The grassland of Inner Mongolia is situated at the boundary of temperate arid and semiarid region.Variations in vegetation composition reveal past environmental changes. Most previous research on Holocene vegetation history in Inner Mongolia comes from lakes and peat bogs in forested regions. These sequences contribute little to our understanding of Holocene grassland dynamics. However, Holocene palaeosol sequences are well preserved in the more arid interior. In the past, these sequences have received little attention for two reasons: the scarcity of continuity and chronological control and the lack of sensitivity in grassland palynological records for grassland dynamics.

Phytolith analysis provides an alternate means for studying long-term in *situ* vegetation in grassland ecosystems, since phytoliths are much more taxonomically diagnostic for grass taxa. Phytoliths produced in grass leaves and glumes have much greater morphological variations than grass pollen and become an effective method for interpretating grassland vegetation change in response to large-scale climatic controls.

Phytolith and pollen preserved in the Taipusi Banner paleosol profile, central eastern Inner Mongolia, provide evidence of Holocene grassland vegetation, climate and human impact. The Taipusi Banner paleosol profile (41○58¡ä30¡åN, 115○10¡ä32¡åE, 1340 m asl), about 70 km away from southern margin of the Otindag sand region, lies at a transition from steppe to sandy lands that is particularly sensitive to the monsoon climate changes. The palaeosol profile consists mainly of sandy soil, 140 cm thick. The profile shows no sign of either erosional hiatuses or aeolian sand layers. The bottom of the sequence is underlain by loess and sand layers. Three ^{14}C age are measured at the depth of 30-40 cm, 70-80 cm and 130-140 cm, dated to 2300¡À95, 4830¡À130, and 9495¡À50 cal B.P respectively. The bottom of the profile, based on these dates is estimated to date to ca. 10000 yr B.P. The ages of sampled horizons were interpolated between radiocarbon-dated horizons.

In order to aid in the interpretation of the Taipusi Banner paleosol sequence, surface soil samples were chosen from each of the vegetation types identified in the region. To establish a workable Poaceae short-cell phytolith reference collection for Inner Mongolia grassland, 23 common species of Poaceae were collected from the two fenced permanent research stations where there are communities of *Aneurolepidium chinese* and *Stipa grandis* in Inner Mongolia. Both research stations were closed to grazing in the early 1980's. More than 50 species of other taxa were examined for redundant phytolith forms. Soil identifications for Poaceae focused mainly on leaf short cell forms, except where otherwise noted.

Correspondence analysis is carried out. The combined phytolith and pollen records reveal a major change in vegetation composition about 5000 yr B.P. Before 5000 yr B.P., the vegetation was dominated by *Aneurolepidium chinese - Stipa grandis* grassland of C_4 grasses. After 5000 yr B. P., C_4 grasses rapidly retreated, indicating a shift to colder and more arid conditions. The gradual invasion of *Stipa krylovii*, *Agropyron desertorum*, *Ephedra*, Chenopodiaceae and *Caragana* reveal the onset of grassland degeneration. Between 10000 and 8720 yr B.P., the *Aneurolepidium chinese - Stipa grandis* grassland included a small proportion of *Artemisia* shrub and *Echinops* type plants, implying a strong winter monsoon and very weak summer monsoon. From 8720 to 7000 yr B. P., the climate was characterized by a strengthening of the summer monsoon. Between 7000 and 5000 yr B. P., the Holocene thermal maximum was evident, with a significant expansion of C_4 plants and the presence of some trees (such as *Pinus* and *Betula*, and so on) in or near the study site. From 4200-3000 yr B. P., a sandy grassland of *Artemisia* and *Agropyron desertorum* together with *Aster*-type taxa developed. Minor precipitation amelioration took place between 3000 and 2170 yr B. P., with a small expansion of C_4 grasses. From 2170 yr B.P. to present, human activities accelerated the process of grassland degeneration.

Late Pleistocene vegetation history and climatic changes in the northern Baikal region derived from a high-resolution pollen record

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A sediment core (CON01-603-2) from the northern basin of Lake Baikal was studied by means of pollen analysis to reconstruct changes of vegetation and palaeoclimate during the Last Interglacial (Kazantsevo Interglacial) in the northern Baikal area.

The chronology of core CON01-603-2 was based on paleomagnetism (Demory et al. in press). The age model applied demonstrates that the palynologically studied sediments were deposited between ~130 – 115 kyrs BP.

The pollen sequence spans the very end of the late glacial of the Taz Glaciation, the fully developed interglacial succession and the beginning of the Zyryanka Glaciation. The pollen diagram has been divided into 7 Local Pollen Assemblage Zones (LPAZ) and several subzones.

In the north Baikal region, according to palaeobotanical data, the Kazantsevo Interglacial lasted from 129 to 117.4 kyr BP, i.e. about 11.6 kyr. The end stage of the late glacial is expressed by an expansion of shrub communities (*Duschekia fruticosa)*. Following the decline in *Duschekia*, the spread of birch shrubs (*Betula* sect. *Nanae/Fruticosae*, spruce (*Picea obovata*) and tree birches (*Betula* sect. *Albae*) mark the onset of the interglacial. Optimum growing conditions (126. 5-120 kyr BP) are expressed by early development of dark taiga with *Picea*, *Abies*, and *Pinus sibirica*. The maximum development of birch forest-steppe took place during the period ca. 126. 5-125.5 kyr BP. The expansion of *Pinus sylvestris* at around 124. 4 kyr BP marks the beginning of the formation of the light taiga forests type. Expansion of steppe communities, *Duschekia fruticosa*, birch, and shrub willows and the recession of forest communities at around 117. 4 kyr BP mark the end of the interglacial succession.

The late glacial/interglacial transition took place under a very moist and cold climate, while the end of the interglacial succession of the forest communities in the region of north Baikal took place under an extremely dry and cool climate.

The vegetation changes in the north Baikal area recorded in the core studied provide evidence of climate instability during the Last Interglacial in central southern Siberia. The development of forest communities was disturbed as a result of three distinct, short-lived climatic oscillations. The earliest of these, the dry and cool Early Mid-Kazantsevo phase (126-125.5 kyr BP), led to a clear reduction in the occurrence of fir in dark taiga communities. The next, first Late Mid-Kazantsevo phase (121.5–120.0 kyr BP), took place during the maximum development of light taiga and was characterised by a somewhat drier and cooler climate. The youngest, second Late Mid-Kazantsevo phase (119,5-119 kyr BP) initiated the general trend of climatic change towards cooling.

Poster session h2

PLEISTOCENE POLLEN RECORDS: PATTERNS AND PROCESSES OF ENVIRONMENTAL AND CULTURAL CHANGE

Vegetation dynamics and recovery following catastrophic Kurile Lake caldera eruption 7,7 kyr BP, Kamchatka, Russia, based on pollen data

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The catasrophic volcanic eruptions could strongly affect the paleoenvironments but the range of this influence is still poorly investigated. Our study represents the preliminary estimations of vegetation damage and recovery as a result of such an eruption in Kamchatka, Russian Far East.

The Kurile Lake caldera (KO) eruption in southern Kamchatka occurred at 77700 ^{14}C yrs BP and produced 140-170 km^3 of ignimbrites and tephra, which was spread over a distance more than 1200 km from the source. The volume of erupted products exceeds that for any eruption in the Kurile-Kamchatka volcanic arc during the last 10,000 years and ranks the KO eruption with the largest Holocene explosive eruptions on Earth.

The KO eruption was probably an ecological catastrophe for Kamchatka. In a conservative estimate, an area of about 5,000 to 6,000 km^2 was devastated by on-land pyroclastic flows, surge deposits and heavy ash fall. Serious vegetation damage probably was incurred over an area of about 15,000 km^2, where KO ash thickness was more than 5 cm.

Nevertheless, pollen records from sediments directly above KO eruptive deposits indicate that some plants survived. Because the area devastated was so large, successful seed immigration from elsewhere could hardly be expected and so surviving plants should be regarded as the main recovering source. We hypothesize that

some plant refugia survived under heavy snow pack, which persists in south Kamchatka up to July. In support of this hypothesis, tephra from the beginning stage of KO eruption is rich in shrub pollen, suggesting that June, when most shrubs flower, might be the initiating time of eruption.

Based on pollen data, secondary succession involves alder. We hypothesize that some alder survived on the river valley slopes, where tephra may have been rapidly eroded by rains soon after eruption and buried topsoil re-exposed. Here shrubs (at least, their viable root systems) could have been preserved where cool ash layers would protect them from fire caused by surge and pyroclastic flow. Alder is known as a plant that rapidly produces shoots from buried sprouts, but its reproduction would have been restricted to the unburied slopes, where soil organic resources would be accessible. So, secondary succession on the slopes resulted in the same vegetation establishment (shrub formation with *Alnus kamtschatica*) as the one before KO eruption.

Primary succession would have been initiated on the bare surfaces of thick (up to 150 m) and burning hot (an initial temperature could be estimated in range of 300-600 °C) ignimbrites. Pollen data from the deposits just above the top of KO ignimbrites allowed us to define three stages of initial plant invasion, among which the third stage ("grasses") is most distinct. This stage, mainly corresponding to the start of soil formation, is characterized by high values of Poaceae and Asteraceae pollen. In the same samples, relatively high percentages of transported alder pollen (which shows an upward decrease in this soil) probably means the density of the local colonists, and their pollen production, were still low.

Stone birch (*Betula ermanii*) pollen is absent in pollen rain just after the eruption but appears in the third stage. Areal expansion of birch is restricted ecologically by the strong competitive ability of alder, confirmed by modern observations of the relationship between these two edificators. But the newly formed substrate produced by the KO eruption could have provided for successful invasion by birch seedlings, which are better adapted than alder to the stressful conditions (nutrient-poor, acidic, rapidly draining) of pumiceous or ignimbritic surfaces. In general in the studied area, modern stone birch occurrence follows valley-ignimbrite distribution, confirming our supposition. In this example of the relationship between alder and stone birch, the ecological consequence of the catastrophic KO eruption is comparable to vegetation changes attributed to abrupt climate change.

Palaeoecology of the Early Weichselian/Eemian transition in the Upper volga region (Russia)

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Ples (57°27'N, 41°32'E) is one of the key-sections of the Mikulino (Eemian) Interglacial in the north-central Russian Plain. It was first studied palynologically by M.P. Grichuk and V.P. Grichuk in 1959. The sequence of peat and lacustrine deposits in Ples also includes sediments of the early part of the Weichselian glacial epoch. Pollen profile of this section reflects spread of the broad-leaved forest dominated by *Quercus*, *Ulmus*, and *Tilia* with participation of *Acer*, *Fraxinus*, and *Carpinus* in the optimum phase of the Interglacial. In the latter part of the interglacial, a gradual cooling and increasing humidity of climate brought about a decline in the broad-leaved forest and a development of dark-coniferous communities (*Picea-Abies-Pinus sibirica*). It was followed by Scots pine and birch forest, and replaced by communities of tundra shrubs (*Betula nana*, *Alnaster fruticosus*, *Salix* spp.) with patches of very open birch forest during the first cold stage of the Early Weichselian glaciation. A profound cooling during the early (more humid) part of this stage is indicated by spread of a typical arcto-alpine plant – *Selaginella selaginoides*.

