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## Food production and food procurement in the Bronze Age and Early Iron Age (2000-500 BC)

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## **PART TWO: THE BOTANICAL RESEARCH**



## 4 The botanical material under study: introduction to the methods

### 4.1 Introduction

The core of this thesis is constituted of newly obtained results deriving from the analysis of botanical macro remains from locations in the study area (the south part of the Netherlands, Luxemburg and the region of Lorraine in north-eastern France). The 24 investigated locations are indicated on the maps in figure 4.1 and figure 4.2.

In the three following chapters, the relevant information on the individual study locations will be presented, i.e. the excavation itself, the excavated structures that are relevant to this study, and the botanical results. In the present chapter some general information is given on the methodology, the nature of the study locations, the selection of archaeological contexts and sampling strategy, the chronology, and the nature and mode of preservation of the botanical material.

The large majority of the locations studied are situated in the Moselle region of Luxemburg and Lorraine. This group comprises 23 locations. Around this study, an intensive co-operation arose particularly with the archaeological service of Lorraine (described in section 4.6 of this chapter). The area in question is almost 100 kilometres in length and stretches from Peppange (Luxemburg) in the north to Crévéchamps (France) in the south. Some concentrations of sites can be distinguished. The first is a concentration of eight locations north of the town of Thionville: Peppange, Budersberg, Rémerschen, Gavisser, Rettel, Betting, Basse Ham, and Yutz. The second group of ten sites is located around the town of Metz: Gandrange, Trémery, Flévy, Ay-sur-Moselle, Ennery, Woippy, Ars-sur-Moselle, Jouy-aux-Arches, Marly, and the Aéroport Régional. The third group of four sites is located further to the south: Frouard-Haut de Penotte, Frouard-Saule Gaillard, Gondreville and Crévéchamps. At a later stage the results from these locations will be compared to (published) botanical data from other sites in the study region (see section 4.7 for a survey)

The Dutch location studied is the site of Geldrop, situated in the south part of the Netherlands. For the purpose of a meaningful analysis of the results in a later stage, the botanical investigations of twelve other locations from the MDS region will be taken into account (see section 4.7).

### 4.2 The nature of the investigated locations and the adopted sampling strategies

In the next chapters the unbalanced composition of the total series of samples will immediately attract attention. The nature of the excavations as well as of the sampling strategies and the treatment of the samples is very diverse.

In all cases, unfortunately, the author was never present at the excavations to accompany the archaeologists in the field or to take botanical samples herself. At times, it concerned large-scale excavations of whole prehistoric settlement sites covering several hectares, at other times a location where only one pit was excavated. Also, the sampling strategies applied are far from uniform. In some cases a very elaborate and systematic sampling program was executed (systematic or random sampling), in others, only a restricted number of samples were very selectively taken (judgement sampling). Furthermore, there are cases where an extensive systematic sampling strategy has been carried out, afterward which a selection of samples for study was made. This selection was often related to organisational or financial conditions, or was simply due to lack of time. Besides, sometimes the main accent of the archaeological excavation lay on the study of earlier or later periods and only low numbers of samples dating from the Bronze Age or Early Iron Age were available.

The treatment of the soil samples was as diverse. As mentioned, all the samples for archaeobotanical analysis had already been taken before this study was started. Therefore, I did not have the opportunity to give my own instructions in the field, nor afterwards. It appeared that each individual archaeologist had her or his personal approach with regard to the sample processing. Below I will go further into the specific methods applied by the Service Régional de l'Archéologie de Lorraine, with whom I co-operated intensively in the framework of this study.

Where sampling strategies are concerned, the following alternatives were applied:

