THE OSTELOGICAL AND BOTANICAL EVIDENCE FOR NEOLITHIC AGRICULTURE IN EUROPE

by

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PREFACE

Any work of this kind, in which the amount of published data cannot be assessed, must start as an act of faith. It was Professor Stuart Piggott who supported this faith with much practical help, and his clear and valuable criticism has resulted in the work in its final form. For the many patient hours he has spent in discussing and advising me, my indebtedness is very great. Professor Charles Thomas of Leicester first suggested the possibility of this survey, and I am grateful for his early encouragement.

Whilst in America I became indebted to Professor and Mrs. Robert Braidwood of Chicago who helped greatly with valuable discussions, information and hospitality, and also to Professor C. Reed of Yale who provided details from Near Eastern sites, and stimulating discussions. Professor Boessneck of Munich, Professor Stenberger of Stockholm and Dr. Bokonyi of Budapest kindly corresponded with information and copies of their publications, which were impossible to obtain in this country. Dr. M. Hopf of Mainz provided much useful information and help in clarifying botanical terminology. It is on her advice that I have adopted the generic names for bread wheat and club wheat as *Triticum aestivum* and *Triticum aestivo-compactum* rather than *Triticum vulgare* and *Triticum compactum*, on genetic grounds. Following Helbaek (1959a) the flax found in Europe has been designated as *Linum usitatissimum* and the names which appear in the earlier reports have consequently been changed throughout this text and catalogue.

The/
The archaeological cultures have been dated by means of the carbon 14 method using the half-life of 5570±30 years, and the Suess effect has been corrected for in the Groningen dates. All dates mentioned appear in years B.C. It must also be mentioned that this thesis is not based upon examination of the original osteological and botanical material, but upon the numerous interim reports and final publications by authorities in this field.

This work could not have been completed without the assistance of friends and colleagues who have helped in so many ways to encourage and sustain me, especially Dr. and Mrs. D.I. Smith whose helpful suggestions solved many problems. Finally, towards the latter stage of this research, both my husband and son tolerated much irritability and neglect on my part, but did not desert me either spiritually or physically.
INTRODUCTION

This dissertation is a survey of the various agricultural communities to be found in neolithic Europe. The evidence collected takes into account material known and accessible to the author up to 1966. It is composed of the osteological and botanical remains from sites, where these have been recorded, and where possible these are put into their appropriate cultural group. In the majority of cases sufficient evidence for conclusions regarding the subsistence-economics of the cultures concerned are obtainable. The agriculture of these archaeological cultures are then compared and contrasted.

It must, however, be stressed that in many instances there is either insufficient detail or none at all in the site reports. The greatest value clearly lies in the reports which provide descriptions, comparisons and a statistical analysis of both the bone and plant remains that have been discovered. Such reports are unfortunately few in number, and in the majority of cases only the species of animals present are known. In other instances it is stated that a certain animal was the basis of the economy, but the evidence upon which this statement was based is not provided. This is particularly unfortunate, since the numbers upon which a conclusion is reached are all-important. The larger the number of bones or plants involved, the greater is the probability that the information derived gives an accurate representation of the economy. In many cases, both in the early part of this century, and occasionally up until the present day, the bones and plants found during excavations were regarded/
regarded as being totally unimportant and so were discarded without even being mentioned in the final publications. Such practice has made a coherent knowledge of the subsistence-economics in certain areas virtually impossible.

During the second half of the last century, some remarkable work was done by Rutimeyer and Heer on the domestic animals and cultivated plants of the 'lake dwellings' in Switzerland. Rutimeyer found remains of small domestic animals which he termed 'turbary'. These include cattle (*Bos brachyceros*), sheep (*Ovis aries palustris*), goat (*Capra hircus palustris*), pig (*Sus scrofa palustris*) and dog (*Canis familiaris palustris*). These small domesticated animals were later found in many other areas of Europe and the same name was applied. Rutimeyer and Heer provided not only a description and identification of these remains, but also a statistical analysis so that an idea of the relative importance of the different animals could be obtained. This was the first time that archaeology and the natural sciences had worked together so successfully, and they provided, and still do provide, one of the best examples of how this work should be done. At a slightly later stage equally important work was being done in Scandinavia by Winge and Pira on the osteological remains of the coastal kitchen middens. The first person to recognise the importance of the archaeological food remains in this country was Pitt-Rivers, and at around the same time Pumpelly and Duerst provided the first comprehensive report on the faunal remains in the Near East at a site in Turkmenia. This report on the excavations at Anau is still one of the best to be found in the/
the Near East. This encouraging beginning to the investigation of the agriculture of prehistoric communities was, however, soon to subside, and in many areas of the Near East and Europe very little information was obtained during the following thirty years. More recently the interest in this subject has been revived, and in most regions of Europe and the Near East the animal bones and plant remains have been preserved and identified by experts.

The animals involved in the problems of domestication are species which survived the climatic change from the Pleistocene to the Holocene periods. There are four main species to be considered, namely cattle, sheep, goat and pigs. Of these, cattle and pigs were still to be found in most areas of Holocene Europe and the Near East, as they had been during the Pleistocene. The position of sheep and goat on the other hand is slightly different. They were common during the Pleistocene in both Europe and the Near East, but as their environment changed, they became concentrated in the Near East, and the general opinion is that they ceased to exist in Europe as the climatic conditions became unfavourable. The accepted distribution of these four wild species during the period which in archaeological terms is the transitional mesolithic/neolithic phase is shown in Fig. 1.

Wild cattle, or aurochs, which were found over most of neolithic Europe, are classified as *Bos primigenius*, and it is this species which occurs again in the Near East. The version found in eastern Iran and India is referred to as *Bos namadicus*. It is basically the same animal as/
as the aurochs, but with certain modifications as a result of its different environment. No small breed of wild cattle has been established, although there have been various claims for its existence. Hence it is from the large species of aurochs that the domesticated animals must originate.

The distribution of wild sheep and goat is confined to Asia and certain Mediterranean islands. The following species of sheep need to be considered as the prototypes for the domestic form: the European mouflon (Ovis musimon) which is confined to the islands of the Mediterranean, and the Asiatic mouflon, or red sheep (Ovis orientalis), the urial or mountain sheep (Ovis vignei), and the argali (Ovis ammon). The Asiatic mouflon and the urial have many similarities and it has been suggested that the latter could be included in the former group (Reed 1960). The distribution of the urial lies to the east of that of the mouflon, extending from Iran, through India to Tibet. The argali is found to the north of this in the Altai mountains of China (see Fig. 1). The sheep relevant to the origins of domestication in the present context are the mouflon and the urial.

The position of the goat is much less complicated. There is only one species of wild goat, the bezoar or pasang (Capra hircus aegagrus), and it is from this that all domestic forms arise. The bones of domestic sheep and goat are virtually identical with only a few distinguishing features. For this reason these animals are often considered together and called ovcaprids. The small domestic ovcaprids are described as turbary, and large sheep similar to the mouflon which were found during the late neolithic have been called 'Copper sheep' by Duerst.

All/
All domestic pigs originate from the same wild species (*Sus scrofa ferus*). There is, however, a sub-species, *Sus vittatus*, which is found in South-East Asia, and is a slightly smaller animal. It has been suggested that pig domestication originated in this region of Asia, and so spread to western Asia and Europe (Sauer 1952). The wild pig found in south-east Europe bears some similarity to this south-east Asian variety, and is smaller than the more common *Sus scrofa ferus*.