During the first post-Eemian cooling the climatic conditions were not uniform, as a short climatic amelioration separated it into two sub-stages. This minor warming is indicated by an increase in birch (*Betula alba*) pollen percentages and concentrations and an appearance of herbaceous plants – satellites of an open birch forest: *Polygonum bistorta, Sanguisorba officinalis, Valeriana,* and *Thalictrum*. In general, the vegetation was probably close to the birch forest-tundra or open woodland. Pollen spectra of the latter part of the cold stage are dominated by non-arboreal pollen (65-85%), mainly that of Poaceae and *Artemisia* with a large variety of meadow and steppe plants: *Convolvulus, Linum, Bupleurum, Centaurea cyanus, Echinops, Euphorbia*. Presence of

xerophytes resistant to low winter temperatures (*e.g., Ephedra, Eurotia ceratoides*) and halophytes from Plumbaginaceae family is indicative of the cold and relatively dry climatic conditions.

The first Early Weichselian cold stage was followed by a warm interstadial, when mixed spruce-birch, and later larch-pine and spruce-Siberian pine forests, similar to those of the middle taiga sub-zone of West Siberia, occupied the region. This interstadial is called Verkhnevolzhsky (the Upper Volga Interstadial). Sediments of this age were previously described from several sections in the central Russian Plain where the layers of the Eemian (Mikulino) Interglacial are overlain by the Early Weichselian (Valdai) deposits (*e.g.*, Mikulino – Grichuk, 1961; Boyarshchina and Borkhov Rov – "Palaeogeography of Europe during the last 100,000 years", 1982). Based on its stratigraphic position and inferred climatic features, this interval can be provisionally correlated with the Brörup Interstadial in West Europe. A much slighter and shorter warming within the first cold stage of the Weichselian glaciation has not been described earlier for the Russian Plain, as the interval beyond the interglacial itself was not studied in detail, and there was no information on pollen concentrations.

In West and Central Europe, pollen data on some sections also suggest that there were similar "birch" intervals within the first Weichselian (Herning) cold stage. For example, there are short warm phases of this age in the pollen profiles Rederstall-I (Menke & Tynni, 1984) and Grebern (Litt, 1994), where the Early Weichselian deposits are especially fully represented and studied in detail. Presumably, the transition from the Last Interglacial to the Weichselian glacial epoch had a complex structure, being marked by a sequence of secondary climatic oscillations of varying magnitude.

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Eemian/Early Weichselian and Holocene vegetation history and climate change in the Central Russian plain: a case study from Butovka section

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A 920cm long sediment core was extracted from a small forested bog near Butovka village 80 km southwest of Moscow (55°10'N, 36°25'E). Clayey sand at the base of the section is overlain by lake clay sequence containing two peat layers at the depths of 766-620 cm and 180-0 cm. Pollen analyses show that these sediments were deposited during a long time, from the Saale termination to the Weichselian early stages, and then, after a substantial break, during the Holocene. Twelve pollen zones were identified, including four zones showing the evolution of vegetation through the Eemian (Mikulino) interglacial and tree through the Holocene, the peat layers generally corresponding to the warm epochs.

In the end of the Saalian glacial (the Moscow stage), the region was covered by complex vegetation of the periglacial forest-steppe type, which included patches of open pine-birch and spruce forests, communities of cryophilic shrubs (*Alnaster fruticosus, Betula nana*), and dry *Artemisia*-Poaceae-Chenopodiaceae steppes. Despite a certain similarity in the successions of vegetation, the climate at the end of Saalian was probably less continental and more humid than during the Weichselian late glacial.

The warming at the beginning of the Eemian (Mikulino) interglacial caused a rapid spread of spruce, birch and Scots pine forests over the area. During the first half of the interglacial, the broad-leaved forests dominated by *Ulmus* and *Quercus* with abundant *Corylus* in the undergrowth widely expanded. At the middle (optimum) part of the interglacial broad-leaved forests were especially rich in tree species, including *Acer platanoides*, *Carpinus betulus*, *Fraxinus excelsior*, *Quercus* (2 species), *Tilia* (2 sp.), and *Ulmus* (3 sp.). Hornbeam became dominant in the second (more humid) part of the optimum phase. An increase in soil moisture is indicated by spread of swamped forests formed by *Alnus glutinosa*. During the final part of the interglacial the role of pine, spruce, birch and fir in the forest communities increased substantially, while the broad-leaved trees showed a marked decline.

With the onset of the Weichselian (Early Valdai) glacial the forests became more open. During the first cold stage they were formed mainly by birch and pine with participation of larch, and by spruce. Increasing role of herbaceous plants, including xerophytes (*Ephedra distachya*), heliophytes (*Helianthemum*), and cryophilic species (*Botrychium boreale*, *Lycopodium pungens*, *Selaginella selaginoides*), and spread of the cold-tolerant shrubs (*Betula humilis*, *B. nana*, *Alnaster fruticosus*) suggest that the vegetation became similar to the forest tundra. The climate in the region was then colder than at present. During the early part of the Weichselian (Valdai) glacial

epoch, reflected in the Butovka pollen diagram, the climate grew both more continental and arid, as indicated by the decreasing role of mesophilic plants and an increase in abundance and variety of the xerophytes and species, which occur at present in the regions with highly continental climate. With this tendency at the background, two intervals of climatic amelioration can be distinguished. Both of them are marked by spread of the open forest communities similar to the contemporary northern taiga of West Siberia, but with certain specific "periglacial" features. Accumulation of low organic clay and silt in the paleolake ceased before the onset of the Middle Valdai warming, as the shallow depression was filled in with sediments. Peat accumulation started once again in the early Holocene (according to the basal 14C date 9170±70, Ki-701), when the climate became sufficiently warm and humid for the mire development.

Pollen sequence for the Holocene shows a development of forests caused by climate warming. *Betula alba* and *Pinus sylvestris* were predominant at the beginning of the Holocene. During the optimum phase dense broad-leaved forests formed by *Ulmus*, *Quercus*, and *Tilia* with rare *Acer* and *Fraxinus* covered large areas. In the Subatlantic, pollen spectra again became dominated by birch, possibly, partly due to the human impact on the vegetation.

Reconstruction of mean temperatures of the coldest and warmest months (January and July) for the climatic optimums of the Last Interglacial and Holocene was performed using the method of climatograms (Grichuk, 1969). These values are attained by determining the present-day climatic ranges of each species of a fossil flora and combining them to establish a common climatic field. In the optimum of the Mikulino (Eemian) interglacial T_I= -2°C, T_{VII}=19°C (that is, 8° and 1,5° higher than at present). For the Holocene optimum the reconstructed deviations are smaller: ΔT_I=4,6°, and ΔT_{VII}=1°). Both optimum intervals under consideration had more oceanic and humid climate compare to the modern one.

Inland Würm Interstadial (OIS-3) pollen records from NW Iberia

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Ecological conditions during the Oxygen Isotopic Stage-3 (OIS-3) are still scarcely known for large areas of the Iberian Peninsula. Certainly some key pollen sequences from peatbogs or lakes exist, but most of them are southern or eastern localities near the Mediterranean coast (see i.e. HUNTLEY et al., 2000). Consequently these data cannot be easily extrapolated to the most oceanic Iberian regions, where situation was surely quite different. In addition, a number of diagrams from Cantabrian caves exist, which commonly result in fragmentary, ill-dated, low resolution sequences, given that these are not optimal media to catch and preserve pollen (D'ERRICO & SÁNCHEZ GOÑI, 2003). Other alternative may be using the North Atlantic pollen-rich deep sea cores (VOELKER et al., 2002) These marine sediments have the advantage of be able to produce datable, rather continuous long sequences, valid for climate reconstructions. However also present some mayor objections: all pollen offshore has necessarily travelled long-distances before the sedimentation, so any less mobile palynomorphs might be missing; and also so the source areas as the original biomes could result mixed, obscured and not easily recognisable in the pollen spectra. Instead, a number of sediments belonging to the last Glacial-Interglacial cycle have been described in the NW Iberia coastal area, so in the Atlantic as in the Cantabrian margins. Most of these profiles (i.e. Area Longa and S[ta]. María de Oia) are currently at the shore-line, where they surge after being the sediments eroded by the tides and the marine transgression; and other group appear in littoral valleys, been opened by fluvial erosion or artificial trenches (i.e. Moucide). Most of all these sites enclose organic levels of continental origin. They were accumulated in the past, when these localities were wetlands. Therefore, these are suitable media to perform high-resolution sequences, since its pollen content is exceptionally high and well-preserved. Furthermore they are organic levels valid to be rightly dated; and moreover, they constitute inland records from different well-located sites, because they may be genuinely compared or interrelated.

In this communication we will discussed several pollen profiles from NW Iberia which as been dated as belonging to the OIS-3. This stage represent and interstadial phase during the Würm which in this region never before has been described as completely recorded in an inland site. The pollen record from the Level III in Area Longa (Lugo) practically represents the whole Würm Interstadial (OIS-3), while other pollen strata in the region may be assigned to any part of that period: i.e., the Level IV in Moucide (Lugo, Galicia) which base has been

dated as >44.730 B.P.; the limnetic levels of the Profile B in Caamaño (A Coruña); and the organic layers in San Xian and S[ta]. María de Oia (Pontevedra). Correlation between all these sites reveals that the Würm Interstadial in the Cantabrian-Atlantic Iberian territories might enclose at least three stages of deciduous trees pollen expansion (Fazouro I, Fazouro II, Baixo Miño), intercalated by other phases where pollen of herbs and shrubs was dominant (Xistral I, Xistral II, Xistral III). In this area OIS-3 begun as a stage (Xistral I) reflecting the prevalence of open landscapes. After it, the warmer Fazouro I (dated as >42.200 B.P) shows a major increase of *Quercus robur*-type percentages. The pollen representation of heaths augments again after 41.000 B.P. (Xistral II), while the subsequent Fazouro II is mainly reflecting the existence of forest with *Quercus robur* and *Betula*, been also present *Pinus, Corylus, Ulmus, Alnus, Carpinus, Ilex, Crataegus, Fraxinus* and *Salix*. Later, the diagrams show the return to the open biomes domain, with new peaks for Ericeceae and Gramineae (Xistral III). The Wurm Intestadial ends with warmer stage (Baixo Miño) characterized by the spread of the deciduous *Quercus* and *Betula* in most of the sites, while other taxa as *Pinus pinaster* tp., *Betula, Corylus, Ulmus, Carpinus, Tilia* and *Ilex* are also commonly recorded. Moreover this last phase finish in S[ta]. María de Oia with the expansion of *Fagus*, which has been dated as later than 35.850 B.P.

