally significant, species-rich loess steppe vegetation. During the winter of 2011 the research team of Professor Pál Sümegi conducted an undisturbed core in Ecse-halom and complex archaeometrical analyses were carried out on the profile of the mound. The mound comprises two construction layers as indicated by the decrease of magnetic susceptibility. The examination of organic compounds and carbonate content at various levels showed different values. The distribution of grain size within the section is characterized by mid-sized silt fraction.

Kivonat

Az Ecse-halom egy a késő rézkor és kora bronzkor során, keleti nagyállattartó népek által felépített kurgán a Hortobágy területén. Maga a halom két modern település határvonalán található, amely mentén egy, már a középkor során kialakult földút mélyül a kurgán központi részébe. A halom déli részét a 20. század közepén rizsföldként hasznosították, később egy szovjet katonai megfigyelő pontot is építettek a halomra. Ennek ellenére a halom felszíne helyenként viszonylag jól megőrződött, ezeken a részeken fajgazdag löszsztyepp vegetáció maradt fenn. 2011 telén Sümegi Pál professzor vezetésével egy zavartalan magfúrást mélyítettünk az őskori népek által kialakított halomba és a béléscsöves fúrás által feltárt üledékszelvényen komplex archeometriai vizsgálatot végeztünk el. Az egyes rétegződések eltérő mágneses szuszceptibilitás-értékei is megerősítik, hogy a halmot két fázisban hordták fel, míg a karbonát- és szervesanyag-tartalom arról tanúskodik, hogy igen változatos talajtani környezetből származott a halom üledékanyaga. A szemcseösszetétel alapján a kőzetliszt volt az uralkodó szemcsefrakció a halomtestet alkotó üledékanyagban.

KEYWORDS: GREAT HUNGARIAN PLAIN, HORTOBÁGY, KURGAN, COPPER/BRONZE AGE, ARCHAEOMETRY

KULCSSZAVAK: ALFÖLD, HORTOBÁGY, HALOM, RÉZKOR/BRONZKOR, ARCHEOMETRIA

Introduction

Due to the constant agricultural cultivations in the eastern areas of the Great Hungarian Plain, most of the mounds are endangered. Many have permanently disappeared; the remaining is struggling from being destroyed. Therefore, research of mounds in Hungary is highly important and indispensable. We need to act now to perform scientific data collections, surveys and cadasters to protect the cultural heritage of these earth monuments. Nowadays, mounds are vanishing monuments of the landscape of the Great Hungarian Plain. Surveying and protection is our common goal, which needs precise, reliable scientific research work. Our research plan is the thorough surveying of mounds in the Tiszántúl and Hortobágy region, and to establish a strategy for their protection.

The kurgans are mound-graves in the steppe zone of Eurasia and nomad people built these mounds during the prehistoric ages (Late Copper/Early Bronze Age). Hungary is the westernmost point of the Yamnaya culture (Anthony 2007; Ecsedy 1979). Mounds can be found at the banks of no longer existing rivers and at some points of higher altitude areas. According to their origin, mounds can be classified as burial sites and sacred points of ancient nomad people (Horváth 2011; Dani & Horváth 2012).

These mound-graves are highly important from archaeological and other points of view in the Carpathian Basin. In the 18th century the number of kurgans was estimated to be around 25,000 in the Great Hungarian Plain, but lot of them vanished in the past two centuries. Only a few hundred is still in good condition (Tóth 1988).

Mounds are salient cultural elements of the landscape of the Hungarian Plain. Through detailed and complex study they provide information not only on the history of millennia, the life, archaeological heritage and customs of the people buried inside them, but also on the occupied environment, the ancient flora and fauna, and the geological formations on the surface (Barczi et al. 2011; Pető & Barczi 2011; Szilágyi et al. 2013).

In order to protect all the remaining mounds, we need to perform a thorough archaeological, environmental historical, topographical, and morphological survey in these areas. This work needs a lot of field studies, and collections of data from archives and old maps.

In 2012 it became possible to launch the scientific analysis of the Ecse-halom, located in the area of the Hortobágy National Park (Sümegi 2012). The aim of this article is to present the preliminary results of the research from a geomorphological, landscape historical, botanical, sedimentological and micro-morphological point of view (Bede et al. 2014).

Methods

The handmade maps from the 18th and 19th century and later the printed maps broadly supported geomorphological and landscape historical researches, which were able to follow up the landscape changes of the last two and a half centuries. Since the Ecse-halom has stood on the borderline of settlements already in earlier ages, there are available documents available of border-passing charters from the Middle Ages and the Early Modern Period, which retained very valuable records not only about the kurgan as a border-point, but the surrounding landscape and its usage as well.

We used a Topcon (Hiper SR GNSS, FC336 type) high accuracy satellite positioning equipment (RTK) for the preparation of the Ecse-halom's contour-map and for the field-modelling. With the help of this tool we were able to assess the entire superficies of the kurgan and its immediate surroundings (buffer zone) in great details as well. We evaluated the data and edited the geomorphological two and three dimensional field models with the help of ArcGIS 10 and AutoCAD Map 3D 2010 programs. With the help of these softwares we have also reconstructed the status of the kurgan before the disruption.

During the botanical investigation of the Ecse-halom we prepared a complete list of vascular plants, with attributes of frequency and coating. We made a 3D vegetation map, too. Each vegetational patch was documented by seven phytocoenological samples covering 2×2 m areas, and a 3D vegetation map was made.