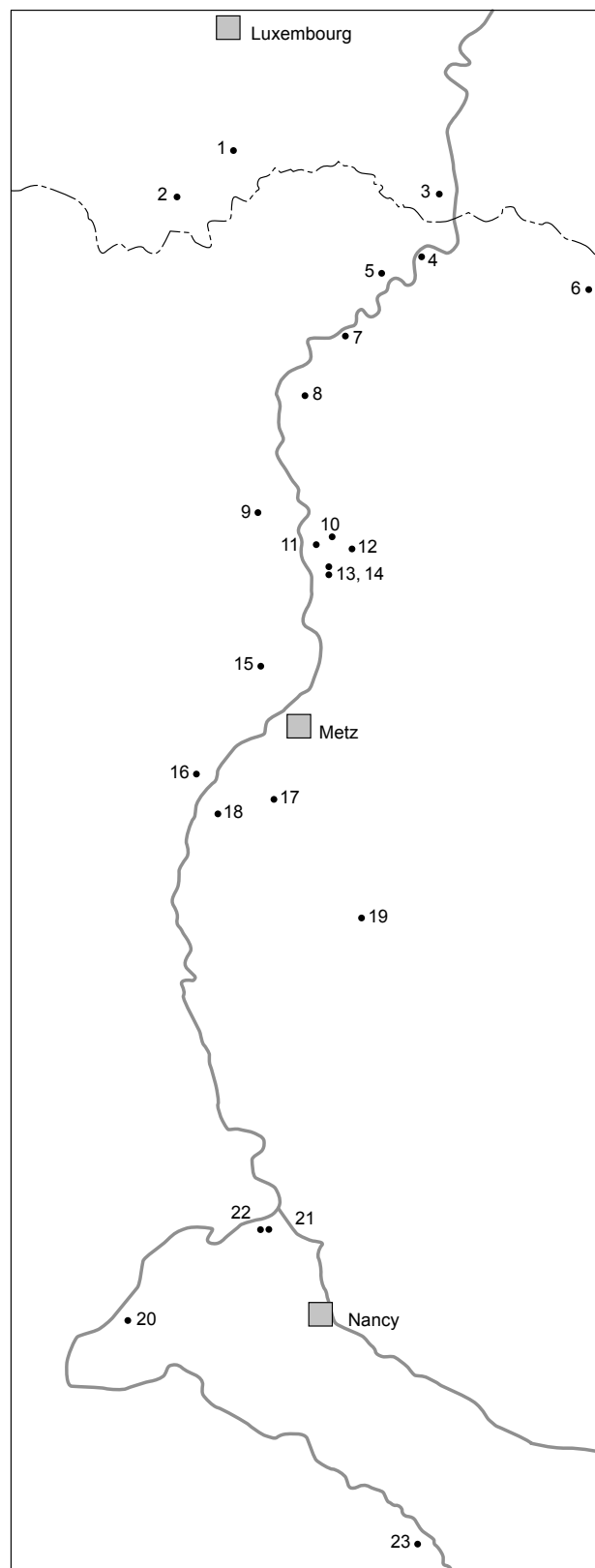
1. A systematic sampling strategy was carried out, in which all relevant, datable features were sampled for botanical analysis.
2. In some cases a systematic sampling strategy was carried out for the analyses of other categories of material like



Fig. 4.1 Study area. The site of Geldrop and the Moselle region

Fig. 4.2 Study area. The locations in the Moselle region.

- 1 = Peppingen
- 2 = Budersberg
- 3 = Rémerschen – Schengerwis
- 4 = Rettel
- 5 = Gavisse
- 6 = Betting
- 7 = Basse Ham
- 8 = Yutz
- 9 = Gandrange
- 10 = Trémery
- 11 = Ay-sur-Moselle
- 12 = Flévy
- 13 = Ennery Solotra
- 14 = Ennery Kléber
- 15 = Woippy
- 16 = Ars-sur-Moselle
- 17 = Marly
- 18 = Jouy
- 19 = Aéroport Régional de Lorraine
- 20 = Gondreville
- 21 = Frouard “Haut de Penotte”
- 22 = Frouard “Z.A.C. du Saule Gaillard”
- 23 = Crévéchamps



pottery, lithic material, charcoal, fragments of burnt loam etcetera. The residues were examined for botanical macro remains.

3. Sometimes, an ad hoc sampling strategy was employed in which only small numbers of selected features were sampled for a botanical analysis.

With regard to the volumes of the samples, the following alternatives were present:

1. A standardised volume of 5 to 10 litres of sediment was taken.
2. Sometimes, features were too small to take the standard volume of 5 to 10 litres. In those cases, the remaining part of the filling of the feature was sampled as a whole.
3. In some cases the volume of the sample is unknown.
4. At times, only a smaller part of a standard sample was sieved. This choice was made when the sediments were too hard to sieve (clay or loam) or on the basis of the absence of fossil plant remains, at first sight.

