Palynologists and
Plant Micropalaeontologists of Belgium (PPMB)

Latest Developments in Palynology and Palaeobotany

Program and abstracts
Edited by P. Steemans & P. Gerrienne

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Université de Liège

Paléobotanique
Paléopalynologie
Micropaléontologie

PROGRAM

10h00-10h20: **E. Pétus, P. Gerrienne & C. Prestianni** - *Physostoma* cf. *stellatum* Holden : a Bashkirian spermatophyte from Bouxharmont (Belgium).

10h20-10h40: **C. Prestianni, D. Fokan & P. Gerrienne** - Record of wildfires in the Famennian of Belgium.

10h40-11h00: **P. Gonez & P. Gerrienne** - Comments on *Cooksonia*, a basal Eutracheophyte.

11h00-11h20: **P. Gerrienne, C. Strullu-Derrien & P. Steemans** - A Lilliputian lignophyte from the Lower Devonian?

11h20-12h00: **P. K. Strother** - The Cambro-Ordovician "Cryptospore" Record and its Significance for the Origin of Land Plants.

12h00-14h00: Dinner at University restaurant

14h00-14h20: **T. Servais** - The Great Ordovician Biodiversification Event: linked to a (phyto-) plankton revolution?

14h20-14h40: **J. Mortier** - The Upper Ordovician to Silurian Tihange section, Condroz Inlier: a litho- and biostratigraphical study.

14h40-15h00: **J. Verniers** - Chitinozoans from the Ordovician-Silurian transition in the Röstanga borehole (Scania, Sweden).

15h00-15h20: **C. Cornet, L. Fontaine & J. Dagnelie** - Miocene marine diatom biostratigraphy of Mem Moniz (Algarve, Portugal).

15h20-15h40: Coffee break

15h40-16h00: **F. Damblon, M. Court-Picon, D. Bonjean & S. Pirson** - Current palaeobotanical research on the Scladina cave (Meuse basin, Belgium).

16h00-16h20: **L. Vrydaghs** - Entre prairies et labours : l'analyse phytolitairenne des lames minces des terres noires bruxelloises (10^{è} – 13^{è} siècles AD).

16h20-16h50 : **E. Roche** - Palynologie du Quaternaire: distinguer les effets climatiques des effets anthropiques, mythe ou réalité ? Deux exemples: la Tunisie septentrionale et l'Afrique centrale.

16h50-17h10: **F. De Vleeschouwer, C. Luthers, D. Mauquoy, C. Wastiaux, G. Le Roux, J. Pawlyta, A. Pazdur, J.Sikorski, & N. Piotrowska** - Multiproxy study in the Misten bog (East Belgium) during the last millenium. Palaeoclimatic vs. anthropogenic signals.

Miocene marine diatom biostratigraphy of Mem Moniz (Algarve, Portugal)

C. Cornet, L. Fontaine & J. Dagnelie

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The white marls of Mem Moniz (Algarve, south of Portugal) contain many microfossils : calcareous nannofossils, foraminifera, diatoms and siliceous spicules.

The diatoms of the five samples studied are marine and characteristic of coastal regions. The most abundant are : *Paralia sulcata, Pseudopodosira westii, Thalassionema nitzschioides and Thallassiothrix longissima.* The following stratigraphically important species are also present : *Actinocyclus ellipticus, Actinocyclus ingens, Denticulopsis punctata* var. *hustedtii, Hemidiscus cuneiformis, Nitzschia praereinholdi, Thalassiosira yabei and Andrewsiella fossilis*. These allow to link the samples of Mem Moniz to the diatom unitary association U.A.5 defined by Monjanel (1987).

This unitary association has been compared with the diatom zonation established for the low latitudes of the equatorial pacific ocean by Baldauf and Iwai (1995) and can be placed at the level of the *Craspedodiscus coscinodiscus* and *Actinocyclus moronensis* zones. The presence at Mem Moniz of *Denticulopsis punctata* var. *hustedtii* allows to locate the samples in the *Craspedodiscus coscinodiscus zone.*

In this study, the diatom zonations are correlated with the geologic time scale of 2004. This allows to suggest the samples cover the late Serravallian - early Tortonian. Calcareous nannoplanckton has been studied by Cachao (1995). It allows to locate the outcrop in the CN5a of Okada & Bukry (1980) of the Serravallian.
On the other hand, planktonic foraminifera determine the N16 or even N17 zone, defined by Blow (1969), corresponding to Tortonian (Antunes *et al.*1981, 1990, 1992).