For sedimentological researches machine drilling was carried out at the highest point of the mound, and samples were lifted from a double drill pipe 10 cm in diameter. The complete length of the core was 10 m; 99.7% of the core was removed. Samples were taken from the 1000 cm long core at 8 cm intervals on average; altogether 116 samples were included in the sedimentological, magnetic susceptibility, organic material, and carbonate analyses, furthermore for micromorphological survey (Dean 1974; Sümegi 2012). Micromorphological analysis was carried out according to the work of Murphy (1985).

Particle size measurements were conducted using an OMEC Easysizer 2.0 laser granulometer. Sediment samples were treated with hydrogen peroxide to disperse clay aggregates prior to analysis. Magnetic susceptibility measurements were taken with a Bartington MS2 meter. Graphical representation of the results was produced using Psimpoll software. For the element analyses the five-step extraction technique of Dániel (2004a; 2004b) was used. This involved extraction in distilled water as a first step to measure water soluble ions and ions bound weakly onto the mineral surface. In this paper the changes of the water soluble Fe content is shown because a contex was found between MS and water soluble Fe data.

Geomorphological results

The Ecse-halom kurgan is located in the Great Hungarian Plain, in Jász-Nagykun-Szolnok County, in the area of the historical Nagykunság (Greater Cumania), in the Hortobágy region, within the Hortobágy National Park, 12 km north-northeast of Karcag. It is a border point between the administrative areas of the settlements of Karcag and Kunmadaras (**Fig. 1–2**).

Fig. 1.: Ecse-halom on the Great Hungarian Plain

1. ábra: Az Ecse-halom az Alföldön

Fig. 2.: The Ecse-halom from the south, spring of 2014 (photo by Á. Bede)

2. ábra: Az Ecse-halom déli irányból, 2014 tavaszán (Bede Á. felvétele)

The Ecse-halom itself is located on an elevated point in the landscape, on a remnant surface covered by Pleistocene infusion loess. It shows connections with the loess landscape of the Nagykunság area, basically it is its northeastern protrusion that wedges into the Holocene alluvium of the Hortobágy. The mound rises on the eastern end of a slightly elevated, elongated loess ridge that is clearly separable from its surroundings on the basis of its vegetation and geomorphology. This remnant surface is surrounded (primarily in the north and east) by floodplain marshes and creek beds that are an organic part of, or geohydrologically connected to, the rather complex Kunkápolnás marsh system (**Fig. 3**).

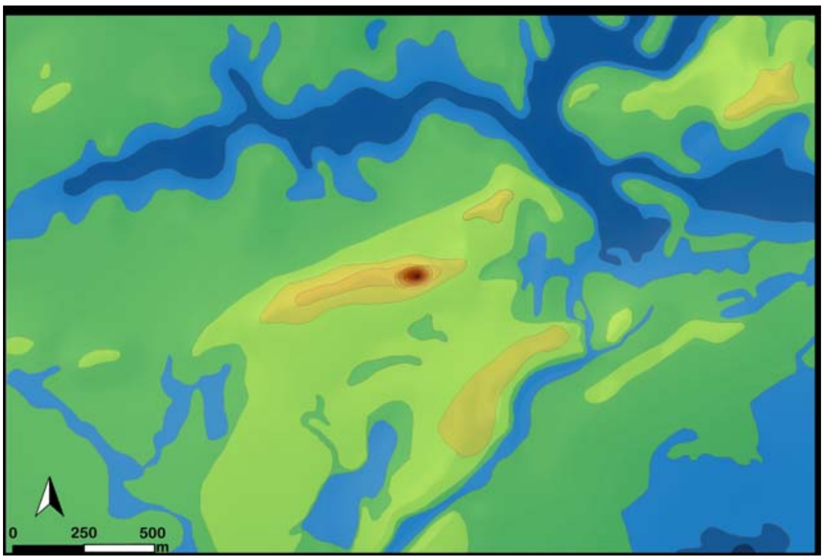

Fig. 3.: The Ecse-halom and its vicinity (based on M.5 and M.12). Dark blue: deep floodplain; light blue: shallow flood plain; dark green: high floodplain; light green: unflooded area; yellow: loess ridge; brown: Ecse-halom

3. ábra: Az Ecse-halom és környezete (M.5 és M.12 nyomán). Sötétkék: mélyártér; világoskék: alacsonyártér; sötétzöld: magasártér; világoszöld: ármentes terület; sárga: löszhát; barna: Ecse-halom

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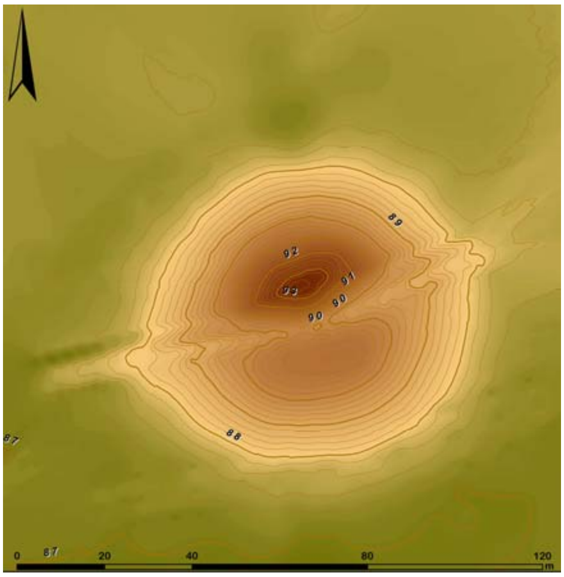

Fig. 4.: Contour map of the Ecse-halom

4. ábra: Az Ecse-halom szintvonalas felmérése

The roughly round mound, slightly elongated along its west-east axis, has been deformed considerably during the past centuries (**Fig. 4**).