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Pollen analysis and the coastal route for the peopling of the Americas

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Archaeological discoveries in South America indicate a human presence in the Americas by at least 12,500 radiocarbon years B.P., preceding the discovery of Clovis culture in New Mexico by about 1,000 years. The previously favoured "Ice-free Corridor" hypothesis for entry of the first humans from Asia is no longer able to adequately explain this early human presence, since it was "closed" by glacial conditions before 12,000 B.P. An alternative Pacific Coastal Route has grown in importance as the likely earliest route of human entry into North America, following the pioneering research of Calvin Heusser and Knut Fladmark. Geological and paleoecological research, including pollen and plant macrofossils, is providing a detailed picture of environmental conditions during the critical Late Pleistocene interval between 15,000-12,000 B.P., when glacial recession proceeded rapidly along the outer coastal shelf of British Columbia. Pollen analysis of ponds and lakes on the Queen Charlotte Islands, and also from sites now submerged by postglacial sea-level rise, reveal a succession of terrestrial plant communities. Deglaciated landscapes were initially colonized by sparse tundra-like vegetation, followed by a mosaic of sedge, grass, and forb communities with dwarf shrubs. Dwarf shrubs include *Salix* and *Empetrum*, and herbaceous plants such as *Heracleum lanatum* and *Hippuris vulgaris* were important components of the shelf vegetation. Some communities were rich in herbaceous flora , and others were dominated by only a few taxa such as Cyperaceae and *Equisetum*. This landscape was productive and includes many plants that are edible and may have been used by humans for food and technology, along with marine resources. The presence of bear fossils in caves during the late Pleistocene suggests that large omnivores could survive on the coast at this time. Pollen records show that this tundra-like environment was rapidly converted to coniferous forest of *Pinus contorta*, with *Alnus crispa* and ferns in the understory, between 12,400-12,200 B.P., followed later by the spread of *Picea* and *Tsuga*. Rapid sea-level rise "drowned" the shelf vegetation soon after 10,400 B.P. on the outer coast, but submarine geological exploration by the Geological Survey of Canada and Parks Canada has identified at least two sites where *in situ* woody fossils of conifers are preserved on the sea floor. Archaeological discoveries by Daryl Fedje and co-workers have pushed the evidence for presence of humans on the coast back to the Pleistocene/Holocene boundary. Whether they were there earlier is speculative at present. The most favourable period for early human migration along the coastal corridor was likely between about 13,500 –12,200 B.P., when retreating glaciers, low sea levels and a productive treeless landscape allowed for easy travel on land and sea.

Palynomorphs of the Holocene in Central México

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In sediments from Chignahuapan and Chalco Lake, central Mexico, were identified and described 105 palynomorphs from the last 10,000 years. Eight taxa were found for algae, one family with one genus for Equisetopsida and Lycopodiopsida, and 6 families with 10 genera for Polypodiopsida. Pinophyta was represented by 3 families and 4 genera, Liliopsida by 11 families and 16 genera, and Magnoliopsida by 44 families and 65 genera.

The samples were treated with acid, acetolized.

The morphological features used for the description were type and number of apertures, ornamentation, exine structure, and size of palynomorphs.

The palynomorph identification was made according to the literature and the pollen collection of the Facultad de Ciencias, UNAM.

These palynomorphs showed the presence of large extensions of temperate forests. Among these were found Abies, Pinus, Quercus and moist forests. The components of the moist forest were: Alnus, Carya, Fraxinus, Celtis, Cupressacea/Taxodiaceae, Juglans, Liquidambar, Myrica, Populus, Prunus, Rosaceae, Salix and Heliocarpus; aquatic and subaquatic vegetation components such as Cyperus, Luzula, Myriophyllum, Typha and Schoenoplectus were also present.

The species harvested by humans appear to be the Cucurbitaceae and Zea mays. Cuburbitaceae is older since it is present 2 500 years BP and Zea mays appears later. Cyperus, Schoenoplectus, Luzula, Juncaceae, Typha, Berula, Datura, Sagittaria and many Asteraceae are among the plants with potential uses. The forests surrounding the lake offered raw materials for timber, instruments, house construction, etc., and also fruit trees such as Prunus, Juglans and Carya. The Quercus forest was probably exploited for coal approximately 3 000 years BP, because it diminishes gradually while bushes and weeds appear more frequently.

Noteworthy, species as *Batis maritima, Nuphar* and *Eriocaulon* were found, where they have not been collected in modern times in the Lerma's River High Basin. The presence of *Eriocaulon* starts during the Holocene, it is scarce and intermittent and its last register is from 3,000 year BP, while the *Nuphar* scarcely appears 2,000 years BP. Many species of *Heteranthera, Schoenoplectus, Populus, Salix* and *Quercus* that were founded could not be connected with current taxa. Finally, pollen grains of *Bursera, Heliocereus* and *Asemnantha,* were found and its presence cannot be explained.

Late Quaternary vegetation history of southwestern Yukon Territory, Canada

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Late Quaternary vegetation and climate history of the southwestern Yukon is of interest to paleoecologists as this region remained unglaciated during the last glacial period and formed the southeastern corner of Beringia. Rampton (1971) cored Antifreeze Pond (AP) from which he obtained 7 ^{14}C bulk sediment dates and analysed the pollen. The basal dates indicate that the AP sediment record extends 30, 000 ^{14}C yr. B.P. If this chronology of AP is correct it is one of only two known lakes in the Yukon Territory with a sediment record extending into the middle Wisconsinan, a period poorly understood in southeastern Beringia. This chronology has been questioned due to a date reversal near the base of the core and the possibility of old carbon within the lake. A new core from AP has been obtained and 23 samples of terrestrial plant macrofossils from throughout the sediment core have been submitted for AMS ^{14}C dating.

Pollen, stomate, and plant macrofossil analyses of a 5 m long sediment core from AP provide a vegetation history of southeastern Beringia. Using a multi-proxy approach will provide both a regional and local signal of past vegetation. Preliminary evidence suggests that during the late Quaternary southeastern Beringia underwent five major environmental shifts. The early vegetation history was dominated by sedges (Cyperaceae) and grasses (Gramineae) along with *Artimisia*, and *Thalictrum*. This period is followed by a possible interstadial inferred by an increase in *Picea, Alnus,* and *Salix* pollen along with macrofossils of *Ranunculus aquatilis, Potamogeton, Chara, Sphagnum,* and statoblasts of the bryozoan *Cristatella mucedo*. Also conifer stomates are present during this period suggesting that southeastern Beringia could have been lightly forested. This may represent an eastern expansion of *Picea* woodland into southwestern Yukon Territory during the middle Wisconsinan, although this has been previously hypothesized, the pollen data from this region have been inconclusive. Following the interstadial is an environment again dominated by Cyperaceae and Gramineae. Minimal macrofossils were recovered during this period, which may represent a hiatus in the lacustrine record. Approximately 13,000 yr. B.P., *Salix* pollen increases coeval with a rise in *Hippuris, Eleocharis, Ranunculus aquatilis* and *Potamogeton* macrofossils. This period is also marked by a rapid sedimentation rate. The characteristic boreal forest vegetation with increased *Picea, Betula, Alnus,* and *Salix* and a decrease in herbaceous pollen occurred approximately 9,000 yr. B. P.

RAMPTON, V. 1971. Late Quaternary vegetation and climatic history of the Snag-Klutlan area, southwestern Yukon Territory, **Canada. Geological Society of America Bulletin** 82: 959-978.

Palynostratigraphy oxbow-lake deposits near village Zabolotje (Belarus)

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In a section at village Zabolotje Rogachev district Gomel region in 2002 were opened sand (d. 1,61-1,75 m), clayey silt (d. 1,41-1,61 m), peat (d. 0,18-1,41 m), soil (d. 0,00-0,18 m). Deposits was investigated by palynologycal analysis of 70 samples. Evolution of ecosystem is reflected in 34 palynocomplexes (PC).

Sand and clayey silt (d. 1,41-1,75 m, PC 1-10) was deposited in Late-Glacial time (AL-2-a-b-3-DR-III-3). The large involvement of herbs pollen (11-47 %), presence of spores (1-13 %), domination coniferous (*Pinus sylvestris* (78-95 %) and *Picea sect. Eupicea* (2-21 %)), small quantity *Betula sect. Albae* (10-18 %) and *Alnus* (2-10 %) was characteristic of it. The herbs was represented *Poaceae* (4-25 %), *Artemisia* (5-22 %), *Asteraceae* (19 %), *Polygonaceae* (9-18 %), *Chenopodiaceae* (7-9 %), *Cyperaceae* (43-89 %), *Typha latifolia* (6-15 %). *Polypodiaceae* (96-100 %) was dominated from spores. *Sphagnum, Selaginella selaginoides, Lycopodium clavatum, Hypnum* was met at small amount. The distribution was received rarefied pine woods with a birch, fur-tree formations, open spaces with cereals, wormwood and water-marsh plants associations.

Overlying thickness of peat and soil (d. 0,00-1,39 m) was accumulated in Holocene (PB-1-SA-1-3; PC 10-34). Prevalence of pollen trees (81-98 %) over pollen of grasses (2-8 %) and spores (0,5-13 %) was peculiar to it. During all this time was dominated coniferous *Pinus sylvestris* – 73-97%, *Picea sect. Eupicea* – 2-16 %, *Abies* (0,5 %). Small-leaved (*Betula sect. Albae* - 0,5-17 %, *Alnus* - 0,5-5 %) and broad-leaved (0,5-2 %: *Quercus robur* (0,5-1 %), *Ulmus* (0,5 %), *Tilia cordata* - 0,5 %, *Carpinus betulus* - 0,5 % and *Corylus avellana* (0,5 %)) breeds was presented at a small amount. Grasses was submitted *Cyperaceae* (61-93 %), spores — *Polypodiaceae* (100 %), *Lycopodium clavatum*. Distribution was received pine woods with small participation of birch, alder, oak, hornbeam and fur-trees.

In the Atlantic period of Holocene broad-leaved breeds was not form precisely maximum (1-1,5 %: *Quercus robur* (0,5-2 %), *Ulmus laevis* (0,4 %), *Tilia cordata* (0,4 %), *Carpinus betulus* (1 %)), but they was have the greatest variety compared with the other stages. At this time pine-broadleaved woods with a fur-tree, a birch, a hazel, fir, alder was widespred.

Thus, conducting researches have allowed to establish, that formation of first terrace sediments of the river Dnepr near Rogachev occurred in Lateglaciale and Holocene. The sand, covering a bottom of paleobasin, was deposited in AL-2-a-b-3 — DR-III-1-a-b in conditions of some delay of a water drain. Than, the subsequent formation of silt and peat in DR-III-2-a-b-3 — AT-1-3 testifies to a gradual shallowing of this reservoir and its fast bogging. Finds of sinantropical plants (*Polygonum aviculare, Fagopyrum saggitatum*) was marked in SB — SA-1-3 and correspond to formation of soil horizon.