The following sample processing methods were employed:

1. The material was washed carefully with water over a series of sieves with decreasing meshes down to 0.5 mm.
2. The material was washed over a sieve with meshes of 2 mm in order to recover other categories of material. The plant remains were detected with the naked eye and picked out from the residues.
3. In the case of the samples of Geldrop, a flotation machine was employed to separate the botanical material.<sup>6</sup>

For the final identification of the macro remains, the fractions were studied individually using a Wild M5 stereo microscope (magnification up to 50x). All plant remains that were identifiable were picked out and later identified, sorted, counted and stored in glass tubes. The identification of the seeds was greatly facilitated by descriptions of seeds published elsewhere. Much use was gratefully made of the extensive expertise of the colleagues and of the reference collection of the palaeo-ethno-botanical laboratory of the Faculty of Archaeology, University of Leiden. After identification the recovered species and quantities of the various sites were listed on the computer to facilitate sorting and calculations. The identifications of the material for this study were carried out by Wim Kuijper, Johan Goudzwaard and the author, all connected to the Faculty of Archaeology of the Leiden University.

#### 4.3 The archaeological contexts

All the sampling sites discussed here are prehistoric settlements. Therefore, the sampled and investigated contexts are all anthropogenous settlement features in the broad

sense of the word. It concerns the structures characteristic to prehistoric farmyards, as described in chapter 2. In particular, postholes of houseplans and annexe buildings and structures were examined. The filling of enclosures or arable layers have not been examined, and neither were natural deposits. In several cases the investigated location consisted of only one feature, like a single pit. The investigated contexts can be put into a kind of hierarchical order, according to the expected exploratory value of the botanical finds:

- (closed) storage contexts, like silos, underground storage vessels ("vase-silos") and storage pits
- ovens, so-called Polynesian ovens
- postholes of granaries and barns
- postholes of farmhouses and their hearths and house ditches.

We should note, however, that possibly, in some cases so-called settlement noise or scatters form the majority of the plant remains concerned. Only in some cases did larger quantities of seeds point to the possible presence of storage finds or the clear remains of crop processing stages.

#### 4.4 Dating of the samples

The dating of the botanical material is principally based on association. The archaeological dates of the features from which the samples were derived are applied to date the plant material.<sup>7</sup> We should note however, that the degree of certainty of association is dependent on the type of structure the material is associated with. Consequently, the botanical contents of closed storage contexts yield a more reliable dating association, than, for example, the infill of a posthole (see above). For the purpose of this study we made use of chronological sequences for the Moselle region and the MDS region designed by the Service Régional de l'Archéologie de Lorraine, respectively, the periodisation made for the "Handbook of Dutch Prehistory" (van der Broeke et al. in prep) and the Dutch Archaeological Data Base (ARCHIS) (see figure 2.1).

##### *Dating and grouping of the samples from the Moselle region*

This section presents the chronological distribution of the samples from the Moselle region studied. The objective is to cluster the contemporaneous seed assemblages from the 23 sites under study. I made use of the chronological scheme that was designed for the Lorraine region. Clearly, the dating of the Late Bronze Age and Hallstatt sites in the Moselle region is very accurate thanks to the precise nature of the regional typo-chronology of the pottery. For the purpose of the analysis of the material in a later stage, five chronological groups have been distinguished. The available dating evidence for the locations under study makes up the following chronological sequence:

Stage 1: Néolithique final, Chalcolithique, Bronze Ancien, i.e. date before 1500 BC

Stage 2: Bronze Moyen, Bronze final I-IIa, i.e. 1500 BC-1100 BC

Stage 3: Bronze final IIb-IIIa, Bronze final IIIb-transition Hallstatt C, i.e. 1100 BC-750 BC

Stage 4: Premier Age du Fer (Hallstatt ancien, moyen, final), i.e. 750 BC-450 BC

Stage 5: Second Age du Fer (La Tène), i.e. date after 450 BC

#### *Dating and grouping of the samples from the MDS region*

The chronological distribution of the Geldrop samples and the material available for comparison (see 4.7) is shown in the chronological scheme (figure 2.1). For the MDS region also five chronological stages have been distinguished to facilitate the comparative analysis:

Stage 1: Late Neolithic, Early Bronze Age, i.e. date before 1750 BC

Stage 2: Middle Bronze Age, i.e. 1750 BC- 1100 BC

Stage 3: Late Bronze Age, i.e. 1100 BC-750 BC

Stage 4: Early Iron Age, i.e. 750 BC-500 BC

Stage 5: Middle and Late Iron Age, i.e. date after 500 BC

#### **4.5 The preservation of the plant material**

The investigated samples yielded mainly carbonised remains. This is related to two factors. The study locations are all so-called upland-sites (*Trockenboden-Siedlungen*). In wetland-sites habitation layers are present below the water table and consequently plant remains are preserved in waterlogged conditions. This is not the case for the 24 sites under study here. Also, the nature of the investigated features (anthropogenic settlement structures) implies that mainly charred seeds were found. By way of exception, waterlogged material was recovered, especially, in the samples taken from wells. This material has its own specific mode of arrival into the archaeological features. It is quite difficult, as well, to compare inventories of charred and uncharred plant remains. Therefore, I chose to neglect these data in the further analysis and the reconstruction of the agricultural system.