An isotopic dating $^{87}Sr/^{86}Sr$ performed on planktonic foraminifera shows an age of 12.5 (+0.7/-1.7) million years, i.e. Serravallian. The diatom biostratigraphy presented here agrees well with calcareous nannofossil biostratigraphy and the $^{87}Sr/^{86}Sr$ dating.

Current palaeobotanical research on the Scladina cave (Meuse basin, Belgium)

F. Damblon*, M. Court-Picon*, D. Bonjean & S. Pirson***

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The palynological records from cave infillings in north west Europe are often deceiving due to complex taphonomic processes leading to corrosion, intrusion or reworking of pollen grains through the deposits. Moreover, the stratigraphic sequence which support any complementary palaeoenvironmental investigation generally appears as not enough precise and reliable.

The excavation made at Scladina cave by the team of D. Bonjean was the opportunity to improve the geological approach of the Pleistocene loessic deposits with a fine microstratigraphical study and gain new pollen data with regard to previous results obtained by Bastin (1992).

Here we present a first set of pollen spectra distributed in the full sequence of deposits completed with charcoal found in some layers, both detritic and stalagmitic. The direct link between the detailed stratigraphy and the palaeobotanical results leads to a coherent interpretation of the sedimentary dynamics and the corresponding environment along the sequence.

The largest part of the loessic sequence points to cold steppe environments while humic layers and soil horizons record climatic improvements favouring expansions of trees such as pine during the weakest ones. On the contrary, a clear development of mesophilous tree taxa (oak, ash, elm, ..) is recorded in the biggest stalagmitic floor CC4. Significant amounts of spruce (*Picea*) are also recorded in some humic layers. Such results confirm the data of Bastin in broad line but a fine connection between them is still in work notably due to the difference in precision of the previous and the new stratigraphical approaches.

This needs further pollen and charcoal analyses, mainly on stalagmites but also on some loess layers, with the goal of improving the climatostratigraphical interpretation. A better knowledge of the chronostratigraphical framework is also absolutely necessary to position these climatic fluctuations in the Upper Pleistocene reference sequence.

A major aspect standing out from all these results is the importance of a strong interdisciplinary approach in the study of cave entrance sedimentary sequences. Each discipline brings some information but only the confrontation of all the data allows a reliable interpretation. Excellent complementarities of geology and palaeobotany are worth mentioning.

A direct consequence from these results in a next future is that they should lead to a better understanding of the climatic fluctuations and the palaeoenvironment in Belgium during the last glacial as well as a better knowledge of the context of the numerous archaeological and palaeoanthropological remains from cave entrance sequences.

Multiproxy study in the Misten bog (East Belgium) during the last millenium. Palaeoclimatic vs. anthropogenic signals.

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Strong pollution over East Belgium during the last two millennia has been characterised a few years ago using geochemical records in the Misten Bog, an ombrotrophic bog located in the Hautes-Fagnes Plateau (East Belgium). While the Roman period and the industrial revolution are evidenced by elevated concentration in lead and associated heavy metals, the Middle Ages display low heavy metal concentrations. Possible explanations are either a loss of knowledge in mining techniques, or an external factor causing reduced human activities.

In February 2008, a new core was therefore taken, with the purpose of investigating proxies giving indication on climatic conditions over the past 1000 years. We present here a series of biological and geochemical proxies: pollen, macrofossils, humification and δ13C. These proxies are accompanied by 14 radiocarbon dates performed by accelerator mass spectrometry on carefully selected *Sphagnum* macrofossils.