Spreading of *Ambrosia* in the Hungary

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Only one ragweed species is native to Europe (Ambrosia maritima L.) and at the beginning of the XXth century other ragweed (*Ambrosia*) was unknown in our continent. It is originally North American species, was imported into Central Europe mainly after World War I, and started its expansion from Croatia to Hungary towards the north during the second half of the 20th century, causing considerable health problems to the sensitive allergic population.

The adaptive radiation of this allergenic weed seems to follow two different directions in the last 80-90 years to the centre of Carpathian Basin, to Hungary:

1) The first direction was probably the following: ports of the Adriatic Sea → Croatia → Southern Transdanubia in Hungary → all of Transdanubia→ Austria and Slovakia. The first data about the appearance of ragweed in Croatia are from the beginning of the 1920s. It must have spread to the North-East and reached quite soon the south-western parts of Hungary. Within three years the one tenth of the country's area had been occupied and in 1926 even the southern suburbs of Budapest had already been colonized by ragweed. It really became part of the human landscape there after the first World War. Until now ragweed has already colonized the whole western parts of the Carpathian Basin - including Slovakia and Austria - although it is still the most abundant in the southern parts of Hungary.

1) The second expansion was more leisurely. The short ragweed (*Ambrosia artemisiifolia*) was firstly collected in 1908 in the south-eastern part of the Carpathian Basin, in Orsova near the Black Sea. The line of Ambrosia spreading probably the following: from East (South Romania) or West (from ports of Adriatic Sea) → part of Danube -Tisza Interfluve in Serbia→ southern part of Danube –Tisza Interfluve on Great Hungarian Plain → all Great Plain in Hungary. Recently most polluted area by Ambrosia pollen is the eastern part of the country between cities Debrecen and Nyíregyháza.

Although the invasion of ragweed is promoted mostly by human disturbance, the area of potential distribution is limited by climatic factors. That is why in most of the European countries this plant is still absent or rare enough to be almost absolutely unknown for allergologists. The climatic conditions in the Carpathian Basin are similar to the one found at the centre of origin of the genus, in North America. Two of its major adaptation characteristics make ragweed a problem: the production of seeds in very large quantities and the long survival period in the ground. In territories with different agricultural management, where noxious weeds, such as ragweed, are less or not at all tolerated, its progress is still under control. In other places it is the climate that limits ragweed, even if the human environment would allow for its establishment, but we don't have to forget that there are several signs indicating that global climatic change is going to enhance its further spread towards the North, promoting millions of new allergies caused by this simple plant in the near future.

There is an urgent need to organize international interventions, within the framework of EU, to stop ragweed expansion and to eradicate Ambrosia in the areas already polluted by ragweed, not only in Hungary but in all areas of Carpathian Basin.

Vegetation dynamics of a small *Sphagnum* peat bog from North-Hungary, from the Late-Pleistocene until late Holocene: palynological and macrobotanical data

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This study presents the findings of a research carried out on Nádasd -to located on the northern side of a 516 m high mountain near Nagybárkány in the Eastern Cserhát of Northern Hungary (360 m a.s.l.). The lacustrine basin is slightly elongated in a direction of N-E with a highly narrowed projection on the southern part bearing a

width of 5-10 m only. The basin is a 100 m long covering an area of 2000 square meters, and the width of its widest portion is around 40 m.

The basin is surrounded by a moss-capped oak woodland. Three major vegetation associations can be observed today on the area of the marsh. The central part is occupied by a peat-moss willow marsh poor in species (Salici cinereae-Sphagnetum recurvi). This association is rather rare in Hungary, mainly restricted to the local depressions or valleys with a closed drainage and a relatively good water supply of the Mid-mountains and the Great Hungarian Plains. Due to the high precipitation in the year of sampling (2003) the willow marsh used to form a floating swamp. The willow marsh is surrounded by reed poor in species as well (Scirpo-Phragmitetum), except for the western side. The reed is encircled by high bulrush (Caricetum ripariae). The area of the marshland has suffered significant transformation since the time the first vegetation map was prepared, which is quite interesting (MÁTHÉ-KOVÁCS 1959). In 1959 the extension of the willow marsh and the area covered with peat-moss was relatively small. *Sparganietum erecti* was a characteristic species in the area. In 2003 the willow marsh extended to the areas formerly covered by reed, and the former reed areas were occupied by *Sparganietum erecti*. This latest vegetation association is totally missing today indicating that the pond is about to reach an oligotrophic phase, which will most likely bring about the expansion of peat-moss associations.

Paleoecological boring was carried out in the NW part of the marshland occupied by willow marsh. The sampling was carried out at 5 cm intervals with a Russian type corer. We have come across peat from the surface down to a depth of 110 cm with and underlying open water area to a depth of 130 cm (floating swamp). This was underlain by alternating layers of peast and peat mud with highly varying rates of organic matter to a depth of 300 cm. Between the depths of 300 and 340 cm we could find silty lacustrine beds. As the analysis of macrofossils becomes more and more indispensable to Quaternary paleobotanical studies (BIRKS & BIRKS 2000) besides pollen analysis the investigation of macrofossils was also carried out. An important methodological breakthrough was the adoption of the QLCMA (semi-quantitative quadrate and leaf-count macrofossil analysis technique) (BARBER ET AL., 1994) in our work, which was developed in Southampton following the former predictive techniques enabling an accurate and detailed modern analysis of pollens. The QLCMA method was originally developed for acidiferous *Sphagnum* peats, it brings no new results when applied to basic peats or lacustrine deposits poor in organic matter, compared to the former predictive techniques, because these latter tend to embed plant tissues as well (mainly roots). On the other hand, very few seeds and fruits tend to come to light from the majority of the peats making the outcome of the analysis quite truncated. A modified version of the QLCMA method has been developed at the Department of Geology and Paleontology, University of Szeged, which may help us solve these problems (JAKAB – SÜMEGI –MAGYARI, 2003, JAKAB-SÜMEGI-JUHÁSZ, 2003). The following results have been found regarding the local vegetation: in contrast to previous findings (MÁTHÉ-KOVÁCS, 1959) the invasion of *Sphagnum* into the area of Nádas pond of Nagybárkány by not all means a recent phenomenon. Different species of peat-moss have been continuously present since the birth of the lake, however they become prominent only in the last phase of the Holocene. Two major marsh formation periods can be observed in the history of the marshland. The first one is recorded in the deposits between 240 and 200 cm, with the second one between 110 cm up to the surface. The pond is characterized by an eutrophic state between the these two periods. The first fen phase was a eutrophic marsh with a dominance of reed while the second phase is characterized by the formatting of floating marsh and oligotrophic processes. The history of the marsh can be divided into two phases: an allogenic one (340-110 cm) and an autogenic one (110-10 cm). In the first phase it must have been the climate and the hydrology that mainly influenced the development of the vegetation, while the extending peat-moss resulted in an increasing oligotrophy of the pond in the second phase.

The results of palynological analysis corroborated these changes in the local vegetation as well. This is the third radiocarbon dated palynological analysis yielding new data on the vegetation history of an area under Sub-Carpathian climatic influence. The dynamics of the terrestrial vegetation is highly similar to the data of the radiocarbon dated diagrams published so far (WILLIS ET AL, 1997, JUHÁSZ, 2002).

Late Pleistocene vegetation history reconstructed from the pollen spectra of boring cores in Naka-ikemi, Japan

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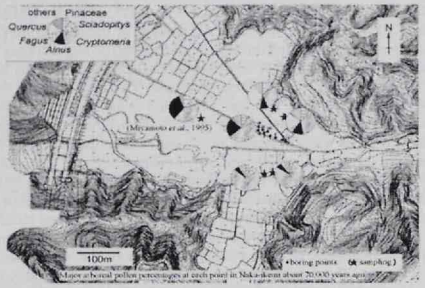
Naka-ikemi is the small basin, about 20 ha, located in Fukui Prefecture, Japan sea side of central Japan. It is the waste filled valley, dam up by the Tsuruga fault running east of the basin. It has 40 m thick humus sediment, because the basin, west of the fault, has been sinking. Underground sediment of Naka-ikemi is divided into the Lower Sand and Gravel Layer, and the Upper Humus Layer including widespread tephra such as Ata(105ka), K-Tz(95ka), Aso-4(90ka), DKP(50ka), AT(25ka) and K-Ah(7ka). Vegetation changes during the Late Pleistocene are reconstructed comparing pollen spectra of the Upper Humus Layer below the AT from 6 drilling cores. Deposition of the Humus Layer began at the central part. Occurrences of *Largerstoemia* and *Quercus* subgen. *Cyclobalanopsis* at the base of the Upper Humus Layer suggest the warm climate, which would be correlated to oxygen isotope stage 5e or 5c. Generally *Cryptomeria* pollen dominated. *Cryptomeria* is characteristic pollen type of the early glacial in central Japan. Differences of pollen assemblages between the sampling points reflect the vegetation in and near the Naka-ikemi. That is, *Quercus* forest distributed on the hill and slope near the northern part, *Alnus* forest was growing in the wetland, and *Cryptomeria japonica* forest stood along the valley of southern part. About 80,000 years ago, *Castanea/Castanopsis* pollen occurred remarkably and after that pollen of deciduous broadleaf trees occurred remarkably. This short term deciduous broadleaf tree pollen dominance is commonly observed from other sites in central Japan about same ages, and could be correlated to oxygen isotope stage 5a. When *Castanea/Castanopsis* pollen increased deposition area enlarged to south, and after the increase of deciduous broadleaf tree pollen, it enlarged to north. Naka-ikemi changed from lake to moor around 50,000 years ago. *Alnus* and *Lysichiton* pollen increased, *Sciadopitys* pollen decreased and Cupressaceae type pollen increased, and *Hedrangea* type pollen increased temporary. Increase of *Tsuga*, *Pinus* subgen. *Haploxylon*, and *Betula* pollen below the AT indicate climatic change to the last glacial maximum, oxygen isotope stage 2.



Robust pollen signals during the last few centuries in and around the European Alps

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We described recently (van der Knaap et al., 2000) trends in pollen types during the last few centuries that were synchronous among 25 pollen diagrams from the western Swiss Alps or close by. New, unpublished data

show that some of these trends are consistent over a much larger area and in a wide variety of sites ranging in size from a few tens of meters across (fens surrounded by dense forest) to more than a hundred kilometres across (the Adriatic Sea; part of the Mediterranean Sea). Physical dating supports synchronicity of some of these pollen trends, so now we possess robust pollen signals suitable for preliminary dating of pollen diagrams of this time period likely valid for the entire European Alps and its wide surroundings. Examples of such pollen signals are: (1) pollen of the cultivated plant *Cannabis*, which reaches several percents of the pollen sum since early Medieval times, increases to a maximum around AD 1880, and then declines, rapidly so (within 1-2 decades) in the northwestern Alps but more gradually (>7 decades) in the southern Swiss Alps, eastern Alps, and the Adriatic Sea; (2) pollen of *Mercurialis annua*, a lowland arable weed of fertile soils, never abundant (<1%) but often having a maximum from AD 1900 to 1950; (3) increase of tree pollen starting AD 1920 or later; (4) selective decline during the second half of the twentieth century of pollen of grassland plants disfavoured by artificial manuring such as *Plantago lanceolata* and *Rumex acetosella*; and (5) increase at AD 1950 of pollen of *Ambrosia*, a weed introduced more than a century ago from America. These trends are detectible in pollen diagrams reflecting widely varying local vegetation developments. Since all these trends are interpreted as responses to human action, the cause for the observed synchronicity may be large-scale economic forcing of land-use and forestry practices.