In general the conservation of the charred organic remains is moderate to bad. This especially concerns the small seeds, but larger remains like cereal grains have also suffered from disadvantageous soil conditions and corrosion. This makes identification up to species level sometimes an arduous task. In the chapters 8-11 the botanical results are presented in three categories. The primary data underlying those presentations are listed in the original species lists joint to the location description in the following chapters (5-7). The three categories applied are the cultivated species, the gathered species and the arable weed species. Under the category of the crops I listed the cereals, pulses and oil-containing

species that were cultivated each for their specific value. Listed in the category of the gathered species are the fruits and nuts of wild (uncultivated) plants that were collected because of their nutritional value to humans. In the third category I grouped the herbs and wild species that are interpreted, without exception, as arable weeds. The arguments for this choice are discussed in chapter 9. This rather simple classification in three groups is also applied to the available data used for comparison (see 4.7). This implies that parts of the original classification of the species lists were sometimes modified especially where the arable weeds were concerned.

#### **4.6 Co-operation with partners**

For the purpose of collecting the botanical data I co-operated with several partners. The samples from Geldrop were made available by the University of Amsterdam (J.P. Pals). The staff of the Musée National de Luxembourg collected the botanical samples from the Luxemburgian sites. The plant material from the region of Lorraine was made available by the archaeologists of the Service Régional de l'Archéologie de Lorraine. In the following sections, the policy of this archaeological service is broadly outlined.

#### *The regional archaeological service of Lorraine*

Archaeological research in the Lorraine region is carried out by the Service Régionale de l'Archéologie de Lorraine (SRAL). This regional service covers the four departments: Moselle, Meurthe-et-Moselle, Meuse and Vosges. Today, all archaeological sites in this part of France are excavated for rescue reasons. The majority of the infrastructural, industrial and economic activities that threaten archaeological valuable areas in the region are concentrated in the zone along the river Moselle. Therefore, the majority of the attendant archaeological prospective investigations and rescue excavations take place in the departments of Moselle and Meurthe-et-Moselle.

#### *Policy: prospection and excavation*

Since halfway through the 80s, the SRAL has carried out excavations in the Lorraine region. The archaeological policy of the service is based on the principal of "*de veroorzaakt betaalt*" and is an active policy of preventive archaeology. This implies that threatened terrains in this region are systematically evaluated with the help of the investigation of historical sources and a series of archaeological prospective investigations in the field. With these prospective investigations the destructive impact on the soil archive of the intended works is established. Trial trenches are laid out in the terrain with a relative distance of c. 20 metres. In this way, 5% of the terrain or more is prospected. As soon as the trenches yield any archaeological traces they are widened and their number is increased to enable a better establish-

ment of the nature of the site and the level of preservation. With the help of this method it is possible to make a fast evaluation of the extent of the archaeological excavation and the finances that come with it. Up until now, this way of working has produced good results (Collectif 1992, 1993, 1994, 1995). In the surrounding countries archaeologists make more and more frequent use of this so-called “sondage à 5%” method (Fokkens, pers comm).

#### *Sampling strategy*

In principal, all various specialisations are integrated into the archaeological research executed by the SRAL. Therefore, extensive sampling programs make up a standard element of the excavational activities. Even so, the extent to which a systematic sampling strategy is consistently carried out still depends on various external conditions and the personal interest of the individual archaeologist. Below, the procedure of the SRAL with regard to sampling is outlined. These procedures are in general applied to the study locations presented in the next chapter, unless otherwise indicated.

The fillings of postholes of buildings and groups of loose postholes are systematically sampled for the study of archaeological remains (charcoal, loam, pottery fragments etc.). At least 1 litre of sediments per feature is sieved on large meshes and examined. Large features, like pits, ovens and silos are excavated half by hand. From the remaining half of these, samples are taken for various analyses (C14, charcoal, pottery etc.). These samples are sieved through sieves with meshes of 5 and 0.8 mm, and sometimes 0.5 mm, and the archaeological micro remains are picked out. The evidence is applied for spatial analyses and assignments of functions of buildings and features, among other things. Botanical examination of these samples does not yield many results as they are sieved through rather large meshes. Besides, these samples are often examined with the naked eye. As a consequence, small seeds, especially, are easily overlooked.