Preliminary interpretations indicate that a series of proxies show similar trends between 1200 and 1800 AD. These similar trends mirror hydrological changes in the bog, possibly triggered by the Little Ice Age cold events. The Little Ice Age may therefore be a plausible explanation to reduced human activities in East Belgium during this time span. This study also emphasizes the fact that, conversely to studies dealing with pollution using geochemical proxies, palaeoclimatic studies in peat bogs need as much proxies as possible, together with highly accurate age-model. Therefore, in a near future, these different analyses will be undertaken on two more short cores, in order to test the reproducibility of the various proxies and their interpretation.

A Lilliputian lignophyte from the Lower Devonian?

P. Gerrienne, C. Strullu-Derrien & P. Steemans

PPM, Dept of Geology, Liège University

The lignophytes are the plants that possess a bifacial vascular cambium, producing secondary phloem (inner bark) towards the outside and secondary xylem (wood) towards the inside. Thanks to this innovation, lignophytes evolved the tree habit which allowed those plants reaching much greater heights, increasing mechanical stability, propagule dispersion and light interception efficiency. Lignophytes have the ability to achieve the largest and most complex bodies in the plant kingdom. Their advent during the Devonian is therefore a major event in the history of life. It had a profound impact on terrestrial environments, as lignophytes also evolved long-lived roots which had major implications on the elaboration of early soils and complex microbial communities. To date, the earliest remains of lignophytes are included in the Aneurophytales (Middle to Upper Devonian) and possibly in the Stenokoleales (Middle Devonian to Lower Carboniferous). Members of both orders were medium-sized plants or shrubs. The earliest truly arborescent lignophytes belong to the Archaeopteridales, which had a cosmopolitan distribution at the end of the Devonian.

The present work is the description of a possible early representative of the lignophytes from Châteaupanne quarry (Montjean-sur-Loire, Armorican Massif, France). Based on spores, the locality is attributed to the Lower Devonian (Pragian or less probably early Emsian). During a recent re-investigation of the flora from the quarry, we have found a new fossiliferous layer which yielded a large collection of a pyritised tiny plant. Nothing is known on the external morphology of the plant, but its anatomical structure is partly preserved. Axes are 1-3 mm in diameter. In transverse section, a massive circular xylem strand is visible, with an elongated centrarch protoxylem area. Metaxylem is comprised of P-type tracheids with scalariform pitting. In many specimens, the central part of the strand with randomly arranged tracheids is surrounded by a zone of tracheids placed in radial rows. Up to now, it has not been possible to decide if those radially disposed tracheids were aligned primary xylem (produced by the procambium) or secondary xylem (produced by the cambium). Nevertheless, such an internal organization had never been observed in any Lower Devonian plant and locates the plant from Châteaupanne at the very base of the lignophyte clade.

Comments on *Cooksonia*, a basal Eutracheophyte

P. Gonez & P. Gerrienne

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The genus *Cooksonia* Lang, 1937 is currently considered as including the earliest vascular plants and central to the definition of Eutracheophytes. The circumscription of the genus is however problematical: the original diagnosis is not restrictive enough, and most of the few characters are plesiomorphic. The type-species, *Cooksonia pertoni* Lang 1937, is comprised of specimens with slender leafless axes isotomously branched, and terminal trumpet-like sporangia wider than high. *Cooksonia paranensis* Gerrienne *et al.*, 2001 and *C. banksii* Habgood *et al.*, 2002 appear morphologically very close to *C. pertoni*. The only perceptible differences are the following: the axes of *C. paranensis* and *C. banksii* are more slender and their sporangium seems to be sunken into the axis. The conspecificity of *C. paranensis* and *C. banksii*, respectively described from compression fossils and three-dimensionally preserved specimens, is also discussed. An allometric study on more than one hundred specimens of *C. paranensis* was performed. It allows discriminating between true morphological variation and ontogenetic stages. This allometric study of specimens which are indisputable members of the genus and the re-examination of the type-material itself allow us to suggest more precise diagnostic characters. The latter should be included in an emended diagnosis of the genus. The type-material of another species of *Cooksonia, C. caledonica* Edwards, 1970, as well as new large specimens, was also studied. The sporangium of that species is clearly different from that of the type-species as it is bivalved and possesses a complex distal structure for dehiscence. The specimens of *C. caledonica* are compared with those of *Sporathylacium salopense* Edwards *et al.*, 2001, which show the same sporangial organisation. Our observations should lead to a better circumscription of the genus *Cooksonia* that may help to produce more accurate phylogenies of early vascular plants.