VAN DER KNAAP, W. O., VAN LEEUWEN, J. F. N., FANKHAUSER, A., & AMMANN, B. 2000. Palyno-stratigraphy of the last centuries in Switzerland based on 23 lake and mire deposits: chronostratigraphic pollen markers, regional patterns, and local histories. **Review of Palaeobotany and Palynology** 108: 85-143.

Late Quaternary palynological records from Southern Spain highlight the influence of ecosystem properties in the long-term dynamics of Mediterranean vegetation

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This paper examines the Late Quaternary environmental history of several lacustrine basins from southern Spain, with the goal of establishing the mechanisms exerting control on vegetation change. Palaeoecological indicators include pollen, microcharcoal, spores of terrestrial plants, fungi, and non-siliceous algae, and other microfossils. The studied sequences are shown to be sensitive to climatic change, although the control exerted by climate on vegetation is ultimately shaped by disturbances and species interactions, determining the occurrence of century-scale lags and threshold responses. Eventually, biotically-induced changes of vegetation are also shown at the intrazonal levels of variation. The existence of mid-elevation glacial refugia for a number of temperate and Mediterranean trees is shown. A mid-Holocene phase (c. 7500-5200 cal yr BP) emerges regionally as the time of maximum forest development and highest lake levels. The early Holocene occurs as a generally dry, pyrophytic period of pine forests, with grassland-scrub in high altitudes, and the late Holocene as a period of protracted vegetation sensitivity, with return to development of pine forests, spread of xerophytic communities, and increased fire activity, under the context of dry spells, localized anthropogenic disturbance, and shallowing and desiccation of lakes. Several events described here correlate with established times of abrupt transitions in the climates of northern Europe, the Mediterranean basin, north Africa and the Sahel.

Pollen diagram and ^{14}C dating of sediments from lake Kwiecko (N Poland)

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Lake Kwiecko (54° 01' 30" N, 16° 42' 00"E) is situated in the West Pomeranian Lake District, Northern Poland within the stadial moraines of the Late-glacial time.

The palynological study of over 22-meter-thick sediments from the lake allowed for reconstruction of the vegetation history during the entire Holocene. In the pollen diagram 7 L PAZ have been visually distinguished. More then 200 pollen samples were analyzed. Over 200 plant taxa from various groups (algae, mosses, pteridophytes, gymno- and angiosperms) have been distinguished.

The main goal of the pollen-analytical studies was to assess the human impact on vegetation. The first signals of human activity in the pollen diagram are linked to Mesolithic period.

The increase of human indicators in the pollen diagram is synchronous with the *Ulmus* decline. The first signs of cereals cultivation in the area are coincident with the decrease of *Quercus*. The significant increase in NAP occurs parallely with the final reduction of mixed deciduous forest taxa such as: *Ulmus, Tilia, Quercus and Corylus.*

The 3 radiocarbon AMS dates were obtained from *Drepanocladus aduncus* remains and 10 AMS dates were obtained from pollen extracts. All the radiocarbon ages performed on moss remains appeared to old in comparison to pollen succession. The greatest difference between them occurred at the bottom of the core and reached about 6000 years BP. Dating of the pollen extracts from the same stratigraphic level resulted in much younger ages, but still to old, especially at the base of the core. At the same time the loss-on-ignition analysis showed the highest carbonates concentration in this portion of the core. All the data suggest the possibility of so-called "old carbon error" occurrence.

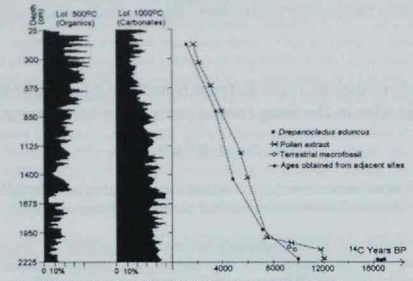

Fig. 1. Radiocarbon age-depth relation and loss-on-ignition results for Kwiecko Lake core.

Problems of Quarternary palynology of Kazakhstan

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The diversity of the geological-geomorphological structure of the arid zones of Kazakhstan, and also the relative stability of the conditions during the different periods of the Quarternary makes difficult the reconstruction of the historical evolution of the vegetation cover and the reconstruction of the paleoclimate with stratigraphic division of the Quarternary deposits.

The arid belt of Kazakhstan belongs to the extraglacial zone and thus, the vegetation change under climatic fluctuations takes a different way than in the forest-steppes and forest zones intermixed within it. Here the main zonal type is herbaceous, shrub and half-shrub vegetal steppe assemblage, semidesertic and desertic with azonal and intrazonal Tugai forest vegetation, coniferous and relict forests.

The modern representations about the geographical distribution of the vegetal cover of Kazakhstan with very complex and mosaical contours, is not always convenient for the palynological research of the Quarternary deposit.

Today we are presenting a geographical division of Kazakhstan based on the geological-geomorphological and on the landscape-climatic (generalized) criteria.

The selected areas include the Aral-Caspian, the Mugodjarski- Saryarkinski (Central Kazakhstan) regions, the Kazakh part of the south-west Siberian lowland and the Orogenic belt, divided into districts and subdistricts.

The modern problems of palynology of the arid zones of Kazakhstan are subdivided in several directions. Among them the palynological group of the Institute of Geological Sciences of Kazakhstan, the only institution studying the palynology of the arid countries of Central and Middle Asia, is concerned with these aspects: analysis of minerals and modern spore-pollen spectra, morphology of relict and endemic spore and pollen, the allocation of valuable recent and subrecent spore-pollen spectra from referential and stratigraphic sections of deposits of various periods; the creation of a database from the morphology of modern spore-pollens for the identification of the mineral composition of the spore-pollen complexes; the elaboration of techniques of interpretation obtained from the structural and statistical data of the spore-pollen deposits of the arid zones; the creation of correlates of particular landscape and climatic referential zones of spore-pollens spectra.

These materials contribute to resolve the problem of the reconstruction of the paleobotanical and paleoclimatic evolution of the arid zones (even in the absence of pollens of wood plants in the spectra).

It has been established that within the limits of the landscape zones, the spectrum reflects the zonal vegetal type, while in the boundary zones a transient area of various width has been observed. This is testified by the mixed borders of these zones under climatic fluctuations.

A displacement of the vertical mountain belt depending on climate has also been clearly detected.

Thus the order and sequence of changes under the displacement of zonal borders downwards at the rise of the glaciers can become a significant index of the complete destruction of the forest belt and of the steppe shrubs and the formation in the mountains of vast zones of cold deserts and steppes.

In these circumstances the retraction of the vegetal genofund in refuges - in deep canyons has been observed. The analysis of the rules of the pollenic transfer from arboreal type brought from the adjacent areas of Western Siberia, Altai, mountainous regions of Northern Tianshan and also Caucasus, makes the interpretation more difficult, but also promotes a more precise definition of the displacement of the limits of the forested zones in different regions under the influence of climatic change.

Today our data permit the acceptance of the following situations: to the mountain glaciations of the Quaternary correspond a pluvial phase in the arid zone, and to the interglacial- a arid phase.

The phenomenon of the arid zone – forested area and their palynological analysis provides interesting material reflected in the spectra of warm (dominant) and cold periods; and the spore-pollen deposits from pedo-complexes have shown that interruption in the precipitation and in the morphological formation of the concerned soils (mountain chernosem and meadow soils) reflect a rather long rest in the precipitation under relatively favourable conditions (warm and wet).

The impoverishment of the spore-pollen spectra of the forests testify considerable speeds of forest accumulation in piedmonts strata.

The reconstruction of the palynospectrum from the glacial and fluvio-glacial deposits is hindered by the features of their accumulation. However, through the obtained spore-pollen spectra, although of mixed composition, it is nevertheless possible to establish under the guidance of the specimen the vegetal types rearranged at the level of the remaining moraine.

It has been established that the lowest position is occupied by the moraines of the Middle Pleistocene (up to 1600-1800 m. above sea level) and that during that period Alpine meadows were distributed at this level. The fundamental index for their reconstruction came out of the pollens of Cyperaceae, Poaceaea (Graminea), Rosaceae, Ranunculaceae etc. (these data are confirmed by the material of MM Pakhomova, LN Chupina, SA Jakupova). Today at this altitude is found the lower border of the forested zone and the Alpine meadows are found above 3000 m.

The most representative samples for the arid zones came from the spore-pollen spectrum from fluvial valleys and lacustrine deposits (saline and fresh) allowing one to receive the detail characteristics of the warm and cold periods. In the near future they will also enable the creation of a biozonal scale of the Quarternary deposits in the arid zones.

The preliminary basis for the biozonal scales were obtained from the late Pleistocene and Holocene of Semirechie and Pre-Karatau region of Southern Kazakhstan, and have also their correlates in Central and Northern Kazakhstan. The Kazakhstan material of the Quaternary period are correctly correlated to the data of the West Siberian lowland and of the East European plain.

Environmental impact of early palaeometallurgy: pollen and geochimical analysis

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Interdisciplinary researches, in middle mountains areas in France, aims to document historical mining and smelting activities by means of pollen and geochemical analyses. These investigations are developed from peat bogs cores collected in the Morvan mountains (MONNA *et al.* in press), in the Lozere mount in South Massif Central (LAVOIE *et al.* in press) and in the Basque Country (Pyrenees) (GALOP *et al.* 2001). They documented palaeoenvironmental impact since the beginning of those activities, in areas where archaeological data indicate important mining and/or smelting activities in several historical periods, and where there is an abundance of mineral resources.

Different phases of mining are recognized from the presence of anthropogenic Pb in peat (anthropogenic lead is recognized by the way of its isotopic composition). They have all led to modifications in plant cover, probably related in part to forest clearances necessary to supply energy for mining and smelting. Vegetation cover may have been drastically affected by selective deforestation, affecting especially *Fagus* in Morvan and Lozere. This species is well-known to provide good energy for fuel.

According to radiocarbon dating, some periods of high metallurgical activities were related with archaeological evidence of mining or smelting activities. For example, in Morvan, lead inputs and woodland collapse peaked at the height of Aeduan civilization (1st century BC) and then decreased after the Roman conquest of Gaul (at the beginning of our era), when the site was abandoned. The abundance of mineral resources, in addition to the strategic location, might explain why early settlers founded the city of Bibracte at that particular place. In the Lozere Mountain, two periods of mining activities are documented for the last 2200 years. The first one, well marked, occurred during the Antique period, the second one during the Medieval period (XI-XII centuries). The Gallic major peak in led abundance is in disagreement with the archaeological and geomorphological data which attribute to the medieval times a major mining activity and the main clearance phase. In the Basque Country, in an area recognized by archaeological data as being an old metallurgical center since the 1st century BC, several phases of metallurgical activities linked with environmental modifications are attested between Late Neolithic and modern times (Middle Bronze Age, Late Bronze Age, Antiquity and finally modern times). Most of these phases are clearly related to forest clearance, however it arises that locally the impact of the metallurgy on wood peaks at the beginning of century 18th.

