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A new ^{14}C (AMS) date from former heathland soil horizons at Kuršių Nerija, Lithuania

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Abstract The history of heathland management in the coastal area of Lithuania started at about Birth of Christ according to the new ^{14}C information (1900±40 ^{14}C BP, TUa – 4762). The following stage of the vegetation management was dated back to the thirteenth century (735±40 ^{14}C BP, TUa – 4763). AMS technique was applied for the dating of small charcoal peaces collected from heathland soil horizons in Vingiakopė site, Kuršių Nerija (Curonian Spit), W Lithuania. A new data confirms the repeated application of fire for the management of the local vegetation. The use of the area for animal pasturing and timber production have at least for three periods been followed by dune activity, most likely because of damage of the vegetation cover, either by unsuccessful burning perhaps in combination with rough deforestation, which, in both cases, have open up for wind erosion.

Keywords *Heathland soil, ^{14}C dates, pollen data, Kuršių Nerija, West Lithuania.*

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INTRODUCTION

A palynological review of former heathland vegetation in the south-eastern coastal areas of the Baltic Sea (Fig. 1) has recently been presented by Savukynienė et al. (2003), a vegetation type studied by e.g. Gams (1929, 1932), Gams and Ruoff (1929), and Gross (1935a, b, c), and obviously connected to well documented coastal, west-European coastal heathland vegetation. So far the occurrence of the Baltic heathland seems in general to be the north-eastern most limit of a heathland distribution from Portugal to North Norway (Haaland 2002, Moe 2003). In most cases the heathland vegetation was in some areas, - in other areas still is, - a result of farming practising with frequent heather burning, heather mowing including intensive pasturing by sheep and burning (Keit & Mothes 1942, Noirfalse & Vanesse 1976, Kaland 1986, Haaland 2002). Changes in the agricultural economy during the last 100-50 years has reduced the use of former heathland areas, and a reforestation is taken place several areas.

Studies from northern Europe date the start of the heathland development from the middle and upper part

Fig. 1. Survey map of the south-eastern area of the Baltic Sea and the middle part of Kuršių Nerija, Lithuania. The site Agilos-Vingiakopė dune I-8 is marked. For site description see Gaigalas et al. 1991.

of the Sub-Boreal chronozone (about 4.0-3.2 ^{14}C kyr BP), with some delay towards north. The establishment of the Lithuanian heathland vegetation is not known so far only one ^{14}C-dating from Kuršių Nerija (Curonian Spit) has given a minimum dating of 1200 ^{14}C year BP (Gaigalas et al. 1991). A major aim with this additional project is to create more precise data to understand the dune history and use of the area at Agilos-Vingiakopė site at Kuršių Nerija (Savukynienė et al. 2003).

GEOLOGICAL AND ARCHAEOLOGICAL BACKGROUND OF THE AREA

The geography of the studied area has formerly been presented in detail (Savukynienė et al. 2003) and for this reason only a few facts discussed here. Existing as a strict geological-geomorphological divider between the Baltic Sea and Kuršių marios Lagoon, Kuršių Nerija was formed by the processes that took place during the Late Weichselian and Holocene in this part of the Baltic Sea (Gudelis 1955, Kabailienė 1967, Bitinas et al. 1996). Predominance of the sandy dunes as the main geomorphological form known since the earliest descriptions of the peninsula and this phenomenon was investigated by many scientists (Gudelis & Michaliukaitė 1976, Gudelis 1986a, b, Gudelis et al. 1993, Bitinas, 2004). Throughout the ages the proportion of open sand areas and those covered by forest have changed remarkably (Fig. 3 in Savukynienė et al. 2003) and human activity influenced this process as well. Before four-five centuries an interface between the nature and people has increased especially. Most of the Kuršių Nerija peninsula was from 1600 AD up to about 1850-1900 AD a coastal sand dune with small villages. Predominance of the open sandy landscape was determinated by the intensive forest clearances that took place in area (Gudelis & Karužaitė 1962). After this time several reforestation projects were established, and nowadays only small sand dune areas exist. Neither the history before 1600 AD, nor the establishment of the first dunes is fully known or dated (Gudelis & Michaliukaitė 1976, Gudelis 1986a, b, Gudelis et al. 1993). At Kuršių Nerija the sand dune system consist nowadays of two types: old dunes stabilized during the last 150 years as a result of a stabilizing planting program, and secondly selected and protected areas with still open active sand dunes (Gudelis & Karužaitė 1962). In these areas some palaeosoils are exposed as black 5 cm to about 15 cm thick band/levels. Former studies (Gaigalas et al. 1991, Savukynienė et al. 2003) show that the charcoal rich fossil soil was rich in pollen of *Calluna vulgaris* and other heathland plants which are not frequently found today. Within the area some vertical sequences have none or only one single soil horizon visible, in other up to seven layers have been excluded. Three-four horizons are most widely spread and have stratigraphic significance (Gudelis & Michaliukaitė 1976, Gudelis & Savukynienė 1995). In between only pure aeolian sand without pollen is found.