The most apparent is the deep road cutting the centre of the mound in an east-west direction, which has served as a road of local significance since medieval times and due to continuous abrasion and erosion cuts now many meters deep into the body of the mound (Bukovszki & Tóth 2008). A border line of medieval origin, which is still visible immediately north of the road in the form of a border ditch, was established along it.

The mound is topped by a triangulation point.

The effects of the 20th century are visible on the southern periphery of the mound, in the form of parallel dams and embankments of the rice field established here. A larger amount of soil was removed from the southern side of the mound, but the same can be said about the highest part of the northern side as well. Based on the environmental reconstruction it could be established that the body of the mound had two layers: the first, earlier was 1.3 m thick, the second was 2.9 m (**Fig. 5**). The traces of a ditch that was created when the earth was piled up on the mound are barely perceivable around the mound (Sümegi 2012). This filled up, geomorphologically hardly detectable ditch is more visible on the northwestern and northern edges.

The central coordinates of the Ecse-halom are N47°25'31.11", E20°57'47.71"; its absolute height is 93.5 m asl, its relative height is 5.5 m, its length is 75.5 m and width is 67.5 m.

Its geomorphological and geological characteristics are similar to the Csípő-halom mound, also located in the Hortobágy region, near the village of Egyek (Barczi & Joó 2003; Barczi et al. 2006).

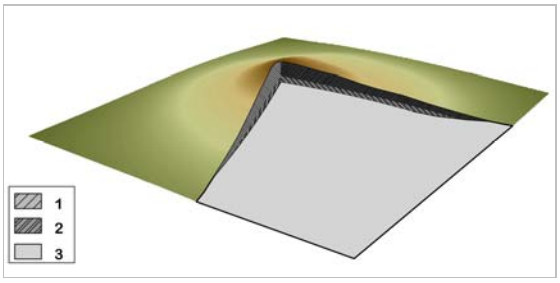

Fig. 5.: 3D detail section of the reconstructed Ecse-halom. 1: the second construction layer of the mound with the recent soils; 2: the first construction layer of the mound; 3: the surface of the palaeosoil under the mound

5. ábra: A rekonstruált Ecse-halom háromdimenziós metszete. 1: a halom második felhordási rétege a mai talajfelszínnel; 2: a halom első felhordási rétege; 3: a halom alatti paleotalaj felszíne

Its best parallel, however, is 3 km to the west, also located in the Kunmadaras plain: the slightly lower and smaller Nagy-Füves-halom mound.

Landscape historical results

The mound had been built by nomadic people of the pit grave kurgans of eastern origins (Yamnaya culture), and can be dated to the Late Copper Age/Early Bronze Age (3300-2500 B.C.) (Dani & Horváth).

The first part of the name of the Ecse-halom (eče ~ äčä) is a Cumanian word meaning "sister (mother, woman)" (Baski 2007). Local tradition considers it as a personal name and connects it to a Cumanian warrior called Ecse, who was the owner of the mound (Pesty 1978; Győrffy 1921). The Ecse-halom is such a salient element of the landscape and a series of place names had been formed from its name in the vicinity during the past centuries: Ecse-rét (Ecse meadow) (M.3, M.6, M.7), Ecse-róna (Ecse port) (M.3), Ecse-zug (Ecse corner) (M.5, M.7, M.10), Ecse-fenék (Ecse depth) (M.9), Ecse-kút (Ecse fount) (M.9), Ecse-háti-tanya (Farm of Ecse beck) (M.11), Ecse-halmi-major (Grange of Ecse mound) (M.12) and Ecse-gát (Ecse barrage) (M.12).

The topographical significance of the mound is also shown by the fact that since the 18th century until recent times, manuscript and later printed maps all indicated its position and name: "Ecze halom" (M.1), "Etse halma" (M.2), "Etse Halom" (M.3), "Etse halom" (M.4), "Ecse halom." (M.5), "Ecse halom" (M.6, M.7), "Ecse-hlm." (M.8, M.9, M.10, M.11, M.13, M.14, M.15), "Ecsehalom" (M.12).

The Ottoman Period treasure tale connected to the mound indicates its disturbance in the past.

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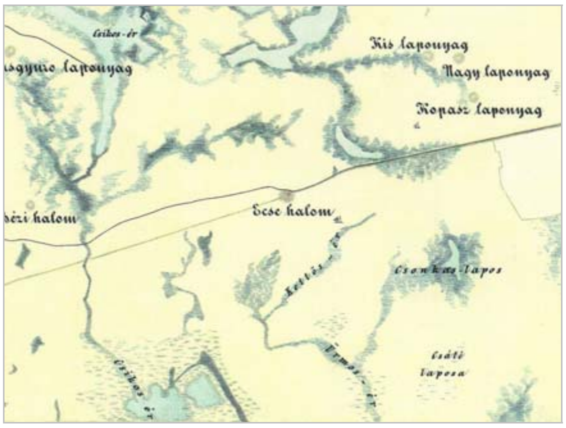

Fig. 6.: The Ecse-halom and other mounds in the vicinity on the Second Military Ordnance Map of the Habsburg Empire (M.6)

6. ábra. Az Ecse-halom és a környező halmok a második katonai felmérésen (M.6)

A miserly man from Kápolnás, when running from the Turks, dug a large pit into the side of the mound with his two servants. They lowered a punt full of money here, and then the envious master pushed in the two servants as well, buried them and smoothed the ground. He was, however, cursed and sunk knee deep into the ground, and could never again lift his legs from the earth of the mound. He went mad and stayed like that until he died (Kimnach 1903).

