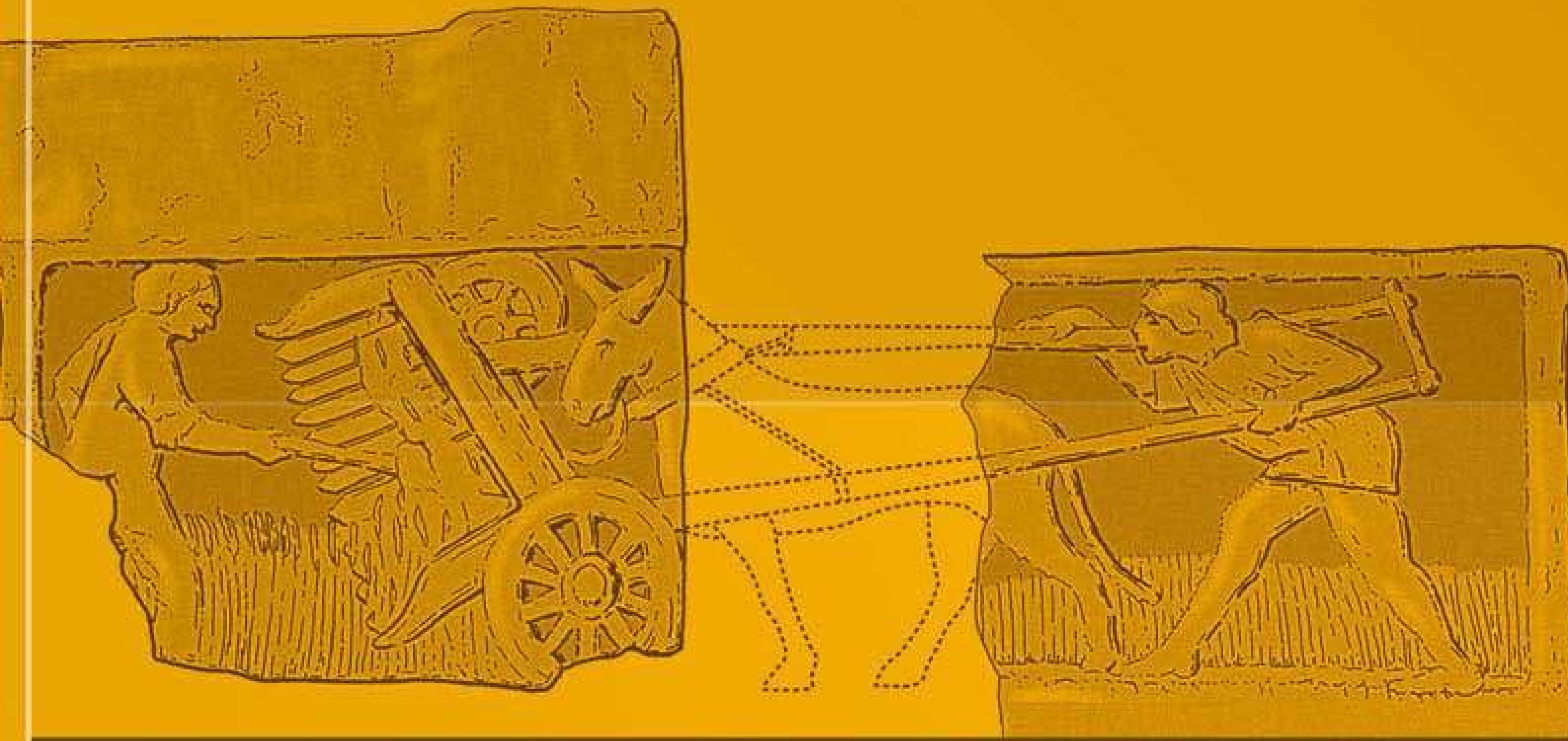
Corrie C. Bakels



The Western European Loess Belt

Agrarian History, 5300 BC – AD 1000

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by

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Springer

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Cover illustration: The picture represents the reaping machine from Gaul; it is based on fragments of tombstones found in Buzenol and Arlon in Belgium, reunited as suggested by C. Massart.

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Preface

Many books on the agrarian history of Western Europe begin with the Middle Ages, which is quite understandable, because they are mostly based on written sources. But everybody who is interested in agriculture knows that agriculture started much earlier and also that information on that millennia-long period is provided by archaeology. Admittedly, there are books which deal with almost the entire story, from prehistory to well into historical periods, but the problem with them is that they focus on the past of modern nations, disregarding the fact that their boundaries were not necessarily the boundaries of former times. I wanted to write using another kind of unit: a region with only one type of soil and climate, as these two are all-important factors where farming is concerned.

I chose the region covered with loess, west of the river Rhine. The scientific background is explained in Chapter 1 of this book. Another reason was that I devoted and still devote much of my own research to this region. And, I have to admit that my interest was also triggered by the fact that I was born there.

Writing a book on a single region has, however, a distinct disadvantage compared with writing a book on a modern nation. There are always periods about which archaeology or other sources have nothing to tell. Authors dealing with a nation can always switch to a part of their country where information is not lacking. For instance, if information about farmers on loess soils is absent, there may be information available on farmers in sandy or marshy areas during the required period. This is often the case, but the practice of switching over leads to gaps in our knowledge being smoothed over. It is my opinion that switching is not always the correct approach, as the history of one region is not a priori identical to the history of another region. In my approach voids cannot be ignored. It lays bare how much we know, and how much we do not know.

This book starts with the first farmers and ends when food production is no longer the chief source of livelihood for the entire population. The long period, 5300 BC–AD 1000, is divided into six stages. Each stage has its own chapter with subchapters devoted to crops, crop cultivation, livestock and livestock handling, the farm and its yard, and the farm in connection with other farms and the outside world. Because the book is intended for a general public interested in the subject, every chapter starts with a short outline of the cultural context. After that the known facts are presented. The crop plants and animals are mentioned together with their origin.