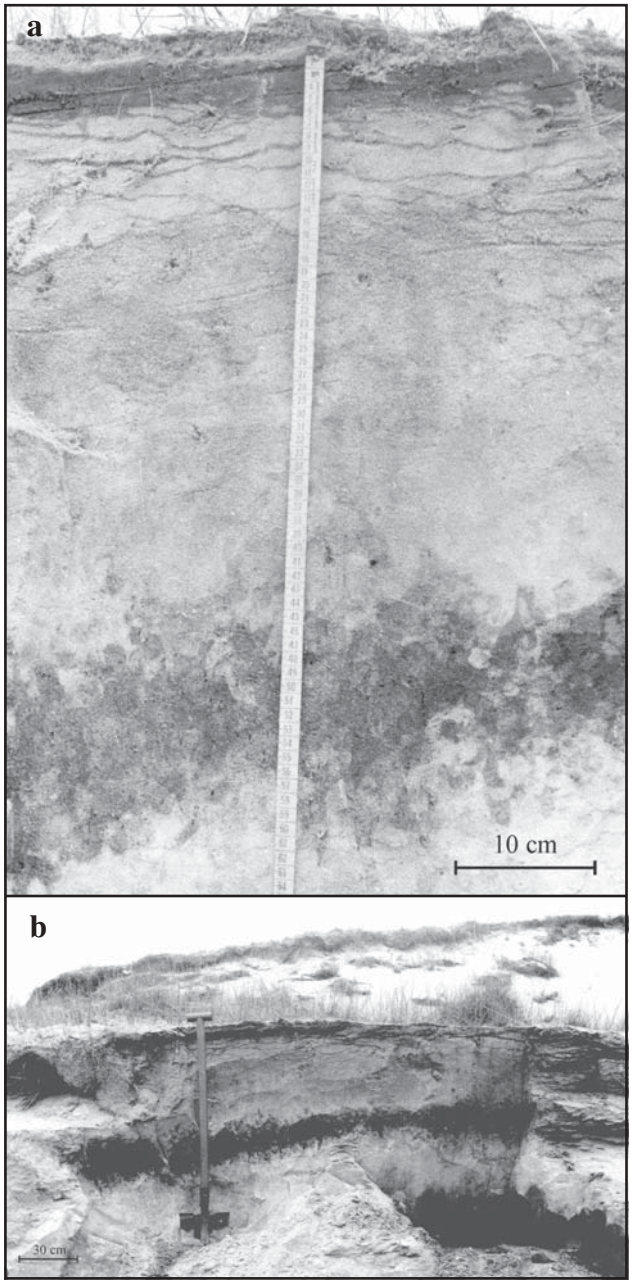

Fig. 2a, b. Exposed buried soil layers in the sand dunes from Agilos-Vingiakopė site I-8. Photo by V. Klimavičienė.

Despite numerous archaeological expeditions and observations, that started in Kuršių Nerija already during first half of the 19th century (Beehrbohm 1933) the human and agricultural history of the area is only partly known. Mostly of the prehistorical sites discovered in peninsula were dated to the different stages of the Neolithic (Rimantienė 1989). In Nida where archaeological site was settled by the inhabitants of the Late Neolithic Bay Coast culture, evidences of the agriculture and animal husbandry occurred (Rimantienė 1989, 1999). Later stages of the prehistory and historical times were represented by the Bronze Age, Early and Late Iron Age sites discovered near Juodkrantė and Nida but density of the population decreased in Kuršių

Table 1. ^{14}C-dates from the studied area, Agilos-Vingiakopė site l-8. (Abbr. TUa= Trondheim (Norway)/Uppsala (Sweden) accelerator dating. BC/AD calibration is in accordance with Stuiver & Becker (1993)).