Based on the environment and old maps we may assume that until the 20th century the Ecse-halom was primarily used for animal husbandry (pasture, mowing), and no arable farming was carried out in the immediate vicinity (**Fig. 6**).

The dirt road (practically a road cut deep in the soil) running across the Ecse-halom was shaped by hundreds of years of use and the consequent erosion. It was used already in the Middle Ages (16th century), since a road of local interest ran this way, connecting Kunkápolnás and Nádudvar (Elek 2008).

Later on (after the destructions of the Late Ottoman Period) it lost its significance, although locals still use it until this day. The continuation of the road to the east is the Ecse-gát (Ecse barrage), which enables the crossing of the deeper parts of the Kunkápolnás marsh system.

The Ecse-halom is mentioned first in a charter describing village borders from 1521 (in the form “Echehalma”) (Benedek & Zádorné 1998; Gyárfás 1883). In the Early Modern Era it was the border point between the villages of Asszonyszállás and Kápolnás. Today it lies on the administrative border between Karcag and Kunmadaras; the borderline breaks in an angle on the tip of the mound.

Manuscript maps from the 18th 19th centuries (M.1, M.2, M.5, M.6) and later printed maps (M.7) consistently represent the whole area of the mound as pasture. In the beginning of the 20th century, however, its southern half was ploughed due to the increased demand for arable land, such as in 1943 (M.8). Socialist large-scale agriculture and the consequent large-scale landscape transformations did not spare the Ecse-halom either: in the 1950s rice parcels were established on its southern side (M.10), that traces are still visible. In the 1960s the area served again as pasture (M.11), and is used like that till today. In the wider vicinity of the mound farmsteads, dirt roads, ditches, embankments, grass fields and lower lying swamps can be found.

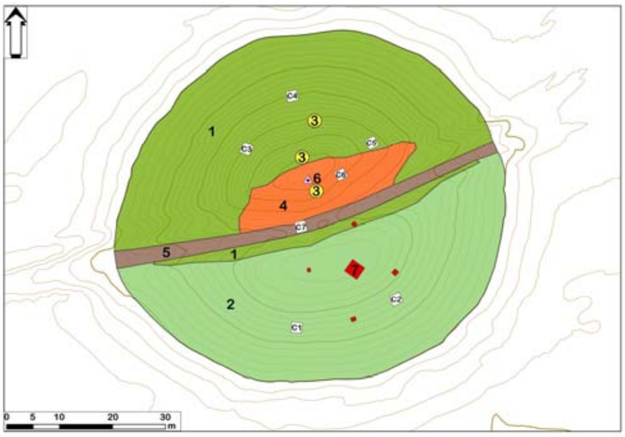

Fig. 7.: Vegetation map of the Ecse-halom: 1: loess steppe; 2: uncharacteristic dry grassland with loess steppe elements; 3: population of *Agropyron cristatum*; 4: very dry ruderalia; 5: dirt road with trampled weeds; 6: triangulation point; 7: concrete elements of the foundation of the military observance tower on the surface; C1–7: coenological samples

7. ábra: Az Ecse-halom vegetációtérképe. 1: löszpusztagyep; 2: jellegtelen száraz gyep, löszpusztagyep-elemekkel; 3: taréjosbúzafű (*Agropyron cristatum*)-állományok; 4: igen száraz, ruderális gyep; 5: taposott gyomnövényzet (földút); 6: háromszögelési pont; 7: katonai megfigyelő torony alapozásának felszíni betonelemei; C1–7: cönológiai felvételek