The other animals to be considered are the dog and the horse. Various suggestions have been made for the wild ancestor of the dog. These include dingos, jackals, pariah dogs, unspecified wild dogs and the wolf. The idea of a wild dog as the ancestor was first proposed by Dahr (1937), who pointed out that the differences between the domestic dogs and wolves were too great for the former to have originated from the latter. The dingo and pariah dog are thought to be recent representatives of this group. However, it has been shown that domestication can reduce the size of the animals appreciably, so that Dahr's argument for an unknown wild dog as ancestor is no longer valid. There has been no detailed study of the pariah dog, so that its role in the origin of the domestic dog cannot be established (Reed 1960). It has also recently been proved that the jackal was not the wild ancestor of the dog (Clutton-Brock 1962; Reed 1960). There remains the wolf. There are two types to be considered, the large European wolf (*Canis lupus*) and the smaller Arabian wolf (*Canis lupus arabs*). Both of these played an important role in the emergence of the domestic dog, and it is probable that both were domesticated independently.
Wild horses can be divided into two main groups (Lundholm 1949). The Eastern group includes the Przewalski horse and the tarpan, and the western group consists of the large Germanicus horse and the smaller Micohippus horse. The Przewalski horse has always been confined to Asia, even during the palaeolithic, and recently new sightings of this wild horse have been reported from Mongolia (Kaszab 1966). Both this horse and the tarpan were present in various areas of the Near East during the neolithic period. Of the European horses the Germanicus breed is found to the north in Scandinavia and Germany and the Micohippus breed to the south of this. The distribution of the tarpan extends into southern Russia and into eastern Europe. Other equoids mentioned in this thesis are the half-ass or onager, and the donkey. Both of these occur wild in the Near East, and were domesticated during the Chalcolithic period. Of these various equoids the tarpan is thought to be the most important one involved as the wild progenitor of the domestic horse (Lundholm 1949).

In connection with the donkey it should be mentioned that although this animal was thought to be extinct in Europe after the Palaeolithic, it has recently been shown to be present during the early neolithic in eastern Europe by both Bokonyi and Necrasov. There is, however, no evidence for its early domestication.

The "noble" grasses, as the wild prototypes of the cultivated cereals are called, have a much more limited distribution. With the exception of millet, they are confined to Asia. Their generalised distribution is shown/
shown in Fig. 2.

The wheat genus is divided into three groups. The first is the diploid group of which einkorn is the only representative, the second is tetraploid and includes emmer, hard wheat and other varieties which do not enter into this discussion. The final group is composed of the hexaploid wheats, namely bread wheat, club wheat and spelt.

Einkorn originates from *Triticum aestivum* and emmer from *Triticum dicoccoides*, and of these einkorn has the widest Asiatic distribution and also is found in a small area of southern Greece (see Fig. 2).

There appear to be no wild prototypes for the hexaploid wheats. Both bread wheat and club wheat are thought to have arisen as a result of chromosome aberration in emmer. The origin of spelt is more obscure. Hybridization between emmer and club wheat has been suggested, as has chromosome aberration in club wheat. Spelt occurs in a few instances during the neolithic but was not of importance until the Iron Age. Hard wheat is also derived from emmer.

All cultivated barley originates from a single wild form, *Hordeum spontaneum*, which has a wider distribution than either of the wild wheat forms (see Fig. 2). This wild form is two-rowed, and the earliest cultivated variety was also two-rowed. From this species the six-rowed barley emerged. It has also recently been created artificially from the two-rowed form by radiation treatment. Four-rowed barley is also recorded in Neolithic Europe, and it is derived from the two and six-rowed types.
Millet occurs wild in both Europe and the Near East and may be divided into two cultivated species. The first is broomcorn millet (*Panicum miliaceum*) and its wild progenitor is unknown (Helbaek 1959b). The other variety is Italian millet (*Seteria italicana*) which is derived from *Seteria viridis* and is found in southern Europe.

Various legumes are found wild throughout Europe and the Near East, and those cultivated include peas, lentils, vetch and bean.

The other important plant to be cultivated was flax. This has been shown to be derived from *Linum bienne* by Helbaek (1959a), and it is found wild in the Near East. Another species is found in central Europe *Linum austriacum*, but the cultivated flax found in Europe is not derived from this species.

There are two regions which lie within the distribution of wild cattle, sheep, goat, pig, wolf, sinkorn, emmer and barley. One lies above the source of the Tigris in Kurdistan and the other is in Palestine. The former forms a crescent-shaped area in the foothills of the Zagros mountains, and is referred to by Braidwood as the Fertile Crescent. In this hilly zone crops would seldom be lost because of lack of rain, and sheep and goat, which seem to be the first animals to be domesticated, are found wild in the surrounding countryside. In the primitive cereal fields sinkorn, emmer and barley all occur together, and never separately, so that the centre of cultivation must lie within the area of their common distribution. Braidwood maintains that this happened within the Fertile Crescent in Iraqi-Kurdistan, and Kenyon says it took place in Palestine.

The/
The first site to be excavated by Braidwood was Jarmo, which lies in the Chemchemal valley, and evidence of an aceramic agricultural society was found. The date of this site is in some doubt as various carbon 14 dates were obtained, although Braidwood favours a date of around 6000 B.C. Since then several sites have been found, all lying within the Fertile Crescent, which provide evidence for early agriculture. One of these sites where sheep were in the process of being domesticated (Zawi Chemi Shanidar) is dated to around 9000 B.C.

The site upon which Kenyon's argument is based is Jericho, where domestic goats have been found. The plant remains have not yet been reported upon, although from the vast size of the settlement it seems reasonable to assume that cereals were being cultivated rather than gathered. There are, however, no further sites known to support this theory, and the general climatic conditions are more in favour of the Fertile Crescent as the centre for the evolution of agriculture.

Braidwood has discussed the emergence of these food-producing societies in detail (1952; 1953a; 1953b; 1954; 1957; 1958a; 1960a; 1960b; 1960c; 1962a; 1962b; Braidwood & Negahban 1960). As he sees it, the evolution was a gradual one, starting with specialised food-gathering and the exploitation of a particular animal, and developing into a period of incipient agriculture from which the cultivation of wheat and barley emerged together with the domestication of ovicaprids. From this arose the primary village-farming communities which cultivated grain and kept sheep or goat within an enclosed area. This gradually became more intensified and new animals and/
and plants were added to the domestic stock. Eventually cattle were castrated and an ox-drawn plough was constructed. Irrigation was invented to provide better crops and to extend their areas of cultivation. Experiments were being made in the specialised breeding of animals, and sheep were reared for wool, cattle for milk, and different breeds of dogs emerged.

This is the background to the origin of agriculture in Europe, and in this thesis the evidence from the Near East is first considered. Throughout the various sections the relative importance of cattle, ovicaprids, pigs, dogs, equoids are assessed, and histograms have been constructed to provide a visual presentation of their relative importance. The vertical scale used throughout is 1 mm, as equivalent to 1%, and the animals are considered in the order listed above. Should any particular species be absent at a site a gap is left in the appropriate position so that its absence is at once apparent. The key to these histograms is given below.

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NEAR EAST

In order to investigate the evidence for European neolithic agriculture it is necessary first of all to examine briefly the evidence from the Near East, which provides the background to the inquiry. Five sections need to be considered. These consist of the Natufian sites of the mesolithic, and the Transitional, Aceramic, Neolithic and Chalcolithic sites.

a) - Natufian

The Natufian culture is centred in Palestine between 8500 and 7000 B.C. In the late stages villages with circular or oval houses have been found as well as the traditional cave dwellings. Burials occur in the dwellings, be it house or cave.

Microliths form the basis of the flint industry. Burins, scrapers, sickle blades, hoes occur as well as ground stone vases, figurines, querns, mortars and pestles. The microlithic arrow heads take the form of lunate blades rather than the tanged shape. Many bone sickle hafts survive. Sometimes these have finely carved handles in the form of an animal's head, which are realistic and carefully executed. Other elements in the bone industry include needles, awls, harpoons and fish hooks.

Food was obtained by the hunting of animals and gathering of plants. The animals exploited include red deer, roe deer, fallow deer, aurochs, gazelle, goat, horse, boar, hyena, fox, small carnivores, hare and tortoise./
tortoise. Fruits and berries were gathered, wild grasses reaped and other vegetables and roots collected.