Age, uncal. ^{14}C BP	Depth, cm	Lab. No.	Age, cal. AD/BC	Dated material
735±40	4-10 cm	TUa-4763	AD 1275-1295	Pieces of charcoal
1900±40	47-59 cm	TUa-4762	AD 75-140	Pieces of charcoal

Nerija at that time (Hollack 1895, 1900, Rimantienė 1999). Remarkable decline in Kuršių Nerija population started in 16th-17th centuries when due to the deforestation of the area intensive aeolian processes started. Until the beginning of 20th century about 14 small villages were buried beneath sand.

RESULTS

In addition to former palynological studies (Savukynienė et al. 2003), accelerator ^{14}C dating have been made from one of the studied profile (Agilos-Vingiakopė, site 1-8, 55°28'25" N, 21°05'37" E) at Kuršių Nerija (Fig. 2 and 3) (Fig. 4c in Savukynienė et al. 2003). Charred particles collected in the sediments were dated in Trondheim (Norway)/Uppsala (Sweden) labs. Two dates have been made (Table 1).

DISCUSSION

The history of the Kuršių Nerija sand dunes are not fully known, they may be established during the Late Glacial time, or much later. Buried soils horizons that exist in many places along the peninsula were assumed as one of the factors confirming a few generations of the dunes formation and this presumption confirmed by the results of ^{14}C investigations (Gudelis 1960, Gerasimov & Zavelski 1980, Chichiagova & Cherkinski 1988, Gaigalas et al. 1991). Binomial structure of the investigated parabolic dune was established after the application of geophysical, lithological and optically stimulated luminescence (OSL) survey near Pervalka village (Mauring 1994, Bitinas & Damušytė 1998). According to the results of the OSL dating the upper part of the investigated dune is younger than five hundred years and the rest part of the sand bed formed at about 1000-1500 yr BP (Bitinas 2004).

The palynological studies of the buried soil layers in Agilos-Vingiakopė site 1-8 show temporary shorter vegetation periods with some local woodland and shrub/herb vegetation (Fig. 3). The woodland was dominated by alder (*Alnus* spp.), tree birch (*Betula* spp.*)*, pine (*Pinus sylvestris*), while the treeless vegetation was dominated by heather, (*Calluna vulgaris*), together with some bog-myrtle (*Myrica gale*), herbs, and mosses. This mosaic of open heath landscape together with patches with some forest existed in periods dived by sequences with sand dune, and sand dune activities. Burning has obviously been a most frequent and known technique to maintain the best pastures (ref the dated