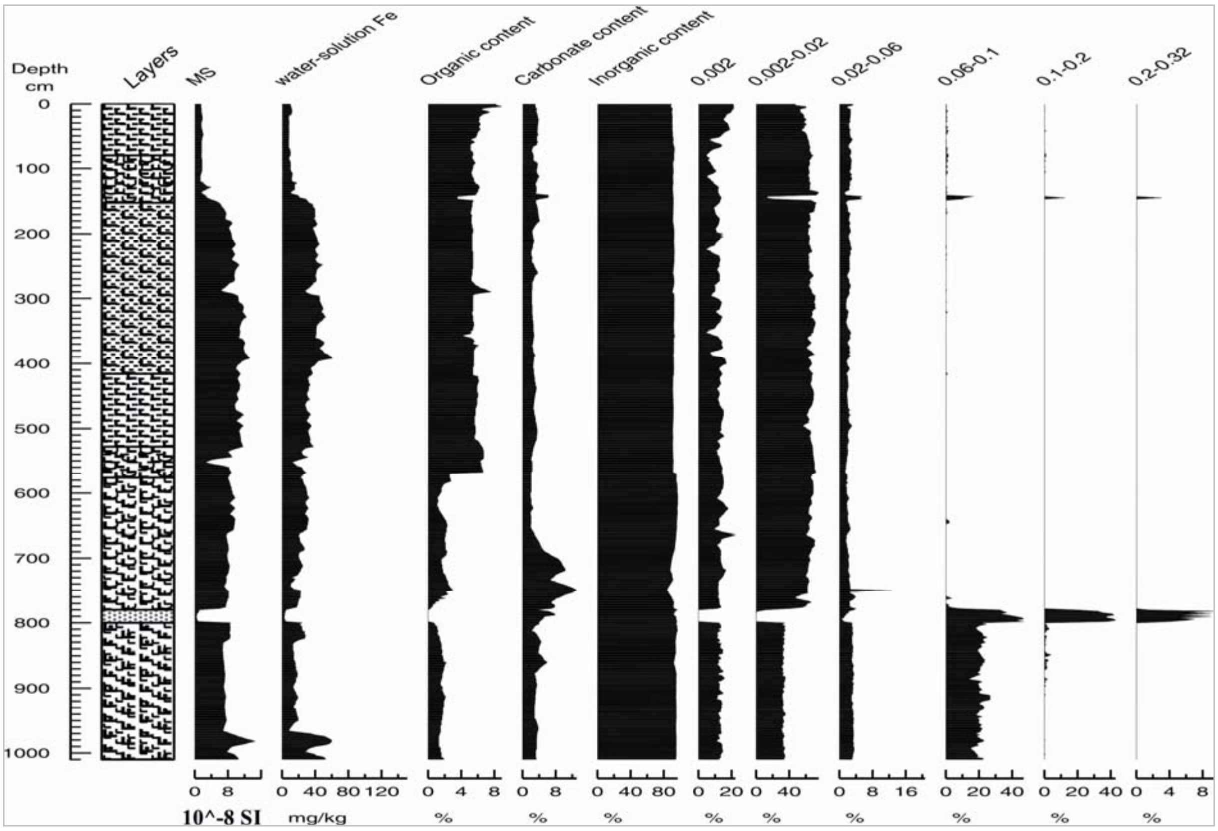

Fig. 8.: MS, water-solution iron content and sedimentological data from the core sequence of the Ecse-halom

8. ábra: Az Ecse-halomba mélyített fúrás rétegsorának MS-értékei, vízoldható vastartalma és üledékföldtani adatai

The mound was used as an observation point of the Soviet military shooting-range of Kunmadaras, from where the bombings and shooting practices were controlled. As a consequence, a small sentry-box was set up on the northern edge of the mound (M.12), and when it was demolished in the second half of the 1980s a multi-storied, steel-framed observation tower was built in the southern side (Tóth 1988). The tower, which significantly diminished the landscape value of the mound, was pulled down by the national park after the pullout of the Soviet military troops, but its concrete base elements sunk into the mound are still there (**Fig. 7**); their removal and dispatch is an urgent task.

Botanical results

The vegetation of the Ecse-halom is in fairly good condition, partly due to its maintenance and the regular but not excessive grazing and mowing.

The kurgan rises above its marshy, alkaline environment, thus most of its surface is covered by a loess steppe association (*Salvio nemorosae-Festucetum rupicolae*) and its derivatives (**Fig. 7**). The mounds are characteristic places of survival of these, from a conservationist point of view, significant habitats and the association itself (Illyés & Bölöni 2007; Horváth et al. 2011; Joó 2003). In the northern half of the Ecse-halom, loess steppe in a fairly good condition can be found. Crested wheatgrass (*Agropyron cristatum*), characteristic for the dry vegetation of loess bluffs, forms only a few smaller patches beside the top and on the northern side. In the southern half of the mound, vegetation is secondary, uncharacteristic dry grassland, a fallow unploughed for decades. But even this area contains already a few loess steppe species. The steep, south-looking side immediately to the south of the top is covered by dry ruderal species, and is separated by a fairly sharp border from other vegetation zones. On the road cutting through the mound in an east-west direction the tracks are flanked by trampled weed associations. Arboreal vegetation is only very sparsely present in the area.

We have detected the occurrence of about 90 vascular plant species until now from the kurgan. It could be established that the flora of the mound is rich in species in a countrywide comparison. Among the attested species we may mention *Aegilops cylindrica*, *Agropyron cristatum*, *Androsace elongata*, *Bassia sedoides*, *Carthamus lanatus*, *Linaria biebersteinii*, *Muscari comosum*, *Ranunculus pedatus*, *Salvia nemorosa* and

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Verbascum phoeniceum. Although the Ecse-halom is not among the most valuable mounds in terms of plant species composition, regionally it certainly represents significant natural value, especially thanks to the presence of species characteristic of loess steppe.

Sedimentological results

The vegetation and soil characteristics of the mound and its immediate environment (extralocal level) are different on local and regional levels. At a regional level, hydromorphic soils are typical, while at a local level hydromorphic and alkaline soils dominate. The same can be observed in terms of vegetation as well: marshes, alkaline marshes and wet alkaline meadows dominate at a regional and local level in the wider area. Extralocally, however, drier type of alkaline meadows and the vegetal elements of loess grassland dominate (Sümegi et al. 2013).

The MS values were at a maximum in the lower part of the core, where in some cases they exceeded the value of 100*10-6 m^3kg^{-1}; in contrast, they diminished drastically in the upper layer, between 150 cm and the surface. The MS minimum observed in the material of the mound (420–0 cm) indicates that the mound had been built in two phases. The decrease of magnetic susceptibility values also indicates solution and migration processes; these were observed both in the paleosol and in the 'B' level of the higher, recent soil layer (**Fig. 8–9**).

The maximum of organic material was recorded in the sole of the core. The organic content of one sample exceeded 10%, in others it was around 6-7%. The carbonate content at the same levels, however, was lower. In the lowermost layer, above the sole, we observed diminished organic material content and increased carbonate content.

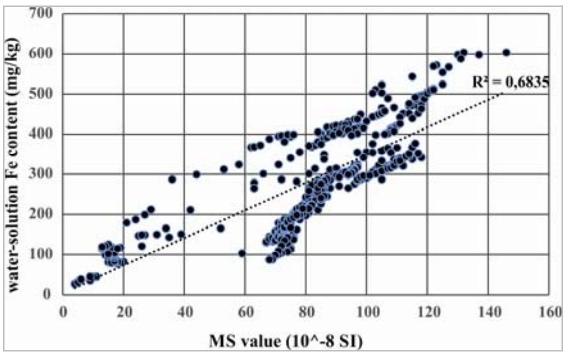

Fig. 9.: The correlation between water-solution iron content and MS data from the core sequence of the Ecse-halom

9. ábra: A vízoldható vastartalom és az MS-értékek összefüggése az Ecse-halom rétegsorában

This trend, however, reversed in the layer at 800–780 cm depth. From 800 cm both carbonate and organic content values fluctuate. In the zone between 150 and 80 cm we observed a significant decrease in organic material and an increase in carbonate content. The same anomaly was detected on a lower horizon of the core (570–530 cm). In these levels carbonate values reach their maximum (**Fig. 8**).