Domestic Animals

Cattle

The only claim for cattle domestication comes from el-Khaim and it is based upon a single find (Neuville 1951). The jaw in question belongs to a young animal and has also been examined by other authorities including Reed and Zeuner. They both concluded that it could equally well stem from a wild animal. There was no evidence for domestication.

Ovicaprids

The domestic goat is said to be present at el-Khaim (Neuville 1951). This is based upon the sudden appearance of bones of a bezoar-like goat in levels III–IV. Once again both Reed and Zeuner agree that these remains are morphologically identical to the wild goat. Since the site is within the natural habitation of the wild species there can be no question of domestication.

Pig

The sudden appearance of a single bone of a large pig in the Natufian levels at el-Khaim is the basis for the statement that they were domesticated. Since wild pigs existed in the vicinity of this site there is once more no basis for supposing that they were domesticated.

Dog/
Dog

Reports of the presence of dogs comes from the Belt Cave which lies near the Caspian Sea (Coon 1951; Pohlhausen 1954) and from Mount Carmel in Palestine, (Clutton-Brock 1962; Garrod & Bate 1937).

According to Reed (1960) the necessary anatomical studies had not been carried out on the Belt Cave material. He thinks it probable that the bones belong to the wild jackal rather than the dog. The bones found at Mount Carmel have been recently re-examined by Clutton-Brock (1962). The remains in question were found in the Wady-el-Mughara and Shukbah caves. In the original report Bate (1937) suggests that the dog she identified in the Natufian levels was derived from the jackal found in the earlier levels. After examination of this material and comparisons with various other canids, Clutton-Brock came to two conclusions. These were that the canid of the earlier levels was not in fact the jackal but the small Arabian wolf (Canis lupus cf. arabs.), and that the Natufian 'dogs' fall within the range of the small Arabian wolf and the pariah dogs. The only factor suggestive of domestication was a relatively wide jaw found in the cave of Keberah. It is possible that this represents an animal in the initial stages of domestication, but this cannot be proved.

There is no definite evidence for the domestication of dogs at this stage. Most of the reports of dogs are in fact reports of jackals or Arabian wolves, but there is a possibility that their domestication was commencing during this phase.
Cultivated Plants

Although there is no evidence for plant cultivation in the Natufian culture, it is necessary to mention the presence of numerous flint sickle blades at the majority of sites. When these blades were examined it became apparent that they bore a characteristic sheen which is only obtained by cutting reeds and wild or cultivated grasses. From the frequency of the flint blades, and from the presence of querns, mortars and pestles it may be assumed that although there is no evidence for cultivation, intensive reaping of wild grasses and probably reeds was practised.

Summary

The claims for the domestication of cattle, ovicaprids and pigs are unfounded. There is also not sufficient evidence for the domestication of the dog, and some of the early claims have been shown to be incorrect. There is however, a possibility that their domestication was in its initial stages at this time. Wild grasses were harvested but there is no indication of their cultivation.

b) - Transitional

There are two Transitional sites to be considered, Karim Shahir and Zawi-Chemi Shanidar. Both lie in the Tigris-Euphrates region. This stage is approximately contemporary with the Natufian culture, although Zawi/
Zawi-Chemi Shanidar is slightly earlier, between 9000 and 8500 B.C.

The oval and circular houses of the Natufian period continue and a large proportion of the flint industry is still microlithic. Millstones, querns and hoes (ground and chipped) are all found, but sickle blades are not as common as in the Natufian culture. Well made ground stone objects include those used for personal decoration such as rings, bracelets, pendants and beads.

It is at this stage that the first evidence for domestication appears. Hunting was still widely practised and the animals killed include red and roe deer, aurochs, pig, gazelle, sheep, goat, wolf, fox, bear, polecat, hare, tortoise, crab, rodents, birds and fish.

**Domestic Animals**

**Ovicaprids**

The only animal that is thought to have been domesticated at this stage is the sheep. Definite characteristics of domestication have been found at Zawi-Chemi Shanidar (Perkins 1960; Reed 1962). Several horn cores exhibit a medial flattening, which is regarded by Reed and Zeuner as the first morphological indication of domestication. These sheep were domesticated from the local *Ovis orientalis*, of which several bones have been found. At this stage there is also a great increase in the number of immature animals present, and sheep are more frequent than goat for the first time. Throughout the 75,000 years of occupation at the nearly Shanidar cave goats outnumber sheep by three to one, but at the open site of/
of Zawi Chemi goats are relatively rare, indicating a distinct change in the economy.

There is a possibility of sheep domestication at Karim Shahir, but the bones were in such a fragmentary state that it was impossible to be certain of their status (Reed, personal communication). Ovicaprids are more common than any other animal (see Table No. 1).

The first signs of sheep domestication appear at this stage, but there is no evidence for the domestication of goat, dog, cattle or pig.

Cultivated Plants

There is no evidence for the cultivation of plants during this Transitional period. However, the gathering of wild grasses was continued as is shown by the flint sickle blades, but it is notable that these are not as numerous as they were during the Natufian culture. The querns and millstones were probably used to grind the wild grain.

Summary

The only animal which appears to have been domesticated is the sheep. The wild animal used for this purpose was Ovis orientalis. No other signs of domestication or cultivation have been found.

c) - Aceramic

The different stages of the Aceramic period are best illustrated by
the finds made at Jericho, where three phases were observed.

The earliest stage is characterised by permanent settlements with a flint industry of Natufian type. It occurs immediately above the Natufian occupation and at this stage there is no direct evidence for agriculture. This 'Proto-neolithic' period may be placed between 7500 and 7000 at Jericho although it may be slightly later elsewhere. This is followed by the earliest known fortified town of 'Pre-pottery A', which appears to have developed out of the Proto-neolithic phase, and has been dated by radiocarbon to between 7000 and 6700. The houses still have an oval or circular plan, and are built with characteristic 'hog-backed' bricks. The flints are of Natufian derivation, and there is a rich bone industry.

Pre-pottery neolithic B shows a complete break with the former occupation. The town was still walled, but the houses now have rectangular plans and consist of several rooms with plastered floors. Rush mats are found on these floors, and skulls with restored plaster features give an excellent impression of the appearance of these new people. The flint industry is entirely different from that of pre-pottery A, and finely worked stone bowls, vases and querns appear as well as stone axes. This stage occupied the period between 6500 and 5700.

The site of Jarmo lies in the Chemchemal valley in Iraqi Kurdistan and it may be equated with the pre-pottery B phase of Jericho. The site is a village settlement of rectangular houses, and many fine stone vessels, microlithic flints and obsidian tools have been found. Unbaked clay figurines/
figurines are also common. These elements are also present at Hacilar which lies on the Konya plain in Anatolia. However, this site has not yet been fully excavated, so earlier stages may be present beneath this late aceramic settlement. A late aceramic level was also found in the Belt Cave which lies near the Caspian Sea. It is dated to between 6100 and 5500.

The animals that were hunted include red and roe deer, aurochs, wild pig, leopard, onager, bear, wolf, fox, gazelle, wild sheep and goat, badger, beechmarten, rodents and a small cat (Braidwood 1960). The actual proportion of domestic animals is not known at any of the sites mentioned.

Domestic Animals

Ovicaprids

Domestic goats are known from both Jarmo (Braidwood 1960) and Jericho (Kenyon 1960; Zeuner 1955, 1958), but in neither case is there any evidence for sheep domestication. At the first site many horn cores bore characteristic signs of domestication, and some compare well with the modern Kurdish domestic goat. The material as a whole shows considerable variation, and all the transitional stages between the wild and domestic animals are represented. Similar features were found at Jericho, where the goat clearly belonged to the aegagrus species.