The subchapters on crop cultivation deal with the operational chain from preparing fields to storage. The introduction of tools, such as the plough, the wheel and wagon, and the scythe is discussed. Farm buildings, or at least their ground-plans, are described. The clustering of farms into hamlets or the absence of such aggregations is mentioned. Two short chapters deal with the impact of farming on the landscape.

The information is drawn from my own work, but also to a large extent from publications written in French, German or Dutch, which are not easily accessible for a wider public. It was my intention to bring all this information together. But if I were to mention all my sources in the text, the book would have become unreadable. Therefore I have refrained from mentioning references and provide a 'select bibliography' instead. The publications mentioned there provide more details and more specific references.

Of course there had to be illustrations. Most of them are derived from or based on the multitude of articles read up for this book. I thank all the original authors for their willingness to allow me to use their intellectual offspring. I cannot mention them here, but their names are to be found in the list of 'Sources of figures and tables'. All the figures have been redrawn by one single person: Joanne Porck, who I thank for her great enthusiasm and care. As mentioned before, I wanted to make the agricultural history of the loess region west of the river Rhine known to a larger public. Therefore I wrote the book in English and this English had to be corrected of course. Kelly Fennema I thank you for this part of the work and also for assisting me with the editing of the manuscript.

Three referees have searched for scientific mistakes: Rose-Marie Arbogast of the University of Basel (Switzerland), Michael Ilett of the University of Paris I Panthéon-Sorbonne (France) and Willem Willems of Leiden University (the Netherlands). A fourth critical referee, who was not familiar with the subject at all, has read the text in order to see whether it was palatable to the kind of public I had in mind: Garbrand van Dijken, a Dutch agricultural engineer. I have learnt much from the comments of all four.

Contents

Chapter 1
The Loess-Covered Region West of the River Rhine, 5300 BC–AD 1000

1.1 Introduction

At first sight it may seem strange to have a book on agricultural history devoted to a region defined by its type of soil. But soil is, next to climate and availability of water, an all-important factor where farming is concerned. Thus, writing a history of farming on a specific class of soil makes perhaps more sense than writing an agricultural history of a present-day state.

My choice fell on the European loess belt. It is there that traces of the earliest farmers of Central and North-western Europe were discovered. These farmers settled almost exclusively on loess. This belt running roughly east-west covers a wide region, certainly too wide to be covered by a single book. Therefore I have concentrated on its western part, which I define as the part west of the river which runs from south to north (Fig. 1.1). This large river forms a natural barrier, but is not impossible to cross. In the past and into modern times its course has served repeatedly as a political frontier. During the period covered by this book this was most obvious during the Roman era. In addition I have chosen a western limit, namely the Channel. This wide stretch of water represents another natural barrier. As a result, the agricultural history of neither the English part nor the Channel Islands part of the loess belt is featured in this book. I also left out the north coast of Brittany, because this outlier of the continental loess belt seems to have had a rather different cultural development.

The first farmers west of the Rhine displayed a remarkably uniform cultural identity, though some slight subregional differences can be pointed out. The cultural cohesion was maintained during the following centuries. And even at the end of the period covered by this book cohesion was still present, firstly because the entire region became part of the Roman Empire and secondly because the region was the core of the early medieval Merovingian and Carolingian kingdoms.

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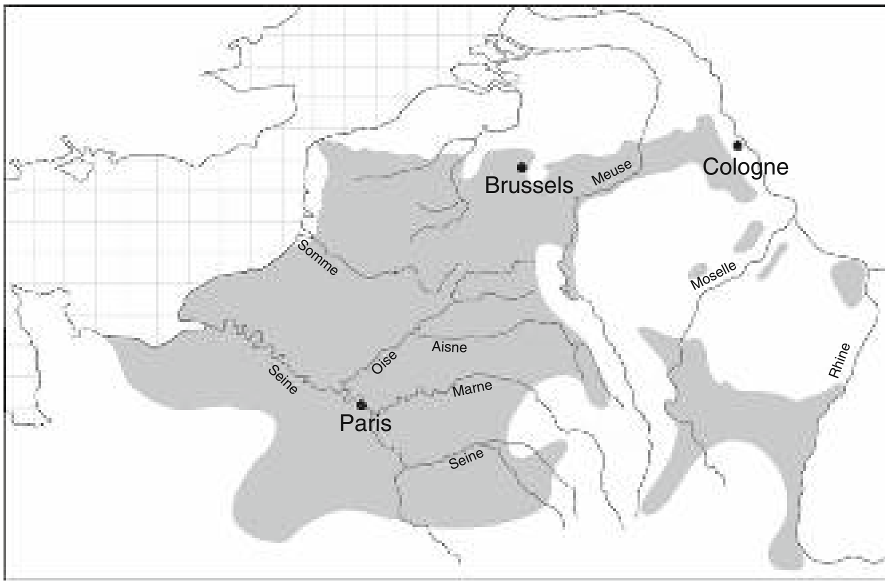

Fig. 1.1 The loess belt (*grey*) between the river Rhine and the Channel

1.2 Loess

Loess is an aeolian deposit, which means a sediment consisting of particles with sizes smaller than 60 μm transported by wind before settling down. Wind is able to pick up such material from deserts and carry it in suspension over considerable distances. The loess of the region in question was picked up in polar deserts bordering the ice-caps of the last two Ice Ages and was blown southward. The dust was either dropped by a decrease in wind velocity or washed down by rain. In the process the material was sorted out. Heavier particles of the size of sand settled closer to the deserts, and lighter particles were blown further away from the original source. Thus, a belt of aeolian sand lies north of the belt of loess. The east-west orientation of the belt is explained by the predominance of winds blowing from northerly points of the compass.

