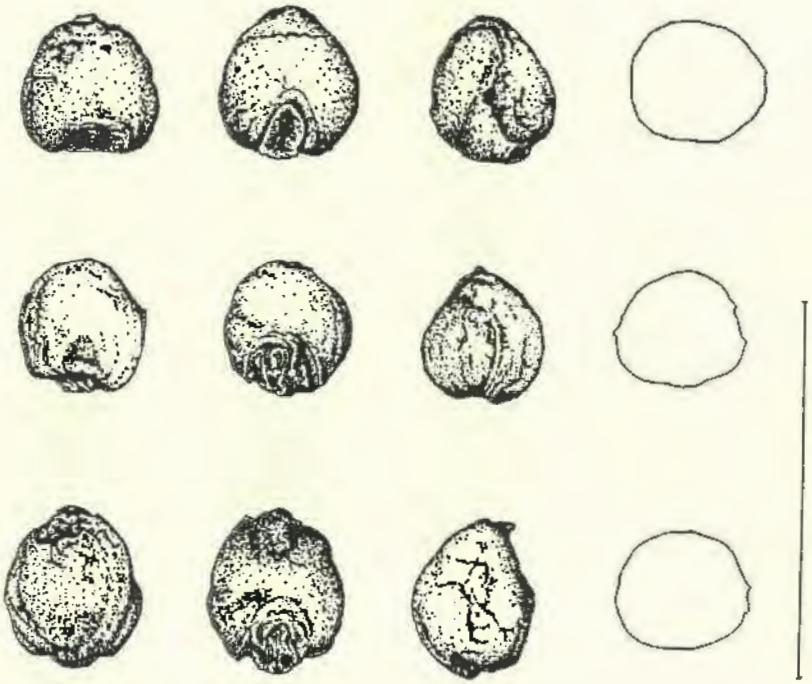
10. Symposium

der

Internationalen Arbeitsgruppe für Paläoethnobotanik

11. - 18. Juni 1995

Botanisches Institut der Universität



10TH Symposium

of the

International Work Group for Palaeoethnobotany

June, 11 - 18 1995

Botanical Institute of the University

in Innsbruck

DAS 10. SYMPOSIUM DER INTERNATIONALEN ARBEITSGRUPPE FÜR PALÄOETHNOBOTANIK WURDE VON FOLGENDEN INSTITUTIONEN UNTERSTÜTZT

THE FOLLOWING INSTITUTIONS DID SUPPORT THE 10TH SYMPOSIUM OF THE INTERNATIONAL WORK GROUP FOR PALAEOETHNOBOTANY

Bundesministerium für Wissenschaft, Forschung und Kunst

Leopold-Franzens-Universität Innsbruck

Institut für Botanik der Leopold-Franzens-Universität Innsbruck

Österreichische Akademie der Wissenschaften

Landes-Hypothekenbank Tirol

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Programm/*Program:*

Montag, 12. Juni/*Monday, June 12th*

Vormittagssitzung: Hörsaal A des Instituts für Botanik

Morning-session: Lecture-room A of the Botanical Institut

0900 - 1000 Eröffnung: Begrüßung der Gäste durch Seine Magnifizenz, den Rektor der Leopold-Franzens-Universität Innsbruck, Herrn Univ. Prof. Dr. Hans Moser, den Dekan der Natruwissenschaftlichen Fakultät, Herrn Univ. Prof. Dr. Erwin Hochmair und den Vorstand des Instituts für Botanik, Herrn Univ. Prof. Dr. Sigmar Bortenschlager

0900 - 1000 Opening Ceremony: Words of Welcome by the Rector of the Leopold-Franzens-University of Innsbruck, Univ. Prof. Dr. Hans Moser, the Dean of the Faculty of Natural Sciences, Univ. Prof. Dr. Erwin Hochmair, and the Head of the Botanical Institute, Univ. Prof. Dr. Sigmar Bortenschlager

1000-1030 Kaffeepause/*Coffee break*

1030 - 1300 Sektion 1: Theoretische und methodische Aspekte

Subsektion 1.1: Generelle Probleme

Section 1: Theoretical and Methodological Aspects

Subsection 1.1: General Problems of Theory and Methodology

Chairperson: Karl-Ernst BEHRE

Nachmittagssitzung: Hörsaal A des Instituts für Botanik

Afternoon-session: Lecture-room A of the Botanical Institut

1430 - 1630 Subsektion 1.1: Generelle Probleme; Fortsetzung

Subsection 1.1: General Problems, continued

Chairperson: Glynis JONES

1630 - 1700 Kaffeepause/*Coffee break*

1700 - 1835 Subsektion 1.2: Neue Methoden/ *Subsection 1.2: New Methods*

Chairperson: Stefanie JACOMET

Dienstag, 13. Juni/*Tuesday, June 13th*

Vormittagssitzung: Hörsaal A des Instituts für Botanik
Morning-session: Lecture-room A of the Botanical Institut
0815 - 0900 Sektion 1: Theoretische and methodische Aspekte, Fortsetzung
Subsektion 1.3: Experimentelle Paläoethnobotanik
Section 1: Theoretical and Methodological Aspects, continued
Subsection 1.3: Experimental Palaeoethnobotany
0900 - 1000 Sektion 2: Lokale Studien; Subsektion 2.1: Mittelalter
Section 2: Local Studies, Subsection 2.1: Middle Ages
Chairperson: Marijke VAN DER VEEN

1000-1030 Kaffeepause/*Coffee break*

1030 - 1300 Subsektion 2.1: Mittelalter & Subsektion 2.2: Römerzeit
Subsection 2.1: Middle Ages & Subsection 2.2: Roman Period
Chairperson: Corrie BAKELS

Nachmittags: Übungsräume des Instituts für Botanik
Afternoon: Practical-rooms of the Botanical Institut
1430 - 1900 Demonstration von paläoethnobotanischem Material: Übungsraum 2
Demonstration von Computerprogrammen und Datenbanken: Übungsraum 1
Demonstration of palaeoethnobotanical material: Practical-room 2
Demonstration of Computer-software and Data-bases: Practical-room 1

Nachmittagssitzung: Hörsaal A des Instituts für Botanik
Afternoon-session: Lecture-room A of the Botanical Institut
1630 - 1900 Subsektion 2.3: Eisenzeit/ *Subsection 2.3: Iron Ages*
Chairperson: Manfred RÖSCH

Abends: Glashäuser des Botanische Gartens
Evening: Greenhouses of the Botanical Garden
1900 Geselliger Abend/*Social Evening*

Mittwoch, 14. Juni/*Wednesday, June 14th*

Vormittagssitzung: Hörsaal A des Instituts für Botanik

Morning-session: Lecture-room A of the Botanical Institut

0815 - 1000 Subsektion 2.6: Paläolithikum, Mesolithikum, Präkeramisches Neolithikum

Subsection 2.6: Palaeolithic, Mesolithic, Pre-pottery Neolithic

Chairperson: Willem VAN ZEIST

1000 - 1030 Kaffeepause/*Coffee break*

1030 - 1300 Subsektion 2.4: Bronzezeit/*Subsection 2.4: Bronze Age*

Chairperson: Kislev MORDECHAI

Nachmittags: Übungsräume des Instituts für Botanik

Afternoon: Practical-rooms of the Botanical Institut

1430 - 1900 Demonstration von paläoethnobotanischem Material: Übungsraum 2

Demonstration of palaeoethnobotanical material: Practical-room 2

Hörsaal B des Instituts für Botanik

Lecture-room B of the Botanical Institut

1630 - 1900 Posterpräsentation/*Poster-session*:

Donnerstag, 15. Juni/*Thursday, June 15th*

Vormittagssitzung: Hörsaal A des Instituts für Botanik

Morning-session: Lecture-room A of the Botanical Institut

0815 - 1000 Subsektion 2.5: Neolithikum

Subsection 2.5: Neolithic

Chairperson: Angela KREUZ

1000-1030 Kaffeepause/*Coffee break*

1030 - 1300 Subsektion: Neolithikum/ *Subsection 2.5: Neoltihic, continued*

Chairperson: Hansjörg KÜSTER

Nachmittags: Übungsräume des Instituts für Botanik

Afternoon: Practical-rooms of the Botanical Institut

1430 - 1900 Demonstration von paläoethnobotanischem Material: Übungsraum 2

Demonstration of palaeoethnobotanical material: Practical-room 2

Nachmittagssitzung: Hörsaal A des Instituts für Botanik
Afternoon-session: Lecture-room A of the Botanical Institut
1630 - 1900 Sektion 3: Regionale Studien und Übersichten
Section 3: Regional Studies and Surveys
Chairman: Helmut KROLL

Freitag, 16. Juni/*Friday, June 16th*

Vormittagssitzung: Hörsaal A des Instituts für Botanik
Morning-session: Lecture-room A of the Botanical Institut
0820 - 1000 Sektion 3. Regionale Studien und Übersichten, Fortsetzung
Section 3: Regional Studies and Surveys, continued
Chairperson: Maria HOPF

1000-1030 Kaffeepause/*Coffee break*

1030 - 1300 Sektion 3: Regionale Studien und Übersichten, Fortsetzung
Section 3: Regional Studies and Surveys, continued
Chairperson: Jim H. DICKSON

Nachmittagssitzung: Hörsaal A des Instituts für Botanik
Afternoon-session: Lecture-room A of the Botanical Institut
1430 - 1600 Sektion 3: Regionale Studien und Übersichten, Fortsetzung
Section 3: Regional Studies and Surveys, continued
Chairperson: Jan Peter PALS

1600-1630 Kaffeepause/*Coffee break*

1630 - 1800 Schlußsitzung/*Closing-session*

Abends: Landhaus, Maria-Theresien-Straße
Evening: Landhaus, Maria-Theresien-Straße
1930 Empfang durch den Landeshauptmann von Tirol, Herrn Dr. Wendelin Weingartner, und den Bürgermeister der Stadt Innsbruck, Herrn Dr. Herwig van Staa
Reception

Samstag, 17. Juni/*Saturday, June 17th*

0700 - 1900 Exkursion: Vinschgau/*Post-Congress Excursion: Vinschgau*

Vorträge und Poster/*Lectures and Poster Contributions*

Zeitplan/*Schedule*

Montag, 12. Juni — **Sektion 1:Theoretische und methodische Aspekte**
Subsektion 1.1: Generelle Probleme
Monday, June 12th — ***Section 1: Theoretical and Methodological Aspects***
Subsection 1.1: General Problems of Theory and Methodology

Subsektion 1.2: Neue Methoden / *Subsection 1.2: New Methods*

Dienstag, 13. Juni — **Sektion 1: Theoretische und methodische Aspekte, Fortsetzung**
Subsektion 1.3: Experimentelle Paläoethnobotanik
Tuesday, June 13th — ***Section 1: Theoretical and Methodological Aspects, continued***
Subsection 1.3: Experimental Palaeothnobotany

Sektion 2: Lokale Studien / Subsektion 2.1: Mittelalter
Section 2: Local Studies / Subsection 2.1: Middle Ages

Subsektion 2.2: Römerzeit
Subsection 2.2: Roman Period

Subsektion 2.2: Eisenzeit
Subsection 2.2: Iron Age

Mirtwoch. 14. Juni **Sektion 2: Lokale Studien**
Subsektion 2.6: Paläolithikum, Mesolithikum, Präkeramisches Neolithikum
Wednesday, June 14th ***Section 2: Local Studies***
Subsection 2.6: Palaeolithic, Mesolithic, Pre-pottery Neolithic sites

Donnerstag, 15. Juni — **Sektion 2: Lokale Studien / Subsektion 2.5.: Neolithikum**
Thursday, June 15th — ***Section 2: Local Studies / Subsection 2.5: Neolithic***

Sektion 3: Regionale Studien und Übersichten
Section 3: Regional Studies & Surveys

Freitag 16. Juni — **Sektion 3: Regionale Studien und Übersichten, Fortsetzung**
Friday June 16th — ***Section 3: Regional Studies & Surveys, continued***

Kurzfassungen/*Abstracts*

COMPARATIVE BOTANICAL ANALYSIS OF MODERN AND NEOLITHIC DUNG OF DOMESTIC HERBIVORES

ÖRNI AKERET

Botanisches Institut, Schönbeinstrasse 6, 4056 Basel, Switzerland

In a joint project of archaeozoologists and archaeobotanists (MGU-Projekt 19/93 "Viehwirtschaftssysteme und Paläoökologie") the relations between domestic animals and their environment are studied. The project is carried out under the direction of Jörg Schibler and Stefanie Jacomet, Basel.

Experimental investigations are to provide basics and methods to prove neolithic cattle management. Experiments are planned with old breeds of cattle, goats and sheep. In 1994 a first experiment was carried out with Scottish Highlands in a pasture in Alsace, France. The vegetation was compared with the identifiable plant remains found in their dung.

In addition neolithic dung from Arbon/Bleiche 3 (Thurgau, Switzerland) is examined.

The expected results are supposed to enable more understanding of the role of man and his domestic animals in the history of environment and landscape.

PLANT REMAINS OF ANCIENT RUSSIAN CULTURE (10th/11th CENTURY AD) IN NOVGOROD AND VICINITY (RUSSIA)

ALSLEBEN Almuth, Inst. f. Ur- u. Frühgeschichte, D-24098 Kiel

Soil samples for archaeobotanical examinations were taken from culture layers of the 10th up to 12th century. This work is part of a programm which deals with the economy of rural slavonic settlements in the vicinity of political and economical centres in the Baltic area from the most western to the most eastern part of the slavonic settlement region.

Novgorod is situated about 200 km south of St. Petersburg on the bank of the river Volchov where the river runs off lake Ilmen. During the Iron Ages (ending 400 AD) the area around lake Ilmen was settled by Finno-Ugrian tribes. From the 6th century onward a period followed which is known by traces of the Long-Barrow cul-ture. The people lived from extensive farming, cattle-breeding, fishing, and hunting. During the 8th/9th century Slavs and Skan-dinavians immigrated into this area and first trading settlements and towns appeared on the higher terrasses of the rivers.

In the middle of the 9th century Gorodisce on the right bank of Volchov became the seat of the prince and oldest centre of Nov-gorod region. Settlements on a peninsula on the west side of lake Ilmen belonged to the rural vicinity. Some 100 years later Nov-gorod was founded on the opposite side of the river. In competi-tion to the prince's court Novgorod became the economical and political centre of the young Russian state.

The culture layers of Novgorod contain waterlogged material. In the dry and sandy layers of Gorodisce and the rural settlements only carbonized plant remains are preserved. Differences of agri-cultural economy and nutrition in different social structures should be shown, as there are rural settlements (Georgij), the court of a prince (Gorodisce) and the early town (Novgorod).

SOCIAL DIFFERENTIATION WITHIN THE EARLY MEDIEVAL DOMAIN OF SERRIS LES RUELLES (VII-VIII CENTURY, SEINE-ET-MARNE, NORTHERN FRANCE): A PALAEOBOTANICAL INVESTIGATION

BAKELS Corrie, Leiden

Notiz /*Notice:*

Kurzfassung siehe Seite 16
Abstract see page 16

5000 Jahre Kulturpflanzengeschichte in der Siedlungskammer Flögeln, Niedersachsen

Karl-Ernst Behre
Niedersächsisches Institut für historische Küstenforschung, Postfach 944, 26357 Wilhelmshaven, Deutschland

English abstract

Fifteen years of excavation in the area of the Siedlungskammer Flögeln, situated on Pleistocene soils between the rivers Elbe and Weser, have provided thousands of samples with carbonized macroremains. Settlements from the Neolithic, Bronze Age, Roman and Migration periods as well as from the Middle Ages and Modern times gave excellent material for elucidation of the 5000-year history of cultivated plants and arable agriculture in this old morainic landscape, the history of recent times being complemented by written sources from the area.

House remains from the Middle Neolithic Trichterbecher culture (from 4500 years BP) yielded predominantly hulled barley and emmer (each > 40%) and also naked barley and other wheats (each 5%), including some einkorn, and one grain of millet.

Excavations from a Late Bronze Age settlement yielded surprisingly 45% of oats (no species identification possible), both barley forms, some bread/club wheat and little einkorn.

Large settlements of the Roman and Migration periods were uncovered and yielded large amounts of cultivated plants. From the second century A.D. onwards, rye was the dominant cereal followed by hulled barley, some common oats and flax and very little of other species. Evidence from other sites outside the siedlungskammer suggests that in fact rye was already one of the two main cultivated plants in the Roman period.

The excavation of the deserted village Dalem, which dates to the Early and High Middle Ages also gave large numbers of carbonized grains. Rye is now at more than 70%, followed by hulled barley with less than 20% and oats with about 7%, complemented by a little flax, celtic bean, wheat and hemp. Hemp cultivation spread in late Medieval times, and buckwheat was introduced probably already in the 13th century.

Investigation of the weed flora indicates that rye was cultivated in the Roman and Migration periods and probably also in the Early Middle Ages as a summer crop.

THE LATE NEOLITHIC SETTLEMENT "PESTENACKER", LKR. LANDSBERG/LECH (BAVARIA, GERMANY)

FELIX BITTMANN, Inst. f. Palynlogie u. Quartärwiss., Univ. Göttingen, Wilhelm-Weber-Str. 2, D-37073 Göttingen

From 1988-1993 palaeoethnobotanical investigations were undertaken on the cultural layers of the moist-soil settlement "Pestenacker", 20 km south of Augsburg, Bavaria. The analysis was carried out as part of the DFG-project "Siedlungsarchäologische Untersuchungen im Alpenvorland".

Archaeologically, four superimposed settlements could be distinguished, all of them belonging to the Late Neolithic "Altheimer Kultur". According to the dendrochronological data the first settlement, founded 3496 years BC, was partly destroyed by fire four years later and built up again thereafter (phase Ia). Phase Ib lasted 15 years, afterwards the settlement was abandoned. Thirty years later a second settlement (II) of the "Altheimer Kultur" was set up on the same place and buildings followed the ground-plan of the previous houses. The duration of settlement II is unknown due to the lack of preserved wood pieces. In a similar fashion the macrofossil record became poorer. This is because since 1930 the groundwater table was lowered by drainage of the valley. Therefore only carbonised material was present in the upper layers which represent the settlements III and IV. Settlement III was shifted about 10-20 m eastward, settlement IV was situated above II but the orientation of the buildings did not correspond with the older settlement struktures. By means of pottery and other archaeological finds these settlements could be assigned to the "Altheimer Kultur" likewise.

Altogether, approximately 280 taxa could be recognised. The most important crop was Emmer throughout the whole interval of about 100 years (after pollenanalytical data). Einkorn was important too above all at the base. A little barley (naked as a rule) and wheat (Triticum aestivum/durum) were found in every phase. Flax, opium poppy and pea were cultivated in addition to the crop. The gathering of wild fruits played a large role in nutrition.

The livestock was fed by leaf fodder procurement and forest grazing. During the night and in winter animals were kept in a stable within the house. The detection of a dungheap behind one of the houses, the great number of grassland species and pollenanalytical evidence speak in favour of hay collecting.