Both sheep and goat have been identified at Hacilar. There has been no detailed analysis of the material as yet, but some of the remains are thought to belong to domestic animals (Mellaart 1961; Mellaart, personal communication)/
communication). There is a possibility that domesticated ovicaprids are present at the Belt Cave, but no detailed examination of the bones has been carried out (Coon 1951; Pohlhausen 1954; Reed 1960). The basis of the argument for their domestication rests upon their sudden appearance in level 17. However, they account for less than a twentieth of the fauna at this stage.

The goat is known to have been domesticated at this stage from the wild Capra aegagrus. This has been established in both Palestine and Iraqi Kurdistan, but there is no evidence for sheep domestication.

Dog

The dog is only known from Jericho in Palestine (Zeuner 1958). Some of the bones from the Pre-pottery B stage have been identified as dog and a considerable range in size is apparent. One animal is almost wolf-size and another is close to the fox terrier. Zeuner concludes that more than one breed is present, but according to Reed at least some of these Jericho dogs lie within the range of the small Arabian wolf (Personal communication).

In connection with this discussion some figurines found at Jarmo must be mentioned. Models of very dog-like animals were found, and although they are very small, the tails are clearly upturned and curled. This is a feature unknown in wolves, and only occurs in domestic dogs. Clearly the inhabitants of Jarmo must have had some contact with dogs.
Cultivated Plants

Wheat

The earliest known evidence for the cultivation of grasses is found in this period at both Jarmo and Hacilar.

Wheat was well known at Jarmo (Helbaek 1960). Both einkorn and emmer have been identified by impressions in clay and carbonised grains, and they show that the crop was not far removed from the wild Triticum dicoccoides and Triticum aegilopoides. Some emmer found at Jarmo is both larger and coarser than the oldest emmer known, and it is very different in appearance from that of the later neolithic period. However, the components of the crop varied a lot, with certain examples much closer to the wild species than others. The relative importance of these two wheats is not known.

There is no full report on the cultivated plants found at Hacilar, but the crops are said to be very similar to those of the late neolithic period (Mellaart, personal communication).

Both einkorn and emmer were cultivated during the Aceramic neolithic period. At one site they are still close to the wild prototypes and so could not have been cultivated for very long.

Barley

Barley was being cultivated at Hacilar at this time although the species is not known (Mellaart, personal communication), and also at Jarmo (Helbaek 1960). The two-rowed variety has been identified at the last site/
site. Evidence for cultivation was provided by the non-brittle axes and the actual kernels which have a greater volume than those of the wild prototype. There was no evidence for the cultivation of six-rowed barley.

Barley was cultivated during the Aceramic Neolithic, and the first type to be grown was probably two-rowed and so originated from *Hordeum spontaneum*. Its importance relative to wheat is unknown.

**Legumes**

Peas and lentils were identified by Helbaek (1960) at Jarmo, but they are all still in their wild state. Nothing is known of the legumes found at Hacilar.

**Summary**

Both the goat and the dog were domesticated during this period. The goats are still fairly close to *Capra aegagrus* from which they originate. There is no evidence for the domestication of either cattle or pigs at this stage. Einkorn, emmer and two-rowed barley were cultivated and are also close to their respective wild prototypes.

d) - **Neolithic**

The sites now considered may be described as being truly 'Neolithic' since pottery, polished stone and evidence for agriculture all occur together. At some of the sites such as Abou Gosh, Jarmo and Djeitun the pottery/
pottery is primitive and rough, and at later sites or more centralised sites it is much finer and may be burnished or have a cream slip. At the end of the neolithic period painted ware occurs, and consists generally of a red design on a cream background. This became the common form during the early Chalcolithic. The neolithic may be placed between 6500 and 5500, except in some remote areas where this period persists for longer.

The importance of hunting relative to domestication is not known. Red and fallow deer, aurochs, pig, gazelle, donkey and possibly other equoids, antelope, sheep, goat, wolf, fox, leopard, cat, tortoise and birds were all hunted and probably formed a substantial part of the diet (see Table No. 2).

**Domestic Animals**

**Cattle**

The earliest evidence for cattle domestication comes from three neolithic sites in the Near East. These are Anau, Çatal Huyuk and sites representing phases A and B in the 'Amuq, all of which belong to the late neolithic. There is also a possibility of their presence at a further three sites (see Table No. 3).

The evidence for cattle domestication in phase A in the 'Amuq comes from the site of Judaidah (Braidwood & Braidwood 1959). Some cattle bones were found and have tentatively been identified as those of domestic animals. Phase B is represented by Judaidah and Mersin where these bones occur.
occur again. The cattle at Judaidah appear to be of the large *namadicus*
race, which is the Asiatic version of the aurochs.

This same species occurs at Anau (Pumpelly 1904; see Table No. 5). The late neolithic culture of this site (in between -20 and -10 ft.)
contained bones which illustrate the emergence of the domesticated form.
This was not fully accomplished until the early Chalcolithic, according to
Duerst (Pumpelly 1904). Some of these bones show a close agreement with
those of the sacred Bull of Apis and so Duerst concludes that the
inhabitants of Anau and those of Ancient Egypt were breeding the same type
of cattle.

The other site with evidence for cattle domestication is Çatal Hüyük,
where they were found in the late neolithic levels. After a preliminary
investigation with Reed, Mellaart concluded that there were a preponderance
of cattle bones, and that they were probably domesticated (Mellaart 1962
& personal communication). These animals were clearly of great ritual
importance both at this site and at Hacilar. The bones from the neolithic
levels of the last site have not yet been examined.

Bones of cattle are said to be very numerous at Abou Gosh in Syria.
However, no evidence for domestication is given (Perrot 1952; Reed 1960).
There is also no description of the remains from the Belt Cave where cattle
account for a quarter of the fauna (Coon 1951; Pohlhausen 1954). Only
two teeth of medium sized cattle were found at Tepe Siyalk, and from
Amscheler's unpublished notes there is no indication as to whether or not
he thought they were domesticated (Reed 1960). Ghirshman claims that
they/
they are (1939). Domestic cattle are definitely not present amongst the
remains found at Djeitun and Jarmo.

Cattle were in the process of being domesticated during the later
neolithic period, and are present at sites in Iran, the 'Amuq and Konya
plain. The evidence indicates that they were domesticated from *Bos
namadicus*.

**Ovicaprids**

Sheep or goats are known from all sites at which a more thorough
investigation of the osteological material has been made.

The evidence for phases A and B in the 'Amuq comes from Judaidah and
Mersin (Braidwood & Braidwood 1959; Garstang 1939). Sheep or goat were
probably domesticated at the first site and sheep are recorded in the late
neolithic levels of the second.

Both wild and domestic sheep have been found at Anau (Pumpelly 1904).
The site lies within the distribution of the mountain sheep *Ovis vignei*,
and it is probably this species which was domesticated at Anau. According
to Lydekker there is no great difference between this sheep and that of
the steppe *Ovis orientalis*. Duerst has divided the horn cores from the
lower levels of the late neolithic into three categories; these represent
the male and female wild animals and the domesticated animals. Those of
the latter group show the usual domestic features and are noticeably
smaller and more slender than the wild examples. In the upper layers of
Anau these horn cores are seen to get progressively smaller until in the
Chalcolithic/
Chalcolithic levels some of them show great similarity to those of the turbary sheep, *Ovis aries palustris*. This leads Duerst to his conclusion that the turbary sheep of the Swiss lakes were descended from *Ovis vignei*. No goats are present in the neolithic levels of this site.

Ovicaprids are said to be domesticated at the Belt Cave, but there has been no detailed study of their remains (Coon 1951; Pohlhausen 1954). They account for more than half of the fauna, so there domestication is probable. Goats are recorded at Abou Gosh, but no reasons for their said domesticity are given (Perrot 1952). From an initial examination of the bones Reed and Mellaart think it is highly probable that ovicaprids were domesticated at Çatal Huyuk, although their bones were not as frequent as those of cattle (Mellaart 1962 & personal communication).