The deposit was prevented from being taken up again by wind because it was retained by vegetation, which was a steppe vegetation at the time. Loess is unstratified. Its particles are not firmly bound but loess is firm enough to maintain vertical exposure without immediate collapse. Drainage of surface water is good, but the capillary structure of the deposit is such that water retention is also good. Therefore loess is good for raising crops. It is also easy to till. Heavy rain in winter does not stay long enough on the surface to damage winter crops and the capacity for water retention is large enough to bridge dry spells in summer.

The loess deposits are oxidised to a pale brown colour. Originally the loess was calcareous, but during considerable stagnations in deposition, decalcification took place in connection with soil formation, resulting in several soil horizons separated

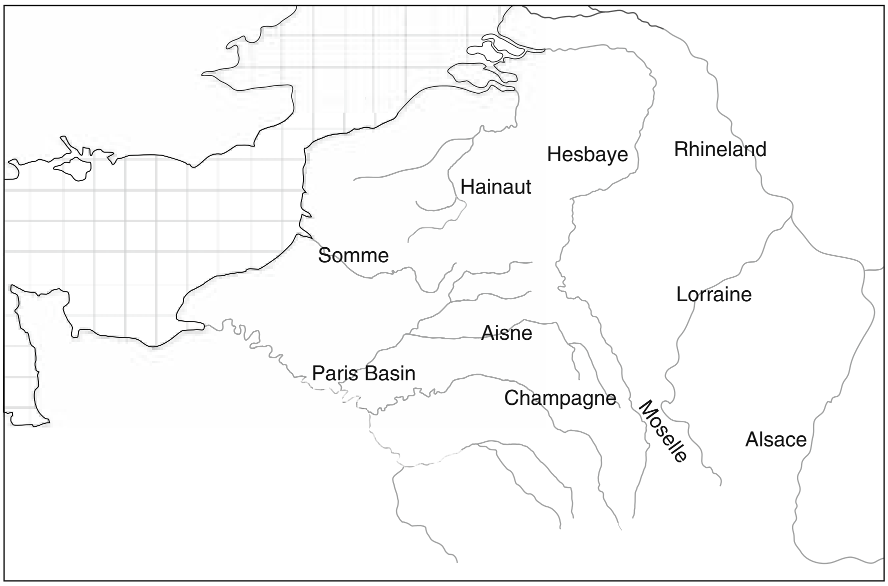

Fig. 1.2 The location of some important areas mentioned in the book

by unaltered loess. Such horizons are not important for agrarian history, except for the last one which developed after aeolian deposition had finally ceased.

Loess is very often associated with the soil type chernozem (black earth): a soil characterised by a thick, black, largely organic layer lying almost directly on top of the unaltered parent material. However, chernozem belongs to regions having a continental climate and limited rainfall. To what extent chernozem initially played a role in the region considered here is still a point of debate. Certain blackish deposits in prehistoric pits are interpreted by some researchers as relicts of a former black earth, but undeniable proof is still lacking. More probably, the amount of rainfall was too high to be compatible with the development of true chernozems, at least in the long run. The present-day soils show a displacement of soluble matter and the finest mineral particles from the top levels to a deeper level where they accumulated. The result is a 'brown earth' or 'grey-brown podzolic'. If the layer with enrichment of fine mineral particles (clay) is well developed this goes in certain areas under the name of 'brick layer', because it is more sticky than the parent loess and therefore suitable for making bricks (and pottery).

The exact process and speed of soil formation is still not very well known, but remnants of ancient soil trapped in deep pits or preserved by fire as lumps of burnt loam show that some soil formation had already taken place before the arrival of the first farmers. They must have found an already decalcified loess and something like a 'brick layer'.

As mentioned earlier, loess is very suitable for growing crops. Nevertheless, it is not optimal as far as nutrients are concerned. On the one hand loess is better than sandy soils, but on the other hand it is inferior to river loam. To maintain fertility it requires marling and manuring, but whether such techniques were already practised during the period covered by this book will be discussed in the appropriate chapters.

The thickness of the loess cover is very uneven. In some areas it may be as thick as twenty metres; in others the cover is very thin. The most important part with a thin cover is the north-western part of France, around the town of Amiens and further to the west. The rock immediately beneath this cover is chalk and this limits the water-retaining capacity of the overlying loamy deposits, making them less favourable to general crop growing. The same condition is found in the areas bordering on the French Champagne district (Fig. 1.2). In the Champagne district itself loess is only present in very small patches. It may be questioned whether these areas should be included in a book concerned with agriculture on loess, but I included them firstly because they may have lost some of their loess cover through erosion, and secondly because there were no indications during the writing of this book that they had a different agricultural history.

1.3 The Loess Region

The altitude of the region does not exceed 300 m above sea level. Essentially most of the region is a vast plain with a gently undulating surface, dissected by rivers. Stronger relief is mostly found at the edges, where loess accumulated only on the lee side of elevations in the original landscape. An example is the lower course of the river Moselle.

The rivers flow in valleys that were formed long before the deposition of loess. Some of the valleys are wide with gentle slopes, such as the valley of the river Rur (in Dutch Roer) in the German Rhineland, others have cut deep valleys with steep slopes, such as the lower course of the river Aisne in France. They divide the region into units which are known as ‘plateaus’. It is the plateaus which are covered with loess. Gentle slopes have a loess cover as well, but steep slopes and valley floors do not. Loess is very prone to erosion. Slopes of 2% may already be too steep when not protected by a vegetation cover. Erosion may stop, if only temporarily, at the ‘brick layer’, which has more cohesion and only starts to give way at a slope of 8%. The eroded silt settles in depressions and shallow valleys as a sediment called colluvium. In valleys with active running streams the silt is taken up by the flow to be deposited elsewhere as river loam.