THE ICEMAN: PALAEOBOTANICAL RESULTS

Bortenschlager S., Kofler W., Oeggl K.* & W. Schoch**
* Institut für Botanik, Stenrwartestraße 15, A-6020 Innsbruck
** Labor für Quartäre Hölzer, Tobelhof 13, CH-8134 Adliswil

In 1991 an extraordinary discovery was made in the mountains of the Ötz valley. At an altitude of 3160 m a naked corpse was melting out of the ice. Weapons, commodities and clothings found nearby enabled the dating of the find back to the neolithic period. The corpse as well as the artefacts are in an excellent state of preservation, due to conservation in the ice over 5000 years.

This, in many respects, particular finding demanded a multidisciplinary research programm. The palaeobotanical investigations are carried out by the Botanical Institute of the University of Innsbruck. One point of main interest is emphasized on the plant remains of the excavation. An other is focused in reconstructing the environment of the „homo tyrolensis" in inner parts of the Ötz valley during the neolithic period. In the course of this research, recent palynological analyses give evidence of an early human impact in the highland zone ecosystems. During the Subboreal Chronozone a marked increase is visible within indicator species of pasture: especially *Ligusticum mutellina* spreads in the alpine grasslands. By now, this impact is proven for the last 5000 years within the inner parts of the Ötz valley. These palynological and the first palaeoethnobotanical results are presented.

SEASONAL ASPECTS IN ARCHAEOBOTANY. TWO CASES FROM THE NETHERLANDS.

OTTO BRINKKEMPER, R.O.B., Kerkstraat 1, NL-3811 CV Amersfoort, the Netherlands.

Some archaeobotanical samples potentially result from a specific event and cover a restricted part of the year. Examples of such samples are specific layers in dwelling mounds and other accumulation layers of human settlements and distinct heaps of botanical material such as carbonized hay or straw. Such samples may more or less equal palaeo-biocoenoses (sensu Willerding); they represent the remains of one single former vegetation. In dwelling mounds, such samples may be represented by the delicately layered, horizontal spreading of stems of reedy vegetations, which were used to create a clean and stable floor level. The botanical composition of these samples allow us to get insight into former vegetation composition, especially if Körber-Grohne's qualification of *reine Proben* (pure samples) is met with. Her work on Feddersen Wierde is still an outstanding example of the interpretative potential of such samples in view of vegetation composition.

Next to this subject, however, such pure samples have many other potentials for archaeobotany. One of these is the seasonal signal represented in the botanical remains. The time range of flowering of species is a well studied actuo-botanical subject, which can be used for archaeobotanical remains. Of course, we mainly work with seeds and not with flowers, but the time of seed ripeness and the time of flowering have some relation to each other. By assessing the start and end month of flowering for all species present in a pure sample, clear patterns may emerge. Especially the month of the start of flowering appeared to be informative in both a waterlogged Iron Age floor layer of reed stems and a carbonized heap of hay from the 17th century. With these examples, yielding contrasting results, the potential of seasonal aspects in archaeobotany is illustrated.

Archaeobotanical investigations from two late neolithic lakeshore settlements (lake of Biel, Switzerland)

Christoph Brombacher, Botanisches Institut der Universität Basel
Schönbeinstr. 6, CH-4056 Basel

In the last few years different lakeshore sites were archeologically investigated by the Archeological Service of the Kanton Bern. From two stations of the late neolithic Horgen culture, dated between 3400 and 3200 - 3100 BC, macrobotanical remains could be investigated up to now.

One of the sites (Nidau BKW, 3400 BC) is situated at the outfall of the lake in a flood-plain forest area. The other station (Lattrigen VII, 3200 - 3100 BC) is situated at the right lake-side at the bottom of a slight slope. We investigated:

31 samples with a total volume of 24.5 l from station Nidau, 70 samples (total volume of 29.6 l) from Lattrigen VII. From both excavations random samples, as well as selected samples with concentrations of macrobotanical remains, were taken. The determinations of the macrobotanical remains (seeds, fruit and charcoal) resulted in the following important results:

- The different natural surrounding of both stations reflects clearly in the proved plant spectra. In Nidau water-, lakeshore- and forest-plants come to 50% of all determined taxa, whereas only 37% in Lattrigen belong to this group. Vice versa only 18% of the taxa from Nidau are weeds and grassland species, yet 25% in Lattrigen.

- Also differences between the spectrum of woodspecies of the two stations are shown. In Nidau species of river bank forests (Alnus, Populus, Salix), as well as Betula, Quercus and Tilia are dominant, whereas in Lattrigen species of noble broadleaved woods (Corylus and Fagus, above Quercus) are represented mostly in the charcoal-spectrum.

- The frequent cereals in the Horgen culture in Switzerland were naked wheat (Triticum aestivum/durum), emmer (Triticum dicoccum) and barley (Hordeum vulgare). In the early Horgen-Period (station Nidau) naked wheat was dominant in the field of wheat-find.
  Later (3200-3100 BC) this species lost a lot of importance and was replaced by emmer (Triticum dicoccum). Further cultivated plants were flax (Linum usitatissimum) and poppy (Papaver somniferum).

- Wild food plants were very important, too. In Nidau berries are frequent (Fragaria, Rubus, Sambucus, Physalis) whereas in Lattrigen quite an amount of Corylus, Malus and Quercus were found.

- With the spectra of water- and lakeshore-plants a well developped reed bank can be covered on both sites. Water eutophization is indicated by Zannichellia, Ceratophyllum and Potamogeton species.

THE TRIFOLIAE: PROBLEMS IN IDENTIFICATION.

BUTLER Ann, Institute of Archaeology, UCL, 31-34 Gordon Square, London WC1H OPY, UK

Small legume seeds are commonly recovered from Epipalaeolithic and Early Neolithic sites in North Africa and S.W.Asia, often as a high proportion of the total plant remains. Their role is uncertain, but it is thought that small-seeded legumes may once have been a human food resource. They are difficult to identifiy. The gross morphology and testa surface micromorphology have been investigated in fresh seeds of members of the leguminous tribe Trifolieae and some related tribes. The 4 genera *Medicago, Melilotus, Trifolium,* and *Trigonella* can largely be separated by the multivariate analysis of 7 seed characters. These can be seen in experimentally-charred seed specimens. Since they have also been observed in well-preserved ancient charred small legume seeds, they could aid identification. Although identification to the level of species usually still seems impossible, identification to generic level could provide information useful for the interpretation of these plant remains.

Archaeobotanical remains of hulled and naked cereal in the Iberian Peninsulae: Implications for the role of plant foods and ecological context.

by Buxó,R; Alonso, N; Canal, D; Català, M; Echave, C & Gonzalez, I.

The Iberian Peninsula has a diversified landscape climate and flora, therefore in our paper we can distinguish three areas: the mediterranean area; the central plateau including a chain of sierras and the "meseta" dry plain with almost continental; and the rocky Atlantic north coast.

The aim is to contextualizate the presence and evolution of the most important cultivated cereals in the Iberian Peninsula, wich have been identified in the archaelogical sites from the Neolithic period to the Roman presence. The vegetable species are: free-threshing wheat (*Triticum aestivum/durum*) hulled wheats as emmer (*Triticum dicoccum*), einkorn (*Triticum monococcum*), and spelt wheat (*Triticum spelta*) and barleys, hulled barley (*Hordeum vulgare*) and naked barley (*Hordeum vulgare var. nudum*).

The archaeobotanical findings in Spain show differences in the representation of the different wheats and barleys. From the beginning of agriculture (7000 bp aprox.) there can be found all the species of wheats and barleys in the sites of the eastern Peninsula. But in later periods of the early Neolithic era a higher incidence of free-threshing wheat compared to the hulled wheats may be observed in the north-east and south-east of the Peninsula. N evertheless there is a similar incidence of naked and hulled barleys from that period.

The archeobotanical analysis in the south-east and the east of Spain, show the importance of naked barley (and one legominous -the broad bean-) and the scarcity hulled barley in the third millenium bc. This is not the case in the north-east, where hulled barley has a similar incidence in this period until the Iron Age, when both hulled barley and free-threshing wheat are the most importance species.

The substitution of naked barley for hulled barley in the south-east of the Iberian Peninsula is very significant in theperiod of greatest growth of the Argar culture, which can be related to an intensification of food production.

Free-threshing wheat can be found in all the studied area in a similar frequency and both with barleys play an important role in the vegetable food of the human communities.

Hulled wheats seem to play an secondary role in nutrition during all the periods, although it is constanly present in our samples. Nevertheless spelt wheat only takes on a significant role from the Roman period onwards (only in the Cantabrian north coast), when it plays an important outstanding.

The studies bear witness to the fact that cultivation of cereals was based on free-threshing wheat and on two types of barleys, unlike the sites of the eastern mediterranean where hulled wheats and two-rowed barley are the most important. Thus it can he concluded that stratagies used to exploit species differed in accordance with the biogeographical contexts.

COLLIERS DE LITHOSPERMUM PURPUREO-COERULEUM DANS L'ENEOLITHIQUE DE ROUMANIE

CARCIUMARU Marin, Bucarest

Notiz /*Notice:*

PLANT REMAINS AT THE NEOLITHIC SITE OF QUADRATO DI TORRE SPACCATA (ROMA, ITALY)

ALESSANDRA CELANT, DONATELLA MAGRI, MARIA FOLLIERI
Dip. Biologia Vegetale, P.le Aldo Moro, 5, 00185 Roma, Italy

The neolithic settlement of Quadrato di Torre Spaccata, 58 m a.s.l., approx. 10 km SE of the center of Rome, lies in an area, between the ancient roads Tuscolana and Labicana, very rich in prehistorical and protohistorical archaeological findings, from the palaeolithic to the iron age, and particularly of neolithic and eneolithic ages.

The Neolithic excavation at Quadrato di Torre Spaccata (Anzidei, 1987) has brought to light pottery fragments, lithic material, elements of sickle and grindstone, bones of both domesticated (Ovis vel Capra, Bos taurus, Sus scrofa) and wild (Cervus sp.) animals, together with the plant remains subject of this study. Four radiocarbon dates on carbonized wood indicate an age between ca 6000 and 5500 BP (between ca. 5200 and 4200 cal. a.C.). The palaeobotanical material consists of charcoal, seeds and fruits, generally not very well preserved. Most remains are cereal grains, mainly of Triticum compactum type. The size of the wheat caryopses is very small (average: L 3.65 mm, B 2.6 mm, Th 2.27, L/B 1.4, L/Th 1.61, B/Th 1.15, B/L x100 71); only in one case out of ten examined, the length of the grain was >4 mm. Remains of Hordeum sp., as well as of various legumes, are mostly fragmented. A few seeds of Sambucus ebulus L. were also fouud. The commonest tree taxa identified from the carbonized wood fragments are deciduous and evergreen oaks and Ulmus. These arboreal plants, together with Corylus and Fagus, were the main components of the forest vegetation, as indicated by the pollen data from Valle di Castiglione, a site 10 km NE of Quadrato di Torre Spaccata, where archaeological evidence for neolithic settlements was also found.

PLANT AND FOOD REMAINS FROM THE RITUAL SITE OF ORIA (APULIA, ITALY)

CIARALDI Marina, London

Notiz /*Notice:*

"VEGETAL REMAINS IN AN ANCIENT ROMAN VILLA (CENTRAL ITALY)"

COCCOLINI Gemma, Roma

Notiz /*Notice:*

ARCHAEOBOTANICAL RESEARCH AT ROMAN TONGEREN, FLANDERS, BELGIUM.

COOREMANS Brigitte, I.A.P., Doornveld 1 bus 30, B-1731 Asse (Zellik), Belgium

Excavations in the "Kielenstraat" and "Hondstraat" at Tongeren revealed traces of habitation dating back from the end of the 1st century BC to the 4th century AD. The contents of cesspits, refuge deposits, postholes, habitation layers and ditches revealed macrobotanical remains, mostly carbonised and sometimes mineralised. The aim of the research is to gain more information about the agricultural system and food-supply and the changes they underwent due to romanisation. In a first approach the material from 1st century contexts is studied. The agricultural system does not seem to change dramatically with the arrival of the Romans at Tongeren as compared with the global picture obtained from the Iron Age. Barley and wheat, in particular spelt wheat and to a lesser extent emmer wheat, seem to have been the most important crops. Two grain supplies, one of spelt and one of barley, indicate that monoculture was already practised to some extent. The scanty admixture of other cereals in the spelt supply may indicate crop rotation. No more than the cereals do the other edible plants show much trace of Roman influence. Imported fruits and spices were scarcely represented. Only some coriander, celery, purslain and origanum was met with.

SOCIAL DIFFERENTIATION WITHIN THE EARLY MEDIEVAL DOMAIN OF "SERRIS LES RUELLES" (VII-VIII CENTURY, SEINE-ET-MARNE, NORTHERN FRANCE): A PALAEOBOTANICAL INVESTIGATION.

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The construction of the "Eurodisneyland" amusement park and of the town of Marne-la-Vallée, both to the east of Paris, led to large-scale archaeological investigations in that area in 1991-93. Among the remains that came to light in these investigations were a number of wites dating from the poorly documented Merovingian age. Especially the information obatined in the excavation of the village of "Serris Les Ruelles" has contributed greatly to our knowledge of the origins and organisations of rural communities in this era. From the time of its first occupation phase onwards, the village of Serris showed the typical features of an early medieval domain, characterised by a sharp contrast between an aristocratic *ferme donamiale* (stone buildings arranged around a court) on the one hand and the habitation/activity areas of the peasant community on the other. The finds recovered from the two different habitation areas indicated a high degree of social differentiation. The architectural features of the *ferme domaniale* and the luxury products associated with it (several *fibulae*, jewellery, pieces of gold wire) are indications of the privileged social status of the inhabitants of the *ferme*. Research was carried out to find outh whether this social differentiation was also apparent in the botanical evidence. Soil samples taken from several structures in the two habitation areas yielded sufficient botanical material for analysis. The samples were found to contain both carred and waterlogged macroremains of crops, fruits, nuts and weeds. The range of species included *Avena sativa*, *Hordeum vulgare*, *Panicum miliaceum*, *Secale cereale*, *Triticum aestivum*, *Coriandrum sativum*, *Malus sylvestris*, *Pyrus communis*, *Mespilus germanica*, *Prunus domestica*, *Vitis vinifera*, *Pisum sativum*, *Vicia faba*, *Camelina sativa*, *Cannabis sativa*, *Humulus lupulus* and *Linum usitatissimum*. These and other species were encountered in large quantities in both contexts. At first sight the botanical data do not confirm the social differentiation inferred from the other finds. This may be due to the great interdependence of the two social groups in terms of food economy.

SIEVING EXPERIMENT; THE CONTROLLED RETRIEVAL OF ARTIFICIAL AND ARCHAEOLOGICAL SAMPLES.

Dominique de Moulins. January 1995.

Experimental retrieval of biological remains from sediment samples was carried out in the summer of 1994 by environmental archaeologists from the Ancient Monuments Laboratory and the Central Archaeology Service of English Heritage. The original aim of the project was to improve retrieval from very heavy clay such as occurs on many English sites. However, three types of sediment were finally tested: clay, gravel and sandy loam. For each sediment type, six different treatments were carried out using three flotation machines of the "Siraf" type, two other machines in use in two archaeological units and one experimental machine.

An artificial sample was made up to be incorporated in the various types of sediment. The material to be retrieved included charred plant remains, charred fish remains, fresh fish remains and marine shells. The plant remains were obtained by mixing glume wheat, barley and weed seeds. The plants were charred under different regimes and divided equally between the 18 treatments (3 types of sediment and 6 machines); a record was kept of each sample. After retrieval by flotation and sieving, each sample was carefully recorded including the state of the remains. Calculations were made of the various recovery rates.

Archaeological samples were taken from two sites and processed through the same six treatments and machines as the artificial samples. 20 l. of sediment were used for each treatment in both the archaeological and the artificial samples. The material recovered was recorded and compared. The details and the results of the charring and of the retrieval of the artificial and archaeological samples are presented in this paper. It was found that some treatments work better than others and the conclusions that can be drawn from such an exercise are at the same time encouraging and alarming.

THE PLANT-DERIVED MEDICALS USED BY RELIGIOUS COMMUNITIES IN MADRID (SPAIN) DURING THE 15TH - 19TH CENTURIES.

DEL RIO Elena, Madrid

Notiz /*Notice:*

FOOD, MEDICINAL AND OTHER PLANTS FROM THE 15TH CENTURY DRAINS OF PAISLEY ABBEY, SCOTLAND.

DICKSON Camilla, Dept. of Botany, University of Glasgow, G12 8QQ, Scotland, UK

Remains of vegetables, medicinal plants and fruit from the Abbey's gardens and orchard were recovered. *Ficus carica* (Fig) and *Myristica fragrans* (Mace) provide evidence of trade with southern Europe and Indonesia, probably through merchants in the Low Countries.

BRYOLOGY AND THE ICEMAN.

DICKSON J.H., Dept. of Botany, University of Glasgow, G12 8QQ, Scotland, UK

There are at least 30 species of Bryophytes washed from the clothing recovered with the Iceman's corpse in 1991. Many could well have been growing in the surroundings of the site but several must have come from low altitutes. The Bryophytes provide much evidence concerning the Iceman's provenance, environment and way of life. Some mosses, notably *Neckera complanata* and *N. crispa*, provide clear indications that the Iceman came from Südtirol (Alto Adige).

GATHERED FRUITS AND CULTIVATED PLANTS AT BERCY (PARIS), A NEOLITHIC VILLAGE IN A FLUVIAL CONTEXT : METHODOLOGICAL ASPECTS, FIRST RESULTS.

DIETSCH Marie-France, Laboratoire d'Etudes des Sociétés Préhistoriques, Université Paris X, Nanterre, France.

Recent excavation at Bercy (Paris) revealed that Chassean people occupied, during Middle Neolithic, a village set along a former channel of the Seine river and threw many refuse in this channel.

The present study is based upon macro-remains (seeds and fruits) issued both from the channel and from archaeological structures.

It is often difficult to find indication of gathering from waterlogged seeds. We undertook to research criteria which authorize to distinguish plants whose fruits have been gathered from those whose seeds are issued from a natural deposit.

The first part of this contribution consists in a presentation of these criteria and of the arguments which allow us to use them as anthropic indicators.

In the second part, we demonstrate that we can observe strong cross-checking if we use following criteria and isolate (1) plants whose several seeds are preserved by carbonisation, (2) plants whose several seeds are present in archaeological structures, (3) plants whose seeds are over-represented and (4) if we consider the spatial distribution and particularly the concentration of seeds of the few taxa isolated by using previous criteria.

The presentation of cultivated plants brings also new interesting data to the knowledge of species cultivated in northern France by Chassean farmers.

"THE PALAEOETHNOBOTANY OF ABU SHA'AR SITE, RED SEA COAST, EGYPT"
1 - FOOD PLANTS AND RELATED INDUSTRIES.