But some evidences of palaeometallurgy, marked by pollution and significant fall in percentage of arboreal taxa, could not be related with archaeological knowledge and then give new data for human settlement in the area. This could explain forest clearances without increase of pollinic anthropogenic indicators linked to agro pastoral activities.

MONNA, F.; PETIT, C.; GUILLAUMET, J.-P.; JOUFFROY-BAPICOT I. *et al.* in press. History and environmental impact of mining activity in celtic Aeduan Territory recorded in a peat bog (Morvan, France), **Environ. Sci. & Technol.**, 9 p.

LAVOIE, M. ; PULIDO, M. ; BARON, S. ; PLOQUIN, A. ; BEAULIEU, J.L. de. *et al.* in press. **Le plomb argentifère ancien du Mont Lozère (Massif Central) : une approche historique, géologique et paléoenvironnementale**.

GALOP, D.; TUAL, M.; MONNA, F.; DOMINIK, J. *et al.* 2001. Cinq millénaires de métallurgie en montagne basque. Les apports d'une démarche intégrée alliant palynologie et géochimie isotopique du plomb. **Sud-Ouest européen** 11 : 3-15.

Late Quaternary paleoenviroments in Dor, the Carmel coast, Israel

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The 10.5 m deep "D-Dor" core was taken at Dor (Tantura Lagoon), Carmel coastal plain, Israel. The established chrono-stratigraphic sequence (based on x-ray radiographs and both luminescence and radiocarbon dating) covers the last ca. 26,000 years. It provides the paleoenvironmental framework for the passage from hunter-gathering to agriculture in the Levant. Three clay units were identified, overlying the kurkar (aeolianite) and covered by 6.3 m sand. The bottom clay unit is a paleosol. Pollen was not preserved in this unit. Gray clay (the top of which was dated to about 12,000 cal. YBP) was deposited, overlying the paleosol, in a wetland environment. Pollen was preserved only in the upper part of this unit. It indicates a drier and cooler climate than today, probably correlative with the Younger Dryas. At the beginning of the Holocene, between 10,250 and 9,550 cal. YBP, a new marsh originated depositing dark clay. High concentrations of well-preserved pollen enabled the reconstruction of several fluctuations in humidity. When the marsh was first formed, precipitation was higher than today and oak maquis was more extensive in the area. Pollen grains of several trees (*Corylus* sp. *Carpinus* sp. and *Juglans* sp.), which do not grow naturally in the area today, may indicate slightly lower temperatures at the time of deposition. The date of the earliest submerged Pre Pottery Neolithic settlement embedded in its upper part indicates that the marsh dried out no later than 9400-8550 cal. YBP. Around 5,000 years ago, long after the Early Holocene marsh had dried up, sand began to accumulate in the region as a consequence of the Holocene sea level rise, covering several submerged Neolithic settlements off the Carmel coast.

Pollen record of surface sediments of Hakodate Bay, Hokkaido, Japan, reflects governmental agriculture and forestry policy

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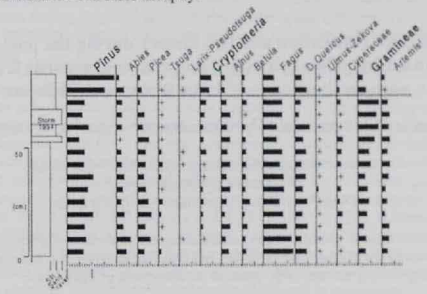
Pollen assemblages in two cores (80cm, 40cm) from Hakodate Bay, Hokkaido, Japan, reflect governmental policy of agriculture and forestry. The pollen assemblages consist mainly of *Pinus*, *Abies*, *Picea*, *Cryptomeria*, *Alnus*, *Betula*, *Fagus*, deciduous *Quercus*, Cyperaceae, Gramineae, and *Artemisia*. The pollen flora does not show any considerable change throughout the cores, but the relative abundances of *Pinus*, *Cryptomeria*, and Gramineae change noticeably in the uppermost part of the cores. *Pinus* shows an abrupt increase, *Cryptomeria* a gradual increase, while Gramineae decreases abruptly.



The horizon of change in pollen abundance of these taxa is upper than the storm sediments of 1954. After this the increase in *Pinus* and *Cryptomeria* pollen indicates the extensive afforestation by the Government after 1957. More recently the decrease in Gramineae pollen reflects the governmental policy of production adjustment for overproduced rice after 1970.

New palynological data from the Cromerian complex, Middle Europe (Hungary)

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From western Hungary from the alluvial deposit of the Danube significant paleontological and paleobotanical fossil assemblages turn up continuously. Based on the vertebrate and mollusc remains the locality was dated to the Günz/Mindel interglacial according to the classical, respectively to the Cromerian interglacial complex according to the modern chronology. (JÁNOSSY-KROLOPP 1994).

Clay lenses were excavated during pebble mining from the sand and pebble layers between 20 and 33 m depth of the deposit. These clay blocks preserved huge amount of macro- and microfossils. The macrofossil analysis was carried out earlier (BAJZÁTH 1995, 1996, 1998), now we report the results of pollen analyses.
At the following depths we found

33 m: *Pinus-Betula* dominance with the presence of *Picea, Tsuga, Larix*,
31 m: *Pinus-Betula*-Poaceae dominance with the presence of *Ulmus, Populus, Carya, Pterocarya, Azolla*,
30 m: *Pinus-Picea* dominance,
25 m: *Pinus-Picea-Alnus* dominance, with the presence of *Quercus, Vitis, Populus*,
20 m: *Pinus-Betula-Alnus* dominance with the presence of *Abies, Quercus, Carpinus, Populus*.

Based on the pollen spectra of certain levels we can state, that the pollen material of the 33 and 30 m depth represents the end of the oligocratic beginning of the telocratic phase of an older interglacial cycle, while the 20–25 m depth identifies the mesocratic phase of a younger interglacial cycle of the Cromerian interglacial complex therefore the traces of at least two interglacial periods can be considered as proven at the locality Gyórújfalu.

BAJZÁTH, J. 1995. Plant macrofosil from Hungarian Pleistocene I. Gymnospermatophyta in Gyórújfalu. **Annales historico-naturales Musei. nationalis hungarici** 87: 5–9.
BAJZÁTH, J. 1996. Plant macrofosil from Hungarian Pleistocene II. Angiospermatophyta in Gyórújfalu. **Annales historico-naturales Musei. nationalis hungarici** 88: 5–20.
BAJZÁTH, J. 1998. Plant macrofosil from Hungarian Pleistocene III. Palaeobotanical study of Gyórújfalu. **Annales historico-naturales Musei. nationalis hungarici** 89: 17–26.
JÁNOSSY, D. & KROLOPP, E. 1994. Lower Pleistocene mollusc and vertebrate fauna from the gravel pit of Gyórújfalu (NW Hungary). **Földtani Közlöny** 124: 422–436.

Vegetation, rice cultivation and fire history during the past 4,000 years indicated by pollen, phytolith and charcoal records from the eastern shore area of Lake Biwa, central Japan

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The application of multi proxies to the palaeoecological study is useful for clarifying the detail history of nature. In this study, using the pollen, opal phytolith and charcoal analyses, we have made clear vegetation, rice cultivation and fire history during the last 4,000 years in the shore area of Lake Biwa.

We took cores from the swamp area of Sone-numa pond, situated in the eastern shore area of Lake Biwa. The pond is located at 86-m elevation in the warm-temperate zone. The modern vegetation at this site is reed (*Phragmites australis*) swamp. There are many paddy fields around this area at present. Also, evidences for ancient paddy fields more than 2,000 years BP were excavated from archaeological sites in the eastern shore area of Lake Biwa (Toyama, 1994).

Vegetation during the last 4,000 years was reconstructed by pollen and opal phytolith analyses. Before 2,700 cal BP, vegetation around the study site was evergreen broad-leaved forests (Lucidophyll forests) dominated mainly by evergreen oaks (*Quercus* subgenus *Cyclobalanopsis*) with several conifers such as *Cryptomeria japonica* and Cupressaceae trees. However, around 3,000 cal BP, Gramineae and *Alnus* pollen increased after the conspicuous peak of charcoal fragments. We found many pieces of phytolith of several Gramineae plants such as *Phragmites* and Panicoideae, indicating reeds swamp with alder thickets. In the horizon dated by AMS as 2,750 cal BP, vegetation changed with occurrence of much charcoal fragments. Evergreen oaks tended to decrease and *Cryptomeria japonica* began to increase in 2,700 cal BP. Also, phytolith of *Oryza sativa* (rice) and *Oryza* type pollen grains by using SEM were detected after this date. These evidences indicate the beginning of the rice cultivation at 2,700 cal BP. Also, continuous occurrences for phytolith of *Oryza sativa* after this date indicate that the rice cultivations by people have maintained since 2,700 BP in the shore area of Lake Biwa. Several conspicuous peaks of macroscopic and microscopic charcoal fragments appeared in the period between 3,000 and 1,200 cal BP., indicating fire events, probably affecting the vegetation. Red pine secondary forests increased during the last 1,200 years in the area. The increase of *Oryza sativa* phytolith during this period suggested the influence of the human activities on the shift of the vegetation to secondary forests

Intra-site correlation and dating of saltmarsh sediments: the potential of pollen analysis. A case study from Connecticut, USA

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Saltmarshes hold considerable potential for reconstructing sea-level changes during the last few thousand years and offer a direct basis for comparing measured sea-level observations (e.g., from tide gauges) with those of the recent geological past. However, dating recent saltmarsh sediments, particularly via radiocarbon methodologies, can be problematic, particularly for the last *ca.* 200-300 years. This paper details the findings of a study aimed at evaluating the use of historically-delimited pollen 'markers' for a) dating, and b) correlating recent saltmarsh sediments on an intra-site scale. The study focuses on a saltmarsh in Connecticut, USA (Menuketesuck River Marsh), a sensitive recording site for the study of sea-level change. Pollen was investigated from five closely spaced (0.5 – 58 m) 1 m cores from a sheltered area of the marsh, 1.5 km from the coast. Through the analysis of local historical documents, nine palynological and other markers were constrained. These include: 1) a decline in birch pollen (1950's-1960's); 2) a chestnut pollen decline (*ca.* 1915); 3) an expansion in opaque spheres dating from the latter quarter of the nineteenth century; 4) a decline in *Quercus* pollen in the early to mid nineteenth century; and 5) an initial rise in ruderal pollen resulting from land clearance in the mid eighteenth century.