Sampling strategies for botanical analysis are undertaken less consequently. The volumes of the soil samples for botanical analysis vary depending on how much is left of the excavated structures. The samples are stored in plastic bags at the depot of the SRAL at Scy-Chazelles. No botanical analyses were carried out for a long time, through the lack of an archaeobotanist. For the purpose of this study, large numbers of sieved and unsieved soil samples were therefore available.

The selected unsieved soil samples were processed partially in the archaeological base at Scy-Chazelles, and partially in Leiden by several members of the staff of the Leiden Faculty of Archaeology. For the unsieved samples the standard Leiden procedure was employed. A minimum of two to five

litres of sediment per sample were washed with running water through a series of sieves with meshes of 5 to 0.5 mm. Residues containing mainly charred plant material were dried in the open air on newspapers. Samples which presumably contained waterlogged material were stored in plastic bags, in water with some formaldehyde added. The Lorraine archaeologists adopted this method of sieving the samples on smaller meshes quite recently, for the purpose of (future) botanical analysis.

#### *Selection of locations and samples for this study*

As quite large amounts of samples from the Lorraine region were available, a selection had to be made. 20 locations in the Lorraine region were selected for this study. Their position is indicated on the map (figure 4.2). With this selection, an attempt was made to offer a representative sample in chronology as well as in spatial distribution. It was inevitable, though, for the emphasis to be placed on the Later Bronze Age and Hallstatt period, as this period is best presented in this region. In some cases, samples were analysed of which the exact date was not known at that time. As a consequence, some results, in a second instance, fall outside the scope of the study, strictly spoken (e.g. with a La Tène date). Where the spatial distribution of the locations is concerned, a concentration along the Moselle was inevitable (as explained above).

#### **4.7 A selection of other locations in the study region**

For the purpose of the analysis of the investigated botanical material a selection was made of published, or otherwise available botanical data from the study region. In order to make a relevant selection of data all archaeological sites that were known to the author and where botanical research was carried out were investigated.

In the Netherlands, archaeobotany has had a long tradition, and as a consequence, the amount of data published or otherwise available is relatively large. In Belgium and Luxembourg archaeobotanical research hardly exists. As a consequence, archaeobotanical data are scarce and irregularly distributed over this part of the study region. In Lorraine, archaeobotany was only recently introduced as a specialisation, but at a fast pace. No published data are available from this region, but in the near future a relatively vast body of data will hopefully be released, beginning with this study. From the available data a selection of sites was made. First, a group of sites that make up the archaeological and archaeobotanical context for the interpretation of our data from the Moselle region. And second, a group of sites in the MDS region (in Flanders and the Netherlands) making up the spatial and chronological context in which we can interpret the Geldrop data.

#### MOSELLE REGION SITES

For a comparison of botanical evidence from the Moselle region we have the following sites at our disposal (table 4.1): Weiler-zum-Turm (Hopf 1980) and Budersberg-Dudelange-Angeldall (Kroll 1997), both in Luxemburg, the sites of Leuze en Hainaut/Tourpes/Fraideberte (Laurent 1998b) and Beloeil-Tourpes (Fechner/Laurent 1995), both taking a more periferal place in the study region, i.e. the south-west part of Belgium and finally the site of Remicourt-Fond de Lantremange (Laurent 1998a), which takes an intermediate place between the Moselle region and the MDS region (see map, figure 4.3).

#### MDS REGION SITES

For a comparison with the botanical evidence from the site of Geldrop we have the following sites in the MDS

region at our disposal (table 4.2): Son-en-Breugel (Bakels/van der Ham 1981), Someren (Kortlang 1998), Riethoven (Vanderhoeven 1991), Dommelen (Roymans 1985b), Bladel (Vanderhoeven 1988) and Sint Oedenrode (van der Sanden 1981) around the town of Eindhoven. In a wider circle around Eindhoven: Loon-op-Zand (Roymans/Hiddink 1991), Hilvarenbeek (Bakels 1975), Oss (Bakels 1981; Bakels 1994; Schinkel 1998; Witmond no date) and Boxmeer (van der Velde et al. 1998) and the Belgian site of Donk (Vanderhoeven 1988). Other botanical evidence comes from two sites located in various parts of the Flemish landscapes: Evergem-Ralingen (de Ceunynck et al. 1984) and Neerharen (Roymans 1985a) (see map, figure 4.4).