The Upper Ordovician to Silurian Tihange section, Condroz Inlier: a litho- and biostratigraphical study

J. Mortier

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In a series of outcrops in Tihange (central Condroz Inlier, Belgium) five lithostratigraphical units are outcropping ranging from the middle Upper Ordovician to the lowermost Silurian. This interval contains many sea-level changes with as most important event the glaciations and sea-level drops of the Hirnantian, followed by the warming up and sea-level rise in the upper part of the Hirnantian.

During the Burrelian to middle Streffordian (Caradoc, upper Sandbian to lower Katian) dark grey, medium grained siltstones belonging to the Rue de Courrière Member, the upper part of the Vitrival-Bruyère Formation, were deposited around the limit between the outer and the middle shelf.

During the Pusgillian to early Rawtheyan (middle Ashgill, upper Katian) brownish grey siltstones are deposited as tempestites. These were decalcified after deposition together with the formation of limestone nodules (Bois de Presles Member, lower part of the Fosses Formation). These sediments are deposited on the outer shelf or around the boundary between outer to middle shelf.

During the Rawtheyan (middle Ashgill, upper Katian) the deposition of sediments became gradually deeper resulting in a siliciclastic Faulx-les-Tombes Member (middle part of the Fosses Formation). It contains greyish green to grey, fine siltstones with very characteristic dark grey, fusiform to elliptic bioturbation traces of a few mm diameter ("schistes mouchetés" *in literis*). To the upper part it becomes more darkgrey and there is an appearance of small rusty spheres to ellipses of maximum 1 mm diameter. These sediments are interpreted to have been deposited on an outer shelf.

During the latest Rawtheyan (upper Ashgill, uppermost Katian) darkgrey, fine siltstones are deposited with rusty spheres to ellipses (millimetric) that are more prominent and larger in comparison with the top of the underlying unit. This is the lower part of the Tihange Member (upper part of the Fosses Formation) deposited on the outer shelf. This is followed by light grey, fine siltstones that coarsen fast upwards in the unit to coarse siltstones with irregular yellow patches (possibly caused by weathering) and yellow laminations. These are deposited on the middle shelf. In the upper part the coarse siltstones fine fast upwards in the unit to fine siltstones with a slightly darker colour and the occurrence of rusty spheres to ellipses identical to the lower part of the Tihange Member. These sediments belong to the upper part of the Tihange Member probably belonging to the Hirnantian.

In the Rhuddanian there is a deposition of dark green to dark grey, finely laminated shales deposited on the boundary of outer shelf to continental slope of the Bonne Espérance Formation.

Physostoma cf. *stellatum* Holden : a Bashkirian spermatophyte from Bouxharmont (Belgium)

E. Pétus, P. Gerrienne & C. Prestianni

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Most Belgian Carboniferous fossil plants are found as compressions. This preservation allows a good understanding of the general morphology of putatively broad parts of plants. In some cases, permineralized accumulations of fossil plant material within carbonated nodules called coal balls are found in the coal seams. . They provide very detailed but restricted anatomical information. In 1936, Suzanne Leclercq reported a very rich fossil flora preserved in coal balls from the "Bouxharmont" seam of the Wérister coal mine near Liège. Based on goniatites, the fossil bearing layers have been attributed to the Bashkirian stage (Lower Pennsylvanian). In 1984, Holmes and Fairon-Demaret published a preliminary revision of the flora, but no detailed study have been published to date. The revision of the so-called "Bouxharmont flora" showed the presence of at least four different types of pteridosperm seeds (Gymnosperms).

This talk focuses on the description and identification of a seed structure studied thanks to the acetate peel technique. Up to 350 peels have been realized, representing as many sections through the seed body. This allows a complete and precise reconstruction. The studied seed is plurimillimetric, apparently acupulate and radiospermic. The nucellus (megasporangium) apex is modified into a complex pollen-receiving apparatus called "hydrasperman modification". The integument is dissected and is comprised of 8 to 9 lobes. These are fused laterally to each other and with the nucellus up to the level of the pollen chamber plinth (base of the "hydrasperman modification"). Numerous characteristics of this seed call remind the architecture of the lyginopterid *Physostoma* (Williamson, 1876; Taylor and Taylor, 1993). Some of its characters are similar to those of *Physostoma stellatum* Holden, 1954. Nevertheless, other characters observed in the seed of Bouxharmont, such as proximal projections, were not described for *P. stellatum*. Therefore, we chose to name the specimens of Bouxharmont: *Physostoma* cf. *stellatum* Holden, 1954.