Erosion took place in the first periods after deposition and afterwards as a result of anthropogenic deforestation. In between the displacement of loess was kept in check by the vegetation cover. This vegetation also provided a good balance between rainfall and drainage. Small valleys did not have surface streams during this period. Investigations in the German Rhineland showed that in such valleys running water was present only before the return of the full climax forest after the Ice Age and after an advanced stage of deforestation by humans. During the period of full vegetation cover, stagnant water in depressions and on valley bottoms was a rare phenomenon as well. The result is that formation of peat was also rare. This fact restricts the possibility of a detailed reconstruction of the former vegetation (see Section 2.6).

In general the loess plateaus have a deep water table. Depths of over 10 m are common; and digging wells is therefore a strenuous task. Easier access to water is provided by springs occurring on slopes where impermeable rock underlying the loess is exposed, or, more commonly, by streams in the valleys. It is not surprising that most of the early occupation was confined to the edges of the plateaus and, in areas with steep slopes, also to the higher parts of valley bottoms.

During the period considered here the region had an oceanic version of a temperate climate, just as today. At present the mean annual temperature is c. 10°C. The mean rainfall lies in the range of 600–800 mm and precipitation is distributed rather evenly over the months. Of course, the temperate climate has not always been exactly the same, but reconstructions offer no indications of dramatic changes. The distribution of precipitation over the year may have altered too. Formerly there may have been slightly more rain in wintertime. Fluctuations occurred all the time. The first farmers arrived during what has become known as the climatic optimum of the Holocene, i.e. the period after the last Ice Age. Since then, summer temperature has decreased by c. 1°C. The worst dip in climatic conditions, a dip towards the cold and wet, is found to have occurred around 800 BC, but subsequently the climate improved again. Some changes may have had local and temporary impact, but they seem not to have affected rural life in the long run.

1.4 The Choice of the Period: 5300 BC–AD 1000

The beginning of the period was not hard to define. In many regions of Europe the integration of agriculture into the daily life of the inhabitants was a gradual process. The old way of procuring food by hunting, fishing and gathering was slowly replaced by the active production of food. Tilling the soil for growing crops was not adopted everywhere at the same time as the tending of livestock. But in the loess region, and certainly in the loess region west of the river Rhine, this slow process seems to have been practically absent. Agriculture arrived as one package to be applied in its entirety; whilst hunting, fishing and gathering lost much ground. The old way of life held out in certain places but was not mainstream anymore.

The beginning of agriculture is dated around 5300 BC. Like most dates in this book it is based on calibrated ^{14}C dates, which means that the values obtained by radiocarbon dating have been converted to their most probable calendar age.

The end of the period is set at the end of the ‘period of direct agricultural consumption’. This choice was inspired by the book ‘The Agrarian History of Western Europe A.D. 500–1850’ published in 1963 by B.H. Slicher van Bath. He remarks that agricultural production before the nineteenth century was concentrated on satisfying the human need for food. Only from the nineteenth century onwards did raw materials other than food become important. He divided the agrarian history of food supply into three stages.

The first: Self-sufficiency, in which each household or small community produces all the food it consumes. This is called subsistence farming.

The second: Partial self-sufficiency, in which, while most people produce their own food, they also supply it as barter to the non-agricultural part of the population. This he calls direct agricultural consumption.

The third: Self-sufficiency, for a relatively small part of the population, while the whole non-agricultural population, and sometimes the agricultural population in part, satisfy their needs through a market where farm products are sold, mainly from districts with agricultural surpluses. This is indirect consumption. It is a society with an ever widening use of money.

The book by Slicher van Bath starts with his second stage, which he places between AD 500 and AD 1150. Its chief characteristic is that it concerns an agrarian society with an incomplete money economy. The consumption of agricultural goods is direct, i.e. there are no middlemen between producer and consumer. Everybody lives directly off the land.

I wanted to stop where this 'living directly off the land' ended. Following Slicher van Bath this should have been at c. 1150. But an important part of society that does not live directly off the land consists of the population of towns. As towns were already flourishing in the loess region before 1150 it was deemed reasonable to set the end of the period earlier. The tenth century is generally mentioned as the century of the rise of the medieval town. Therefore I decided to set the end at AD 1000.

The earliest farming communities belonged, as far as can be reconstructed, to the stage of self-sufficiency. In the course of time a small part of the population detached itself partly or entirely from food production. This has, more or less, been deduced from obvious differences in social status, such as can be detected by archaeological research. It must be kept in mind that the art of writing was not known during most of the period under review and that, therefore, written records simply do not exist. How the process proceeded through time is still a subject of investigation. But what is known is that social differentiation had its ups and downs. To set the lower limit of the second stage at c. AD 500, as Slicher van Bath does, is only half the truth. He chose this beginning because by then a new society was emerging after the collapse of the supply and demand system of Roman times. But in the long stretch of time since the introduction of agriculture, the Roman occupation represents only a short interlude. Elements of the second stage were already present before the arrival of the Romans.

1.5 The Framework of this Book

In the story presented here, the stage of self-sufficiency and the stage of direct agricultural consumption merge almost into one: everybody lived directly off the land. Nevertheless, the need was felt to divide the long period into sub-periods. I have opted for subdivisions with a cultural rather than an economic background. Introductory subchapters give brief outlines of this background, after which crops, crop production, livestock and livestock handling, farm buildings and yards, and the place of the farming communities in a wider context are described as far as known to me.

I have worked in the region for many years, compiled a lot of information and consulted many publications. Because of the profusion of both smaller and larger publications I have refrained from citing them in the text, in order to make the main text easier to follow.

The influence of farming on the natural environment is a subject that should not be neglected. The loess region has been farmed continuously from the beginning of farming onwards. This has changed the landscape completely and therefore two chapters have been devoted to this theme.