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Abu Sha'ar site is about 20 km. north of the Red Sea resort of Hurghada. Its most important architectural features are the fort and two water installations. The fort is the only extant Roman fort thus far identified along the Red Sea coast of Egypt. It had at least two distinct phases of occupation : the earliest was by a mounted unit of the Roman army, stationed there early 4th century; the second phase may or may not had been a period of military use and all evidence points to peaceful abandonment sometime, in the first half of the 7th century. A total of 56 species were identified including 19 species of food plants. Nine of these plants are winter corps including wheat, barley, seeds of the pulses : broad beans, chick-pea and lupine; seeds of salad plants : radish and coriander as well as scale leaves and discoid bulb bases of onions and garlic. Ten of the food plants are trees with edible fruits; stones or stone fragments of : peach, apricots, almonds, olives, sidder and dom palm were recovered. Seeds of grapes, carob and dates as well as nut shells of walnut and fruit skin of pome-granate were also recovered. Among the potteries recovered from the fort kitchen-milling area of the fort are pottery fragments encrusted with remains of food material. The GLC of carboxylic acids content of the sample resulted in : lactic, oxalic and tartaric acids. The later dominated the sample : giving a preliminary impression of "bouza" residues (Ancient Beer-like cocktail). The fort at Abu Sha'ar was garrisoned by portion of cavalry unit, the Ala Nova maximiana, totaled approximately 200 men (Sidebotham, 1994). Our botanical findings from 1990 and later supported the idea, that much of the garrison's food was locally acquired. The archaeobotanical remains included intact spikes of wheat and barley, stones of juicy fruits (olives, apricots, peach, etc...), seeds of grapes and dates, which were likely to have been cultivated nearby, rather than imported from the Nile valley some 200 km to the north-west of Abu Sha'ar. An Ancient pattern of agriculture seems to have been practiced near the wells of Abu Sha'ar El Qibli (ca 5.5-6 km west of Abu Sha'ar fort) for the production of the garrison's need of botanical food.

PLANT REMAINS FROM THE LATE NEOLITHIC LAKESHORE SETTLEMENTS "HORGEN-SCHELLER", LAKE OF ZÜRICH, SWITZERLAND. FIRST RESULTS.

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"Horgen-Scheller" is situated on the north-exposed side of the lake of Zürich, wherefrom no archaeobotanical investigations exist till now. Compared with the well investigated area of the city of Zürich differences in farming practices due to other environmental conditions are expected.

The site was excavated in the late eighties. Four cultural layers belonging to the late neolithic Horgen culture and dated between 3080 and 3030 BC were excavated.

First results from the macrobotanical analysis will be presented.

Analysis of seeds and fruits consider the best preserved two layers, which represent two short settlement periods following each other. During the excavation, no housing structures could be recognized. Due to that, samples were taken by using a 1 m^2-grid. In fact for both layers 20 respectivly 40 of these one-liter-samples distributed over the whole surface were analysed.

In addition to seeds and fruits laying branchwood has been analysed for all four layers. The aim of this analysis was to get further information about expected cattle management.

Multivariate statistic methods should help to detect structures in the data.

Both the analysis of seeds and fruits and the analysis of lying wood suggest that the settlements represent special activities and living conditions.

WOOD RESOURCE IN NORTH-WEST PORTUGAL: ITS AVAILABILITY AND USE FROM THE LATE BRONZE AGE TO THE ROMAN PERIOD.

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The analysis of archaeological charcoal is used to reconstruct the wood resources in north-west Portugal, from the late Bronze Age to the Roman period. Our approach aims to understand the attitudes, both cultural and exploitational, towards the natural environment by former human communities occupying certain areas of this region. Of course these aims are beset by difficulties particularly in the earlier phase of this period when documentary sources are not available.

Our data are based on the results obtained from 12 archaeological sites, where the abundance of charcoal material and the opportunity of carrying out accurate sampling allowed us to obtain statistically viable results.

The climax vegetation community of the area is identified and local variations of this are described. Three principal biotopes are identified in all sites: (I) mixed oak forest, (II) wasteland vegetation and (III) riparian forest. Although some minor differences in carcoal composition are noticed, the results seem to testity to a similar exploitation of the natural vegetation by different populations making use of a similar range of wood resources.

The choice of certain species for particular domestic/constructional purposes is noted. It is possible that wood used for building in this area underwent little preparation. Material from large, mature trees (timber suitable for making planks, beams) is extremely rare. The majority of fragments analysed indicate that they belonged to young, narrow branches or young individual trees (suitable for firewood or light construction).

Attention is drawn to the exploitation of both dry and green wood which can be distinguished by the study of carcoal fragments. The anatomical features of charcoalified wood show evidence of disruption if burnt while green, owing to the pressure and explosive release of gasses on heating. It is possible that the diminution of dry fuelwood in exploited aereas would lead to the collection and use of green wood.

CHARRED CEREALS FROM A BRONZE AGE SITE IN ROGALAND, SW NORWAY.

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Postholes belonging to a Bronze Age house were found at an archaeological excavation at Austbø, Stavanger, SW Norway. Samples taken from the postholes contained charcoal and a large number of charred grains of barley (*Hordeum vulgare*) and emmer wheat (*Triticum dicoccum*).

THE UTILIZATION OF LYME-GRASS (*ELYMUS ARENARIUS L.*) IN ICELAND

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Abstract

Iceland lies in the northern fringe-zone where the cultivation of cereal crop is barely feasible. However, it is widely accepted that barley was grown in the country, from its colonization in the 9th century A.D., but its cultivation appears to have ceased in the 14th century, probably due to climatic deterioration. Environmental and climatic conditions severely restricted agricultural practice and hence the inhabitants had to rely on a wide variety of wild resources, both floral and faunal.

Lyme-grass was gathered and processed in Iceland for human consumption until early this century, but the earliest documentation for its use as food is found in cartularies from the mid 12th century. It holds, in many ways, a unique position among the wild plant resources exploited in Iceland, as its processing requires considerable skill and elaborate techniques and facilities, in some ways analogous to domesticated cereals.

Many aspects of lyme-grass utilization are unclear, such as the feasibility of its exploitation and the circumstances of the utilization, that is, to what extent lyme-grass was relied upon and its importance in the overall subsistence management,. It is, for example of interest, where lyme-grass exploitation was contemporary to barley cultivation, if lyme-grass was harvested as a supplement to the main crop or used only in times of crop failure and famine. There is also the possibility that these crops were not exploited by the same people and that lyme-grass was only utilized by the poorer part of the population as a substitute for crops.

On the basis of an extensive study of various written records on the methods of lyme-grass exploitation, I built an ethnohistorical model and conducted an experiment to test its viability from a methodological and quasi-agricultural point of view. This further provided the opportunity to assess other productivity parameters involved in lyme-grass exploitation, eg. labour cost, caloric return rates and area yields.

Although the model demonstrates lyme-grass utilization by sedentary Icelandic farmers, it may well have broader relevance and hence it could also prove valid for non-agrarian (including pre-agrarian) societies exploiting similar resources.

THE FARMING ECONOMY IN SOUTH AND CENTRAL SWEDEN DURING THE BRONZE AGE. A STUDY BASED ON CARBONISED BOTANICAL EVIDENCE.

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This study reviews new anaylsis of carbonised plant macrofossils in South and Central Sweden. There are a couple of hundred samples from archaeological sites, most of them from the southern part of the investigation area. Most of the plan macrofossils come from the later part of the Bronze Age.

The carbonised material in this analyse consists predominantly of kitchen refuse from Bronze Age houses. We can assume that grains and seeds from household debris reflect the consumption of different cereals and should roughly representative of production.

During the older part of the Bronze Age (1800-1000 B.C.) naked barely *Hordeum vulgare var nudum* predominates, speltoid wheats follow as second. We have probably both emmer *Triticum dicoccum* and spelt *T. spelta* in the material but there are in very few samples that we can separate them from each other. In small frequencies occur einkorn *Triticum monococcum*, hulled barely *Hordeum vulgare*, wheat *Triticum aestivocompactum*.

In the later part of Bronze Age (1000-500 B.C.) we have a quite different picture. Hulled barely predominates and speltoid wheats and naked barely declines. This indicate a radical change in agriculture practice, hulled barely must have more easily soluble nutrients in order to produce an acceptable yield. And the rise of the amount of the weedseed *Chenopodium alba* (and other weedseeds) show that manuring of field starts at this time. Much earlier than the archaeologists have thought.

New cereals in this later part of the Bronze Age are millet *Panicum miliaceum* and oats *Avena*. We don't know if its cultivated of wild oats because there are now glume base intact.

Other plants which have had importance during the Bronze Age Gold of pleasure *Camelina sativa* who was cultivated as oil plant and Oat-grass *Arrenatherum elatius ssp. tuberosus*. It was the starchy steem-tubers from the Oat-grass that was used as food (it occurs also in Iron Age graves).

The picture we get of the agriculture during the Bronze age are very complex. The many cultivated plants are remarkable and this means that the plant husbandry must have been seriously planned.

DETERMINATION KEY FOR CHAROPHYTE OOSPORES: A NEW TOOL FOR RECONSTRUCTING CLIMATIC AND HUMAN IMPACT ON FRESHWATER ECOSYSTEMS

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Because of the importance and wide distribution of stoneworts in aquatic plant communities, the accurate identification of oospores may give valuable informations on ecological parameters such as water temperature, chemistry and light regimes in Charophyte stands. 22 central European stonewort species and 2 species groups belonging to the genera *Chara*, *Lychnothamnus*, *Nitella*, *Nitellopsis* and *Tolypella* may be identified by oospores using a dichotomous determination key based on binocular and light microscope features. Size, shape, membrane decoration, colour and ridge number are used as identification criteria. Rapid changes in a freshwater ecosystem due to climatic or anthropogenic impact (e.g. eutrophication) may therefore be elucidated for prehistoric occupation phases.

RADAR, A RELATIONAL ARCHAEOBOTANICAL DATABASE FOR ADVANCED RESEARCH

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The structure of the Dutch Relational Archaeobotanical Database (RADAR) is presented. RADAR is a rather compact archaeobotanical database that is controlled centrally, but can be distributed to individual scientists. For this reason RADAR contains only the most important archaeobotanical data. For detailed archaeological, botanical and regional palaeoenvironmental information, links can be established with the national archaeological database (ARCHIS), the national botanical database (BBR) and the European Pollen Database (EPD). The software used for manipulation of the database is Paradox for reasons of its highly visible nature, its control facilities for data entry and its possibilities to import and export data from and to many other programmes. The potential of the database is demonstrated with query examples.

BIAX CONSULT: MEDIEVAL RESEARCH

HAENINEN Kirsti, BIAX CONSULT, c/o. Kerkstraat 1, NL-3811 CV Amersfoort, The Netherlands

BIAX *Consult* is a partnership in which biologists and archaeologists work together. Our expertise is the investigation of botanical and zoological remains from the past. We examine material found in archeaological excavations and in natural sediments such as peat layers and soils.

BIAX *Consult* offers the following specializations:

- Palaeo-botany (pollen, seeds, wood)
- Palaeo-geography

We will also accept and contract out commissions for related specialisms such as dendrochronology, palaeo-zoology and radio-carbon dating.

BIAX *Consult* provides a multitude of services, which can be classified under the following headings:

- Bio-archaeological investigations

BIAX *Consult* can contribute to the research of human communities of the past. For example, we reconstruct consumption patterns, environments, agrarian and manufacturing activities and woodworking.

BIAX *Consult* also advises on strategies for the collection of samples at excavations and/or helps to collect and conserve unusual finds (on-site service).

- Environment reconstruction

BIAX *Consult* can make an important contribution to the reconstruction of an environment with its original flora and fauna and/or give advice on the reconstruction of agricultural activities in the past.

If required, we can carry out gaugings to collect material.

For our poster we have selected some of our recent Medieval investigations:

- a rosary made of beads of *Evonymus europaeus*
- cesspits with seeds of *Aframomum melegueta* and pollen of *Syzygium aromaticum* and the close relationship between *Oryza sativa* and *Scirpus mucronatus*
- reconstruction of the environment of *plaggen*-soils
- the visualization of subterranean castle ruins with different tree-species

PLANT REMAINS FROM C15TH-19TH DEPOSITS IN A REREDORTER AT THE HOSPITAL OF ST JOHN, CANTERBURY, KENT, U.K.: SOME PRELIMINARY OBSERVATIONS

ALLAN HALL, Environmental Archaeology Unit, University of York, York YO1 5DD, U.K.

Remains of two reredorters (latrines) at the rear of the Hospital of St John in Canterbury have been recorded by Canterbury Archaeological Trust. They are part of the Norman (late C11th) foundation, and were in use as recently as this century. The fills of one of the reredorters were excavated and sampled almost in their entirety. On the evidence of pottery and other artefacts it appears that the fills represent deposition between the end of the C15th and the C19th, earlier deposits probably having been lost through the efficacy of the 'flushing' system and through a phase of rebuilding in the C15th.

An assessment has revealed that most of the layers are—not surprisingly—rich in remains of food, both from plants and animals, but a variety of other taxa are present and a major task in the analysis of the biota will be the unravelling of the various components. It is hoped to examine bones (especially those of fish), molluscs, insects and other arthropods, and pollen, as well as macrofossil plant remains One aspect of the analysis of plant remains will be the use of image analysis to characterise the size and shape of the abundant *Prunus* fruitstones in an attempt to trace changes through this temporally long sequence of deposits which represent the period in which selection and diversification of plums and damsons is traditionally thought to have taken place.

This contribution will also briefly consider the current practice of project funding with English Heritage, the state-funded archaeology service for England, using the St John's site as an example.

ANCIENT SWEDISH BREAD - NEW ANALYSES.

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In Sweden, fragments from c. 100 prehistoric bread loaves have been found, the oldest is dated to the Early Iron Age. Probably a few of these form a separate type of food-remains, but breadlike in charred condition. About 80 of these bread loaves have been subjected to microscopic analysis, principally by Professor Hakon Hjelmqvist, Lund but also by the author. However already in 1909, the first analysis of this type was carried out by Professor Rosendahl, Stockholm.
Here, three of the Swedish analysed ancient charred bread loaves will be presented. All are dated to the Late Iron Age, and were found in cremetion graves.

PLANT REMAINS FROM AN EARLY ERTEBØLLE (MESOLITHIC) SITE AT HALSSKOV, DENMARK

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Construction work on the bridges and tunnel linking the islands of Zealand and Funen across the Great Belt, was preceded by a flurry of archaeological activity. One of the sites excavated in the campaign was an early Ertebølle "settlement" (ca. 5200-5300 BC) located on what was then a small island in a narrow sound. Sub-fossil wood remains show that the island was covered by oak woodland.

The site itself comprised a thin sandy settlement layer containing flint scatters and charcoal. No evidence of huts or other structures was found, but there were shallow pits and hearths associated with the settlement layer. It was the latter features which produced the plant remains presented here.

In the course of the Late Atlantic transgression the island was flooded and thick layers of gyttja were deposited, sealing the site. The area was reclaimed during the last century and has been used for agriculture ever since. At the time of excavation ca. 1 metre of the gyttja deposits remained over the site.

Twelve samples have been analysed, representing a total of seven features. In addition to large quantities of charcoal, both uncarbonised and carbonised plant remains were present, although the latter were clearly in the majority. They included remains of food plants (*Corylus, Quercus, Rubus idaeus*), nitrophilous weeds (*Chenopodium album, Stellaria media, Solanum nigrum, Galium aparine*), marine aquatic and shoreline plants (*Ruppia maritima, Suaeda maritima*, several species of *Atriplex*) and plants from woodland and the woodland edge (*Melica uniflora, Polygonum dumetorum*, cf. *Vicia sativa* ssp. *angustifolium*). Other interesting finds included small cigar-shaped objects interpreted as carbonised mouse faeces and carbonised lens-shaped galls produced by the female generation of the wasp *Neuroterus quercus-baccarum*, which are normally found on oak leaves.

Botanical Investigations about the Environment of the Early Medieval Wurt Oldorf/Wangerland

Sigrid Heider & Karl-Ernst Behre
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The Niedersächsisches Institut für historische Küstenforschung has carried out a project about the medieval habitation history and the construction of early sea-dikes in the clay district of Wangerland at the eastern border of the East Frisian Peninsula since 1990. Together with archaeological excavations botanical investigations have been carried out to reconstruct the former vegetation around the settlements and its change.

The coastal area of Lower Saxony has been protected from the sea by dikes since the 11th century. Before the construction of sea-dikes people protected themselves from the increasing stormfloods by raising their settlement places. In this way the „Wurten" or dwelling mounds were built, which are the basis of many modern villages. By excavating them the remains of several habitation phases can be found. In the Roman period and at the beginning of Early Middle Ages Wurten were formed by clay and so-called dung layers (fossil hay, litter from the stables, remains of fodder, threshing or thatched roof and, of course, digested material). From the 9th century onwards only clay was used to raise the Wurten.

The Wurt Oldorf, excavated in 1990, belongs to the former type. Inside the water-logged site there were excellent conditions for the preservation of organic matter (large amounts of plant remains as well as bones, textiles etc.). Most of the samples for macrobotanical studies were collected in the byres of farmhouses and from a working place of the habitation layers 2 and 3 (dendrochronologically dated to about 650 and 670 A.D.). Many plant remains of halophyte species (for instance *Limonium vulgare*, *Triglochin maritima*, *Plantago maritima*, *Glaux maritima* und *Juncus gerardi*) and only a few of glycophytes (as *Lycopus europaeus*) demonstrate that Early Medieval Oldorf has been founded close to the former coast-line and was surrounded by marine and brackish environment. According to similar places cultivated plants are expected, but only *Vicia faba* and barley have been found yet.

AGRARIAN PRACTICES IN THE DANISH IRON AGE - ARCHAEOBOTANICAL ANALYSES OF THREE LARGE GRAIN STORES

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In this paper, the results of archaeobotanical investigations of three large finds of crop remains ("granaries") from the end of the Pre-Roman Iron Age will be presented. The aim of the investigations is to interpret crop processing waste and the weed seed flora in the finds in terms of contemporary agrarian practices.

The three finds all come from buildings destroyed by fire. The most important of them, an underground granary at Overbygård in Vendsyssel, contained over 100 litres of carbonised grain, seeds and other plant remains. The grain was stored in pots and leather sacks hung from the roof of the cellar. During the excavation, it was possible to take up the contents of virtually every sack and pot individually. The main crop was Naked Barley, with smaller quantities of Club Wheat, Oats and Flax.

All three sites contain unthreshed, threshed and processed grain, in addition to Flax seeds and large collections of weed seeds stored separately. The latter shows that weed seeds played an important role in subsistence.

The weed seed assemblages in the three finds show that both higher well-drained areas and low-lying wetter ground were cultivated with an uneven use of manure.

Attempts were made to interpret the composition of the finds in terms of agrarian practices using the models proposed by Gordon Hillman, but it became apparent that it was necessary to adjust the models to conditions in northwestern Europe. Attempts to do this will now be made through a series of practical experiments which form part of a much larger interdisciplinary research project. The project is planned to start in the summer of 1995, and is aimed at examining Iron Age agriculture as a whole.

LIFE ON A SCOTTISH CRANNOG: THE PLANTS AND THE PEOPLE FROM BUISTON.

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Buiston Crannog consists of man-made island in a small loch in Ayrshire, S.W. Scotland. Although it was evidently first constructed in the Bronze Age, most of the surviving evidence comes from a brief period of occupation in the 6th and 7th Centuries AD. A detailed analysis of the plant remains from the Crannog's sediments have yielded much information regarding the method of construction, the environment of the loch and the life-style of the inhabitants.

The economy of the site included hulled six-rowed barley, oats and, more rarely, bread wheat. Significant numbers of flax seeds were also recovered indicating the importance of this crop although it is not known whether they were grown for fibre or for their oil-rich seeds. Two important finds include the fruits of coriander (*Coriandrum sativum*) and dill (*Anethum graveolens*) both of which are exotic to the area. They are thought to have been brought to Britain first by the Romans and, evidently, a taste for these Mediterranean herbs persisted on high status sites in Scotland following their departure early in the fifth century.