The distribution of grain size in the whole core shows uniformity. Mid-grained silt fraction, 0.016–0.031 mm in size, appears in the largest quantities. We detected outstanding values in only a few points of the core (**Fig. 8**).

Based on the macroscopic description, sedimentary facies features, geoarchaeological characteristics and magnetic susceptibility data of the core, the following layers, genetic levels and consequently natural and anthropogenic processes could be identified (**Fig. 8**).

The sole of the core at 1006-800 cm depth is composed of unsorted, clayey silt and floodplain sediment. Based on its carbonate content the sediment is the result of the work of the Sajó and Hernád rivers that played a primary role in the formation of the terrain of the area in the Pleistocene. As the results of Franyó (1966), Rónai (1985), Sümegi (1989; 1997), Nyilas & Sümegi (1991), Szöőr et al. (1991; 1992) and their investigations was reconstructed – and after then many others have pointed out – that most part of the near-surface sediments of the Hortobágy is not the poor carbonate sediment Tisza/Old Tisza river, but the carbonate-rich sedimentary Old Sajó-Hernád rivers accumulated. As a result, it was developed loess similar, but basically alluvial sediment (Földvári 1958; Sümegi 1989; Szöőr et al. 1991; Szöőr et al. 1992), which constitutes one of the basic conditions of alkalization and alkalization of bedrock (Scherf 1935).

At 800–780 cm depth a thin layer immediately above the sole can be found, also deriving from the alluvium of the Sajó-Hernád river system, consisting of well-sorted riverine sand. This is indicated by the data on grain composition and carbonate content, and the shell fragments of certain Mollusca species.

The layer between 780 and 570 cm is composed of infused loess formed in the second half of the Pleistocene, consisting of fine and coarse silt fraction, which corresponds to loess sediments found in other areas of Hortobágy. Its age can be placed between 25,000 and 12,000 years, and it forms part of the Holocene base rock.

The 'B' level of the paleosol (570–530 cm) is characterized by high carbonate content and low MS values. Shells of snail species indicate steppe and forest steppe environment, but based on the macroscopically observable traits the paleosol was categorized as meadow chernozem. The 'A' level of the paleosol can be found in the section between 530–420 cm.

Magnetic susceptibility values are almost completely identical to those of the 'A' level of the Early Holocene soil, rich in organic material. At the same time we could detect a change in the MS value at 290 cm depth, indicating the movement of elements and solution, consequently a long-term open surface. Based on this the Late Copper Age-Early Bronze Age Yamnaya community probably raised the mound in two phases (**Fig. 5, 8**). The first layer was found between the depth of 420 and 290 cm. The two mound building horizons are separated by a short period of time not longer than one or two generations (30-50 years), since no carbonate content could be observed in the lower layer, indicating that carbonate movement had not started and become intensive on the surface of the lower kurgan surface. It cannot be excluded that the two kurgan building phases are connected to two major burials, but this could be confirmed only through the complete excavation of the mound.

In the soil of the kurgan we managed to demonstrate the presence of carbonate, ferrous and alkaline patches, which indicate that the kurgan was formed from three types of hydromorphic, alkaline and prairie soils that could have formed a hydroseries in the region. Nevertheless, the majority of the kurgan is made up of prairie soils, thus in the Early Holocene it must have dominated in the vicinity of the kurgan. Consequently, although alkaline and hydromorphic soils must have occurred in the environment of the Ecse-halom, prairie soils must have dominated. The shallow hollow observed in a 100 m radius around the mound must have formed during the collection of the soil for the mound.

The part of the mound close to the surface is covered by a blackish brown chernozem formed during the past 4000 years, which is the pedogenic version of the material of the kurgan, but due to the protrusion of the anthropogenic surface it was formed in a stably drier steppe environment compared to the Early Holocene soil. Significant change in carbonate and organic material content was detected only on the surface of the kurgan: the significant organic material content in the 'A' level of the chernozem soil was formed on the island-like protrusion of the surface of the kurgan, while in the 'B' level, a horizon rich in well-developed carbonates was formed. The formation of both horizons indicates an intensive formation of prairie soil following the creation of the kurgan. The raised geomorphological position, the relatively dry relief and the climatic conditions of the past 4000 years could have played a significant role in the formation of the recent prairie soil covering the surface of the kurgan (Sümegi 2012).

Micromorphological results

Based on the micromorphological research (Bullock et al. 1985; Stoops et al. 2010), three larger layers could be differentiated in the body of the kurgan, which formed on the top of a layer rich in carbonates. The sole, on top of which the whole formation was built, is a sediment horizon containing larger grains, and has low organic material content (**Fig. 10**).

The uppermost part of the mound contains recent soil levels that reflect the current state of the local area. In comparison, the middle level that had been created in its current location due to anthropogenic impact shows re-sedimentation, and occasionally loess-like characteristics. This is why the carbonate content is sometimes elevated in the sediments in the immediate environment of the mound, and occasionally calcareous shells could be detected in the sections. The snail shells found in the midsection of the profile indicate a formative environment different from the present conditions. Above the sole with low organic material content (in the inner part of the kurgan) a layer with low carbonate content can be found, whose grain composition is different from that of both its covering and underlying layers. This layer is contemporaneous with the construction of the kurgan, and is covered by a re-deposited, loess-like sediment. The micromorphological features and shells in the soil layer provide information on the coeval environment and external impacts (**Fig. 11**).