To shed further light on pollen taphonomy in the modern marsh environment, 55 surface samples were collected from three transects extending across the marsh surface (upland border to tidal channel). These analyses showed that whilst regional (non-wetland) pollen taxa have a reasonably even distribution within the mid- to high-marsh zone, the assemblages from proximal creek and channel samples and from upland border samples display a number of consistent differences, with local over-representation of bissachate grains and pollen grains derived from tree taxa in the adjacent upland. These findings have implications for the interpretation of the fossil datasets. The study has confirmed that historically defined pollen markers hold considerable potential for dating and correlating the highly peaty mid- to high saltmarsh sediments of New England, supporting observations made previously in the region (cf. BRUGHAM, 1978; CLARK & PATTERSON, 1984). In contrast to previous studies, this study has highlighted the need to obtain local, catchment-specific historical data to improve the accuracy of the age determinations. The study has also shown that through the analysis of multiple cores, pollen markers can be used to construct isochrons ('timelines') for a single marsh site. They thus provide an excellent framework for i) establishing local marsh accretion rates; ii) examining temporal changes in microfossil (e.g., diatom) distribution

which are integral to the study of sea-level change; and iii) independent cross-validation of AMS radiocarbon and Lead-210 datasets.

BRUGHAM, R. 1978. Pollen indicators of land-use change in Southern Connecticut. **Quaternary Research** 9: 349-362.
CLARK, J. S. & PATTERSON, W. A. III. 1984. Pollen, PB-210 and opaque spherules: an integrated approach to dating and sedimentation in the intertidal environment. **Journal of Sedimentary Petrology** 54: 1249-1263.

Vegetation history and land use in the area of the Neolithic lake settlement Dispilió, Northern Greece

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Palynological research on lacustrine sediments of late Quaternary age of the lake settlement Dispilió - Northern Greece - has been carried out within the framework of archaeological investigations concerning the presence, the activities and the living conditions of the Neolithic man.

Lake settlement Dispilio, which is placed on the south margin of lake Orestiás, Kastoria basin, is being excavated by the archaeological team of Aristotle University of Thessaloniki since 1992. The archaeological investigations have indicated that the site was occupied from the middle Neolithic, 5500BC, until the first stages of Early Chalcolithic, 3500 BC (Chourmouziadis, 1996), meanwhile the study of two cores from lake Orestiás (Kastoria, NW Greece) revealed a rich pollen flora, along with abundant fungal remains.

Archaeopalynological research aims to study and reconstruct the ecosystems of the area throughout the periods of human presence. The study focuses on the vegetational history of the area, on the definition of the cultural landscape as well as on the natural recourses as they are documented on the palynomorphs of lake Orestiás. Similarly, the role of climate, of human influence and the environmental factors on the area's vegetation is studied in that perspective.

The impact of lake settlement Dispilió on the vegetation appears to be very profound in the palynological spectra as a result of the proximity of the cores location to the settlement area (Janssen, 1986; Bos & Janssen, 1996). Seven different local pollen zones, namely Di I-Di VII, mainly based on the AP/NAP ratio, have been recognized for that period, corresponding to the different kind or intensity of the natural resources exploitation. Out of these, zones Di II, Di IV & Di VI, that represent major man disturbance in the area, are correlated with 3 periods of major constructing activities described by the archaeological study of the Neolithic settlement (Chourmouziadi 2001).

The abandonment of the Neolithic site mitigates the environmental stress on the natural vegetation, whilst the continuous human presence -though not so intensive- in the area marks the rest of the Kastoria's basin vegetational history.

BOS, J. A. A. & JANSSEN, C. R. 1996. Local impact of palaeolithic man on the environment during the end of the last glacial in the Netherlands. **Journ. Arch. Sc.** 23: 731-739.
JANSSEN, C. R. 1986. The use of local pollen indicators and of the contrast between regional and local pollen in the assessment of the human impact on the vegetation. in K.-E. BEHRE (ed). **Anthropogenic indicators in pollen diagrams,** pp. 203-208.
CHOURMOUZIADI, N. 2000. Neolithic lake settlement of Dispilió Kastorias: Problems and methodology of space. **Eptakyclos** 15: 104-126 (in greek).
CHOURMOUZIADIS, G. 1996. Dispilió Kastorias: a prehistoric lake settlement. **Kodex**, Thessaloniki, 63p.

First palynological data from the core TG9 in the West slope of the Galicia Bank (Iberian North Atlantic Ocean)

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We document here the first palynological information obtained from one of the gravity core at the nearby sites of the remains of the "Prestige" Ship, corresponding to the expedition done in 2003. The aim of this study is to know the stability of the sediments underneath the ship. The studied core TG9 corresponds to the western slope of the Galicia Bank (Coord. 42º 10.5352' N, 12º 03.5976' W), at a depth of 3800 m. The total lenght of the core is 2,76 m.

The first 35 cm of sediment correspond to sandy mires sienna in colour with a high foraminiferal contain. The rest of the core is constituted by greenish mires with minor presence of foraminifers. The information studied up to the moment (physical, geochemical and magnetic properties) suggest a gravitational origin for this second section.

At first it was supposed that this core would be void of continental palynomorphs due to the fact that the samples are placed in gravitational deposits up to 200 Km from the coast at the West slope of the Galicia Bank. The latter is an orographical accident separated from the coast by the inner Galician Basin that would act like a receiver basin of the gravitational deposits coming from the platform. There have been found enough representatives of Pinaceae and, to a minor extent, of Ericaceae and Isoetaceae. This fact shows two different bioestratinomic behaviours. On the one hand, there are the anemophilous grains such as *Pinus* that present a part of its transport realized by air. On the other, the entomophilous ones as Ericaceae or *Polypodium* have been been transported as sedimentary particles by suspension. As the latter two taxons have very thick exines, it leads to think that this characteristic is one of its favourable conditions for its preservation during the transport and deposition in areas so far away from the Iberian Atlantic Ocean margin.

This location is characterised by the appearance of grains of pollen at these deeps and so far away from the coast. This fact indicates the differential preservation of pollen and spore grains. Therefore there exists a dynamical and/or chemical factor that determines the presence/absence of grains of pollen. Those preserved grains are the most resistant ones. This fact can produce a doubtful palaeoenvironmental reconstruction, not valid if there only are found Pinaceae (*Pinus*), Ericaceae, Isoetaceae (*Isoëtes*). The presence of several taxons of entomophilous pollination indicates a transport by oceanic circulation, overcoming the orographical obstacle of the Bank of Galicia.

The analysis have shown the existence of a high dinoflagellate concentration, mostly Protoperidians, so it is worth considering that it is a condensed level with high rate of sedimentation, that it is a concentration due to post-mortem transportation (slightly probable due to the majority presence of Protoperidinioid cysts) or that this concentration is related to fosildiagenetic mechanism. Zonneveld (2001) identified three groups of organic-walled dinoflagellates based on their sensitivity for post-depositional aerobic decay and suggested that sometimes the fossil cyst assemblages are not in direct relation to paleoproductivity. Its known that protoperidianacean cysts are very easily destroyed in natural oxidant settings. Zonneveld *et al.* (1997) inferred that although protoperidiniacean cysts are highly susceptible to oxidation, they are abundant in unoxidised marine sediments such as turbidites and sapropels. Therefore, the lower values of the G/P (gonyaulacacean/protoperidiniacean) ratios suggest its possibility to be distal turbidites. (McCarthy *et al.*, 2004).

McCarthy & Mudie (1996) suggested that samples with high concentrations of terrestrial palynomorphs (high P/D values) are distal turbidites. It seems to be contradictory the scarcity of grains of pollen and spores to the affirmation that they are turbidites, but it is necessary to have in mind that these grains must cross an orographical obstacle in the Galicia Bank where are also produced turbidites and where most of sedimentary particle remains get retained (including grains of pollen and spores).

The palynomorph assemblages are closely related to oceanic circulation, reworking and oxidation. The relative abundant appearance of oxidation-susceptible palynomorphs (protoperidiniacean cysts) indicates a rapid sedimentation. This idea is suported also by high total palynomorph concentrations associated with high terrigenous flux. Also the increase in sedimentation rate coincide with the increase in carbonate flux (McCarthy et al., 2004).

MCCARTHY, F. M. G., GOSTLIN, K. E., MUDIE, P. J. & OHLENSCHLAGER, R. 2004. The palynological record of terrigenous flux to the deep sea: late Pliocene-Recent examples from 41°N in the abyssal Atlantic and Pacific oceans. Review of Palaeobotany and Palynology 128: 81-95.
MCCARTHY, F. M. G. & MUDIE, P. J. 1996. Palynology and dinocyst biostratigraphy of Upper Cenzoic sediments from ODP Leg 149 Sites 898 and 900, Iberian Abyssal Plain. In: Whitmarsh, R. B., Sawyer, D. S., Klaus, A., Masson, D. G., et al. (Eds.), Proc. ODP Sci. Res. 149: 241-265.
ZONNEVELD, K. A. F., VERSTEEGH, G. J. M. & DE LANGUE, G. J. 1997. Preservation of organic-walled dinoflagellate cyst in different oxygen regimes: a 10,000 year natural experiment. Marine Micropaleontology 29: 393-405.

ZONNEVELD, K. A. F., VERSTEEGH, G. J. M. & DE LANGUE, G. J. 2001. Paleoproductivity and post-depositional aerobic organic matter decay reflected by dinoflagellate cyst assemblages of the Eastern Mediterranean S1 sapropel. Marine Micropaleontology 172: 181-195.

The first results of studying the Palynoteratical statistics from the subfossil sediments of Chernobyl and Leningrad nuclear power stations areas

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Some palynologists (Dzuba et al., 2002) recommend to use the data on teratomorph pollen grains in the plants anthers for the purposes of ecological control opposite to studying them in the subfossil sediments with more valid palynoteratical statistics on separate taxa and on the pollen production of the plants societies of the area simultaneously.

The single finds of abnormal morphology pollen grains could not be used for ecological control as their appearance is typical for each anther, even the one existing in excellent conditions. But some groups of the palynoterates dominating pollen complexes of the anthers and sediments are indicators of the normal, stressed or catastrophic states of generative sphere of the plants, past and present (Ananoa, 1966; Levkovskaya, Khomutova, Berdovskaya, 1983; Levkovskaya, 1986; 1999; 2002, 2003; Levkovskaya, Karzeva, Gavrilova, 2002; Bukreeva, Levkovskaya, 2002). The main principles of differentiation of these types palynoteratical complexes are published (Levkovskaya, 1999; Levkovskaya, present volume).

The mentioned above principles of statistical palynoteratical research were used for studying some subfossil soil samples from the area of ecologically neutral Leningrad nuclear power station (LAES). The palynoteratical complexes of "abortive" type with domination of underdeveloped pollen grains were not found there (Levkovskaya et al., 2002; See: Abstracts of the Conference: Metal Ions in Biology and Medicine, St. Petersburg) though the additional researches are important because the other type of palynoteratical complex was found (with domination of the palynomorphs which had variations of many signs in one pollen grain or spore).