A small proportion of the ovicaprid bones from the primitive neolithic at Djeitun show signs of domestication (Masson 1962). They are outnumbered by the wild species by more than three to one (see Table No. 4). Sheep and goat occur again at Jarmo, and Reed thinks that they are probably present at Sarab (Braidwood & Reed, personal communication).

The mountain sheep *Ovis vignei* is recorded again at Tepe Siyalk (Chirshman 1939). This site lies at the foothills of the Zagros mountains. The horn cores of the female animals are said to be similar to those of domestic goats, and a large proportion of the remains compare well with those of sheep from Anau. There were also a few remains of goat but it is not known whether these were domesticated. It should, however, be noted that Reed thinks it possible that Vaufrey was misled by Duerst's sheep/
sheep at Anau into thinking that the goat-horned oviscaprids at Tepe Siyalk were sheep when in fact they were actually goat.

The domestication of both sheep and goats was practised during the neolithic, and both *Ovis orientalis* and *Ovis vignei* were domesticated. The latter led to the evolution of an animal more or less identical to the turbary sheep of Europe at at least one site.

**Pig**

There is very little evidence for pig domestication during the Neolithic period (see Table No. 3). There is a possibility of their domestication at Abou Gosh (Perrot 1952) and Tepe Siyalk (Ghirshman 1939), but they are known to be absent at Çatal Huyuk, Djeitun and Anau. The pig remains from Jericho and Sarab have not yet been examined.

There are two certain instances of the domestic pig. The first occurs in phases A and B of the 'Amuq sequence at Judaidah and Mersin where they are thought to be of the large *scrofa* variety (Braidwood & Braidwood 1959). They are also present at Jarmo where the change from wild to domestic pigs is illustrated by Reed. This is done on the basis of measurements of the upper second and third molars (Reed 1961, p.32). These animals are still relatively large in size.

There is only a little evidence for pig domestication. The earliest probably occurs at Jarmo in the Chemchemal valley and the other at Judaidah and Mersin in the 'Amuq plain.
Dog

The dog is known from Djeitun and Jericho. The kind of animal present at Djeitun is unknown (Masson 1962), but that at Jericho is said to be very wolf-like. Zeuner (1958) however, concluded it was dog rather than wolf on the shape of the teeth. Reed on the other hand is not entirely satisfied with the identification of certain large dogs at Jericho, since they fall within the range of the small Arabian wolf (Personal communication).

There is also a possibility of a dog's skull being present at Çatal Hüyük, but since it has not yet been compared with other material this cannot be established with certainty (Reed, personal communication).

The dog was known as a domestic animal at this stage but it does not seem to have been very common. The breed involved is not known.

Cultivated Plants

Wheat

Wheat was cultivated at Anau, Çatal Hüyük, Djeitun, Hacilar, possibly Sarab and during phase A in the 'Amuq (see Table No. 6).

Helbaek identified wheat in levels III, IV and VI at Çatal Hüyük, which correspond to the early and mid neolithic periods. The species has not yet been identified. There are only two instances in which the species of wheat has been identified. Emmer is known from phase A in the 'Amuq (Braidwood & Braidwood 1959) and bread wheat is present in the late neolithic at Hacilar (Mellaart, personal communication). Many wheat impressions/
impressions are recorded at Djeitun together with about three hundred sickle handles (Masson 1962).

Emmer and bread wheat are the only species known to have been cultivated although it is probable that other types were also present. The importance of wheat relative to barley is unknown.

**Barley**

Cultivated barley is reported from the 'Amuq phase A, Anau, Djeitun, Hacilar and possibly Sarab. There is no evidence as yet for it from the neolithic at Çatal Hüyük.

The barley from both Anau (Pumpelly 1904) and phase A in the 'Amuq (Braidwood & Braidwood 1959) is hulled, and at the first site it is thought to be probably of the two-rowed variety. Nothing further is known of the rest of the finds of barley mentioned.

Hulled barley was cultivated during this period and the two-rowed variety occurs at at least one site.

**Legumes**

Field peas were found in level IV at Çatal Hüyük and Helbaek thinks they must have been cultivated at this stage (Mellaart 1962 & personal communication). It seems probable that lentils and bitter vetch were cultivated also. The same three legumes were also cultivated at Hacilar (Mellaart, personal communication).

Summary/
Summary

Cattle, ovicaprids, pigs and dogs were all domesticated by the end of the neolithic period. Of these four animals the pig was probably the most recent acquisition. At one site in the Konya plain cattle were the most frequent animal, but elsewhere there is no evidence concerning the relative importance of these animals. The evolution of the turbary sheep from *Ovis vignei* is illustrated by finds in Iran. Both wheat and barley were being cultivated and it is probable that various legumes were also. Emmer and bread wheat as well as two-rowed hulled barley have been identified.

e) – Chalcolithic

The Chalcolithic period may be divided into three main cultures. The earliest is the Hassuna culture, dated to 5500 to 5000, which originates in north Iran. This is followed by the Halaf culture of northern Mesopotamia (5000 - 4000) and the 'Ubaid culture of southern Mesopotamia (4000 - 3500).

Red on cream painted pottery is common over most of the area, but in certain districts the black, grey or brown burnished ware of the neolithic continues. The Hassuna houses are built on a rectangular plan with several rooms, and both villages and fortified towns have been discovered. The designs on the pottery are usually rectilinear, although in the late stages some animal and human figures are represented. Obsidian and marble were/
were worked as well as some semi-precious stones, and copper pins and awls appear. The only region in the Near East where copper is found is in the Highland zone of Iran and Anatolia, so that the Hassuna culture developed within this region.

The Halaf culture pottery is basically similar to that of the Hassuna culture, but more human and animal figures are present. This ware is extremely fine and resembles metal prototypes. Obsidian pendants, vessels and stamp seals were all finely worked, and copper becomes more common. This culture was superceded by the 'Ubaid culture which originated further south. The tholos-like shrines which were found in the Halaf period are replaced by an evolved form of rectilinear architecture which was to become the basis of later Mesopotamian religious buildings.

Hunting and fishing were still practised together with agriculture and the animals exploited are similar to those of the Neolithic (see Table No. 7).

**Domestic Animals**

**Cattle**

Cattle are possibly present at the type-site of the Hassuna culture but there is no definite claim for this, nor is a description of the bones given (Reed 1960). Domestic cattle are, however, present in the contemporary period B in the 'Amuq (Braidwood & Braidwood 1959).

These animals are also known in a Halafian context at Gird Banahilk and in the 'Amuq phases C and D and possibly at Tell Aswad (see Table No. 8).
At Tell Halaf itself all the bones were discarded, as was the case at Tell Arpachiyah. Some indirect evidence for cattle domestication was, however, found at the last site. A finely modelled head of a cow survived, and shows much similarity to the domestic cow of that area today (Reed 1960). At first there was some doubt over the remains found at Gird Banahilk (Reed 1960, 1961). When the first report on the site appeared there was thought to have been a small race of wild cattle in the vicinity, but this has now been shown to be untrue, and the bones in question at Gird Banahilk are definitely assigned to domestic animals (Reed 1961). Both large and small cattle are reported from Tell Aswad, but there is no definite evidence other than size distinction for the bones originating from domestic animals (Reed 1960). Reed thinks that these animals are in all probability domesticated. A single horn core is the only cattle bone to have been recorded at Nineveh. It is not known whether it originated from a wild or domestic animal (Reed 1960).

The cattle found at Siabid belong to the transitional Halaf/Ubaid period and are all small in size. There was no trace of the wild aurochs (Braidwood & Reed, personal communication). In a pure Ubaid context cattle are reported from Shah Tepe III, where they were identified by Amscheler (Arne 1945). They are also present in the 'Amuq in phase E where the small breed occurs for the first time (Braidwood & Braidwood 1959).