The book presents mostly facts. Our knowledge is still too patchy to allow more sophisticated economic or socio-economic analyses in the sense of a history of Longue Durée. An example of this patchiness is a complete millennium missing from the records.

Chapter 2
Sources

2.1 Information About a Distant Past

This book describes a long period during which writing was completely unknown or not commonly practised. Moreover, it deals with a time long ago and oral information is therefore also lacking. We do not know the people at all, except for roughly the last thousand years and then only fragmentarily. This implies that most of this book is based on information obtained through excavations. Information on crop plants, farm animals, tools, buildings, land, all rely on archaeological sources. This hampers our knowledge to a considerable extent as will be explained below. But even when written sources are available, these are of limited value.

2.2 Plants

The general fate of a plant is decay. Plants vanish by rotting away; but in certain environments plant material may survive and specific events may prevent decay. In an entirely dry environment plants are preserved by desiccation. Deserts, but also absolutely dry interiors of buildings or graves offer such conditions. In Western Europe these conditions have hardly ever been met with. On the contrary, the opposite, namely a waterlogged, oxygen-free environment is often encountered. Natural wet areas such as ponds and marshes, and unnatural ones such as wells, offer the right conditions. Preserved are sturdy parts of fruits, seeds, wood, and pollen. Fleshy fruits, tubers, bulbs and leaves become too slimy to recognise (Fig. 2.1).

Preservation by toxic substances is another way. It occurs in contact with, for instance, copper or bronze objects. This kind of preservation is rare though. More common is the replacement of plant tissue by mineral matter. Embedding in an environment rich in calcium and phosphorus salts provides such results. The organic substances become replaced by calcium phosphate. Pits dug in a calcareous soil and filled with dung, or pits filled with a large quantity of animal bone offer the right conditions (Fig. 2.2).

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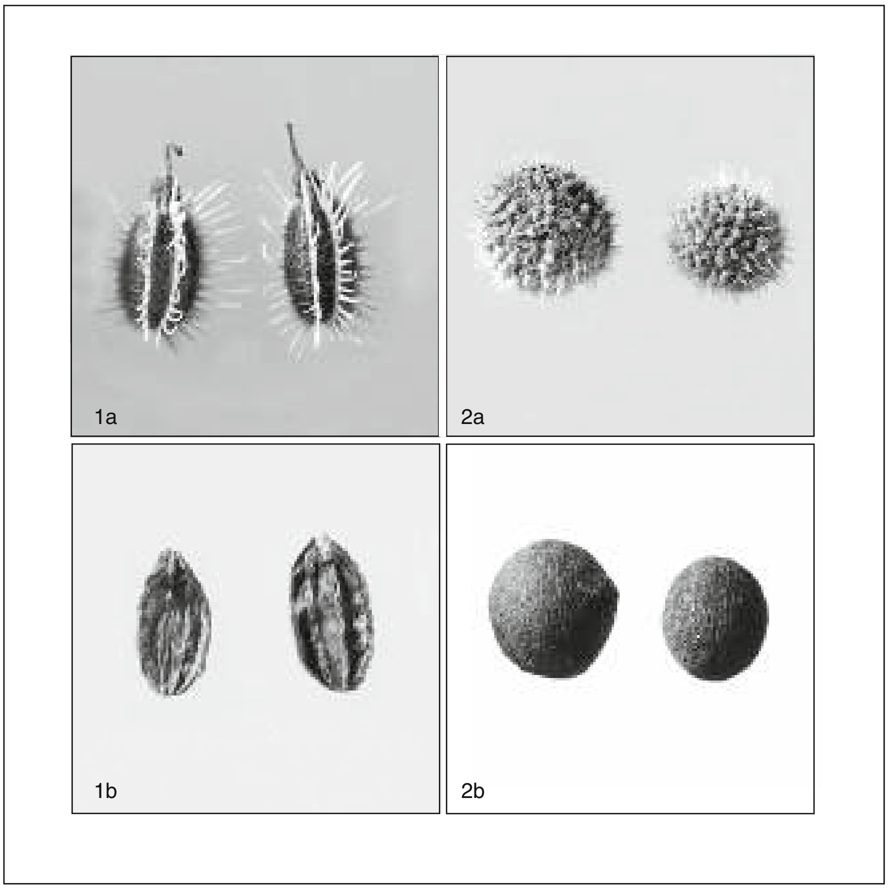

Fig. 2.1 Fruits of carrot (*Daucus carota*), recent (**1a**) and preserved by waterlogging whereby the spines are lost (**1b**); fruits of cleavers (*Galium aparine*), recent (**2a**) and preserved by carbonisation whereby the spines are lost (**2b**)

An event which prevents decay is heating to high temperatures in an environment poor in oxygen. It leads to charring. Especially dry, compact parts of plants are preserved in the resulting carbonised state. Examples are wood and dry seeds. Because most of the organic matter is converted into carbon, bacteria and fungi are unable to attack this kind of remains. The wood and seeds more or less keep their original form and can therefore still be identified (Fig. 2.3). Until quite recently it was thought that carbonised remains would keep forever. But it appears that environments with a high pH are detrimental to them. After burial for thousands of years in a calcareous sediment, such remains tend to fall apart.

Another event that preserves plants in a certain way is by impression. If parts of plants are, on purpose or by accident, mixed in with clay, for instance pottery clay, and if this clay is then fired, the plants burn away but leave an impression.

Fig. 2.2 Mineralised stems of sage (*Salvia officinalis*)

Impressions are studied by making casts which makes the identification of the original objects easier (Fig. 2.4).