Seeds of many non-cultivated plant species were also identified. These have enabled us to source some of the mound construction material and to identify elements of the local environment. It has also been possible to demonstrate episodes of flooding associated with changing relative water levels and to suggest increased eutrophication in the loch as a result of increased dumping of human waste into the lake.

APPLICABILITY OF WESTERN METHODS TO JAPANESE ARCHAEOBOTANY.

HOSOYA Leo-Aoi,

In Japan, an interest in botanical data from archaeological sites is ever increasing these days, especially in relation to the beginning of agriculture. However, the interest still emphasises one-to-one verifications, e.g. the verification of the existence of paddy fields based on phytoliths. This means that botanical data fail to be interpreted in relation to the dynamics of a human society, which is necessary to really understand the shift of economy from hunting-gathering to agriculture.

Western archaeobotany has generated various methods for interpreting botanical data spatially and statistically in order to picture dynamic relationships between plants and human in daily life and social movements. For example, G. Hillman (1981, 1983) established a method to reconstruct a series of human activities in a prehistoric age concerning plants by quantitative analysis of botanical remains, and M. Jones (1985) developed contextual analysis of various parts of carbonised plants to picture a trading system of plant food among a capital and satellite villages in iron age. I believe that application of those methods to Japanese data should lead a breakthrough to this area of Japanese archaeobotanical study.

In this presentation, I would like to introduce my own interpretative method of botanical data, which is developed referring Western methods, an application of it to data from *Yoshino-ga-ri* site (300BC-AD300), *Kyushu*, Japan, as a case study.

Yoshino-ga-ri site is one of earliest and biggest sites of communities based on rice cultivation as the main substantial source. This very large site has rich structures; residential aereas, a graveyard of 2000 coffins, special huge buildings, etc., yet very little has been reconstructed about the state of rice cultivation and the function of spaces relating to it. I intend to develop this aspect of *Yoshino-ga-ri* study with my method towards an understanding of the nature of economical shift and the significance of rice cultivation in prehistoric Japan.

IWGP Innsbruck June 1995

THE STATE OF PALAEOETHNOBOTANICAL RESEARCH ON THE IBERIAN PENINSULA

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In 1990, R. Buxo gave a first overview of the plant macrofossil spectra of the Iberian Peninsula. In his very useful work the species lists of 116 investigated sites from different prehistoric and historic epochs are presented.

Since then a lot more archaeobotanical work has been done in Spain and Portugal; 15-20 new sites were investigated. Therefore we thought it might be be helpful to put together this new summary. We would like to adress two aspects in particular:

- firstly, the number of assemblages that stand up to modern archaeobotanical standards regarding sample size, mesh size and the number of specimens counted, and consequently the representativeness of the data;
- secondly, the problems of identifying certain crop species (e.g. naked wheats) and the associated problem of producing a reliable picture of changes through time and space with regard to crop spectra.

Unfortunately, the information on archaeobotanical investigation in Spain is mainly dispersed in local papers which are difficult to find. There are almost no publications in international scientific journals. We hope that our paper is a step in the direction of changing this situation.

AGRICULTURAL TECHNOLOGY OF THE CORTAILLOD CIVILISATION (MIDDLE NEOLITHIC AGE) ON THE SOUTHERN FOOT OF THE JURA MOUNTAIN CHAIN.

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and
LUNDSTROM-BAUDAIS Karen
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Our communication concerns three Swiss lake shore sites from the Classic Cortaillod civilisation (ca. 3900-3500 BP): Hauterive-Champréveyres (canton of Neuchâtel) on the lake of Neuchâtel, Corsier-Port (canton of Geneva) on the lake of Léman and Twann [1] (canton of Bern) on the lake of Bienne.

The composition of the weed floras on these sites is compared for similarities and differences. On the basis of the ecological factors which characterise these weed species, we attempt to establish the location of the land which were used for agricultural purposes at each site and land-use system which was employed. The factor of the richness of the soil in nitrogen is particularly useful for the formulation of hypotheses on the agrosystem in use during the period concerned. In conclusion we confront the divers possibilities suggested by our analyses with those from other disciplines, principally the dendrochronology.

[1] Bollinger, T. & Jacomet, S. 1981 Resultate der Samen- und Holzanalysen aux den Cortaillodschichten. In B.Ammann et al., *Die neolithische Ufersiedlungen von Twann* 14 : 35-67.

PRELIMINARY RESULTS OF THE ARCHAEOBOTANICAL INVESTIGATIONS OF THE MEDIEVAL (XIII - XIV c.) ELBLĄG, N-POLAND

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The large scale archaeological excavations in the old centre of Elbląg afford valuable material for archaeobotanical investigations. The exceptionally good preservation of fossil remains is guaranted by the high ground water level in the town. Palaeobotanical samples come from various sites which differ in respect to its previous function in the medieval city (houses, yards, latrines, market place etc...).

The most prominent group of the fossil flora is represented by species typical of ruderal habitats and field weeds. Because charred remains are very rare in this material, only single specimens of cereal caryopses and pulses were found. Among cultivated plants *Cannabis sativa*, *Panicum miliaceum* and *Humulus lupulus* appear frequently and in great abundance. In some samples plants used in medicine are present in great number of specimens (e.g. *Hypericum perforatum*, *Prunella vulgaris*, *Betonica officinalis*).

The luxury food plants as imported *Myristica fragrans*, *Piper nigrum* and *Ficus carica* or *Juglans regia*, *Vitis vinifera* and *Prunus persica* which were imported or locally cultivated, underline the high position of the town already at the beginning of its existence.

FIBS IN ARCHAEOBOTANY: SPANISH IRRIGATION REVISITED

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Interpretations of ancient weed floras based on existing autecological and phytosociological data, vary because of the ambiguity inherent in such studies. It is extremely difficult, from observations in the field, to determine to which aspects of the arable environment (water or nutrient availability, sowing time of the crop, degree of shade etc.) weed species are responding. This has led directly to a multiplicity of interpretations of archaeological weed floras and the same evidence has variously been interpreted as due to particular tillage or sowing practices or simply to 'quality' of husbandry. Moreover, it is very likely that the arable habitats which gave rise to the ancient weed floras do not exist in the present or recent past. An interpretative methodology is needed which permits the reconstruction of extinct agricultural regimes.

The 'Functional Analysis of Botanical Surveys' (FIBS), developed by the Unit of Comparative Plant Ecology at the University of Sheffield, provides a basis for such interpretations through an analysis of the 'functional attributes' of weed species. By linking particular species with particular aspects of the arable environment, FIBS provides the key for using the modern data in the interpretation of archaeobotanical evidence. Functional attributes include such variables as: seed size and shape (predicts persistence in soil), specific leaf area (reflects growth rate), epidermal cell size (relates to seasonality of growth). These attributes are indicators of a species' potential in a number of areas (indicated in brackets) and therefore reflect the plant's ability to respond to different environmental factors. For example, high specific leaf area indicates a fast growing species able to respond to temporarily favourable conditions (e.g. irrigation). Various combinations of a plant's potential also contribute to its overall strategy, as a ruderal, competitor or stress tolerator , which again reflects the plant's ability to respond to its environment (in particular productivity and disturbance).

A study of irrigation in Spain (presented at the last IWGP symposium) showed that irrigation levels could be clearly differentiated on the basis of weed species. When this species' data is translated into functional attributes, several of the attributes exhibit patterning relating to level of irrigation. For example, species with very small specific leaf area are associated with dry farming and those with very large specific leaf area are restricted to irrigated fields. As specific leaf area is a measure of a species' potential growth rate, it indicates that the favourable water conditions in fully irrigated fields are likely to be responsible for the presence of species with high specific leaf area rather than, for example, the denser shade cast by a flourishing crop or the compaction of the soil caused by flood irrigation.

PHYTOLITH AND STARCH GRAIN ANALYSIS: NEW EVIDENCE FOR PREHISTORIC PLANT PROCESING IN THE IBERIAN PENINSULA.

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Phytoliths and starch grains are ergastic substances of plant origin that can be of diagnostic value in an archaeological context as indicators of human diet.

The diverse methods used to identifiying plant residues present on archaeological objects have only recently been applied to ground stone objects (grinding slabs of querns, handstones, mortars, pestles, pounders, stone vessels, grating tools).

The purpose of this study is to present different methods for recovering phytoliths and starch grains from these characteristic stone tools. Grinding slabs residues of some prehistoric sites were examined by optical and scanning electron microscopy, and analyzed using a X-ray microanalysis procedure. Phytoliths obtained from human dental calculus and enamel surface are also studied.

It is concluded that human teeth and groundstone residues can contribute to the understanding of grinding and pounding processes and diets of prehistoric populations.

Keyords: phytoliths, starch grains, groundstone tools, plant processing, dental calculus, enamel.

PALAEOETHNOBOTANICAL EVIDENCE FOR PROTOHISTORIC AGRICULTURE IN PARTS OF EASTERN INDIA.

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This paper deals with results of palaeoethnobotanical investigations on materials recovered from a multicultural site of Taradih (district Gaya) in State of Bihar in eastern India (Fig.1). The site has yielded habitational deposits ranging in age from C. 4000 to 1000 bp. The author is highly grateful to the excavation authorities of the Department of Archaeology and Museum (Drs. S.R.Rai and A.K.Prasad), State of Bihar, for kindly inviting me to undertake the palaeobotanical investigations concurrently with the excavations during 1986.

The site yielded habitational deposits of cultures such as Neolithic (C. 4000-3500 bp), Chalcolithic (C. 3500-3000 bp), Iron Age (C. 3000-2400 bp), Northern Black Pottery (NBP), period (C. 2400-2100 bp), Kushana (C. 2100-1700 bp) and Pal period (C. 1300-1000 bp). Each of these habitations have yielded carbonised remains of different plant species in varying proportions. This data constitutes subject matter of the present paper.

Intensive dry and wet sieving techniques were systematically applied to the representative habitational debris from hundreds of well defined contexts resulting in recovery of grains belonging to nearly thirty plant species comprising both wild and domesticated ones. This is giving spatial as well as temporal distribution of ancient plant economy. The data provides us rich insight into the local attempts of intensive cultivation and possibly domestication of rice, wild associates, diversification of agricultural crops, evolving cropping patterns and agricultural system from Neolithic onwards in eastern parts of India. A detailed summary of the palaeoethnobotanical findings has been given in the enclosed Table I & II. This will be elaborated upon along with other relevant sites in parts of eastern India.

(Tabellen im Anhang!!!!!)

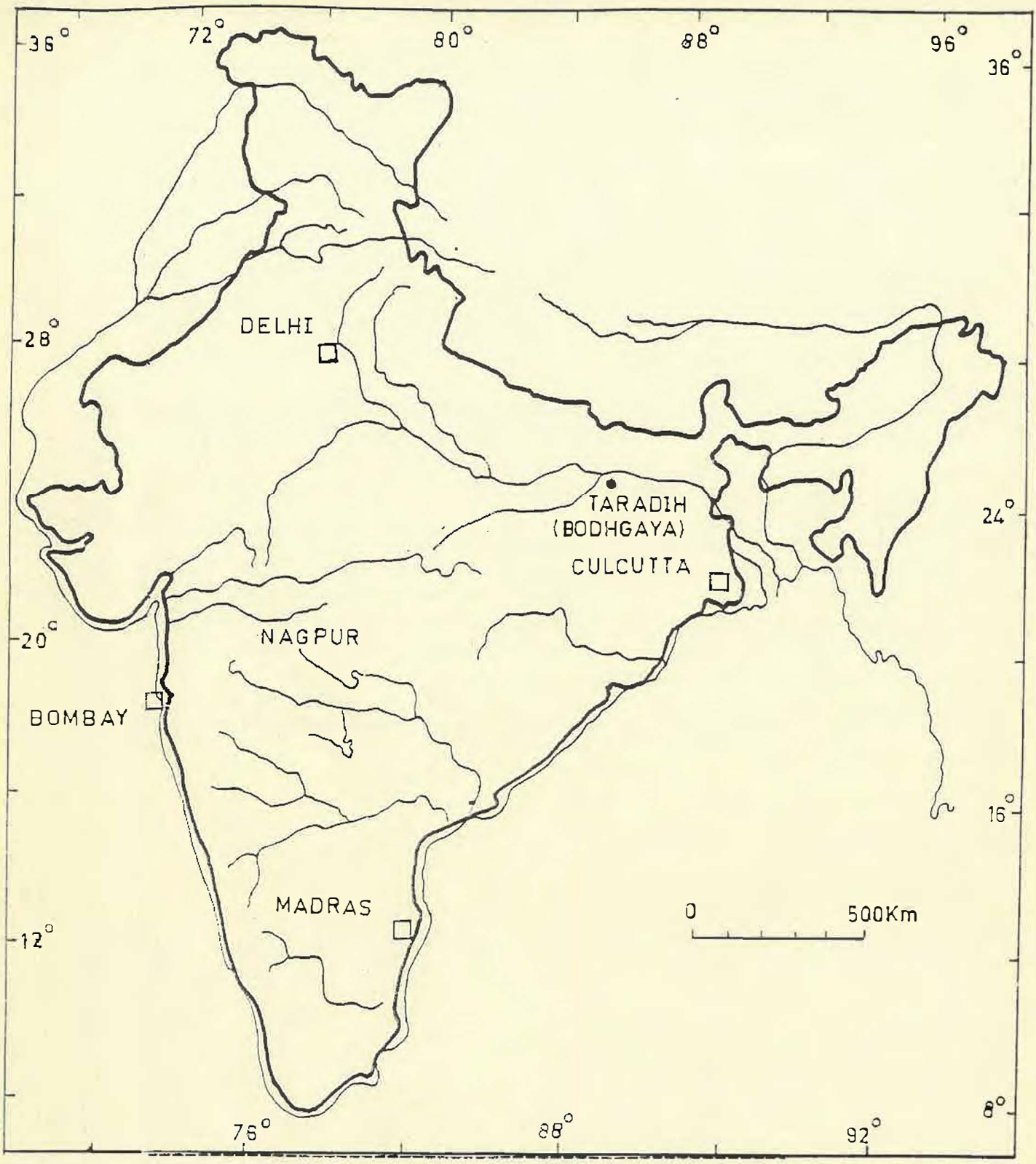

FIG. 1 : LOCATION OF MULTICULTURAL SITE OF TARADIH

TABLE I: LIST OF PLANT SPECIES DIAGNOSED AT ANCIENT TARADIH

(Neolithic- c.4000-3500 bp, Chalcolithic-c.3500-3000 bp, Iron Age- c.3000-2400 bp, Northern Black Polished Ware period-c. 2400-2100 bp, Kushana-2100-1700 bp, Pal Period- c. 1300 bp.)

CEREALS-	1. Rice	Domestic type - Oryza sativa Linn. and Possibly wild type- Orvza sp./Oryza cf rufipogon Griffith
	2. Barley	Hordeum vulgare Linn.
	3. Wheat	Triticum aestivum Perc. type
	4. Panicum	Panicum sp./Panicum cf millare Lam.
	5. Setaria	Wild?) Setaria sp.
	6. Kodo millet type : Paspalum cf scrobiculatum Linn.	
PULSES- (LEGUMES)	7. Horse gram : Dolichos biflorus Linn.	
	8. Hyacinth bean (Indian bean) Dolichos lablab Linn.	
	9. Lentil :Lens esculenta Moench.	
	10. Grass pea : Lathyrus sativus Linn.	
	11. Common pea Pisum cf arvense Linn.	
	12. Black gram : Vigna mungo (L.) Hepper	
	13. Green gram : Vigna radiata (L.) Wilczek	
	14. Black gram/Green gram type : Vigna sp.	
	15. Gram (Chick pea) : Cicer arietinum Linn.	
	16. Medicago : Medicago sp.	
	17. Acacia : Acacia cf coccinia DC type	
OIL SEEDS-	18. Brassicaceae type : Brassica cf juncea ? (L.) Czern & Coss	
	19. Sesame type : Sesamum cf indicum Linn.	
FRUITS-	20. Cucurbitaceae type : Cucumis sp./Cucumis cf melo Linn.	
	21. Indeterminate endocarp	
	22. Persimmon (Indian ebony) : Diosporous cf melanoxylon Roxb.	
	23. Indian jujube : Zizyphus jujuba Lamk.	
HYDROPHYTES-	24. Cyperaceae type : Cyperus sp.	
WEEDS- WILD	25. Papaveraceae type : Argemone cf mexicana Linn.	
	26. Chenopodiceae type : Chenopodium cf album Linn.	
	27. Wild Lady's finger type :Ablemoschus sp.	
	28. Cassia sp.	
	29. Indeterminate cotyledon	
	30. Indeterminate various types	
	31. Indeterminate endocarp	
OTHERS-	32. Tiny coprolites	
	33. Coprolites of sheep/goat	

TABLE II: CULTUREWISE DISTRIBUTION OF PLANT SPECIES IN ANCIENT TARADIH

(Neolithic- c.4000-3500 bp, Chalcolithic-c.3500-3000 bp, Iron Age- c.3000-2400 bp, Northern Black Polished Ware period-c. 2400-2100 bp, Kushana-2100-1700 bp, Pal Period- c. 1300 bp.)

	NEOLI	CHALC	I.AGE	NBP	KUSHAN	PAL
Cereals-						
1. Rice	+	+	+	+	+	+
2. Barley	+	+	+	+	+	+
3. Wheat		+	+	+	+	+
4. Panicum		+	+	?		
5. Setaria (Wild ?)	+					+
6. Paspalum					+	
7. Wild Grass types		+	+	+	+	
Pulses(Legumes)						
8. Horse gram	+	+	+	+	+	+
9. Hyacinth bean			+	+		+
10.Lentil	+	+	+	+	+	+
11.Grass pea	+		+	+	+	+
12.Common pea/Pea type	+	+	+	+	+	+
13.Black gram			+	+	+	+
14.Green gram			+	+	+	+
15.Black gram/Green gram type		+	+	+	+	+
16.Gram					+	+
17.Medicago	+	+	+			
18.Acacia						
Oil seeds-						
19.Brassicaceae type	+					
20.Sesame type	+			+		
Fruit types-						
21.Cucurbitaceae type		+				
22.Indeterminate endocarp			+			
23.Persimmon (Indian ebony)	+			+		
24.Indian jujube		+	+			+
Hydrophytes-						
25.Cyperaceae type			+	+		
Weeds/ Wild types-						
26.Papaveraceae type			+	+		
27.Chenopodiaceae type	+	+	+	+	+	+
28.Lady's finger type						
29.Solanaceae type	+					
30.Trianthema type					+	
31.Indeterm[illegible]			+			
[illegible] various types					+	+
31.Cassia type						+
Others-						
32.Tiny coprolites						
33.Coprolites of sheep/goat					+	

PALAEOFAECES FROM A BRONZE AGE BOGSITE IN ITALY, FIAVE-CARERA

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The identification of goat/sheep excrement was possible during an archaeological excavation at Fiavé-Carera in 1993. The cultural layers of this particular site are preserved very well, and consist of many different findings that were described as "ethnofacies".