Two distinct sizes of cattle are recorded at Dashlydji Depe at the point where copper tools make their first appearance (Masson 1962; see Table No. 9), and cattle are also present in the late Copper Age levels at Beycesultan.
Beycesultan (Mellaart 1959) and Bir-es-Safadi (Josien 1956). At this last site they are far less numerous than sheep (see Fig. 3 & Table No. 10).

There are two Chalcolithic periods represented at Anau, known as Ib and II (Pumpelly 1904; see Table No. 5). The cattle present in the earlier Ib stage are a continuation of the neolithic variety and distinctly larger than the turbary breed known from Europe. During culture II, however, there is a change to the turbary cattle. The long horned breed does not disappear entirely at this point, since a few bones have been found in the lower levels of period II.

Cattle were domesticated during the Chalcolithic period although their remains are by no means numerous. This is probably due to the fact that in early excavations the osteological material was largely discarded as it was thought to be of little importance.

**Ovicaprids**

Ovicaprids have been recorded at the type-site of Hassuna but their status is uncertain (Reed 1960). They are, however, known to be present in the contemporary period in the 'Amuq (Phase B; Braidwood & Braidwood 1959).

Goats occur in a Halafian context at Gird Banahilk (Reed 1960, 1961), and sheep are recorded at Tell Aswad (Reed 1960). Sheep occur again in period C of the 'Amuq sequence which shows Halafian influences, and in period D with Halaf-Ubaid influence (Braidwood & Braidwood 1959). Both sheep and goat are present at Siabid (Reed, personal communication). These are all known to have been domesticated. The goat was domesticated during the 'Ubaid/
'Ubaid period (phase E), and they also occur in this culture at Tell Mefesh (Reed 1960). Some of these sheep show a fairly close resemblance to Ovis orientalis, in particular the examples found at Siabid.

In addition to these occurrences of ovicaprids, goats are known from Ain Gedi (Reed 1960), sheep and goats from the late site of Beycesultan (Mellaart 1958), sheep from Tepe Siyalk III (Ghirshman 1939) and goats from Khirbat Bitar (Reed 1960). Josien (1956) identified a large quantity of sheep bones at Bir-es-Safadi as well as a few of goat. This last site is the only one in the Near East of this period to have a statistical analysis of the bones, and this shows that sheep were the only economically important animal (see Fig. 3 & Table No. 10).

There is a detailed description of the ovicaprids found in periods 1b and II at Anau (Pumpelly 1904; see Table No. 5). The evolution of the turbary sheep which began during the neolithic period (1a) was completed during the Chalcolithic period and this form of sheep is the basic type found until the middle of period II. At this point they are superceded by hornless sheep. This new race of sheep appeared suddenly and in great quantities, and Duerst and Pumpelly could find no certain indication of how or from where they arose. At this stage turbary goats also appear for the first time. Duerst favours the theory that these hornless sheep evolved from the earlier turbary sheep, which still occur sporadically. However, he admits that their sudden appearance together with goats and camel make the thesis of external introduction difficult to reject. On the whole this second hypothesis seems the more probable of the two.

Both/
Both sheep and goats were domesticated during the Chalcolithic period, and on the whole sheep were more common than goat. At one late site they were the basic domestic animal. Animals similar to the wild prototypes as well as turbary sheep and goat and hornless sheep have all been reported from various different areas.

**Pig**

There is no definite evidence for pig domestication during the Hassuna culture since little information is given about the pig bones found at the type site and also about those from Nineveh and Tell Aswad (Reed 1960). There is, however, evidence for pig domestication during phase B in the 'Amuq which has some Hassuna characteristics (Braidwood & Braidwood 1959).

Domestic pigs are possibly present at Gird Banahilk in a Halafian context (see Table No. 8). If these animals are domesticated they are still fairly large in size and belong to the *scrofa* group (Reed 1960; 1961). They are definitely present in phase C in the 'Amuq, which corresponds with the Halafian period, and in phase D which represents the transitional Halaf/Ubaid period (Braidwood & Braidwood 1959). Domestic pigs are also thought to be present at Saibid (Braidwood & Reed, personal communication).

There are no certain instances of domestic pigs during the Ubaid period in Mesopotamia. They are, however, present in phase E of the 'Amuq sequence (Braidwood & Braidwood 1959), and at Shah Tepe III (Arne 1945).

Pigs were being bred at the late site of Beycesultan (Mellaart 1959), and they form a minute proportion of the remains at Bir-es-Safadi (Josien 1956/
1956; see Fig. 3 & Table No. 10). They are also known at Dashlydji Depe where the only other domestic animal was cattle (Masson 1962; see Table No. 9).

Pigs were unknown during the late neolithic at Anau (period Ia), but they suddenly appear in phase Ib of the Chalcolithic (Pumpelly 1904; see Table No. 5). All of the osteological remains from this and the subsequent period are assigned to the turbary pig, *Sus palustris*, by Duerst. They bear much similarity to the remains from the Swiss lakes, and also show resemblance to the wild *Sus vittatus*. Their sudden appearance favours their introduction from outside, since wild pigs are unknown from Anau Ia, Ib and II. About the same time as Anau II, pigs are reported to be domesticated at Shah Tepe III (Reed 1960). These appear to be a domestic form of the local wild pig and are not of the turbary variety.

There is no definite evidence for pig domestication during the Hassuna period in Iran, or during the Halafian or 'Ubaid period in Mesopotamia. Pigs are, however, known from other sites, notable in the 'Amuq, Palestine and Turkestan, where both large and small animals are present.

**Dog**

Direct evidence of the domestication of the dog during the Hassuna culture in Iran is lacking. There is a possibility of their presence at the Halafian site of Gird Banahilk, but this is by no means certain (Rolling Prairie Conference 1961). They are, however, present in phase C
in the 'Amuq which corresponds to the Halaf culture, and also in 'Amuq E in the 'Ubaid period (Braidwood & Braidwood 1959). At this stage Reed (1960) reports that a specialised breed of dog had emerged, namely the saluki dog, which was a little heavier than modern examples. Part of a dog's skull is also recorded at Tepe Siyalk II (Ghirshman 1939). This corresponds to the mid Chalcolithic period.

The other instances of dogs in this context occur at Beycesultan (Mellaart 1959), Bir-es-Safadi (Josien 1956; see Fig. 3 and Table No. 10) and Anau (Pumpelly 1904; see Table No. 5). At the last site the dog appears for the first time in culture II, being entirely absent during Ia (late neolithic) and Ib (early Chalcolithic). A skull of basal length 164 mm. was found and is assigned by Duerst to *Canis familiaris matris optimae*. It seems probable that this animal was brought to the site together with the camel, goat and possibly other animals by some unknown tribe.

Dogs were present during the Chalcolithic, but there is not much direct evidence for an identification of a breed. A saluki dog emerged by the 'Ubaid period, but there is no indication of what breed, if any, was present during the Hassuna and Halaf cultures.

**Equoids**

The question of horse and donkey domestication first arises at this stage. Many bones were found at Gird Banahilk but there was no evidence for their domestication (Reed 1961). Equoid bones are absent in the 'Amuq sequence.
sequence until phase C, and a single bone of a wild koulan is recorded at Dashlydji Depe around the time of the introduction of copper.

The bones from Anau make up the largest collection of equoid remains of this period (Pumpelly 1904; see Table No. 5). Bones of wild equoids were common in the neolithic (Ia) stage, and Duerst thinks that they may have been partially domesticated by the earlier Chalcolithic period when they were more frequent than any other animal. By the later period (II) they were fully domesticated. There has been a certain amount of dispute over the type of equoid that was present. Duerst could find no exactly similar breed so he called it *Equus caballus* Pumpellii. This equoid was of medium size (mean of 137 mm., or between 13 and 14 hands) and had slender bones. Apart from its dental structure it has characteristics of the Oriental group of horses, and recently Hančar (1956) suggested that it does in fact belong to the half ass, *Equus hemionus*, which is a member of this group. Duerst himself noted many similarities between the half ass and the Anau equoid but because of discrepancies in the dental structure did not assign it to this species.