A revision of the genus *Physostoma* is necessary to reassess the weight of the specific characters.

Record of wildfires in the Famennian of Belgium

C. Prestianni, D. Fokan & P. Gerrienne

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The Belgian Upper Devonian flora has been extensively studied. Most of it is preserved as compressions, mainly from the siliciclastic Evieux formation localities. The Evieux flora is highly diversified and is represented by up to 23 taxa. However, no coaly layers had been reported to date. We have recently identified two organic-rich beds from two localities (Val-Dieu quarry and Arbre quarry). In the latter, charcoals are preserved in a thick grained matrix of light (nearly white) sandstone. Plant remains are mainly crushed and disarticulated, but some wood peaces have been collected. The organic-rich layers from Val-Dieu are also such very light, but they are very fine grained. They presumably represent the B-horizon of a parautochtonous paleosol. Plants are exquisitely preserved and consist of abundant leaf fragments, sporangia, and wood fragments. They correspond to 2 different wood types. In radial sections, the first type shows groups of 20 to 40 multiseriate bordered pits in radially aligned rows, corresponding to *Callixylon* wood. The second is constituted by many rods strands? of scalariform tracheids with numerous narrow pits. The results of this work will be discussed and compared with other Upper Devonian charcoal localities as well as with the Evieux compression flora.

The Great Ordovician Biodiversification Event: linked to a (phyto-) plankton revolution?

T. Servais

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The Ordovician witnessed the most sustained biodiversification of marine life in Earth history. The International Geoscience Programme project IGCP 410 (1997-2002) focused on this "Great Ordovician Biodiversification Event" and resulted in the publication of diversity curves of all major Ordovician fossil groups. Its successor, IGCP 503 (2004-2008 "Ordovician Palaeoclimate and Palaeogeography"), has attempted to find the geological and biological causes for this biodiversification. Increasing sea-levels (with the highest levels of the Phanerozoic during the Ordovician) and warm climates before the end-Ordovician glaciation and its associated extinctions were long considered to be possible biodiversity triggers during a period of major continental spreading and dispersal. More recently, the Ordovician climate has been recognized as much more variable than previously thought and a sustained period of cooling prior to the event has also been postulated. An episode of asteroid impacts in Baltica has been implicated in biodiversification on at least a regional scale and the effects of major volcanism and orogeny in and around the Iapetus Ocean have also been considered significant. Major evolution of the phytoplankton at the base of the food chain generated a plankton revolution that followed the Late Cambrian and possibly had profound implications for the entire biota.

The Cambro-Ordovician "Cryptospore" Record and its Significance for the Origin of Land Plants

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Spore-like microfossils (Cryptospores, *sensu* Strother & Beck 2000) are found in estuarine/near-shore marine sediments beginning in the upper part of the Lower Cambrian. These are morphologically poorly-constrained forms that prior workers typically would have classified as "sphaeromorph algae." However, similar cryptospore dyads from Middle and Upper Cambrian strata show laminated and complex wall ultrastructure that mimics sporoderm in the extant liverworts *Sphaerocarpos* and *Riccia*. The morphological diversity of this assemblage from Laurentia is moderately diverse by Middle Cambrian time. Study of more complex Upper Cambrian cryptospores from the Lone Rock Fm in Wisconsin, reveals that the dyad form was the essential end product of reduction division during this time, not tetrads as is more typically the case in Silurian strata. A mixed assemblage of acritarchs and tiny cryptospores has been recovered from a Lower Ordovician section in the Kanosh Shale at Fossil Mountain, Utah, US. This discovery fills a temporal gap between the earliest generally accepted cryptospore assemblage in the Hanadir Formation and the more controversial Cambrian record. The Llanvirnian represents a virtual “tetrahedral tetrad” barrier, prior to which, cryptospores (or their precursors) are based on a meiotic style (successive meiosis), which produced essentially sets of dyads rather than tetrads. The origin of tetrahedral tetrads at this time probably marks a shift to simultaneous meiosis in the sporogenesis of early embryophytes. However, dyads and irregular tetrads do persist through the remainder of the cryptospore record, indicating that successive meiosis continued to characterize sporogenesis in some polysporangiates.