| site                                 | period       | n samples           | author(s)                         | attributed to group |
|--------------------------------------|--------------|---------------------|-----------------------------------|---------------------|
| Leuze en Hainaut/Tourpes/Fraideberte | Bronze final | 11 layers in 1 silo | Laurent 1998                      | 2 and/or 3          |
| Beloeil-Tourpes                      | Bronze final | 1                   | Fechner/Laurent 1995              | 2 and/or 3          |
| Remicourt-Fond de Lantremange        | Hallstatt D  | 2                   | Laurent 1998                      | 4                   |
| Weiler-zum-Turm                      | Hallstatt D  | 1                   | Hopf 1980, cited from Bakels 1991 | 4                   |
| Budersberg-Dudelange-Angeldall       | La Tene A    | 1                   | Kroll 1997                        | 5                   |

Table 4.1 Survey of sites for the comparison of the botanical data from Lorraine and Luxemburg

| site             | period | n samples         | author(s)                                                 | attributed to group |
|------------------|--------|-------------------|-----------------------------------------------------------|---------------------|
| Geldrop          | MBA    | 21                | de Hingh, this publication                                | 2                   |
| Son en Breugel   | MBA    | 1                 | Bakels/van der Ham 1980                                   | 2                   |
| Boxmeer          | MBA    | 1                 | van Beurden/Buurman/de Man 1998 (int. rapport ROB)        | 2                   |
| Oss-IJsselstraat | MBA    | 1                 | Bakels 1981                                               | 2                   |
| Boxmeer          | LBA    | 1                 | van der Velde 1998                                        | 3                   |
| Sint Oedenrode   | LBA    | impression        | van der Sanden 1981                                       | 3                   |
| Loon op Zand     | LBA    | 1                 | Roymans/Hiddink 1991                                      | 3                   |
| Hilvarenbeek     | LBA    | impressions       | Bakels 1975                                               | 3                   |
| Riethoven        | EIA    | 10                | Vanderhoeven 1991                                         | 4                   |
| Someren          | EIA    | 12                | Kortlang 1998 (int.rapport IPP)                           | 4                   |
| Neerharen        | EIA    | 2                 | Roymans 1985a                                             | 4                   |
| Oss-Ussen        | EIA    | 4 and impressions | Bakels 1994, also in: Schinkel 1998                       | 4                   |
| Geldrop          | MIA    | 9                 | de Hingh, this publication                                | 5                   |
| Son en Breugel   | MIA    | 9                 | Bakels/van der Ham 1980                                   | 5                   |
| Bladel           | MIA    | 18                | Vanderhoeven 1988                                         | 5                   |
| Evergem          | MIA    | 1                 | de Ceuninck et al 1984                                    | 5                   |
| Dommelen         | MIA    | ?                 | Roymans 1985b                                             | 5                   |
| Oss-Ussen        | MIA    | impressions       | Bakels 1994, also in: Schinkel 1999                       | 5                   |
| Oss-Mettegeupel  | MIA    | 2 complexes       | Witmond no date (int. rapport Fac. of Archaeology Leiden) | 5                   |
| others:          |        |                   |                                                           |                     |
| Boxmeer          | E/MIA  | 1                 | Buurman 1987                                              | 4 and/or 5          |
| Donk             | IA     | 18                | Vanderhoeven 1988                                         | 4 and/or 5          |
| Oss-Ussen        | LIA    | impressions       | Bakels 1994, also in: Schinkel 1999                       | 5                   |

Table 4.2 Survey of sites for the comparison of the botanical data from the site of Geldrop



Fig. 4.3 Study area. The sites for the comparison with the locations in the Moselle region. 1= Leuze-en-Hainaut (B), 2= Beloeil (B), 3= Remicourt (B), 4= Düdelingen (L), 5= Weiler la Tour (L)



Fig. 4.4 Study area. The sites for the comparison with the site of Geldrop. 1= Geldrop, 2= Loon op Zand, 3= Oss, 4=Boxmeer, 5= Sint Oedenrode, 6= Hilvarenbeek, 7= Son en Breugel, 8= Bladel, 9= Someren, 10= Riethoven, 11= Dommelen, 12= Evergem, 13= Neerharen