An international team of two archaeologists, one sedimentologist, two palaeoethnobotanists and one archaeozoologist took samples of selected ethnofacies for microscopic and chemical analysis in order to get as much information as possible about their compositions. After the sampling, the remaining enthnofacies were sieved during the excavation with a sieve of 2 mm mesh size. The organic remains were described and semi quantitatively recorded by the author. Remarkable finds such as entire faeces, mushrooms were sampled separately. The animal excrement was found embedded in an organic matrix that consisted of short twig fragments and many different seeds and vegetative plant material. We took 50 twigs out of the sieved material in order to determine the wood species, as well as to count and describe the growth rings. The identification of all plant remains from the matrix will be compared with the seeds, pollen and wood fragments in the faeces themselves. The aim of this study is to get information about the composition of the animal fodder and to reconstruct the exploitation of the environment in the Bronze Age site Fiavé-Carera, Zone 4.

EVIDENCE FOR THE THREE-FIELD ROTATION SYSTEM FROM CARBONISED WEEDS FOUND IN MEDIEVAL GRAIN STORES FROM SWITZERLAND

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Weed assemblages from late medieval cornfields have been studied for the first time in northern Switzerland. Eleven samples from at least two different grain stores were investigated. The samples were collected from the carbonised remains of six wooden houses built in the late 13th century A.D. and which burnt down in the middle of the 15th century. The weed floras found in the spelt (*Triticum spelta*) and oats (*Avena sativa*) indicate a high botanical diversity in the cornfields at harvest time. Although oats are normally a summer crop and spelt a winter crop, both summer and winter crop weeds (as well as many different present-day grassland taxa) were found in each type of grain. Most of the weeds found were perennial plants, which was interpreted as an indication of both extensive tillage of the arable land and application of the three-field rotation system (Dreifelderwirtschaft). The spectra of the two palaeophytocoenoses (assemblages of ancient plant remains) studied suggest that the phytosociological method may not be reliable for classification of the late medieval remains into "summer" and "winter" crop weed communities. These findings should provide a better understanding of the development of anthropogenic plant communities, and in particular, the development of crop weed communities.

ARCHAEOBOTANICAL REMAINS FROM AN EARLY BRONZE AGE HOUSE IN THY, DENMARK.

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The Thy Archaeological Project (TAP) is an international research project coordinated by the University of California, Los Angeles; University College, London; and the Danish Ministry of the Environment. TAP, which has excavated several Late Neolithic and Early Bronze Age sites, is concerned with investigating the development of social stratificating during this time period. I will present the macrobotanical remains from the site of Bjerre Enge, a house excavated in 1993 and 1994, which is dated to the Early Bronze Age.

Bjørre is located on an elevated sea bed near the coast in NW Thy. Botanical samples were taken from several contexts, including pits inside and outside the house, floor layers and other cultural layers inside the house, and two cultural layers outside the house. The different types of remains found in these contexts which allows some conclusions concerning the economy of the site to be drawn.

The macrobotanical remains are some of the first Early Bronze Age finds in Denmark. Several types of wheat (emmer, spelt, and bread wheat), barley (both naked and hulled), and a wide array of weed seeds were identified, including many Caperaceae. One of the most interesting finds is that of *Asparagus officinalis* L., which has never been found archaeobotanically in such northerly regions at such an early date.

PROGRESS IN THE COMPUTERIZED KEY OF GRASS SPECIES.

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Since the symposium in Kiel (1991), the computerized key of grass grains has been greatly improved. Among the advances are a significant increase in the number of samples and species on which the data is based, a greater number of grain characters are now available to pin point identifications, and grass species from additional countries are now included in the key -from the Persian Gulf to Crete and Libya. This last point means that the key can now routinely be used by anybody who needs assistance in grass identification. Use of the computerized key will be demonstrated during the conference.

The Gramineae were chosen for the key because of its importance, the large number of species, and the difficulty of identifiying samples. The aims and principles underlying the key are: 1. More rapid identifications. 2. More reliable identifications. 3. Inclusion of all local grass species. 4. Use of all avialable morphological characters. 5. No general requirement to achieve absolute identification, but rather to limit the choice among a few species. 6. With only a few candidates, final identification is easy by using a reference collection.

Future plans include: 1. Extending the geographical range of the key to include the Balkans and Italy and then Mediterranean France and the Iberian peninsula. 2. Increasing the reliability of the key. (It seems in this stage that the search for new varieties having grains with odd dimensions or shape characters is more important than just increasing sample numbers for each species.). 3. Increasing the number of weed samples to benefit those who need help in extent grain identifications.

We hope that the key will open a new era in archaeobotany - computerized help in grain identification.

BEITRAG ZUR GESCHICHTE DER GRÜNLANDVEGETATION AM NIEDERRHEIN.

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Im 1000 qkm großen niederrheinischen Tiefland sind von den heutigen 260 Grünlandpflanzenarten 142 durch subfossile Reste nachgewiesen worden. Bei Berücksichtigung der Erstfunddaten zeigt sich, daß die Einwanderung in vier Schüben erfolgte.

Ihnen entsprechen vier entscheidende Entwicklungsschritte in der Bewirtschaftung des Grünlandes.

1. Bandkeramikzeit (6. Jt.v.Chr.)
   Beweidung durch Schafe und Ziegen auf siedlungsnahen unbestatteten Mager- und Feuchtrasen. 40 subfossile Gründlandpflanzenfunde, darunter 13 Arten von Magerrasen (Sedo-Scleranthetea). Waldweide von Rindern und Schweinen (Transhumanz).

2. Eisenzeit (800 v.Chr. - Chr.Geb.)
   Wegen Klimaverschlechterung und Zunahme der Besiedlungsdichte Standweiden für Rinder in Siedlungsdichte. Aufstallung im Winter. Entstehung von Pflanzengesellschaften der Viehweiden (Cynosurion). 21 neue Grünlandpflanzenarten.

3. Römerzeit (1.-4. Jh.n.Chr.)
   Ausweitung der Viehhaltung für den Truppenbedarf. Große Viehweiden in der Rheinaue. Dort auch erste einschürige Schnittwiesen zur Gewinnung von Winterheu. 52 neue Grünlandpflanzenarten, darunter 13 Arten von Kalk-Magerrasen (Mesobromion erecti).

4. Mittelalter und frühe Neuzeit (6.-18. Jh.n.Chr.)
   Ab Hochmittelalter nicht beweidete, zweischürige Schnittwiesen (Molinio-Arrhenatheretea). Ausweitung des Grünlandes. 12 neue Grünlandpflanzenarten.

Zwei vorneolithische Fundplätze liefern Beiträge zur Frage nach der Herkunft der Grünlandpflanzen:

1. Präboreale Ablagerungen in der Erftaue (9. Jt.v.Chr.) enthalten Reste von 11 Grünlandpflanzenarten.
2. Allerödzeitliche Gewässerabsätze im Rheinalluvium (11. Jt.v.Chr.) enthalten Spuren von 32 Gründlandpflanzenarten, darunter mehrere der heutigen Fettwiesen (Molinio-Arrhenatheretea).

BORDERLAND FARMING: FARMING ACTIVITIES DURING THE ROMAN PERIOD AND THE DARK AGES IN THE CENTRAL RIVER AREA IN THE NETHERLANDS

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The Central River Area is situated in the central part of the Netherlands, just south of the city of Utrecht. It is bordered by the River Lek in the south, by the River Rhine in the northeast and by extensive peat lands of the coastal area in the west.

Before men built dikes (before the eleventh century) this area was dominated by rivers. In the Roman Period and the Dark Ages big stream ridges were the only parts of the landscape suited for habitation. During the Roman Period, habitation on the smaller ones in the south became endangered by the increased activities of the River Lek. The River Rhine constituted the northern border of the Roman Empire. In the Dark Ages the frisian and frankish people battled along this river. The people in this area lived on the edge of the natural possibilities and at the borders of different empires.

Three central questions in my study were: What kind of food was eaten? What were the possibilities of arable farming? What kind of farming activities played a role?

The study proved that the stream ridges did not have natural forest any more. Parts of the fluvial basin areas had lost their natural vegetation as well. The people of the river area were indeed farmers. They produced *Hordeum vulgare* ssp. *vulgare*, *Triticum dicoccum* and *Avena sativa*. Their arable lands, as well as part of the meadows, were situated on the stream ridges. The remaining part of their meadows was situated in the fluvial basin areas.

In the late Roman Period the farmers in the vicinity of Houten produced their cereals by a 2-year rotation. One year the land lay fallow, the following year it was used as arable land.

An important question was, whether any differences existed in farming activities between the Roman Period and the Dark Ages. In the botanical macroremains I did not find any, so I used one of the multivariate statistical analyses: Canonical Correspondense Analysis. These tests did not reveal any differences either. Therefore, the conclusion can be drawn that in spite of, or perhaps because of, the dynamic situations in this river area during the first eight centuries AD, farming remained largely unchanged.

WHEAT VARIATION - FROM PALAEOBOTANY TO MOLECULAR BIOLOGY

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PALAEOBOTANY. It is possible to recognize the morphology of spike, spikelet, glume and grain using fossil materials. Up to now a wide spectrum of wheats, from *Triticum monococcum* to *T. vulgare*, was identified from various locations and periods. There were described new wheats, *antiquorum, parvicoccum* and lately *sphaerococcoid* form from Portugal. Such reports reveal difficulties relating to the interpretation of morphology and taxonomic classification. Flaksberger's ecological description of wheats can supplement a conclusion on spike morphology and internal structure of charred grain (compare differences between, e.g. proles *hygrophilum* and *hungaricum*).

MICROMORPHOLOGY. ***Lodicules*** (for the genus *Triticum*) - in PCA diagram the wheats: *georgicum, sphaerococcum,* diploids, *macha,* AAGG ones and *ispahanicum* are extremes. ***Embryo*** (for hexaploids) - *sphaerococcum* and *spelta* are extremes in PCA analysis. There is here a distinct differentiation between the *spelta* with tough rachis (it is close to *vulgare*) and another one with fragile rachis (close to *macha*). The distance between *compactum* and *sphaerococcum* is large when embryo morphology is used for comparison. ***Morphology of embryo and caryopsis anatomy*** (for di- and tetraploids) - a distinct discrimination of AAGG wheats, threshable and unthreshable AABB wheats is evidenced by the dendrite. Diploids are close to *armeniacum, georgicum* and *dicoccoides* when two best discriminants (width of scutellum and length of coleoptile) were used for a description. *Ispahanicum, dicoccum* and *durum* are distant from diploids. ***Epidermis of glumes*** - width of the lemma long cells, the palea and lemma papilla diameters as well as the amplitude of the sinusoid wall correlate positively with the level of ploidy. *Sphaerococcum, compactum* and *durum* are well discriminated by means of qualitative differences in the structure of palea (pits of papilla, short cell shapes in abaxial epidermis, thickness of sinusoid wall).

MOLECULAR BIOLOGY. Variation in repeated nucleotide sequences reveals less similarity of AABB and AABBDD wheats to *Ae. speltoides* than it is found for AAGG wheats. This can evidence an archaism of AABB ones (Dvorak and Zhang 1990). There was established an origin of the genome A from *T. urartu. In situ* hybridization of the genomic DNA shows considerable homology between the genomes, A and B. An analysis of intergeneric hybrids presents a spatial separation of both genomes and it can be a reason of their different expression with consequences to plant morphology. Wheat variation is increased by numerous translocations between both genomes. There exists an opinion that translocations are different in the *timopheevi* and *turgidum* lineages. This may prove a diphyletic origin of both groups.

PLANT REMAINS FROM CELTIC; GERMANIC AND ROMAN SITES IN HESSEN, GERMANY: SIGNS FOR CONTINUITY OF DISCONTINUITY, SHORTAGE OR SURPLUS?

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During the iron age and roman period Hessen was to some extent a "transit area" for important trade routes and military campaigns passed through the fertile landscapes of its lowland-zone. This historical situation is in contrast to the state of research, as surprisingly little is known about the cultural and other processes which took place, and which in the end were responsible for the formation of the archaeological and archaeobotanical record. As part of a research programm, "Kelten, Germanen, Römer im Mittelgebirgsraum zwischen Luxemburg und Thüringen. Archäologische und naturwissenschaftliche Forschungen zum Kulturwandel unter der Einwirkung Roms in den Jahrhunderten um Christi Geburt", investigations of botanical macroremains from archaeological sites in Hessen and Mainfranken have been launched to analyze the rural economy and its ecological basis. Financial support is provided by the German Research Association (DFG). Some preliminary results will be presented and considered in a supraregional context.

ZUM RÜCKGANG DER WINTERGETREIDE-UNKRAUTFLORA VON FEUDVAR, VOJVODINA

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Beim Dorf Mosorin, Vojvodina, liegt die vorgeschichtliche Siedlung Feudvar am nordöstlichen Rand des Lößplateaus von Titel, das sich etwa 40 m hoch über die Flußebenen von Theiß und Donau erhebt. In dieser Siedlung, die von der frühen Bronzezeit bis in die Eisenzeit bestanden hat, fanden in den Jahren 1986-1988 und im Jahre 1990 jeweils im Hoch- und Spätsommer Ausgrabungen statt, geleitet von Prof. Dr. B. Hänsel, Freie Universität Berlin, und von Dr. P. Medovic, Vojvodina-Museum Novi Sad.

Die Pflanzenfunde aus diesen Grabungen stammen aus 2.204 Proben, jeweils etwa 10 l Ausgangsmaterial umfassend, mit insgesamt 1.197.483 Pflanzenresten. Ohne einen *Chenopodium polyspermum*-Massenfund machen die Unkräuter 13 % des Fundgutes aus. Typische Wintergetreide-Unkräuter wie *Bupleurum rotundifolium*, *Glaucium corniculatum*, *Sherardia arvensis*, *Conringia orientalis*, *Thymelaea passerina* und *Consolida regia* als Beispiele werden zum Jüngeren seltener. Dieser Rückgang einer charakteristischen Unkrautflora, die in Feudvar das *Einkorn Triticum monococcum* begleitet, muß Gründe haben, die vermutlich in der Bewirtschaftung der Äcker liegen. Den entscheidenden Grund für diese Änderung wird man in der Fruchtfolge suchen müssen: Im jüngeren Teil der Besiedlungszeit gibt es sehr viel Hirse *Panicum miliaceum*, die als extremes Sommergetreide den bisherigen Anbaurhythmus durcheinanderbringt. Doch auch vorher gab es etliche Sommerfrüchte, sowohl unter den Getreiden, als auch bei den Hülsenfrüchten und der Ölsaat.

POSSIBLE EVIDENCE FOR USE OF PLANT FOODS IN PALAEOLITHIC AND MESOLITHIC DIET, THE CALOWANIE SITE IN THE CENTRAL PART OF THE POLISH PLAIN.

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The charred remains of vegetative parenchymous organs, roots and tubers, as well as few charred fruit remains (berries?) have been studied from the Germinal Palaeolithic and early Mesolithic site at Calowanie, in the central part of Polish Plain. The Calowanie site is an alluvial and dune island deposited in the huge fossil Vistula valley that was cut in the early Alleröd. The island is surrounded by alluvial and biogenic sediments.
Botanical samples were recovered from occupational layers associated with biogenic sediments (peat trench):
samples from Terminal Palaeolithic layer containing charcoal with radiocarbon determination of 10455+/-90 and 9700+/-80 PB (Younger Dryas) and charred vegetative parenchyma fragments derived from:
- Alisma/Sagittaria tuber
- Ranunculus ficaria tuber (also uncharred speciments)
- Gramineae tuber

samples from early Mesolithic layer containing charcoal with radiocarbon determination of 9410+/-110 and 9200+/-75 BP (late Preboreal and early Boreal) and charred vegetative parenchyma fragments derived from:
- Polygonaceae tuber/stem fragment
- Ranunculus ficaria tuber (uncharred speciments)

These identifications are based on the anatomy of charred vegetative parenchymatous tissues.
Plant material from this site indicates that plant foods, including vegetative storage organs, also played a possibly significant role in the diet and subistence strategies of European hunter-gatherers during the late Pleistocene and early Holocene. It seems also, that plant gathering came to be based on edible roots and other underground parts - rhizomes, tubers rather than on small seeds.
The data presented is a result of research carried out jointly with Dr. Jon Hather from the Institute of Archaeology, University College London.

UNTERSUCHUNGEN MITTELALTERLICHER PFLANZENFUNDE AUS DER ALTSTADT VON OLDENBURG/NIEDERSACHSEN.

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Mit Verleihung des Bremer Stadtrechts am 6. Januar 1345 wurde Oldenburg im Rechtssinne zur Stadt. Erstmals hat man jetzt - im Rahmen von Notgrabungen des Instituts für Denkmalpflege - im Markthallenviertel der Altstadt in Oldenburg mittelalterliches und frühneuzeitliches Pflanzenmaterial geborgen. Zahlreiche Gruben, Brunnen und Kloaken liefern botanische Reste in hervorragender Erhaltung. Ein großer Vorteil bei diesen Funden bietet die Tatsache, daß es sich hier um verkohltes und unverkohltes Material handelt. Die verkohlten Reste geben ein zuverlässiges Bild über den Getreide- und Hülsenfrüchteanbau, dagegen liefern die unverkohlten Reste ein reiches botanisches Material mit einem breiten Artenspektrum, von Gartenfrüchten, Obst und Nüssen bis hin zu zahlreichen Sammel- und Wildpflanzen.
Die Ergebnisse der botanischen Analyse zeigen, daß es sich hier um die Abfallreste der Nahrung der wohlhabenden städtischen Oberschicht handelt, mit abwechslungsreicher Kost, wobei neben einheimischen Lebensmitteln auch ausländische teuere Luxusgüter importiert wurden. Die Untersuchung liefert damit eine Reihe von Erkenntnissen über weitreichende Handelsbeziehungen, aber auch über die eigene Landwirtschaft der gräflichen Stadt Oldenburg.

(Tabelle im Anhang!!!!!)