Chitinozoans from the Ordovician-Silurian transition in the Röstanga borehole (Scania, Sweden).

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Chitinozoans have been extracted from samples of the Röstanga borehole in Scania (southern Sweden), drilled by one of the authors (A.T.N.). The graptolites have been determined by T. Koren and a detailed and well documented graptolite biozonation around the Ordovician-Silurian boundary was published by Koren, Ahlberg & Nielsen (2003). They recognised a new latest Ordovician (Hirnantian) post-*persculptus* and pre-*ascensus* subzone. The interval under interest in the Röstanga borehole is between 46.75 and 56.14 m depth, with the Ordovician-Silurian boundary at -52.70 m. It comprises the *acuminatus* zone (46.75-50.40 m), *ascensus* zone (50.51-52.70 m), *avitus s.s.* zone (lacking the guide fossil *P. persculptus*) (52.80-55.90 m), and the *persculptus s.s.* zone (56.16-56.14 m).

The chitinozoans from 41 samples in these interval are rather well preserved (light to dark brown). The assemblages are dominated by Ancyrochitininae with often broken appendices and rich in *Cyathochitina*. The rare *Spinachitina* allow correlation with other sections. The chitinozoan biozonation in this newly studied borehole will be compared with the biozonation in Scania (a.o. Lönstorp borehole), Laurentia (the GSSP section in Dob’s Linn see Verniers *et al.* 2003), and with the biozonation in Avalonia (a.o. Deerlijk borehole in Belgium), Bohemia and northern Gondwana.

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Entre prairies et labours : l'analyse phytolitarienne des lames minces des terres noires bruxelloises ($10^{è}$ – $13^{è}$ siècles AD).

L. Vrydaghs

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Les phytolithes sont des corps minéraux accumulés dans les tissus des plantes. Leur composition chimique varie, les plus fréquemment publiées étant l'oxalate de calcium ($CaCO_3$) et l'opale (SiO_2).
La morphologie des phytolithes d'opale résulte de l'accumulation de silice dans les espaces intracellulaires, extracellulaires ou les parois cellulaires. Selon les cas, la morphologie autorise l'identification de la famille, de la sous-famille, du genre ou de l'espèce. Les phytolithes d'opale se distinguent des autres microfossiles végétaux notamment par leur nature minérale et leur mode de déposition, essentiellement locale.

Les analyses conduites en relation avec le suivi paléoenvironnemental des fouilles archéologiques en Région Bruxelles Capitale portent sur les phytolithes d'opale. Le matériel soumis à analyses provient d'horizons de terres noires datés entre les 10^{e} et 13^{e} siècles AD. L'archéopédologie de terrain identifie ces horizons comme prairie ou labour. Les analyses phytolitariennes se proposent de contribuer à l'identification de ces horizons de terres noires. A des fins comparatives, le matériel inclut des échantillons d'un horizon reconnu comme jardin par l'archéopédologie.

Les analyses menées se conduisent essentiellement sur lames minces de sol. Une comparaison des spectres de lames minces de sol avec ceux d'échantillons correspondants garantit une équivalence des spectres phytolitariens. L'analyse phytolitarienne des lames minces des sols bruxellois établit donc validement composition des spectres et distribution des phytolithes dans les sols.

Les travaux menés mettent en évidence des différences qualitatives entre les horizons de terres noires. Elles touchent à la composition des spectres phytolitariens, l'abondance relative des phytolithes, leur distribution et leur état de préservation. Les analyses phytolitariennes des lames minces bruxelloises participent donc à l'identification des horizons de terres noires et par conséquent à l'étude de l'anthropisation du paysage bruxellois entre les 10^{e} et 13^{e} siècles.