In the case of the loess region it is the carbonised material that is commonly present. This kind of material contributes most to our knowledge of agricultural practice. Waterlogged material is less common. The water table in the region is rather low almost everywhere. Wells are scarce as will be seen in the following chapters. Moreover, people did not settle on the fringes of wetlands. Therefore, plant matter connected with rural activities had little opportunity to fall into the wet and become preserved by waterlogging. What is commonly found in the marshy parts in valleys was originally part of the natural vegetation. Such remains are used to reconstruct the environment. In this pollen plays a major part (see Section 2.6). Mineralised plants and impressions are not very important in the region.

Most plant remains are not readily noticed during excavations. Only fairly large objects or large quantities of seeds are generally observed and collected by hand. The reason is that plant remains are much smaller than the objects archaeologists are trained to look for. They have to be recovered by flotation or sieving. Carbonised matter tends to float in water whilst mineral matter tends to sink. If soil containing carbonised matter is poured into water and stirred, the plant parts will float to the

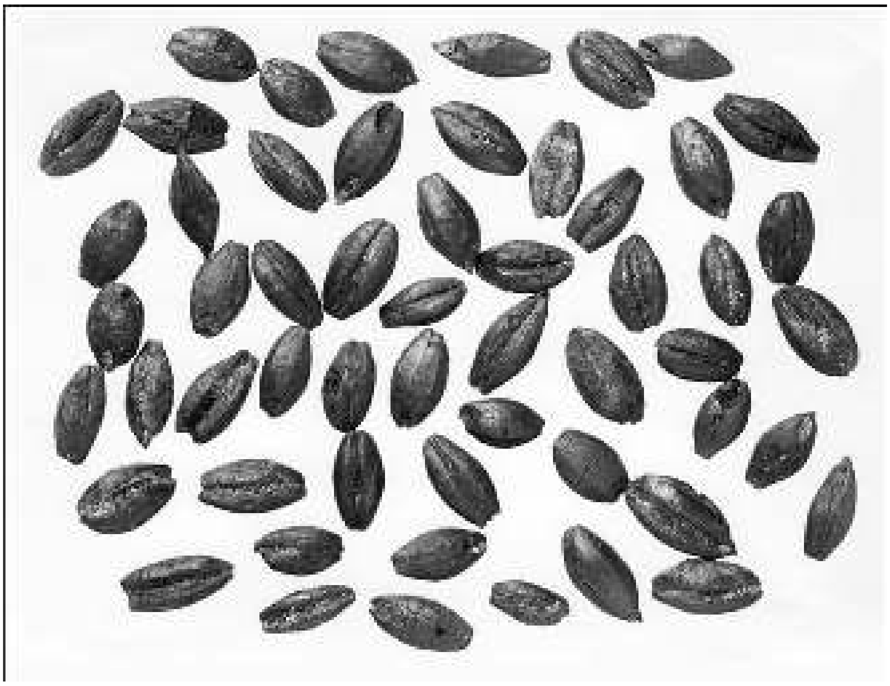

Fig. 2.3 Carbonised grains of barley

surface of the flotation basin and can be poured off. Unfortunately, some carbonised seeds are too heavy for this method and when the sediment sticks to the plants, as clay or loam will do, flotation may fail altogether. In such cases sieving of the wetted soil under running water is the only means (Fig. 2.5).

Waterlogged and mineralised plant remains are also retrieved by sieving, but not pollen. Pollen grains are recovered by a series of chemical treatments of the sediment encasing them. All matter other than pollen is dissolved or extracted by chemical means. This is possible because the outer wall of pollen grains is very resistant to all kinds of chemicals.

Identification of plant remains is achieved by comparing them with plates in atlases and by consulting reference collections of recent seeds, wood or pollen. Identification keys are of minor importance for seeds and fruits because they are often altered in the process of preservation. They tend to lose characteristic spines, for instance (Fig. 2.1). Most keys are based on recent seeds and fruits. The problem is smaller in the case of wood and pollen and keys are commonly used for the identification of these categories.

Summarising all that has been put forward so far, it is clear that not every plant can have survived down the ages. Sturdy, compact parts with a low water content

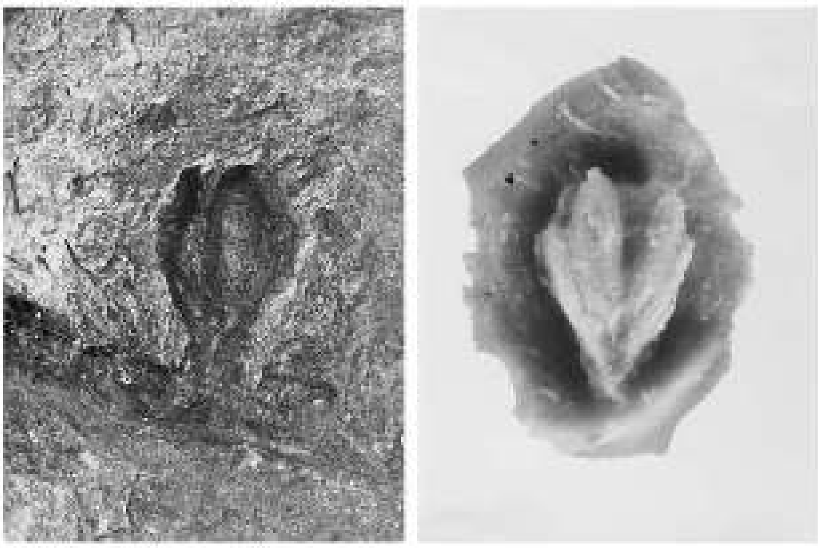

Fig. 2.4 Impression of a spikelet (two grains in their chaff) of emmer wheat in a pottery sherd (*left*) and a cast of the impression (*right*)

have had a better chance. The result is that such parts are the ones that are found during excavations. In the category crop plants cereals, at least their grain and chaff, and pulses are the best off, if deposited in a carbonised state. Oil-containing seeds tend to deform and even explode during charring, though they are quite often found carbonised, but they do better in a waterlogged environment. Waterlogging is also best for condiments and fruit stones. In contrast, waterlogging is detrimental to cereal grain and pulses. Only cereal chaff survives waterlogging.