Bisher nachgewiesene genutzte Arten in den Oldenburg-Proben (13. - 18. Jhdt. n. Chr.)
(Utilised species from Oldenburg samples (13. - 18. century AD), recorded up to now)

	verkohlt			unverkohlt						
Alter	15. Jh.	13./14. Jh.	14. Jh.	14./15. Jh.	15. Jh.	15./16. Jh.	16. Jh.	17. Jh.	17./18. Jh.	sp. MA
Getreide										
Avena fatua	39									
Avena sativa Spelzenbasen		124			210	38	67	6		36
Avena sativa	583									
Avena cf. strigosa	10									
Hordeum vulgare	4254		4*		2*	1*				
Hordeum vulgare Spindelglied	1				1					1
Hordeum nudum		2*								
Oryza sativa					2		3			
Panicum miliaceum		3			18	1	7	4		6
Secale cereale		1*					1*			
Triticum dicoccon	2									
Weitere Mehlfrüchte										
Fagopyrum esculentum					4		1	2		5
Leguminosen										
Vicia faba verkohlt	1									
Vicia sativa verkohlt	53									
Öl- u. Faserpflanzen										
Linum usitatissimum Kapsel		3			8	1	2	10		2
Linum usitatissimum Samen		5			10	3	5	6		5
Papaver somniferum		436			107	41	73	1		275
Obst und Nüsse										
Amygdalus communis Brst.		1								
Cydonia oblonga						18	9			
Corylus avellana		4			3	1	1			
Fagus sylvatica										
Ficus carica		530	1		4472	1004	1156	355	1053	609
Fragaria vesca		5			15	1	2	1		233
Juglans regia					1					
Malus domestica Kerne		235			99	119	54	10		23
Malus domestica Kerngehäuschrst.		1741			442	215	195	44		174
Mespilus germanica		8			5					
Morus nigra							35	2	1	1
Prunus avium		1					23			
Prunus cerasus		333			32	10	38	1		
Prunus domestica / insititia		16			17	16	49 + 32*		3	
Prunus spinosa		186			18	20	45			-
Pyrus communis		74			32	45	40	3		1
Rubus fruticosus		159		16	892	141	248	12	438	12
Rubus idaeus		2		43	95	11	10	1	2	6
Sambucus nigra					5	3	2	21	21	
Vaccinium myrtillus		144	1		1194	1725	1696	14		1332
Vitis vinifera		25			182	54	405	4	37	39
Gewürze und Gemüse										
Aframomum melegueta					3			1		
Anethum graveolens		3			2	1		2		
Apium graveolens		20			3	4	1	1		5
Beta vulgaris		6			1					
Coriandrum sativum Kapsel					15	1	3		1	1
Humulus lupulus		11			16	9	9	1		11
Lactuca sativa							1			
Myrica gale		16			1	2	184			1
Petroselinum sativa		3			2		1			
Piper nigrum		11			12		1			1
Portulaca oleracea						1				
Raphanus sativus		8			3					1
Valerianella dentata										

* verkohlt

* Prunus domestica mit Fruchtfleisch verkohlt 32 Stück

CARBONIZED SEEDS AND FRUITS FROM PITS IN THE MEDIEVAL RURAL SETTLEMENT LAUSEN-BETTENACH (6TH TO 13TH CENTURY AD), KANTON BASELLAND (SWITZERLAND)

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This research is integrated into a project of the foundation MGU (Mensch - Gesellschaft - Umwelt) from Kanton Baselland titled "Plants for food and other human use from the Medieval period to the Post-medieval period in the area of Basel". The project direction is carried out by the historian Dorothee Rippmann, "Forschungsstelle Baselbieter Geschichte" in Liestal (Switzerland) and Stefanie Jacomet, Laboratory of Archaeobotany at the Botanical Institute, University of Basel.
Until now an archaeobotanical research of a medieval rural settlement in Switzerland was not possible because up to now no archaeological site like this was found. With the results of this investigation we hope to get more informations about eating habits, farming practices and environment of the inhabitants of medieval settlements in the Northwest of Switzerland. In addition we expect to make a contribution to the development history of the cultural landscape in the Medieval period. The continuity of this settlement from the 6th to the 13th century is a good condition to get the fitting information.
In the poster first results of the investigation of pits with different age will be presented.

PLANT COMMUNITIES - DO THEY HAVE A HISTORY?

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Since the Neolithic, the number of different stands and plant species was enlarged by anthropogenic activity. In the traditional cultural landscape a maximum of different stands can be seen and classified by plant sociology. Relevees are made in the actual vegetation, and they are classified by grouping them to types of the syntaxa, the names of plant communities. It is not only important to list the species names but also to estimate the frequency of taxa.

It is often attempted to examine the history of plant communities or of syntaxa. But it is very difficult to do this in archaeobotany. By looking at plant materials from ancient sites we list a more or less complete ancient flora, but we do not examine a vegetation. We do not know, whether plant remains which we find derive from plants which grew on the same stand. And it is hardly possible to group a single plant species to one type of a recent plant community as there are many plant species which can grow in several different formations, as e.g. *Lapsana communis*.

The plant community in its present state is situated inside a continuum of development - and this is its history. We cannot describe this history by names of recent syntaxa which did not exist in the past.

POLLEN, FRUITS AND SEEDS FROM CULTURAL LAYERS OF THE EARLY MEDIEVAL PORT OF WOLIN (NW POLAND)

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During the development of the early medieval (9-11th century A.D.) port of Wolin the thick peaty deposit has been formed at the port wharf. The archaeobotanical investigations including analysis of fossil fruits and seeds as well as pollen indicate its complex origin. The very rich fossil flora consists of elements of the natural vegetation typical for river banks and of various anthropogenic communities. The allochtonous component is of importance and reflects different human activities.

The pollen analysis from the port deposits gives valuable information on some taxa (e.g. cereals) which are scarcely represented in macrofossils. It is worthy of note that in the pollen diagram from archaeological layers, similarly as in the pollen profiles from natural sites on Wolin Island, pollen curve of *Secale* is not higher than those of other cereals, which probably indicates its minor role among the crops. Generally, however, the characteristic feature of the material analyzed so far, is a very bad correlation between pollen and macrofossil content. Pollen spectra reflect mostly vegetation from the surroundings of the town, while macrofossil assemblages have been shaped locally, and contain mainly remnants coming due to various means of human transport.

The archaeobotanical data supplemented by the information deriving from the pollen analysis of the profile from the nearby mire enabled reconstruction of some elements of the natural conditions and economy during activity of the early medieval town and port of Wolin.

PREHISTORIC-MEDIEVAL CULTIVATION IN FINLAND ARCHAEOBOTANICAL EVIDENCES OF THE CULTIVATED CEREALS.

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The present paper is a summary of the archaeobotanical evidences of the cultivated cereals in Finland covering fifty published investigations and also unpublished material of the author. The macrofossil grain material is dated to from the Stone Age to the Late Middle Ages and consists of over 6000 grain finds.

The oldest cereal grain find in Finland, *Hordeum vulgare* var. *nudum*, comes from Turku, Niuskala and was dated to 3620-3260 B.P. During the first millenium B.C. the Finns cultivated in SW Finland hulled and naked barley (*Hordeum vulgare*, *H.vulgare* var *nudum*), rye (*Secale cereale*), emmer wheat (*Triticum dicoccum*) and *Triticum compactum*. In the first millenium A.D. they cultivated, besides the above mentioned, also *Hordeum vulgare* f. *tetrastichum*, *Triticum spelta*, *T. aestivum* and *Avena sativa*. In the Middle Ages the number of cultivated cereal species was more limited. Remnants of only *Hordeum vulgare* var. *nudum*, *Hordeum vulgare* f. *tetrastichum*, *Secale cereale*, *Triticum compactum*, *Triticum aestivum* and *Avena sative* were found.

STUDY OF FOOD PLANT OFFERINGS IN THE GALLO-ROMAN BURIALS.

MARINVAL Philippe (CNRS, Toulouse - France)

This contribution is a synthesis of palaeoethnobotanical data supplied by plant food offerings from Gallo-roman funerary contexte.

All of Gaul is studied and 40 sites are presented (see picture).

A study is made of the species, the reasons for these gestures, and the religious symbols of these plants.

Comparisons are established with earlier data (celtic and Greek), together with contemporary data from Italy or other roman provinces.

A STUDY OF THE CARBONIZED SEEDSOF A LA TENE D1 RURAL SETTLEMENT, EXCAVATION "LE CAMP DU ROI" AT JAUX (OISE) FRANCE.

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The large-scale excavation (4 ha) of a Celtic Farm dating to the Final la Tène period and situated on the plateau overlooking the River Oise was carried out by the archaeologists F. Malrain and M. Talon, in the spring of 1993. 50% of the site was exhaustively explored, revealing about sixty structures, 95% of the material was discovered in ditches.
Archaeobotanical material in a exceptional state of conservation was found on this site: a pile of carbonized seeds from a six-pole granary which collapsed after a fire, its contents ending up partly on the ground but mostly in the adjacent border ditch. The cultural layer of 40 cm was excavated in layers of 10 cm each, and systematic samples were taken every quarter square meter. Large quantities of two graintypes were identified: Emmer (*Triticum dicoccum*) and hulled Barley (*hordeum vulgare*).
After analysis of all the systematic samples, it was found that a clear distinction could be made in the places where the two species were found. This leads us to assume that these crops were stored in separate heaps in the storage structure. Apart from in the granary, seeds were also found in a oven, dating to the same period, as well as in a ditch workshop where querns fragments were also discovered.
Several observations can be made from the fact that the plant spectrum is similar in the different structures:
Although the occupation dates to one short period (about 30 years), it does not follow that the activities in the different structures were contemporaneous.
Although these structures were probably not strictly contemporaneous, analysis shows that the plant material always had the same composition.
It could be concluded therefore that successive harvests always comprised of the same plant spectrum.
The destruction of the harvest leaves a further problem to be solved: it appears that the fire was caused deliberately by the inhabitants and was followed by a permanent abandonment of the site.

ARCHAEOBOTANICAL EVIDENCE FOR WILD GRAPE FROM ISRAEL.

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Dozens of subfossil pips of the wild grape *Vitis sylvestris* were identified at Gesher Benot Ya'aqov, Israel. The pips show considerable diversity in shape - from round corpus with small beak to long corpus with large beak. The same diversity can be shown in fresh pips of *V. sylvestris*.
Gesher Benot Ya'aqov is situated on the eastern bank of the Jordan River. The site, dated between 730 and 240 kyr, contains Asheulian artifacts and Middle Pleistocene fossils. The pips were found in most of the site layers. *Vitis sylvestris*, the wild ancestor of cultivated *V. vinifira*, is a perennial climber, growing especially in humid habitats such as riparian forests. The wild grape is widely distributed from the Atlantic coast in France to western Himalayas. It is extended to moist niches of the Mediterranean maquis, including the Jurdan tributaries.
Geologists report that the main geomorphological event in the valley near the site during Middle Pleistocene was the formation of the Korasim saddle, which prevented free water flow to the south and turned the valley into a lake. Moreover, the rivers flowing to the lake formed deltas near its hores. For this reason, it could be assumed that part of the vegetation near this lake was a riparian forest that included wild grape. This belief is strengthened by the fact that vegetative wood from elements that built it, which include trees such as *Quercus*, *Fraxinus* and *Salix*, was found at the site.
Additional, single finds of wild grape pips from Kebara (60-50 kyr), Ohalo II (19 kyr) and Netiv Hagdud (10 kyr) may bridge the gap between Gesher Benot Ya'aqov finds and the first cultivated grape vines. The earliest sings of viticulture come from the near Eastern and Aegean Early Bronze Age. Therefore, it is suggested, that the origin of viticulture could be in the Levant, or that the domestication there was concomitant with other regions.

SOME ASPECTS OF THE PALAEOETHNOBOTANY OF OAKBANK CRANNOG, LOCH TAY, SCOTLAND.

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Oakbank crannog is the only lake dwelling in Britain to have undergone extensive excavation while still submerged to a depth of 3-4 m. The cold, oligotrophic loch waters have assisted in the remarkable preservation of the site, dated 460±60bc [GU 1325] and 595±55bc [GU 1323] from 2 structural timbers. Archaeobotanical analysis of organic detritus has disclosed several aspects of everyday life within an early Iron Age household. Mixed farming is indicated, with *Triticum spelta*, *Hordeum* species, and *Linum usitatissimum* in cultivation. *Papaver somniferum* and *Petroselinum crispum* are noteworthy in their occurrence. Gathered wild fruits include *Rubus*, *Prunus* and *Corylus* species. *Rubus chamaemorus* implies long range, high altitude travel, possibly for herding purposes. Macro and microscopic analysis of sheep/ goat droppings may supply further information on animal husbandry.

SIMILARITIES AND DIFFERENCES BETWEEN THE FAECES OF CATTLE AND HORSES BASED ON THEIR CONTENT OF MACROSCOPIC PLANT REMAINS

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Finds of faeces of domesticated animals (cattle and horses) are commonly reported from archaeological excavations. However it has not been possible to find detailed descriptions of the macrofossil content which make it possible to differentiate between faeces of the two species.

As part of an experimental research project, faeces have been collected from horses and cattle which have either grazed, or been fed with hay from, the same vegetation types.

It is hope to use the results arising from the project in the interpretation of archaeobotanical samples.

PLANT REMAINS FROM THE ENEOLITHIC TELL AT PODURI, ROMANIA.

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Tell at Poduri represents one of the most significant eneolithic sites of South-East Europe. Placed in the saliferous region of the Modavian Club-Carpathians, the Tell Poduri evidences an archaeological deposit thicker than 4.5 m, containing 11 levels of charred dwellings places. The oldest level belongs to the late PreCucuteni II-phase (c. 4800 B.C.) while the most recent - to the Cucuteni B phase (c. 3600 B.C.).

Starting with 1979, emple and systematic excavations have been initiated, in parallels with palaeo-ethnobotanical investigations for the vegetal macrorests. Out of the numerous interesting situations encountered during the excavations, mention should be made only of the discovery of a building with 11 food containers and storage vessels, a building with five grinding mills and four clay silos with a capacity of over half a cubic metre, in which an appreciable (30 kg amount of charred wheat and barley has been discovered).

In the samples colleced, 18 species of plants with alimentar value have been determined, namely: 3 species of *Rosaceae*, a *Cornaceae* species, a *Betulaceae* species, 3 Leguminosae and 10 *Gramineae* species, respectively. Among the wild and weedy plants, 12 species, belonging to the *Chenopodiaceae, Cruciferae, Polygonaceae, Rubiaceae* and *Gramineae* families have been identified. Analysis of the fingerprints found on the adobe permitted the identification of the species: *Tilia platyphyllos*, *Coryllus avellana* and *Phragmites australis*. Up to now, the tell at Poduri offers the most complete floristic list of all eneolithic sites in South-East Europe.

ARE CHENOPODIACEAE TRUELY SYNANTHROPIC IN CENTRAL-NORTH EUROPE?

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The *Chenopodiaceae* family has been chosen for the importance of its pollen and seeds as environmental indicator, but a purely comparative approach between modern phytocoenoses and late-Holocene records would be dangerous as any analogy fixed in advance is subjective. To outflank the difficulties of recognizing indicator-species the phytosociological method is the only tool to offer a wide point-of-view. In order to investigate dynamism and further evolution of man-made landscapes, the sigmatistic approach as defined by the European Vegetation Survey was integrated with palaeoethnobotanical published data. The aim of this research is to check the relationships between the presence of *Chenopodiaceae* in archaeological sites from Mesolithic to Middle Ages and their modern gravitation centres in Europe (still unknown for *Spinacia*, which was omitted). A review was already given for *Beta* L. by SCHÜLTZE-MOTEL (*Kulturpflanze* **20-37**, 1972-89; *Veget. Hist. Archaeobot.* **1-3**, 1992-94) and for *Atriplex* L. and *Chenopodium* L. by WILLERDING (*Göttinger Schriften zur Vor- und Frühgeschichte* **22**, 1986). The temporal variations have been analysed applying a modified van der Maarel scale to a carpological reference matrix for the following taxa: *Atriplex acuminata* Waldst. & Kit. / *A. hortensis* L, *A. littoralis* L. / *A. prostrata* Boucher ex DC., *A. oblongifolia* Waldst. & Kit. *A. patula* L., *Beta vulgaris* L. + *B. maritima* L., *Blitum capitatum* L., *Chenopodium album* L., *Ch. bonus-henricus* L., *Ch. botrys* L., *Ch. ficifolium* SM., *Ch. hybridum* L., *Ch. murale* L., *Ch. opulifolium Schrader* ex Koch & Ziz, *Ch. polyspermum* L., *Ch. rubrum* L., *Ch. glaucum* L., *Ch. suecicum* J. Murr., *Ch. urbicum* L., *Ch. vulvaria* L., *Salicornia europaea* L. + *S. dolichostachya* Moss and *Suaeda maritima* (L.) Dumort. The SYNTAX 5.0 program (J. Podani 1993) was used for different multivariate analyses of these 25 specimens on 274 sites: all the results obtained allow to state that the synanthropism of these crucial taxa at least during the whole prehistory and protohistory north of the Alps was rather weak. Ranges of variations in the specimens suggest a major influence of ecological constraints and geographical gradients at population level. Migrationism has often been invoked as framework to explain a wide range of spatial patterns related to both biogeographical and cultural processes. Many Irano-Turanian taxa have to be assumed as largely shifted westwards during the glacial periods, when they presumably reached the Mediterraenan and the Atlantic sandy coasts. The present-day Euro-Mediterranean florula and the spatial patterns let agree that the use of the term *Chenopodiaceae* Ventenat strictly for *Cyclolobeae* (so as proposed on taxonomical arguments by SCOTT, *Taxon* **26**, 246, 1977) would be more convenient as plants often correlated with less man-induced desertification processes (like *Salsola* and *Suaeda*) belong to *Spirolobeae*. Nevertheless it seems uncorrect to associate always a "Steppenheide" vegetation type to their presence: thus *Chenopodiaceae*-rich communities bear evidence of characteristics of naturality, and not limited to a subdesertic-halophytic plant cover.

ANIMAL DUNG AND SEED TAPHONOMY: A CASE STUDY FROM EASTERN TURKEY

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Naomi Miller and others have drawn attention to the burning of animal dung fuel (Turkish: *tezek*) as a source for charred seeds in the archaeological record. I will address two major questions. Firstly, how can we identify dung-derived assemblages in the archaeological record? Archaeobotanical samples from the Early Bronze Age of Dilkaya Höyük, on the shores of Lake Van in eastern Turkey, contain large quantities of chaff and grain from free-threshing wheat and two-row hulled barley and weed seeds of marshland plants, as well as dung fragments. Do all the plant remains derive from dung, or has mixing of seeds from different sources taken place? Secondly, in the light of recently completed archaeobotanical analyses from the Near East, can we assess the importance was dung fuel in antiquity? Is there patterning in its use, especially in relation to the distribution of woodland?

ARCHAEOBOTANY AND LATE HOLOCENE VEGETATION HISTORY IN BURKINA FASO AND NIGERIA

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In the interdisciplinary project "Cultural development and language history in the West African savanna" (University of Frankfurt, Germany), an archaeobotanical subproject was established to investigate Holocene vegetation history and subsistence strategies in the savanna regions of Burkina Faso and Nigeria. In the project period 1994-1996 research concentrates on the Sahel in northern Burkina Faso and on the Lake Chad area in Borno State, northeastern Nigeria. The studies on vegetation history and archaeobotany are conducted in a combination of pollen analysis and the identification of charcoal, fruits and seeds.

In Burkina Faso, the pollen diagram from Oursi shows that a closed grassland was opened up and partly transformed into fields and fallow lands from 3000 bp onwards. At Kursakata, NE Nigeria, there is evidence for cultivation of *Pennisetum* and for an extensive use of wild plants after 3000 bp. Both in Burkina Faso and in Nigeria, wild fruits (*Celtis integrifolia*, *Ziziphus* sp. and *Vitex* sp.) seem to have been used on a larger scale.

The synchronous results from Burkina Faso and Nigeria indicate that there was no food production in the Sahel prior to 3000 bp. Further research must show if the domestication of pearl millet was an independent invention or if it was introduced, like cattle, from the Sahara. Neither in Burkina Faso nor in Nigeria there is any archaeobotanical evidence for climatic fluctuations after 3000 bp. This does not mean that the climate has remained the same for a time span of 3000 years. Rather we might say that human impact has become so strong that its effects are masking any possible influence of climatic change on the vegetation.

DENDROLOGICAL ANALYSES OF THE ICEMAN

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When the Iceman was discovered on the head of a glacier in the mountains of the Ötz valley in 1991, it was the favourable moment to get hold of the complete outfit of a Neolithic man. It consists of a bow, a quiver still containing arrows, a dagger, a retouching tool and a pannier. In the course of excavations, carried out immediately after the discovery and the year after, several other wooden remains and charcoal particles were found. The dendrological analyses of the wood remains and the charcoal try to shed light on the environment of the Iceman. Besides the spectrum of the species of wood used, investigations on the ergonomy of the artefacts should inform about the technical knowledge of the Iceman. A phytosoziological and phytogeopraphical approach should try to solve the riddel where he was living.