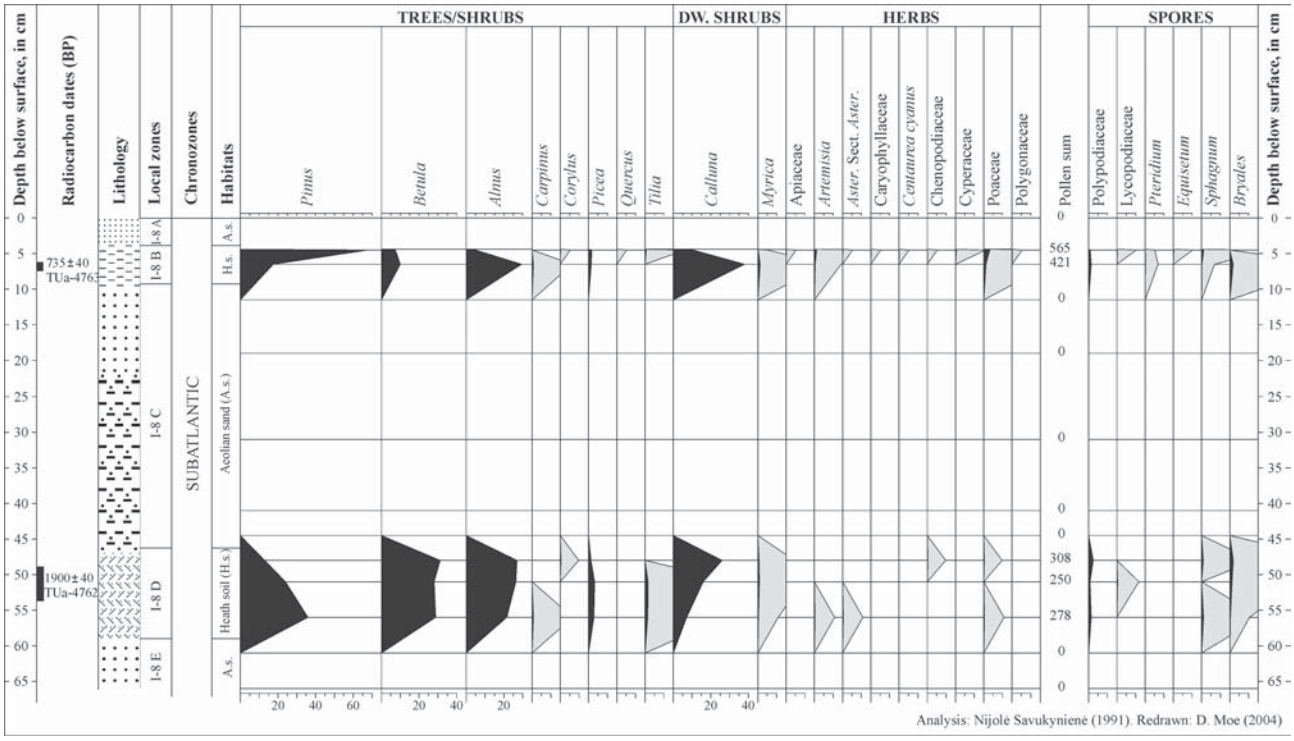

Fig. 3. Pollen diagram from the buried soil at Agilos-Vingiakopė site I-8 (after Savukynienė in Gaigalas et al. (1991); Gudelis et al. (1993); and remade after Savukynienė et al. 2003). Lithostratigraphical description follows proposal by Troels-Smith (1955) (see Savukynienė et al. 2003). (Abbr.: DW- Dwarf shrubs; H- Herbs; Ui- Unidentified taxa).

soil layers from Vingiakopė site 1-8 which contained numerous macro remains of the charred particles). Dry and thin vegetation cover is very sensitive for burning practices (Kaland 1986), and the timing for such successful management are very important, thin snow cover or frosty day may protect the sensitive soil cover and living roots.

The two new dates from the Agilos-Vingiakopė site I-8 (Table 1) give additional information of the agricultural history, despite both are mean dates covering a soil thickness of respectively 6 cm and 12 cm. The older date from Agilos-Vingiakopė site I-8 (AD 75-140) covering a soil package of 12 cm introduce us to the fact that the heathland existed already about the Birth of Christ with use of burning practicing in the management of pasture-farming. This period in the Iron Age is known for heathland management several places in the coastal areas of northern Europe, while the earliest documented is known from middle and late Subboreal (Bronze Age) (e.g. Noirfalse & Vanesse