The chances of survival considerably restrict our knowledge of the crops of the past. And, as remarked above, even carbonised cereals, pulses and oil seeds disappear from the records in the very long run if we are dealing with alkaline soils. This problem is felt in the southern part of the loess region, especially in the French Champagne, Paris Basin, and the areas near the Channel. It is striking that the settlements, occupied during the first millennia of farming in those areas, do not reveal much in the way of carbonised seeds and fruits. Although it has not yet been proven exactly, the calcareous subsoil may be the cause. As it is, most information on plants during this first stretch of time comes from excavations in the northern and eastern part of the loess region. From c. 1000 BC onwards the difference in preservation is no longer observed. From then on, all settlements contribute information concerning plants.

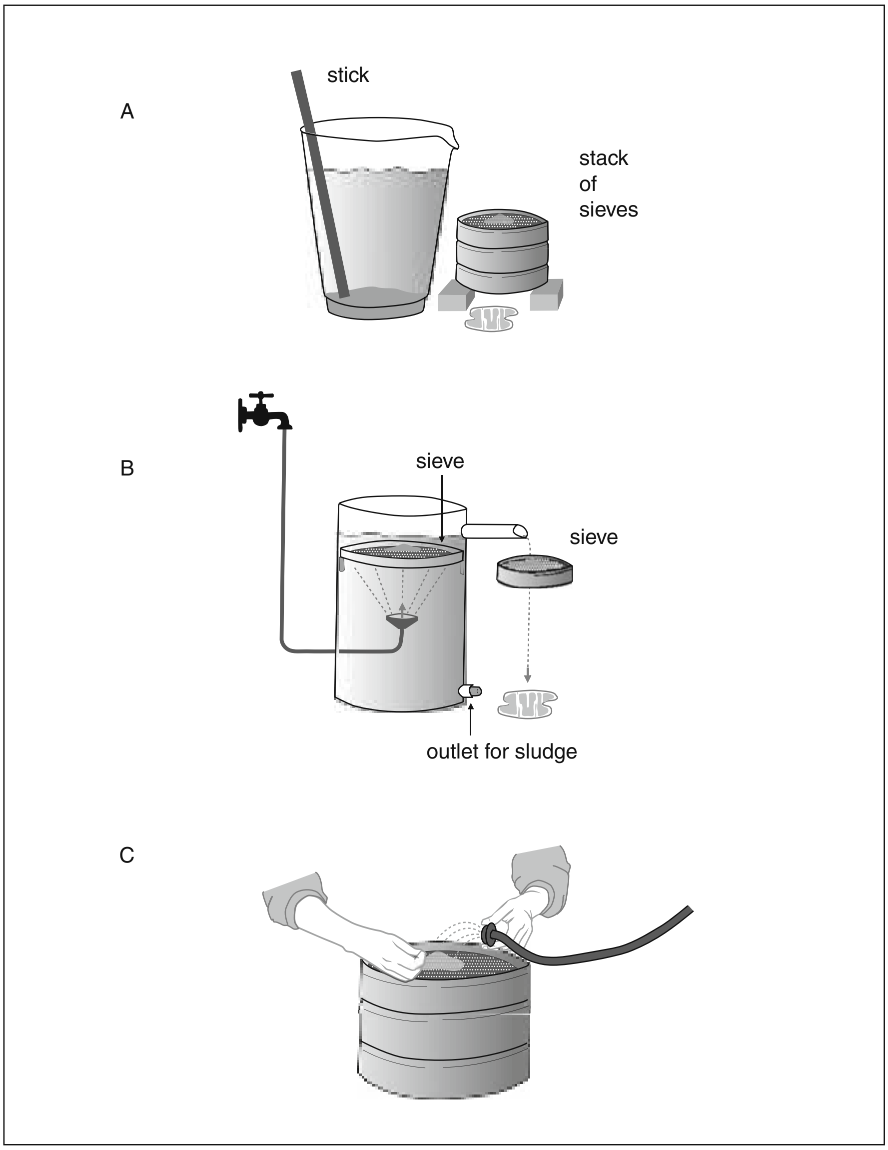

Fig. 2.5 Flotation and sieving. (**A**) A plain flotation method: stirring with a stick will bring the carbonised particles to the surface; the flot is poured from the vessel onto a sieve or a stack of sieves. (**B**) A more sophisticated flotation method: a layer of sediment is spread out on a sieve in the flotation basin and stirred by small jets of water coming from below; light particles swirl upwards and drift through the upper spout to fall on a sieve or stack of sieves. Sediment falling through settles on the bottom of the basin and can be discarded through the lower spout. (**C**) Sieving by hand

2.3 Animals

Just like plants, dead animals are subject to rapid decay. Only in year-round frozen or in desert-like environments can they be preserved as complete animals. Everywhere else their soft tissues rot away. This was the fate of the animals in the region under review. What remains depends on the characteristics of the soil in which they became embedded.

The bone skeleton of vertebrate animals will be preserved if buried in a calcareous environment. Bone is a calcified material. Laid down in it are salts in which phosphate and carbonate are combined with calcium. If a dead animal ends up in a soil poor in calcium its bones will dissolve and disappear from the archaeological record.

Dissolution is also the fate of bone deposited under water if this is not rich in calcium, but what may be preserved under wet conditions is the outer layer of bone which consists of another kind of material. When preserved, this outer tissue has a leathery appearance. Antler behaves in the same way. Not only the bones of vertebrates disappear by solution in a calcium-poor environment, molluscs disappear as well.