PLANT REMAINS FROM WYNALDUM: PALAEOBOTANICAL EVIDENCE FOR AGRICULTURAL DEVELOPMENTS IN THE FRISIAN SALT MARSH AREA DURING THE EARLY MIDDLE AGES

PALS Jan Peter, Amsterdam

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ANCIENT CULTIVATED PLANTS FROM THE NORTH BLACK SEA.

PASHKEVICH Galina, Institute Archaeologii, Ukraine-Kiew, USSR

The region under investigation had a rather specific composition of cultivated plants. Excavations in the greek town Olbia and its hora provided large amount of carbonized remains of cultivated plants. The most frequently occurring naked wheat *Triticum aestivum* and *Triticum compactum*. Hulled six-row barley being widely cultivated as well. Emmer and eincorn declined. Naked barley, rye, millet, oats, pulses were less common. Mixtures of seeds of typical wild and cultivated vine and of transitional forms were often present.

Beginning from the last centuries BC the plant cultivation in this region was prominently intensive and developed under the influence of Greek colonization.

For the period - the end of 5th - and 4th centuries, there was evidence of introduction of new cultivated plants by the Late Scythian tribes especially in the Lower Dnieper region. The composition shows a considerable increasing of naked wheat. Hulled barley and millet also being largely cultivated. Rye, as a new cereal crop, has been observed there.

Contrary this advanced plant husbandry, the nomadic Scythian tribes have primitive agrarian economic. The crop plant assemblages included only *Hordeum vulgare, Panicum miliaceum*, perhaps *Triticum dococcon*.

DIE BOTANISCHEN FUNDE VON NEVALI CORI, TÜRKEI

PASTERNAK Rainer, Kiel

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ARCHAEOBOTANY IN SOUTHERN SPAIN, PREHISTORIC PLANT EXPLOITATION IN ANDALUCÍA.

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Plant remains from two prehistoric sites in southern Spain are presented here. The Cave of Los Murciélagos (Zuheros, Córdoba) has been considered as one of the key sites for the understanding of the Neolithic period in Andalucía. The new set of excavations carried out from 1989 onwards has shed new light into the way the inhabitants of the cave lived. Twenty six samples of charred material have been analyzed revealing the presence of more than thirty species (cereals, legumes and wild plants). The presence of *Papaver* sp. seeds from the first Neolithic occupation (Vth millennium) is perhaps the most interesting aspect since they are the oldest examples within the Iberian Peninsula and one of the earliest in Europe.

The second site is the open-air site of Peñalosa (Baños de la Encina, Jaén) dated to the Bronze Age (1500 BC) and considered as the most northern example of the Argar Culture. After the initial seasons of excavation, Peñalosa became a model example to study the Bronze Age in the Upper Guadalquivir area for two main reasons: its location within the mining centre of Sierra Morena and the excellent preservation of its materials despite the post-depositional erosion.

The excavation and flotation of the different houses has produced a vast amount of plant remains. More than 8000 seeds have been recovered which allow us to understand the economy of the site based on barley consumption. The presence of wild taxa suggests the frequent utilization of many species with different purposes other than for human food.

SOME ARCHOEOBOTANICAL ASPECTS OF WATERLOGGED SITES IN WIELKOPOLSKA, POLAND.

POLCYN Marek, First Piasts Museum, Paleoecological Laboratory, 62-261 Lednogóra, Poland

Over the past several years, archeological and archeobotanical investigations have been conducted on a few early medieval, waterlogged sites in central Wielkopolska. The subject of research has been the culture layers, which, as they are of mainly aquatic origin, have superbly preserved a variety of organic remains.

After analysing many botanical macroremains out of many cubic centimeters, eventually the question arises, which volume of sediment provides the widest spectrum of evidence for plant species. Recently an experiment has been initiated by the Paleoecological Laboratory of the First Piasts Museum, whose main scope is to record the frequency of botanical remains in different sediment units of the sample collected from a given profile of archeological trench. The imminent results are the subject of this paper.

ARCAEOBOTANICAL STUDIES FROM TELL MADRETZ (SOUTH BULGARIA).

POPOVA Tzvetana, Institute of Archeology, Sofia, Bulgaria

In this paper the results of the archaeobotanical material from the Madretz - tell are presented. The tell dates back to the Late Aeneolithic and Early Bronze Age. The material has been gathered during the escavation seasons 1991 - 1993.

The samples come from different sediments, profils, ovens, pottery complexes, near vessels and mill-stones. They give the opportunity of the following conclusions:

The highest concentration of carbonised seeds come from the houses, followed by the areas near mill-stones, and near ovens. Among the crop species *Triticum monococcum* dominates. *Triticum dicoccum* occures rarely. Only naked barley has been used, probably due to the easier way of processing the grains. From the legumes *Vicia ervilia* is most common, in the contrary, *Lens culinaris* and *Lathyris sativum*, are very rare pulses.

Gathering is prooved by fruits of *Cornus mas*, *Sambucus ebulus, Vitis vinifera* ssp. *silvestris,* and *Quercus*.

In the flotated material 6 species of wild plants were found. They are all ruderals, known all over the country in the past as well as nowadays. Part of them have practical qualities, which were noticed and used. *Chenopodium album* is most common, followed by *Poligonum aviculare* and *Galium aparine*. The upper parts of *Galium aparine* are good for feeding animals and the seeds for feeding birds.

So, we can propose, that besides cultivated cereals and pulses the bronze age of Madretz people were also made to use different wild plants for their diet as well as for animal fodder.

On the other side, the widespread distribution made gathering easier. The question if *Poligonuma viculare* and *Chenopodium albim* have the status of domestic plants still exists, but the simple fact that they were used is confirmed by the data from Bulgaria.

PLANT REMAINS AND IMPRINTS FROM THE PREHISTORIC AND EARLY HISTORICAL SETTLEMENT THUNAU / LOWER AUSTRIA 1965-1993.

POPOVTSCHAK, MICHAELA, A-1080 Wien, Laudong. 69/33; ZWIAUER, KATHARINA, A-1080 Wien, Josefstädterstr. 43-45/2/34.

Thunau, situated in Lower Austria, is an archaeological settlement where artifacts of the Neolithic, Late Bronze Age Urnfield, La Tène, 4/5th century A.D. and the Early Medieval (9-11th century A.D.) / Slavic period have been identified. As most finds come from the Urnfield and Slavic hillforts they seem to be the most dominant habitations. Preliminary analyses of botanical remains from this archaeological site were made by E. Hoffmann and H. L. Werneck (published in "Ur- und Frühgeschichtliche Kultur- und Nutzpflanzen in den Ostalpen und am Rande des Böhmerwaldes" in 1949): 15 taxa of charred seeds and one taxa found as an imprint were discribed. Analyses by M. Schneider (1989. unpubl.) resulted in 20 taxa.

As every-year excavation campagnes started 1965 (Univ. Prof. Dr. H. Friesinger, Inst. f. Ur- und Frühgeschichte, Univ. Wien), samples have just been taken. This work includes all preserved charred plant remains and examines imprints of the "Hüttenlehm"-material to get as close as possible to the plant spectra of the relevant periods and to allow first insights into the every-day life of these ancient settlers, their agricultural methods and the effect of their activities on natural and cultivated landscape.

ARCHAEOBOTANICAL WORK IN TROY/TURKEY

Simone Riehl

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This poster will present a short insight into the archaeobotanical work in Troy, an archaeological site in West-Anatolia. Until now mainly the Bronze age layers are the best investigated. The site has been excavated since 1988 with wide participation of natural sciences, including the different dating methods (14C, thermoluminescence, dendrochronology), chemical and isotope analysis of soil and bones, archaeozoology, sedimentology and geophysical survey under the coordination of M.Korfmann and H.-P.Uerpmann. The analysis of botanical macroremains has been practiced since 1991.

The poster focuses on three main aspects: 1. prehistoric economy of the site, 2. ecological environment and 3. archaeobotanical methodology, briefly describing soil processing methods.

This poster documents the above mentioned points with some pictures. The geomorphology and hydrology of the prehistoric Troad, as well as the main features of the landscape history are well investigated. The conditions were similar to the present day area of the Scamander river and the sea coast, which was in prehistoric times (Troy VI) only about 1 kilometer from the city. A map of the excavation area including the prehistoric coastlines will give some information about the extent of the activity area of prehistoric settlers. The prehistoric landscape is represented in the macrofossils which show a high portion of water and wetland plants. Some photos with macrofossils will show a part of the botanical spectrum. Short notes are added to explain the pictures.

ARCHAEOBOTANICAL INVESTIGATIONS AT AN IRON AGE "TELL" SITE AT SMEDEGÅRD, THY, DENMARK.

DAVID EARLE ROBINSON, NNU, National Museum, Ny Vestergade 11, DK-1471 Copenhagen K, Denmark.

The area of Thy in northwestern Jutland is well-known for its Iron Age "Tell" sites - villages of turf-built houses which have been repeatedly demolished and rebuilt over centuries, leading to the formation of distinctive mounds in the landscape. These sites often contain well-preserved plant remains, but until recently little systematic archaeobotanical research has been carried out. In 1992-93 a rescue excavation of a "Tell" at Smedegaard, revealed the stratified remains of turf-built houses spanning the last two centuries of the Pre-Roman Iron Age (200-0 BC). For the first time in an excavation of this nature, large numbers of soil samples were collected from floor layers, refuse layers and pits. Many samples proved to be rich in carbonized plant remains, providing information about change and continuity in the subsistence economy of the early Iron Age, the implications of which reach far beyond the wind-swept hilltop of Smedegaard.

THE DEVELOPMENT OF RUDERAL AND CROP WEED COMMUNITIES IN SOUTHWESTERN GERMANY SINCE NEOLITHIC TIMES

MANFRED RÖSCH, LDA Bad.-Württ., Fischersteig 9, D-78343 Hemmenhofen

Archaeobotanical results from more than 150 sites in Southwestern Germany were compiled. Presence/absence analysis of all registrated taxa enabled us to calculate their constancy for certain periods. For this purpose we defined rather rough periods (Neolithic, Preroman Metal Ages, Roman times, Early Medival times, High Medival times and Late Medival and Modern times). Changes of constancy of cultivated plants from period to period give hints for socio-economic change. Socio-economic change, especially of agriculture, influenced the weed communities and change their floristic composition. This is documented by the appearance, changes of constancy and dissapearance of weeds. For example, the typical weeds of winter cereals on limestone (Caucalidion species) appear or achieve higher constancies for the first time in the Roman period. A second batch with several new species can be observed in the Merowingian period. To interprete such observations in terms of changes in agriculture, the plant species, their biology and their strategy of survival and spread out must be considered very carefully.

PCR-BASED IDENTIFICATION OF WHEAT GENOMES IN ANCIENT DNA IN ANCIENT WHEAT MACROFOSSILS

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This oral presentation will begin with a brief survey of problems in identifying wheat genomes from grains alone (without accompanying rachis remains), e.g. the differentiation of *Triticum aestivum* from *Triticum turgidum*, and the distinction between two-grained *Triticum monococcum* and *Triticum dicoccum*. The potential contribution of the techniques of molecular biology to solving these problems will be discussed. The development of a new method of identifying wheat genomes and its testing on modern wheat varieties will be described. The refinements necessary to make the method applicable to ancient wheat DNA will then be considered. Preliminary results will be presented from the application of this new method for identifying wheat genomes to ancient DNA from wheat from selected archaeological sites, including Assiros Toumba in Greece and Danebury in England. Finally, the paper will discuss how this work could be extended beyond genome identification to permit identification of populations of ancient wheat at the subspecific level.

STARCH MICROSTRUCTURE AND THE PREPARATION OF ANCIENT CEREAL FOODS.

Delwen Samuel, McDonald Institute, University of Cambridge, Downing Street, Cambridge CB2 3ER, U.K.

In the arid climate of Egypt, desiccation has led to outstanding preservation of organic remains. This allows detailed insights into a wide variety of past activities, including food preparation. My current research focuses on the two cereal-based staples of ancient Egyptian diet, bread and beer. Samples from actual preserved loaves and dregs, studied by light microscopy and scanning electron microscopy together, have shown that the microstructure of desiccated cereal survives as well as the macrostructure. Changes in the morphology of the starch granules have been used to detect different processing techniques, such as malting and heating. Comparison of ancient starch granules with modern starch subjected to known treatments has given direct evidence for ancient Egyptian baking and brewing and has shown that these are more sophisticated than previously appreciated. Because food preparation is a complex process, the integration of experimental, ethnographic and archaeological evidence is necessary for understanding its wider context.

THE NEED TO DISTINGUISH THE WHITE FROM THE BLACK MULBERRY: IST CONNECTION TO BOMBYX MORI SILK PRODUCTION

SARPAKI Anaya, Rethymno

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DNA OF TETRAPLOID/HEXAPLOID NAKED WHEAT FROM A CORTAILLOD CULTURE AT THE LAKE OF ZUERICH, SWITZERLAND

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DNA from charred grains of naked wheat (*Triticum aestivum/durum*) from a Cortaillod lake shore settlement at Zürich, Lake of Zürich (Mozartstrasse 3800-3900BC), Switzerland, was investigated. The well preserved grains belong to a stored assemblage consisting almost entirely of naked wheat.

DNA was extracted using a Silica-based method developed for DNA extraction from Pleistocene bones (Höss & Pääbo 1993). A 246 bp region upstream of the gene for the high molecular weight subunits of glutenin was amplified by PCR (Polymerase Chain Reaction). The PCR product was cloned and is currently being sequenced. DNA sequence analysis will provide information about preservation of ancient DNA, sequence variation of ancient DNA fragments from wheat genomes. It will be possible to compare ancient DNA with modern published DNA sequences. Further analysis of naked wheat DNA from different cultures at Mozartstrasse (Pfyn, Horgen, Corded Ware Culture and Bronze Age 3700-1000 BC) and from other lake shore settlements will give an opportunity to study wheat DNA from different sites and cultures and also to address the problem of distinguishing tetraploid and hexaploid wheat.

CHARRED PLANT REMAINS FROM A NEOLITHIC WELL (SCHLETZ, LOWER AUSTRIA)

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The earliest remains from the neolithic settlement area Schletz date back to the early Linearbandkeramik (early LBK) and the Notenkopfkeramik phase (late LBK). The site, situated on a loess hillplateau NE of the Leiser Berge, was discovered by aerial prospection. Archaeological excavation revealed the post holes of characteristic long houses, various types of pits, ovens, and the whole range of artefacts typical for the early agrarian settlers. The most prominent feature of the site is an oval ring ditch of about 300 m in diameter, probably constructed for fortification purposes during the Notenkopfkeramik phase. Several human skeletons, partly dismembered, have been found on its bottom in each excavated section.

Systematic sampling for archaeobotanical analysis started in 1990. 1993 sampling focused on the different filling layers of a structure interpreted as a well. Its depth amounted to approximately 8 m and on the bottom evidence of a decayed wooden frame construction was recorded. Flotation of soil samples from the lower filling layers yielded an unexpected amount of charred seed remains. The great majority was cereal grain and could be identified as remarkably well preserved *Triticum monococcum* (1- grained and 2- grained form). Further a very small number of grains of *Triticum dicoccum* and *Hordeum vulgare* were found. Apart from two einkorn spikelet forks no chaff remains were present. *Pisum sativum* and a fragment of cf. *Lens culinaris* occured as representatives of cultivated legumes. Thus, the classical combination of cereal and legume growing, as reported from many Central European LBK settlement sites can be also postulated for LBK Schletz. The spectrum of recorded wild plant species consisted mainly in common ruderals, as they are generally to be expected within the context of human settlements. However, some of the *Chenopodium*- and *Polygonum* species may have served as food plants, too. If collected for purpose, the toxic species *Solanum dulcamara* and *Sambucus ebulus* could have been used as medicinal plants, *Sambucus ebulus* also as a dye plant.

CHARCOAL ANALYSIS FROM HABUBA KABIRA (FIRST RESULTS)

SCHOCH Werner, Adliswil

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PLANT REMAINS IN LATRINE SAMPLES OF MEDIEVAL TARTU (14TH-15TH CENTURIES).

SILLASOO Ülle, Institute of Botany and Ecology, Tartu University, Lai 40, EE-2400 Tartu, Estonia

At the archaeological excavations in the Old Town of Tartu several latrine deposits (pits) containing various plant remains, seeds and fruits have been found. The material (14th-15th centuries) was collected from 11 pits. On the ground of the most characteristic plant species the following conclusions were made:

Gathered fruits of wild plants played a quite important role in the daily food of the 14th-15th centuries. Frequently occure seeds of strawberies (*Fragaria vesca*), raspberries (*Rubus idaeus*) and blueberries (*Vaccinium* sp.) in the samples. The species also hint to the environment in the vicinity of the settlement.

In the 14th-15th centuries there seem to have been orchards in or around the town, where apple (*Malus sp.*), pear (*Pyrus communis*), bullace (*Prunus insititia*), cherry-trees (*Cerasus vulgaris*) and berry-bushes (*Ribes sp.*) were cultivated.

On the beds near the houses dill (*Anethum graveolens*), celery (*Apium graveolens*) and probably opium poppy (*Papaver somniferum*) was grown. Opium poppy may also have been imported.

As goods referring to long-distant trade of 14th-15th centuries, fig (*Ficus carica*), grape (*Vitis vinifera*), walnut (*Juglans regia*), black pepper (*Piper nigrum*) and millet (*Panicum miliaceum*) occure. The abundance of the seeds of fig indicates the wide usage of the fruits among the residents; the plots with numerous fig seeds may have belonged to the upper classes of the town.

Meadow plants reflecting the vegetation on and around the site were poorly represented in the samples. There were better conditions for the growth (and preservation) of weeds at the investigated sites.

RECONSTRUCTION OF A SALINE 19,000 OLD LANDSCAPE FEATURE AT OHALO II.

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Many charred botanical remains dated to 19,000 bp were found at Ohalo II, a submerged site on the shore of the Sea of Galilee, Israel. The site is located on the south-western corner of the lake, 9 km south of Tiberias. It is generally agreed that also the Sea of Galilee itself is about 19,000 bp old.
Two plants typical to salty habitats were identified. A few thousand seeds of *Suaeda palaestina* type and hundreds of kernels of *Nitraria schoberi* were found. *Suaeda palaestina* grows today in Israel in saline habitats near the Dead Sea. *Nitraria schoberi* occurs today in saline habitats in central and east Anatolia, Iran, Afghanistan and central Asia. It is also found in east Jordan; though it does not grow in Israel today. Finding of these two halophyte species indicates that at ~19,000 bp there had to be a saline area nearby the site in which the two species could grow.
How do the finds of halphytes at this site accord with the present existence of a sweet water lake? Moreover, there are no saline habitats today at Ohalo II region.
There are two ways of reconstructing the ancient landscape, based on the fact that the Lisan formation, which is a salty ground, extends from 100 km south of the Dead Sea to a few km north of Ohalo II.
Existence of a saline region near the site with a small sweet lake situated in the northern part of Sea of Galilee, outside the Lisan formation.
The Sea of Galilee was a big, closed, salty lake with marshes on its shores.