Two teeth were found at Tepe Siyalk in level III (late Chalcolithic), and Duerst attributed them to domestic animals, and thinks that they were probably of the *Equus caballus* Pumpellii breed that he found at Anau (Ghirshman 1939). It is also possible that they represent the half ass if this is true of the Anau remains. Josien (1956) on the other hand reports a few bones of the domestic donkey from Bir-es-Safadi (see Fig. 3 & Table No. 10). This equoid is also known from the later 'Amuq G phase.

There/
There is evidence for the domestication of equoids by the late Chalcolithic period. The donkey is known from one site, and at another it is either a new species *Equus caballus Pumpelli* that is present or the half-ass *Equus hemionus*.

**Camel**

The camel is present in level II (late Chalcolithic) at Anau (Pumpelly 1904). Duerst thinks that it was probably domesticated at this stage and that it was introduced along with the goat and dog. The exact species cannot be determined, but from historical considerations Duerst thinks that it is probably the Bactrian camel *Camelus bactrianus* that was present. Assyrian and Persian representations and sculptures prove that the camel was domesticated at a comparatively early date. A sherd found at Tepe Siyalk III bears a picture of a camel, and a single bone was found at Shah Tepe (Zeuner 1964, p.359). In connection with these finds the occurrence of a single bone at the Tripolye Cii site of Gorodsk should be mentioned. It must also have belonged to a domesticated animal (see p.319).

At the end of the Chalcolithic it appears that the camel was introduced as a domestic animal to the Near East. It is thought to be the Bactrian camel that is present.

**Cultivated Plants**

**Wheat**
Wheat

There is no evidence for the cultivation of wheat during the Hassuna culture. The evidence for the Halaf culture comes from the site of Tell Arpachiya where emmer has been identified (Mallowan & Rose 1935, 15). Numerous grains of wheat are reported from areas TT4, TT5 and from a circular silo. In area TT5 there was much more emmer than barley, but the situation was reversed in TT4. The interesting thing about these grains of emmer is that they were all specially prepared, presumably for storage, and had their hulls removed. This is also known from Mersin (Garstang 1953). In level XXIz (early/mid Chalcolithic) a small proportion of emmer was found but there were no glumes, chaff or whole spikelets.

Emmer is also thought to have been present at Beycesultan, but this could not be established with certainty (Mellaart 1959), and wheat has also been identified at Anau (Pumpelly 1904). Remains were found in both sherds and a brick, which was examined and found to contain an enormous quantity of carbonised cereal grain and straw. The species of wheat have not however been identified, but it is suggested that bread wheat may have been present. It is not known from which level the brick originated.

Emmer is known to have been cultivated during the Halaf culture, and also at a site of the late Chalcolithic. It is the only species of wheat whose presence can be established with certainty, although it has been suggested that bread wheat may also have been cultivated (see Table No. 11).

Barley/
Barley

Barley has been identified at Tell Matarrah in a Hassuna context (Helbaek 1960) and also from the Halaf period at Tell Arpachiyah (Mallowan & Rose 1935, 15). At the last site it was present in small amounts in area TT4, in large amounts in area TT5 and it is also known from a silo.

Barley was much more common than wheat at Mersin (early/mid Chalcolithic level XXIa). Both the two and the six-rowed forms have been identified and the former is a lot more frequent than the latter. Two-rowed barley is the only type to be identified at Anau where it was found in both sherds and the brick (Pumpelly 1904).

The evidence available suggests that barley was more frequent than wheat during the Chalcolithic. It is known from the Hassuna, and Halaf cultures and at other sites where the two and six-rowed species have been distinguished (see Table No. 11).

Flax

The earliest evidence for the cultivation of flax comes from the Halaf culture sites of Tell Arpachiyah and Tell Brak (Helbaek 1960; Mallowan & Rose 1935, 15). Both lie in the Kurdish foothills and are dated to around 5000 B.C. Linum bienne is found to the north and east of the Tigris-Euphrates plain and so these sites lie within the distribution of the wild prototype.
Legumes

Lentils have been identified at Beycesultan, but it is not known if they were cultivated or not (Mellaart 1959). Since various legumes were cultivated during the neolithic period, they would be expected to occur amongst the cultivated plants of the Chalcolithic.

Summary

Cattle, ovicaprids, pigs and dogs are all known during the Chalcolithic period. There is, however, very little evidence for pig domestication, and it is not known from Hassuna, Halaf or ‘Ubaid sites in Iran or Mesopotamia, although it does occur at other sites. Amongst the ovicaprids, large sheep close to Ovis orientalis occur together with turbary sheep, hornless sheep and large and turbary goats. At the only site at which statistics were available sheep were the basis of the economy. Donkeys and possibly half-asses were domesticated during the later Chalcolithic, and towards the end of the period the Bactrian camel is present amongst the domestic animals. Both wheat and barley were cultivated. Emmer is the only species of wheat known with certainty, and there is a possibility of bread wheat also being known. Barley was however much more common at certain sites. Both six and two-rowed forms are represented, with the two-rowed species the more common. Flax was also cultivated for the first time during the Halaf culture, and lentils may be present at a later site.
EUROPEAN AGRICULTURE

The evidence for agriculture in Europe is now considered. As was the case in the Near East, the evidence from Mesolithic sites is investigated first, together with that from Aceramic Neolithic sites. Included in the Mesolithic period is the Ertebølle-Ellerbek culture. The exact status of this culture has been disputed, but it is usually regarded as Mesolithic rather than Neolithic and so is included in this section rather than later.

This is followed by the Initial Colonisation, which is composed of three main cultures, the Starčevo-Körös, Impressed Ware and Linear Pottery cultures. It was by means of these three cultural groups that the knowledge and practice of agriculture was spread over the greater part of Europe. A series of different cultures then developed throughout Europe, all of which either bred animals or cultivated plants to some extent. It is these cultures that compose the section on the Spread and Development of the Initial Colonisation. This is then followed by the cultures which make up the late Neolithic and Copper Age period in Europe.
MESOLITHIC DOGS

Before the influence of the agricultural societies of the Near East reached Europe, there was in Mesolithic Europe, a single domestic animal, namely the dog. These dogs have been found at sites of the Tardenoisian, Azilian and Maglemose cultures.

The Tardenoisian settlements have a basically coastal distribution and may be found in most coastal areas of western Europe. These people lived on sandy soils, where some simple huts have been found and they also sheltered in caves. This culture is characterised by geometric microliths which take the form of triangles, trapezes, rhomboids or crescents. Hunting and shell fish collecting formed the basis of the economy. At present, isotopic dating places this culture between 6000 and 3300, so that in some areas it may be partially contemporary with neolithic communities.

The Azilian culture of western Europe is descended from the earlier Magdalenian culture, but much of the bone and flint is not as fine as that of the earlier culture. This applies to both the bone harpoons and flint blades which form the basis of the material that survives. Painted pebbles also occur. At one site Azilian harpoons are found with a ground stone neolithic axe and at others they are found in a Tardenoisian context (Childe 1957, 4). This implies that this culture belongs to the late mesolithic, and that if the celt is genuine some sites must be contemporary with neolithic cultures. Also included in this cultural group are French sites of the late Magdalenian or Romanello-Azilian culture (see following section)
section), and some Russian sites which have a similar although not identical culture.