Burnt bone is more resistant to decay. It persists even in soils where normally bone dissolves. Unfortunately, this kind of remains is often rather fragmented, a state which affects the possibilities for identification. The enamel of teeth is resistant too, though it consists entirely of calcium salts. Its dense structure slows the dissolving process. In general, the compacter the structure, the slower the decay. Small, thin or hollow bones are the first to disappear. Large, massive bones are the last.

Skin may be preserved in bog environments, but has not been encountered in the region described in this book. The only exception is its derivative parchment, but that was kept under dry conditions. The same applies to hair, and therefore wool. Horn and feathers are not readily preserved either.

Remains of insects can be retrieved from waterlogged environments. Their chitin is not apt to rot. In some cases insects are also found charred, for instance when weevils in stored grain or pulses have become carbonised together with the crop (Fig. 2.6 and 2.7).

All kinds of remains are identified with the help of plates in atlases, but more so by comparison with collections of recent bones etc. Some animals which are of interest here, however, pose problems. It is more often than not impossible to distinguish between sheep and goats. Therefore, the following chapters refer often to sheep/goat. It is also difficult to distinguish mules from horses. And it is hardly possible to separate wild animals from their domestic relatives if the latter have not yet been altered by domestication or if they interbreed regularly with their wild kin. In our region this problem arises during the first stages of farming history where cattle and pigs are concerned. Wild sheep and goats are not native to the region. In later times, when keeping poultry becomes part of life on a farm, the distinction between wild geese and ducks and their domestic counterparts can be troublesome.

Bones provide more information than just names of animals. The morphology of bones and teeth reveal the age of the animals at death. Not exactly, but by age

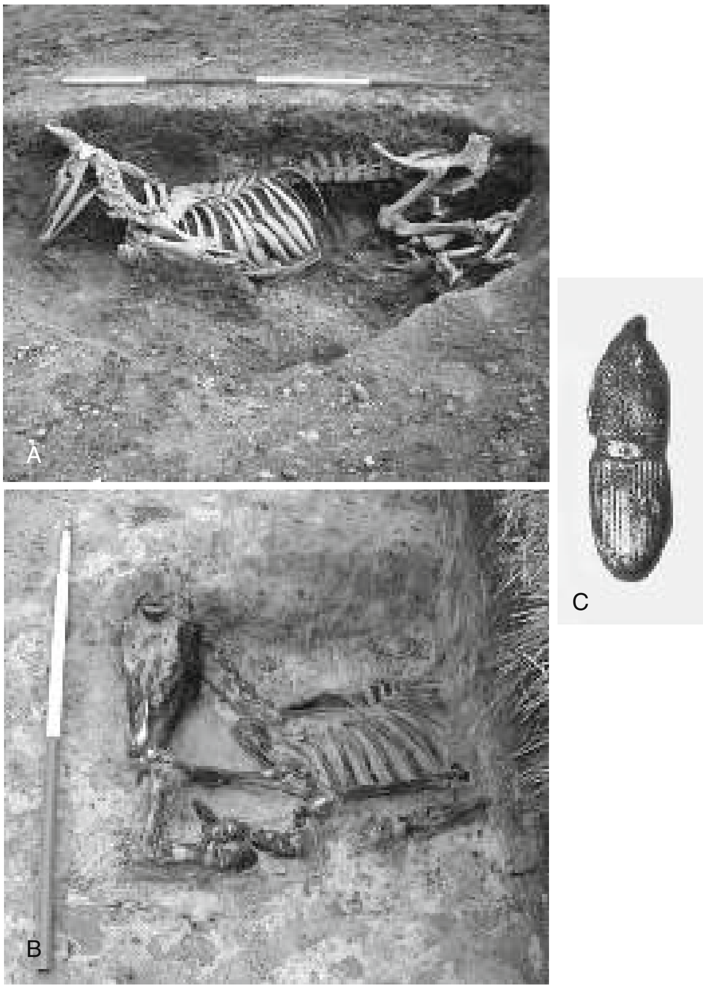

Fig. 2.6 Skeletons of a cow (**A**) and a horse (**B**) preserved under ideal conditions; **C** is an example of a carbonised grain weevil (*Sitophilus granarius*)

class. If, for example, most pigs were slaughtered as piglet or young animal, this will show. This means that pigs were kept for their meat. The few adult animals represent individuals required for breeding. Another example: if many sheep, both rams and ewes, were allowed to reach adulthood and even old age, they may have been kept for their wool. These are just some examples of what can be learned from an analysis of age.

Fig. 2.7 Well-preserved bone (**A**) and burnt bone (**B**), both as found in common waste

Another aspect revealed by bones, is the size of the animals. Whenever possible the calculation of shoulder heights will be mentioned in this book. Castration is still another feature. The practice shows in the bones, and its recognition is of importance for the study of animal traction. Special traces of wear or deformation, caused by too often hauling too heavy loads is also sometimes noticed.

What animals exactly looked like is however almost impossible to reconstruct. If a characteristic is mentioned, such as the hairiness or woolliness of sheep, this is done by comparison with ancient races still living somewhere in Europe. In the case of sheep, a breed often referred to is the Soay breed from Scotland. Only from the Roman Period onwards is more known because of the existence of more or less reliable pictures. Depicted are, for instance, mules, recognisable by their long ears. Nevertheless, such important aspects as colour or spots remain largely unknown.

It is obvious from the above that bone reveals most of the information. But bone is poorly preserved in decalcified environments. Unfortunately such conditions prevail in the northern part of the loess region. Most of the information therefore comes from the southern part. This is just the part where information on plants is poor during the first millennia of agriculture.

2.4 Tools

Before mechanisation of farming, a large proportion of the farmers' tools were made of wood or other perishable material. What is said about plants in Section 2.2 also applies to tools. Turning up in the archaeological records are parts of implements