The present report compares results of SEM- and statistical palynoteratical researches carried out for subfossil soil samples collected 5, 10 and 15 km away from Leningrad nuclear power station (LAES) and 5 and 15 km away from the heart of Chernobyl catastrophe. They are compared with palynoteratical data on samples collected in the ecologically safe territory (Losevo, Leningrad oblast, 90 km away from St. Petersburg). The palynoteratical complexes are illustrated by SEM-micrographs.

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The main principles of Palynoteratical statistics use for modern ecological control and palaeoenvironmental reconstructions

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The vast statistics on distribution of the abnormal morphology pollen grains (palynoterates) of different taxa in natural sediments (Pleistocene, Holocene and modern subfossil from ecologically safe territories) have been collected by the author within 30 years of professional activity. These palynoteratical statistics was obtained for the complexes with no evidence of mechanical abruption. The results of correlating this statistics with different natural ecological characteristics based on traditional pollen, palaeozoological, modern climatological and other data have shown (Levkovskaya, 1999: Palynoteratical complexes as indicators of the ecological stress, past and present // Proceedings of the 5th European Palaeobotanical and Palynological Conference. Acta Palaeobotanica. N 2, p. 643–648) the importance of counting in each complex with no evidence of mechanical abruption the

percentage of the following pollen grains or spores groups for palaeoenvironmental reconstructions and modern ecological control:

1.- Total number of typical morphology pollen grains and spores of all taxa found in the studied sample; 2.- Total number of dwarf pollen grains and spores; 3.- Total number of non-abrupt pollen grains and spores of all taxa with variations of many signs in one pollen grain or spore (e.g.: total number of Coniferous pollen with abnormal quantity or size of sacks + total numbers of other pollen with abnormal quantity of apertures or asymmetrical form, etc.); 4.- Total number of non-abrupt pollen grain contours with undeveloped sculpture (the "abortive" palynoteratical complex) which are difficult to identify though it is clear, that the grains of various forms and size belong to different taxa.

The domination of the first group is an indicator of favourable conditions (past and present) for generative sphere of the plants. The domination of the last group indicates ecological catastrophe for the generative sphere of the most plants in the area. The mutagenous, hybridization or other processes could be the reasons for appearance of palynoteratical group of the third type. The palynoteratical group of the second type dominates the pollen complexes of subfossil spectra from the northern part Siberian tundra zone (Bukreeva, Levkovskaya, 2002) where the dwarf plants dominate in the area due to the temperature deficit.

The described above statistical principles could be used for studying the teratomorph pollen grains in anthers, though the palynoteratical statistics on anthers characterizes the state of single plant generative sphere opposite to the more valid statistics on the sediments. The appearance of single teratomorph pollen grains is normal for each anther even the one existing in excellent conditions. Thus only statistical palynoteratical method is valid for environmental reconstructions, past and present.

Some examples of using the mentioned above principles for studying the subfossil soil samples from the areas of Leningrad and Chernobyl Nuclear Power Stations are published in the present volume (See: Levkovskaya, Zarai, et al.). The palynoteratical complexes are illustrated by SEM-micrographs.

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Čejčské Jezero Lake – palynological and Quaternary-geological research (S. Moravia, Czech Republic)

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Natural lakes are rare in the Czech Republic, since most of its territory has never been glaciated. As indicated by new palynological research, this does not fully apply to southern Moravia. The ongoing palynological research at some sites shows that a number of lakes existed there in the past. Well known examples are the former Vracov Lake, Vacenovice-Jezero Lake as 0well as Čejčské jezero Lake and Kobylské jezero Lake.

During Quaternary-geological mapping in the area of Hodonín the sediments from some localities were found and sampled. These are a phenomenon in the point of view of botany, ecology and geology; they are the so-called wetlands in the forested area of airborne sands of the so-called Moravian Sahara (Doubrava). It concerns a depression between airborne sand dunes filled up with either organic sediments or where impermeable Neogenic clayey-aleuritic sands or white fine-grained sands stand out (Břízová et al. 2000). After the detailed palynological-paleoalgological research two of them were found as being remains of the former lakes (Břízová et Havlíček 1999, Břízová et al. 2001a). These are localities Vacenovice (Břízová et al. 2001b) and Vlkoš (VLK, Gd-17011, 14C: 2160±160 B.P. in the depth of 1,25-1,35 m). Both occur in the vicinity of the former Vracovské Lake, but a succession of their sediments does not include the whole Holocene, there are distinctive hiatuses with an incoherent succession of stratigraphically classifiable layers.

The still continuing palynological research of other localities found during geological mapping goes to show that many of them had been lakes in the ancient past. On the south-western edge of the Ždánický les and the north-western edge of the Dolnomoravský úval between municipalities Kobylí, Brumovice and Čejč there are two morphologically distinct depressions called the Čejčské jezero Lake (Břízová 1993a, 1993b, 1994b, 2001a, Břízová et Havlíček 1994, Břízová 1989 in Čtyroký et al. 1990) and the nearby Kobylské jezero Lake (Havlíček et Zeman 1979) existing since the beginning of the Holocene and artificially dewatered since the beginning of the last century after year 1834. Nowadays, they are morphologically distinct depressions (Havlíček a Zeman 1979), in which the lakes arose in the Late Glacial and in the Holocene. Their creation is connected with rejuvenation of the tectonic activity of transverse faults parallel with the depression of the Nesvačily Trough. In the 19. century the lakes were artificially dried up and the newly arisen area serves even today as fields.

The total thickness of the Čejčské jezero Lake sediments sampled by the borehole Čej 27 is 2 m. Radiocarbon dating on the profile base - 14C: 9990±275 B.P. (preboreal 10250-9100 B.P.; Hv-18924, Hv - 14C und 3H - Laboratorium, Niedersächsisches Landesamt für Bodenforschung, Hannover), but most of all the found pollen community dates the lake origin into the Late Glacial (15000/13000-10250 B.P.), as it is with other lakes (e.g. Vracov, Vacenovice). During its development, deposition of sediment occurred mainly in the Holocene. The vegetation assemblage consists of species with various ecological requirements. Their development and these relations were objects of research. By virtue of favourable circumstances, it has been scheduled for protection and proclaimed the Čejčské jezero Lake Natural Monument.

The landscape vegetation during the Upper Pleistocene in the Benzú shelter site (Ceuta)

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The pollen data of Benzú shelter (Ceuta), is presented. The site is located to 200 m of the coast and 60 m snm, in the west of Ceuta. This space, Arco of Gibraltar or Bético-Rifeño, with Atlantic and Mediterranean characteristic, is limited by the Rift and the Beticas mountains ranges (arround the Alborán sea). The shelter is developed in dolomite formation of the Triasic age, of the Unidad Beni Mesala.

Litology point of view, the 10 levels identified in the filler of the shelter, to define three sequences that correspond to successive solifluxión laundries associated to cold and humid climates and bound espeleotemas to warmer moments. On the other hand, in the first seven levels, next to the existence of boney fragments and the lithic industry of MODO-3 (Musteriense). The lithic industry, attests the human occupation. The sequence is close by blocks with stalactitic mantle.

Vegetation point of view, on have been identified a total of 42 taxa, of which 9 correspond to arboreal taxa, 5 to shurb and the rest are the herbaceous and aquatic plants. Their distribution defines a relatively open and homogeneous landscape, constituted by *Cedrus* and *Quercus* type evergreen, Ericaceae and *Juniperus*, next to a varied herbaceous retinue; always inside the mediterranean environment.

Along the sequence the widespread descent of the forest mass, the substitution of Ericaceae for *Juniperus* and the progressive loss of botanic diversity and of the rate of humidity, is detected.

On the other hand, is verified a correlation, between the polinics zones and the sedimentary cycles, and also it is observed like along the same ones they are accentuated the loss of diversity and of humidity. This could be interpreted like a general tendency toward some drier conditions.

Domestic fires and vegetation along Mousterian and Early Upper Palaeolithic occupations (60-30 KA. BP) in Cantabrian, Northern Spain

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Charcoal analyses from several sites located in Northern Spain have yielded floristic data concerning the fuelwood employed by humans in domestic fires developped along their Mousterian and Early Upper Palaeolithic occupations. Chronology spans from 70-60 to 30 Ka. BP.

Betula, Pinus and Sorbus have been the main taxa employed in these fires followed by a great diversity of shrubs Hippophae rhamnoides, Leguminosae, Arbutus unedo, Prunus spp., Erica sp., among others. The way in which these taxa appear depend on the different geographical possition of sites.

This work have been placed into a interdisciplinary discusion, taken into account palynological data, glaciation patterns and palaeoclimatic events of Southern Europe during middle Pleniglacial period.

The landscape around prehistoric settlements was essentially open with pioneer vegetation cover on soils ice-free but under some periglacials conditions due to the existence and proximity of some mountain glaciers. The latter explain the altitudinal shift of the vegetation. Daily routes taken by Humans in search of economical ressources including woodfire, were influenced not only by palaeoenvironmental conditions but economic and technological factors too.

Key-words : Domestic fires, Mousterian, Early Upper Palaeolithic, Middle Pleniglacial, Cantabria.

Holocene vegetation history and palaeoenvironmental conditions on the temperate Atlantic coast of Argentina

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Holocene vegetation history and palaeoenvironmental conditions are investigated at the south coast of Buenos Aires Province, Argentina. La Olla 1 and Laguna del Sauce Grande sediment sequences are analysed for pollen, calcareous microfossil (ostracods and foraminifers) and macro remains (mainly seeds and charophyte oospores). Supplementary information is provided by sedimentological analysis. Modern surface sample data is used to assist in the interpretation of the fossil records. La Olla 1 sequence covers the period 7890 to 7630 cal. BP. The microfauna recovered is characteristic of a shallow marginal marine environment such as coastal lagoon. The microfossils indicate a marine connection between 7850 and 7800 cal. BP. Plant macro remains and pollen analyses indicate an extension of the water body after 7780 cal. BP. The pollen record reveals the development of a halophytic plant community in a coastal environment. The sediment record from Laguna del Sauce Grande comprises the last 3000 years. Microfossils and macro remains indicate that the lake history begins with a temporary brackish-water phase. This is followed by more stable conditions between 1940-900 cal. BP. Periods of water level fluctuations occur after 900 cal. BP, with high water levels between 660-270 cal. BP. The uppermost samples of the sequence show similar conditions to present day. Pollen spectra indicate a relatively stable vegetation composition once the lake was formed. Pollen assemblages reflect the present regional grassland vegetation with taxa characteristic of the surrounding dune communities. Human settlement was indicated in the pollen spectra by the presence of introduced taxa in the uppermost samples.

Poster session h3

EVOLUTION OF THE LANDSCAPE AND CLIMATE IN THE MEDITERRANEAN ECOSYSTEM

Vegetation history and impact of metallurgical activities on Mont Lozère (French Massif Central) according to pollen and geochemical analysis

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In the Massif Central (France) several pollen studies have been conducted during the last decades. These studies have reconstructed the main features of the vegetation and climate history since the last glaciation.