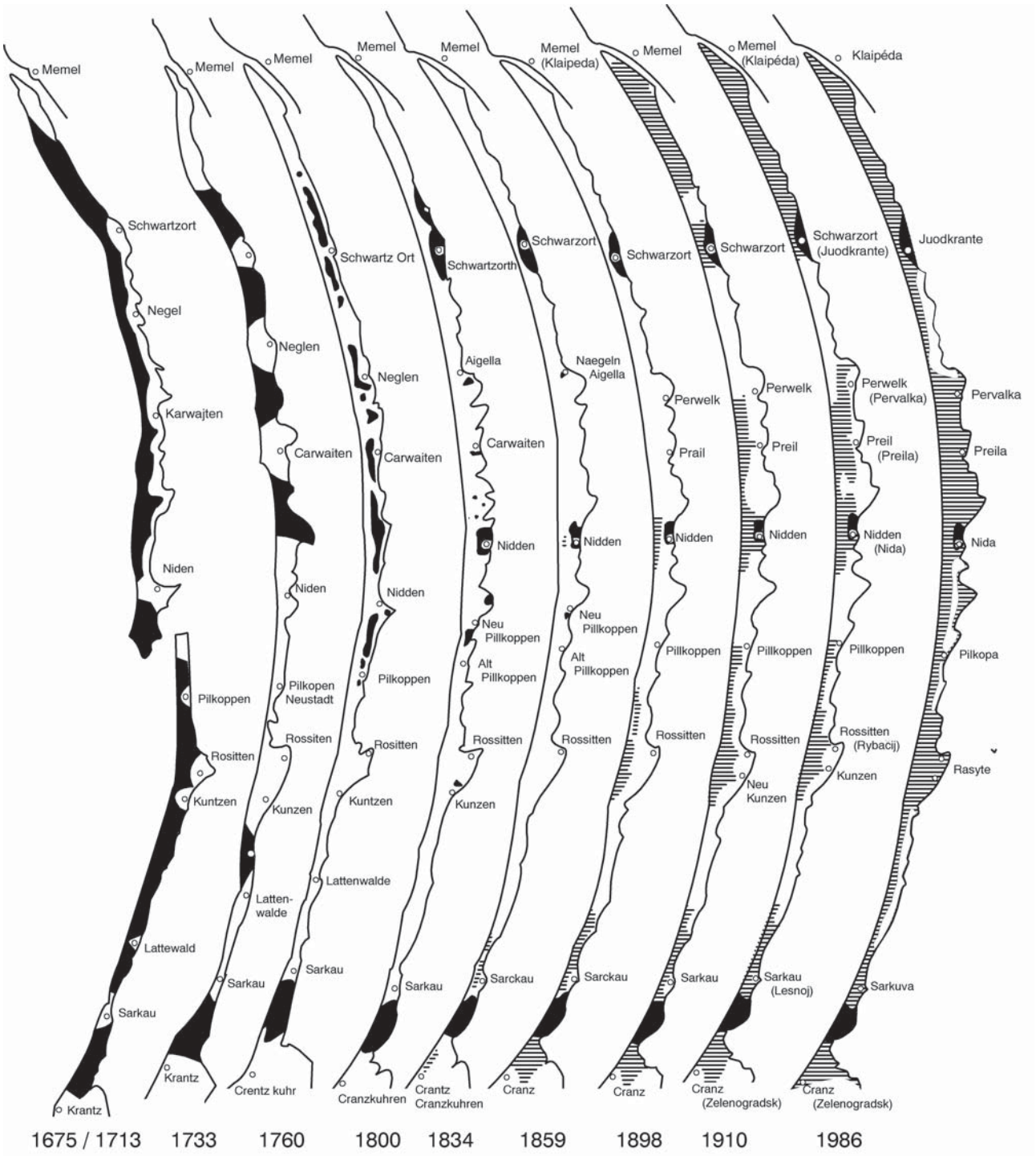

Fig. 4. The history of de- and re-forestation at Kuršių Nerija from AD 1675 to AD 1986. (Black areas= old forest, hatched areas= reforestation (after Fig. 38 in Paul 1944).) An updated version shows still more woodland at the present day (1986), comparable with the situation in 1675 (Gudelis 1986a, b, Savukynienė et al. 2003).

1976, Odgaard 1988, Prųsch-Danielsen & Simonsen 2000, Moe 2003). The real start of the development of the anthropogenic heathland vegetation is still an open question, not only in Lithuania, nor in Kaliningrad or Poland and most other countries in the region. A comparison also with archaeological dated sites from the same areas will be useful in further studies.

The younger date, calibrated to AD 1275-1295, indicates an active agricultural period in medieval time followed by dune activity, partly destroying a vegetation cover by probably both wind erosion and covering the soil itself. Appearance of Rasytė, Nida, Nagliai and other settlements may be assumed as an evidence of rather stable and rich landscape that existed at that time in Kuršių Nerija. The vegetation or forest cover at Kuršių Nerija as a whole about AD 1275-1295 may correspond with the map reconstruction from AD 1675/1713 (Fig. 4) with a vegetation/forest cover of more than 50% of the peninsula. The reduction of forest a little later, at AD 1733/1760 either initiated by intensive pasturing/burning combined with possibly timber export, which took place in several nearby countries, may have started a new erosion and sand dune activity up the mentioned forestation project about AD 1850.

A similar temporary forest and heathland period like the one dated to about AD 1275-1295, may have taken place about AD 800 (1200 BP) (Gaigalas et al. 1991).

The heathland vegetation has normally a very specific flora with among other plants *Sarothamnus scoparius*, *Calluna vulgaris* and *Erica tetralix* (Savukynienė et al. 2003). A reduction of the distribution of the heathland in most areas may have reduced the plant distribution. These plants may therefore have had a much larger and denser range (Balevičius 1992).

CONCLUSIONS

Application of the radiocarbon (^{14}C) measurement in Agilos-Vingiakopė 1-8 site, Kuršių Nerija, has provided the new data discussing the heathland history in the Eastern Baltic coast. In accordance to the pollen and isotopic data an onset of the burning practicing in the management of pasture-farming was dated back to the Birth of Christ in the area under investigation. The following stage in heathland cultivation coincides with the onset of the medieval period when an intensive human interference to the area was confirmed by the establishment of numerous new settlements. Periods of vegetation prospering and human activity were followed by the increasing aeolian processes that determinated the formation of new landscape with sandy dunes as predominating element.

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