The quantity of charred wood remains in the area of the sections is high, which occur there as a result of burial activities preceding the construction of the kurgan. The layer, however, is exempt of recent impacts. This is confirmed by the fill of the voids found in the thin-sections, whose material is calcareous, and were filled after small-scale biological activities (Becze-Deák et al. 2007). Based on the current position of calcareous concentrations and the character of the fill of the voids, the soil buried due to anthropogenic impact must have been meadow chernozem. The number of ferrous inclusions indicating inactive impacts is higher, which characterizes the earlier environment of the area, and shows the duration of water coverage (Páll 2012).

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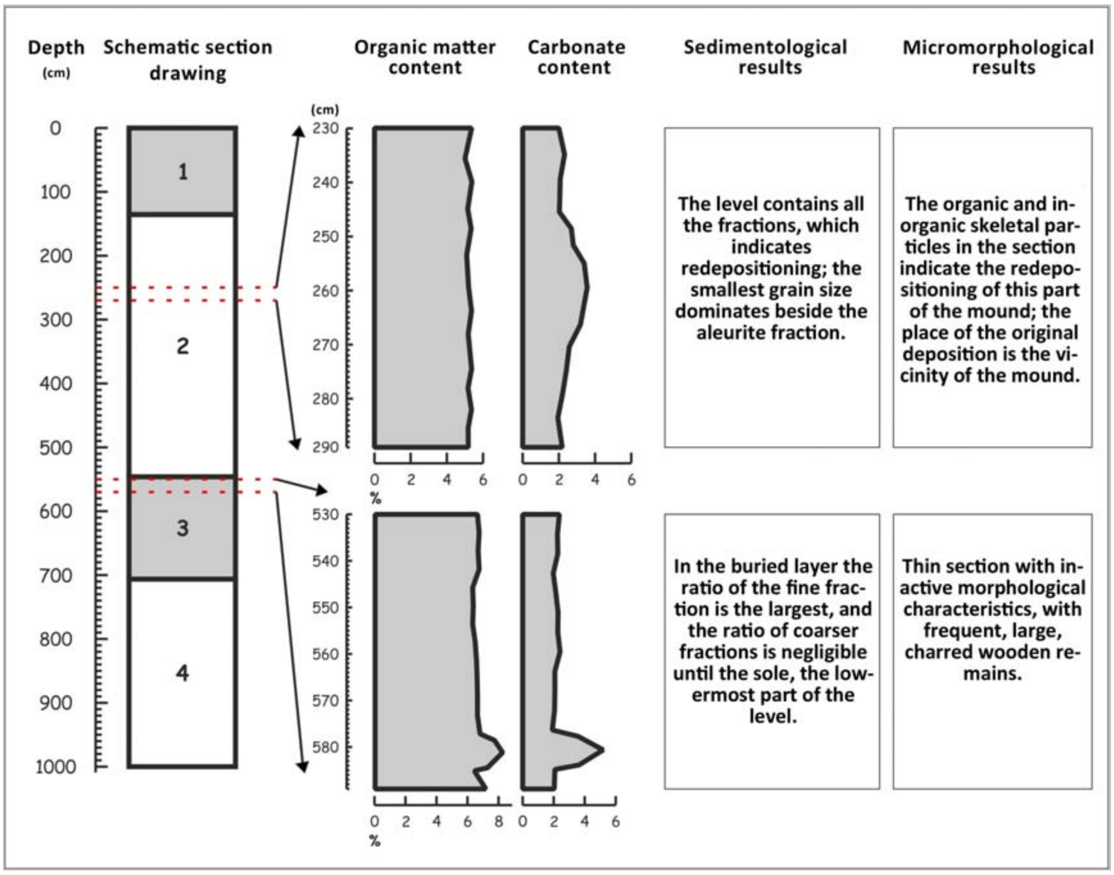

Fig. 10.: Organic material and carbonate content (%) of the sediments from the mound and the comparison of the results of the sedimentological and micromorphological analyses (Páll 2012)

10. ábra: A halomtestből kiemelt üledékek szervesanyag- és karbonáttartalma (%), illetve a szedimentológiai és mikromorfológiai eredmények összehasonlítása (Páll 2012)