CARBONIZED CEREAL FINDS FROM NEOLITHIC AND EARLY BRONZE AGE SITES IN WESTERN NORWAY

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Carbonized cereals were recovered from five archaeological excavations in Rogaland and in Sogn og Fjordane in western Norway. In Rogaland carbonized plant material was found in postholes of two-aisled houses in three of the sites and in a culture layer. Based on the distribution pattern of the carbonized grains and the archaeological artefacts in the cultural layer it is suggested that the place had been used for drying grain.

In Sogn og Fjordane carbonized cereals were found in soil from buried plough furrows. House remains were not found. Most of the cereal grains that can be identified are naked barley (*Hordeum vulgare* var. *nudum*). Few fruits and seeds of weeds were found. Fruitstones of raspberry (*Rubus idaeus*) and shells of hazelnut (*Corylus avellana*) were found in some structures at all five sites. Naked barley from all five sites are dated by accelerator.

A CELTIC BREWERY (LATE HALLSTATT/EARLY LATÈNE) AT HOCHDORF, SOUTHWEST GERMANY?

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During the archaeobotanical examination of the celtic settlement at Eberdingen-Hochdorf, northwest of Stuttgart in Southwest Germany, we unearthed hints for brewing activities. The early celtic settlement (600 - 400 B.C. cal.) refers to the neighbouring wellknown grave mound belonging to the nearby residence of princes called „Hohenasperg". An earlier investigation of the tomb chamber turned out interesting results dealing with botanical macro- and micro-remains (Körber-Grohne 1995). At present ca. 200 archaeobotanical samples (5-10 l Vol. each) are investigated, deriving from pits, pithouses and ditches of the non-waterlogged settlement in a loess covered area called „Strohgäu" with comparatively favourable climatic conditions. In doing this at the bottem of two U-shaped ditches we found a large amount of hulled barley grains which began to germinate before charring. The layer of grains (0.2 x 0.6 x min. 3m), situated directly above the native loess, contains nearly pure barley grains only mingled up with few other grains, chaff and weed seeds. At its top this layer is intermixed with charcoal and clay bricks deriving presumably from constructions referring to the ditch or attending structures belonging to a brewery. To test whether the degree of germination of the charred barley grains at Hochdorf fits for malting, recent barley grains were germinated under controlled conditions, morphologically examined and afterwards got charred. The study of the recent grains showed that hulled barley only gives few morphological hints in early state of germination in which the starch decomposed by enzyme sufficient for malting and ferminating to brew beer. The visible signs on the grains, both the subfossil and the recent ones, are little. They are somewhat detached at the dorsal side and infrequently showing a furrow depression on the back as an imprint of the coleoptile. Such imprints appear much more often at germinated hulled wheats (cf. Piening 1988). Roots and coleoptiles of germinating grains are sensitive by charring and normaly easily get broken. The carbonised celtic remains at Hochdorf contain only few broken coleoptiles but not any root. The study of recent germinated barley grains shows that the subfossil grains at Hochdorf had been suitable for brewing before charring. Written sources of antique Graeco-Romans tell us that the Celts were used to brew and drink beer. Now we have unearthed archeaological and archaeobotanical hints for a celtic brewery, but yet we are not able to prove it securely. Other alcoholic drinks of the Celts are known. In the grave mound at Hochdorf hints for starting to produce mead were found (cf. Körber-Grohne 1985). From the celtic „Heuneburg" in Southwest Germany we know imported vine amphores.

CULTIVATED PLANTS OF THE MICHELSBERG CULTURE (LATE NEOLITHIC) AT HEILBRONN-KLINGENBERG, SOUTHWEST GERMANY - A COMPARISION OF DIFFERENT FIND- CIRCUMSTANCES AND TYPES OF PRESERVATION CONCERNING THE REPRESENTATIVITY

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The first archaeobotanical large area investigation of a settlement of the Michelsberg Culture was expected to show not only the spectrum of the cultivated plants but also the degree of their cultivation and use. The late neolithic settlement (ca. 3500-3300 B.C. cal.) at Heilbronn-Klingenberg is situated on a hill-top above the valley of the River Neckar and the Klingenbach tributary. The loess covered plateau lying in a landscape with favourable climatic and soil conditions is blocked off at its top by two parallel ditches running in an arc. Next to the ditch system the excavation uncovered ca. 270 pits, other features were not preserved. The amount of erosion is particularly great. At this place 150 archaeobotanical samples were taken. The results of analysis of plant imprints in fired clay are faced with those of charred plant remains sampled in pits and ditches. Three pits and two parts of the ditches are explained in detail for nnderstanding the deposits and find assemblages. To find out the degree of cultivation and use of the cultivated plants (representativity in sensu Rösch/Jacomet/Karg 1992), we look upon the percentages of grains and the steadyness of species in samples and different features respectively. The fired clay was mingled intentionally with chaff mainly of the hulled wheats einkorn and emmer. The plant imprints don't show the degree of cultivation but give hints on spatial and perhaps chronological separation of different crop processing activities. The outer ditch contains charred plant remains deriving from burnt threshing residues. It's the only place in the settlement where rachis segments of free-threshing wheat were found. The inner ditch coutains cereal grains and peas in low density without chaff and weeds deriving from cleaned and stored foodstaffs which after carbonization were mingled up with loam and loess. There is a minimum of mixing fonr seperate stored foods: free-threshing wheat, naked barley, einkorn/-emmer wheat (perhaps cultivated together) and pea. In this case the percentage of grains and steadyness of species are influenced mainly by sampling. We find the representativity of the cereal spectrum more likely by looking at the grain remains in the pits. We have four main cereals: einkorn, emmer, free-threshing wheat and naked barley. Einkorn grains are showing the highest steadyness but the lowest percentage of determinable cereal grains. Pea is an important cultivated plant as well (high steadyness), much more than lentil. The role of linseed and poppy is difficult to find out at Klingenberg. We know that charred remains of this species surely are underrepresented (cf. late neolithic lake-shore settlements with both carbonised and uncarbonised preservation).

IRON AGE INTENSIFICATION OF AGRICULTURE IN THE KOREAN PENINSULA.

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This paper discusses radical changes in food production in the Korean Peninsula during the Iron Age. This period witnessed an influx of people from NE China, the arrival of iron technology and new crops including wheats and barleys. These dryland crops complemented established paddy production and thereby intensified agricultural land use. Evidence for both cultivated and wild foodplants from the 1st century BC site of Shingchang-dong will be discussed in the wider context of cereal biogeography and agrarian technology.

THE PLANT REMAINS FROM MONS CLAUDIANUS, EGYPT: NEW EVIDENCE FOR THE FORMATION PROCESSES OF DESICCATED PLANT REMAINS

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Mons Claudianus is a Roman quarry settlement situated in a remote part of the Eastern Desert of Egypt, some 500 kms south of Cairo, in the heart of the Red Sea mountains *c.* 120 kms east of the Nile. The quarries around the settlement formed the source of some of the finest granodiorite used in the palaces and temples of Rome. In addition to extensive areas of quarries, the site comprises a defended settlement, animal lines, granary, cemetery and substantial midden deposits. The site is remarkably well preserved: many buildings stand intact to roof height. Thanks to the extreme aridity at the site a wide variety of organic materials (food remains, textile, leather, basketwork etc.) has survived in remarkable abundance and richness. Excavations have been carried out between 1987 and 1993 by a team of European archaeologists and papyrologists from Belgium, Britain, Denmark, and France, with logistical support from the Institut Francaise d'Archéologie Orientale in Cairo. The writer has acted as archaeobotanical consultant to the project.

Most of the plant remains are preserved in desiccated form, though some charred material is also present. The range of food plants available at the settlement was considerably greater and more varied than had originally been anticipated, and life in this remote settlement appears to have been quite luxurious: cereals, pulses, fruits, nuts, vegetables and herbs have all been identified. One of the most striking aspects of the plant assemblages is the presence of large quantities of chaff, especially of rachis internodes of wheat and barley and cereal culm nodes. Both culm nodes and rachis internodes of free-threshing cereals are generally under-represented in the archaeobotanical record, but their presence is often interpreted as evidence for the early stages of crop processing, and by implication local agricultural production. A detailed analysis of the composition of samples from different contexts (middens, rubbish layers, wall plaster, mud-brick etc.) suggests another interpretation for their presence. Both the archaeobotanical and the textual evidence (ostraca) indicate that chaff was transported in very large quantities over very large distances in Roman Egypt and probably represented a valuable commodity. The evidence from Mons Claudianus suggests that the formation processes of desiccated plant assemblages are complex and require more detailed study.

Leicester, December 1994

THE CHANGING WORLD OF ARCHAEOLOGY IN THE NETHERLANDS: REASON TO START AN ARCHAEOBOTANICAL PARTNERSHIP

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Recently the number of archaeological, and with it archaeo-ecological, jobs decreased while there is plenty of work to be done and more to come in the near future, for instance with the construction of large railroad tracks and the execution of the European "Malta" law.

In this changing world a small group of archaeobotanists was "raised". After their schooling they could either work in the uncertain world of freelancers or try to win the race of scholarship applications. Steady jobs were not to be expected so a choice had to be made; participate in the old structures as one of many freelancers or working together and trying to anticipate on future possibilities. After a lot of discussion, in january 1994 a partnership in palaeo-ecology and -economy was born: BIAX *Consult*. This partnership is a kind of company with the possibilities to work closely together and share certain costs but have a great deal of independence too. Our way of organizing includes having a partnership contract in which we regulate amongst other things how we work together, divide the work and guarantee quality.

The main fields we work on are
- Archaeology
- Management of Archaeological Heritage
- Environment and Nature management

Some examples of last years work will be given.

It is quit obvious that for the best results a research should not only include the botanical point of view but other aspects as well. Because all eight off us are archaeobotanists, we induced a network of other disciplines. By introducing ourselves here in this way we hope to get more international contacts and cooperation.

CURRENT SWEDISH ARCHAEOBOTANY

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Imprints have played an important role in Swedish archaeobotany, over the years thousands of seed impressions have been examined and determined by Hakon Hjelmqvist. During the last decades, however, focus has been on charred plant material, and soil samples for flotation are now secured at most larger excavations. Archaeobotanical analyses and research is done at the universities of Lund, Stockholm and Umeå. Pits, hearths, and postholes from long houses are looked upon as important sources of archaeobotanical information. The postholes may yield charred plant material which reflects the different functions of the different sections of the longhouse. Indications of kitchens, grain stores and stables have now been found in many houses examined in this way. Along with the imprints this type of randomly formed botanical evidence is well suited for compilations and surveys showing the development and regional variability in agricultural activity during prehistoric times in Sweden. A project including experiments on cultivation, crop processing and carbonsation has just been concluded in Umeå. This approach proved valuable in increasing the interpretative potential of crops and crop residue. Following up the experimental results "old" archaeobotanical investigations, eg Vallhagar, are now being reexamined and interpretations of the agrarian economy sometimes renewed.

In south Sweden a certain type of large pits with firecracked stones have recently proved to yield charred spikelet forks, rachis segments etc, from spelt wheats. This has been interpreted as the remains of parching before grinding and the pits as specially designed for this purpose. Great interest is now also being shown for plant material found in graves. From Bronze Age /Iron Age graves in central and south Sweden there are finds of cereal grains but also tubers from *Arrhenaterum elatius* and *Filipendula vulgaris*. Such material gives scope for a discussion of non -functional aspects of the use of plants by ancient man.

ARCHAEOBOTANICAL DATING OF THE MONTH OF ASHKELON DESTRUCTION - THE STRENGTH OF EVIDENCE.

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Shkelon is a port city in the south coast of Israel. Layer 11A was destroyed by the troops of Nebuchadnezar, king of Babylon in the year 604 B.C.E. The botanical remnants from this layer were collected from four areas, namely "Philistine house", "robbed building", "accounting office", and "pit". The finds - most of which are fruits - were divided according to their ripening seasons (Table 1). The greatest number are of grape and olive, the remainder are pomegranate, carob, and walnut (fig nutlets are not included in the discussion). From the ripening time of the crops one can estimate the month in which the fruits were brought to the city. Because the most abundant fruits are grape and olive, they can be regarded as time markes.

Most of the wars in ancient periods took place during the summer and therefore most of the destruction layers in archaeological sites occur in the summer. It is assumed that the relative abundance of the different crops is changed from season to season. This influences the nature of archaeobotanical remnants, that are charred during the destruction. According to the Babylon chronicle. Ashkelon was captured by Nebuchadnezar in Dezember 604 B.C.E. This information is corresponded to the archaeobotanical evidence.

TABLE 1: Botanical finds at Ashkelon 11A - two ripening seasons

Area	Autumn ripening (tree fruits)	Spring ripening (cereals & legumes)
Philistine house	80	56
Robbed building	204	79
Accounting office	1759	196

ARCHAEOBOTANICAL INVESTIGATION ON LATE LA TÈNE AND EARLY ROMAN SETTLEMENT STRUCTURES AT THE OPPIDUM BIBRACTE MONT BEUVRAY (BURGUNDY, FRANCE)

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Archaeobotanical work was carried out at the oppidum of Bibracte in eastern France since 1991. The oppidum is situated on the top of Mont Beuvray, a prominent hill at the western slope of the Haut-Morvan hillside-region in Burgundy. The archaeological remains of the hillfort-site are large settlement areas dated to the late celtic and the augustean period, and more than 5 km of strong fortification-walls well known as 'murus gallicus-type'. Bibracte was mentioned in Julius Caesars description of the Gallic War to be the largest and richest oppidum of the gallic tribe named Aedui. In winter 52 b.C. Julius Caesar made his winter-camp in Bibracte and started to write his memories of the Gallic War.

Archaeobotanical work on Mont Beuvray is part of an international research-projekt with different excavation teams from all over Europe. Main aim of the archaeobotanical work is to reconstruct agriculture, food supply and storage for the late celtic and early roman period. Different archaeological structures had been sampled: settlement-layers, storage finds, chaff and other cereal waste .Most of the investigated material was carbonized and only a few samples from the water basin of Fontaine St. Pierre contained uncarbonized plant remains. Two main archaeobotanical finds of stored cereals and chaff will be discussed and a list of used plants from the site will be presented.

The most interesting storage find of carbonized cereals was excavated in an augustean cellar at the Pâture du Couvent. The building had been used for storage of different cereals before destruction by fire. Five samples with burned cereals from the charcoal layers of the cellar pit were analysed: The main cereal stored in the building was *Triticum dicoccum*. The grains are still hulled by their glumes; a lot of them shows clear signs of beginning germination. This find can be a hint to the preparation of beer but although spoiling by wetness is posssible. Other stored cereal crops were *Triticum aestivum* (compactum-type) and four-rowed barley. Only few grains of *Triticum spelta*, *Triticum monococcum*, and *Panicum miliaceum* were found in these samples. During early roman times these cereals seemed to be only additional crops. The samples gave notice of a wide range of cornfield weeds, because the stored crops were not completly cleaned by seeving and winnowing: *Bromus secalinus*, *Centaurea* cf. *jacea*, *Avena fatua* and several species of *Vicia* are the most common weeds of the augustean cornfields.

Another complex being very similar in the composition of taxa was found in a long rectangular box made from wooden planks. It was excavated near the sanctuary of La Terrasse in 1993. According to the scarcity of well dated archaeological finds and the strange composition of twigs mixed with chaff, cereals and burned bones, the dating and interpretation of this find is still questionable. But according to the archaeologists the box may be dated to the Augustean period. The main content of the botanical samples from the interieur of the box was burned straw and chaff mixed with grains of cereals. *Triticum dicoccum* was dominant, but most of its remains were chaff. It seemed to be waste from harvesting and crop-processing of emmer wheat. Other cereals are again *Triticum aestivum* (compactum-type), *Hordeum vulgare vulgare* and *Triticum spelta*. With *Panicum miliaceum* and *Setaria italica* two different species of millets were present. Finds of *Setaria italica* are important, because they are still scarce and restricted to the southern and eastern parts of France. The presence of *Setaria italica* is the first record of this food plant in France for roman times. Main weeds growing in the emmer-fields are *Bromus secalinus*, several species of vetches and *Centaurea* cf. *jacea*, the latter partly preserved as whole fruit-heads. The interpretation of this strange mixture of plant remains is still doubtful. The whole complex may be connected with sanctuary rites and offering. Another more practical interpretation is that the waste in the wooden

box was fodder for horses or cattle, or cereal waste and straw were used to protect something of the unknown former interieur of the box from damage.

NEW EVIDENCE FOR EARLY PLANT EXPLOITATION FROM THREE PRE-POTTERY SITES ON THE EUPHRATES (SYRIA).

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Preliminary results from an archaeobotanical project involving three aceramic sites dating from 9800 to 7800 BP which are being excavated in the valley of the Middle Euphrates will be discussed. The finds are presented in the light of evidence from similarly dated sites farther north in eastern Anatolia, and are compared to the contemporary vegetation. These results provide new information about the vegetation and the plant economy for this period.

Carbonised plant remains recovered by flotation from levels dated to between 9800 and 9200 BP indicate that wild cereals (einkorn wheat, rye and barley) were exploited together with a number of pulses. Other plants such as wild grasses, *Pistacia*, wild almond and oak, suggest that the local vegetation provided a rich diversity of resources. Later levels see the appearance of domestic crops such as emmer, naked wheat and barley, but wild type cereals persist. The cultivars appear to have been introduced from elsewhere aud later eighth millennium species include olive and flax. A study of the weed taxa such as *Papaver*, *Polygonum*, *Glaucium*, *Galium*, *Silene* and *Camelina* is being carried out in order to see whether an iucrease in this group could be used to identify the cultivation of wild cereals.

Ash, vine, willow, poplar, maple, plane and elm made up the gallery forest. What is now denuded steppe contained taxa such as *Amygdalus*, *Pistacia*, *Rhamnus*, a number of chenopods and oak at low frequencies.

HUNTER-GATHERER PLANT USE: ARCHAEOBOTANICAL REMAINS FROM MESOLITHIC BASQUE SITES

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Archaeobotanical research in the Basque Country has traditionally focused on pollen analysis. The archaeoethnobotanical information we have got for the Atlantic Façade of the Iberian Peninsula is very small. Only recently have archaeological sites started to be adequately sampled in order to recover macroremains.

Very little is also known about Mesolithic plant use in Europe. Though the role and importance of hunter-gatherers' plant use is a common subject among archaeologists, the direct evidence is still very scarce. This is due 1) to the difficulty of identifying plant remains which often include parenchymatous tissues; 2) to the lack of sampling strategies on excavations; it is still very common to assume that plant food remains do not preserve.

Some recently studied sites will be reviewed, particularly the caves of Aizpea (Navarre, Western Pyrenees), Pico Ramos (Biscay) and Kanpanoste Goikoa (Araba) with sequences that include Epipaleolithic levels and ^{14}C dates from 7790 $\pm$ 70 to 5860 $\pm$ 65 B.P. (non-calibrated). Geometric Epipaleolithic industry, abundant environmental evidence (fish, mammals...) as well as human remains have been retrieved on these sites. Isotopes analysis are being done on the human bones in order to evaluate the relative importance of the different components of the Mesolithic diet. In some of the caves, the archaeobotanical material presents a very good preservation; different fruits and nuts are the most frecuent taxa identified.

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