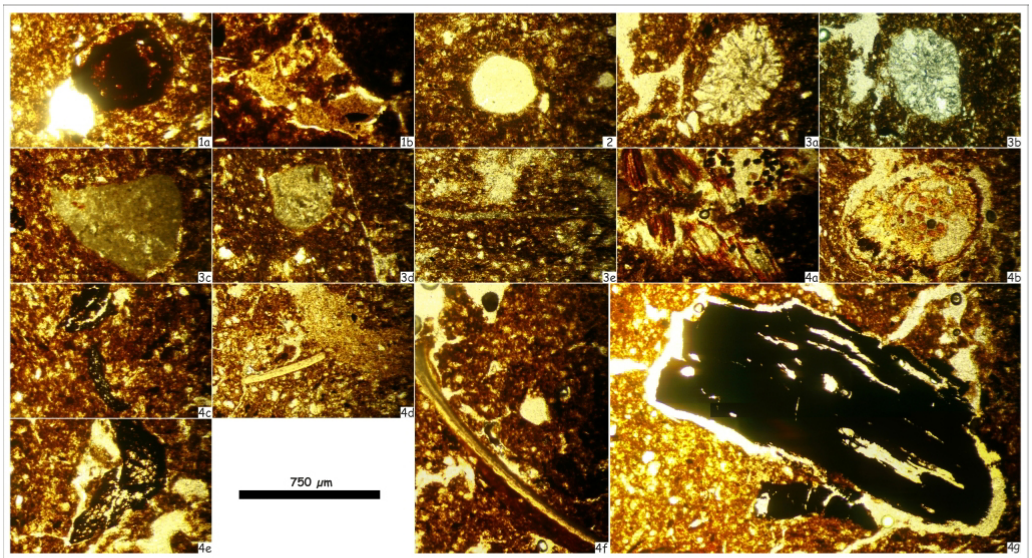

Fig. 11.: Micromorphological features. 1a–1b: ferrous concretions in the sections; 2: void; 3a–3e: calcareous concretions and skeletal particles of various size and appearance; 4a–4g: skeletal particles of various size and form in the thin sections (excretion, root remains, snail shells, charred wood remains) (Páll 2012)

11. ábra: Mikromorfológiai jellegzetességek. 1a–1b: vasas szeparálódások a metszetekben; 2: üreg; 3a–3e: különböző méretű és megjelenésű meszes göbecsek és vázrészek; 4a–4g: különböző méretű és alakú vázrészek a vékonycsiszolatokban (ürülék, gyökérmaradvány, csigahéjak, szenült famaradványok) (Páll 2012)

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Conclusions

Although, these kurgans are important features of the Hungarian landscape, we still do not have enough information of them. Many hypotheses exist that blurs the current point of views. But mounds have high importance, as they hide numerous information dating back to the past thousand years. Each mound keeps valuable information from geoarchaeological, ethnological, onomastical, local historical, botanical, zoological, hydrological, and of course from archaeological point of view.

The geomorphological and landscape historical results show the Ecse-halom is surrounded primarily with alkaline marshes and meadows. Presently it stands on the border between two modern settlements, Karcag and Kunmadaras, along which runs a road of medieval origin, cutting deep into the centre of the body of the mound. It was further distorted during the 20th century, as its southern half was ploughed and used as a rice field. Later, a military observation tower was built on the top of it. Despite all this the surface of the mound is in a fairly good condition and provides a home for a regionally significant, species-rich loess steppe grass.

The kurgan, built in the Late Copper Age/Early Bronze Age by eastern nomadic peoples, comprises two construction layers as indicated by the decrease of magnetic susceptibility results. The examination of organic compounds and carbonate content at various levels showed different values. The distribution of grain size within the section is characterized by mid-sized silt fraction.

The micromorphological studies of Ecse-halom could clearly demonstrate that the levels of accumulation of the original habitat are not present. It deposited during different conditions by anthropogenic effects. The layers originate from the immediate vicinity of the mound, but due to local circumstances they have different characteristics than present-day soils. Micromorphological studies supported the results of sedimentological analysis indicating that a diverse, mosaic meadow chernozem soil with saliferous soil patches run in the study site during the formation of the kurgan at the end of the Copper Age and beginning of the Bronze Age. As a result of mound-grave creation, soil formation transformed. As a result, typical chernozem soil developed on the surface of the mound, forming an island surrounding by solonetz and meadow soils in the study area.

Maps

M.1: First Military Ordnance Map of the Habsburg Empire, 1783, 1:28.800, C.XXII. S.XX. Institute and Museum of Military History, Budapest.

M.2: “Geometrica delineatio totius terreni privilegiati oppidi Cumanicalis Kartzag Uj Szállás”, 1784-1787, 1:40,000, Kováts, Gy. Archives of Jász-Nagykun-Szolnok County, T.300.

M.3: Territory of Kunmadaras (Ecse-rét), 1788, 1:14.400. Archives of Jász-Nagykun-Szolnok County, T.95.

M.4: Regulational plan of Berettyó river and Nagy-Sárrét meadow, 1794, 1:86.400, Gasner, L. National Archives of Hungary, S12. XI.132.

M.5: “A’ Nagy Kun Karczagi Határ Átnézeti Térképe” (Overview Map of Karcag in the Greater Cumania), 1859, 1:28.800. Archives of Jász-Nagykun-Szolnok County, T.166.

M.6. Second Military Ordnance Map of the Habsburg Empire, 1861, 1:28.800, S.50. C. XL. Institute and Museum of Military History, Budapest.

M.7: Third Military Ordnance Map of the Habsburg Empire, 1883, 1:25,000, 5066/1. Institute and Museum of Military History, Budapest.

M.8: Military ordnance map of the Hungarian Kingdom, 1943, 1:50,000, 5066 NY. Institute and Museum of Military History, Budapest.

M.9: Military ordnance map of Hungary, 1952, 1:25,000, L-34-18-D-b. Institute and Museum of Military History, Budapest.

M.10: Military ordnance map of Hungary, 1956, 1:25,000, L-34-18-D-b. Institute and Museum of Military History, Budapest.

M.11: Military ordnance map of Hungary, 1966-1967, 1:10,000, 409-424. Institute and Museum of Military History, Budapest.

M.12: Topographical map (Hungarian uniform map system), 1977, 1:10,000, 68-413.

M.13: Military ordnance map of Hungary, 1980, 1:25,000, L-34-18-D-b. Institute and Museum of Military History, Budapest.

M.14: Military ordnance map of Hungary, 1991, 1:25,000, L-34-18-D-b. Institute and Museum of Military History, Budapest.

M.15: Military ordnance map of Hungary, 2003, 1:50,000, L-34-18-D. Institute and Museum of Military History, Budapest.

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