The inhabitants of Maglemose sites were hunters and fishers who were armed with bows and arrows. These sites occur in northern Europe in Poland, Germany, Scandinavia, England and also in the southern North Sea area which was then still dry land. This culture may be placed between 8000 and 5000 B.C. The settlements often occur near lakes so that much of their material culture survives. Bone harpoons and spears for hunting and fishing, microlithic flint arrowheads as well as primitive stone axes and adzes all appear. Antler was used for hafting the axes and adzes as well as for awls, needles and spearheads. These people had learned how to make a good adhesive from birch bark by applying heat, and this is the oldest known artificial substance made by man in Europe. The basis of the food supply was hunting, perhaps with the aid of the dog in some cases, and this was supplemented by the gathering of berries and fruit. The main animals to be hunted were red deer, followed by roe deer, elk, aurochs and pig.

Other animals to be identified at the late mesolithic sites at which dogs are known include seal, sheep at one Russian site, horse, badger, otter, beaver, bear, marten, wolf, fox, lynx, cat, hare, rabbit, hamster, hedgehog, squirrel, vole, mouse, turtle, fish and birds (see Table No. 12). In connection with the wild fauna the cattle found at Star Carr must be mentioned. These Maglemose cattle were found to vary considerably in size (see Jewell 1962, Fig. 18) and it has been suggested that two sizes of/
of cattle may be present (Clark 1954). After a careful examination Jewell came to the conclusion that the difference in size was purely a result of sexual dimorphism and was not due to the presence of wild and domestic cattle.

**Domestic Animals**

**Dog**

The dog is known from six sites in Russia, one in Germany, eight in Denmark, one in Norway, one in Sweden and two in Britain (see Table No. 12).

Sureny II, Fatyna-Koba and Shan-Koba all produced remains of dog in an Azilian context, and they are known in a Tardenoisian context at Fatyna-Koba, Kik-Koba, Kukrek-Koba, Mourzak-Koba and Shan-Koba (Birula 1930; Gromova 1953). The only instance in which a racial identification has been made is at Mourzak-Koba where Gromova found a small turbarly dog.

The dog found at Senckenberger Moor in Germany is probably the oldest known European dog (Mertens 1936). It was found together with bones of an aurochs, and Mertens says that both animals were drowned shortly after, or whilst, the dog was eating the aurochs. Unmistakable domestication characteristics were visible on the dog's skull (basal length 168 mm), and Mertens regards this dog as the ancestor of the intermedius variety.

Racial identifications have been made at three of the Danish Maglemose sites. Degerbøl (1928) thought it probable that *Canis familiaris inostranzewi* was present at Holmegaard, where a skull of basal length 168 mm. was found. This breed was again detected at Øgaarde (Mathiassen 1943)/
1943). At this last site considerable variation was seen amongst the size of the bones, and this is best illustrated by the jaws. Some of these were fairly weak and are attributable to Canis f. palustris ladogensis, whereas others are much stronger and lie close to the wolf in size. The presence of two types of dog is also seen from an examination of the limb bones.

The majority of the dog bones found at Svaerdborg were quite large. Brinkmann (1924) thought that some bones represent the early stages of wolf domestication. When Degerbøl re-examined these remains he came to the conclusion that they belonged to the race Canis f. inostranzewi (Degerbøl 1927). He made this identification from a jaw which would have originated from a skull of basal length 180 mm., and compared exceptionally well with the Iron Age dog found at Hjortspring. Further jaws of this size were detected as well as some which were similar to Canis f. palustris ladogensis. The main difference from this breed lay in the size of the teeth which approached those of inostranzewi dogs. The same applies to the remains found at Braband which belong to the neolithic and are very similar to those from Svaerdborg (Degerbøl 1927).

Two types of dog are once more present at the Norwegian site of Viste (Brinkmann 1924). The easiest to identify was the smallest, which belonged to the turbary breed (Canis f. palustris). After various calculations Brinkmann came to the conclusion that the larger dog was either a cross-breed with a wolf, or else a member of the Canis f. inostranzewi group. From the above evidence the latter seems the most probable. It is interesting/
interesting to note that out of the sixty skulls examined by Brinkmann from mesolithic sites and Ertebølle sites in Scandinavia, two out of every five teeth had anomalies. He attributed this to the lack of nourishment during the early years of the dog’s life. The type of dog present at the Swedish site of Ågerod is not known (Althin 1954).

It was originally suggested that some of the canine remains found at Star Carr in Yorkshire belonged to a dog (Fraser & King 1950), but in the final publication this decision was reversed (Clark 1954). In 1961 Degerbøl re-examined some of the skull and limb bones and decided that they did in fact originate from a domesticated animal. The jaw found was much smaller than that of a wolf, and the measurements show that it falls within the range of variation of the Maglemose dogs in Denmark. The basal length of the skull would have been about 155 mm., which puts it within the range of the turbary dog. All these bones are smaller than the corresponding ones from any known European wolves. The limb bones are approximately the same size as those of the Senckenberger dog, but the skull characteristics are entirely different. Only a single bone was found at Thatcham which could be attributed to a dog. It is smaller than similar bones from Star Carr and compares reasonably well with the dog from Øgaarde (Wymer 1960).

Two breeds of dog are known during the late mesolithic in Europe. The larger is probably Canis f. inostranzewi and the smaller Canis f. palustris ladogensis. Some of the last group of dogs had larger teeth than is usually found in this breed, and there is one instance of a small turbary/
turbary dog. The evidence also indicates that the local wolves were domesticated, resulting in at least the larger breed observed. The large teeth of the small dogs shows that they had evolved comparatively recently, and the similarity with inostranzewi teeth makes it probable that they evolved from the latter group.
ACERAMIC NEOLITHIC

Three sites are considered in this section, and the most important of these is Argissa in Thessaly. At the base of this tell there was an occupation layer with no pottery, but much flint, obsidian, stone and bone implements, and evidence for agriculture. The flints include several microlithic forms, some of which were evidently used as sickle blades since the characteristic sheen was present. There were no large stone implements and axes were absent. This last fact is reminiscent of Jericho. The date of this occupation is thought to be before 6000 B.C.

Khirokitia in southern Cyprus has a carbon 14 date of around 5500 B.C. The site is best described as a small town, since the evidence indicates that several thousand people lived there. The domed houses were built on a circular plan and constructed of mud bricks. Many polished stone bowls and dishes have been found and some have spouts. One of these spouted vessels was found in the Amuq phase A (neolithic). Other elements in the culture include a flint industry reminiscent of the Upper Palaeolithic, obsidian, stone and bone personal ornaments, and bone awls, needles and pins.

The site of La Adam lies in Dobrogea near the Black Sea coast. An aceramic neolithic level is claimed to be present by Radulesco & Samson (1962). The flint industry is described as poor but neolithic. Polished stone ware is however still absent. Recently Bokonyi identified some of the osteological remains from the "post-palaeolithic" levels of this site and found bones of a hippopotamus. For this reason it is necessary to treat the evidence from this site with a certain amount of reserve.
Domestic Animals

Cattle

Domestic cattle are known from Argissa in Greece (Milojčić 1962), but are absent at both La Adam (Radulesco & Samson 1962) and Khirokitia (Dikaios 1953). Their absence at the last site is particularly striking since a large quantity of bones are known to have been found. It implies that they were not domesticated during this period in Cyprus. Cattle were the least important of the domestic animals at Argissa, and the majority of the bones are said to compare well in size with the material from central Europe (see Fig. 4 & Table No. 13).

Cattle were only of minor importance to the economy at this time and are only known from Greece.

Ovicaprids

Sheep were domesticated at all three sites mentioned, and goats were present at one site.

In the aceramic levels of Argissa ovicaprids are the most important of the domestic animals (Milojčić 1962; see Fig. 4 & Table No. 13). Only sheep could be identified and these appear to belong to a fairly strong race on average. A considerable variation in the size of the horn cores was apparent, but there was no indication of hornless animals. Two exceptionally robust cores were found which compare well with the description of the sheep found at Tepe Siyalk in Persia, but there was no first hand material for direct comparison. The sheep from Tepe Siyalk are/
are assigned to the *vignei* group. No apparent relationship was present between the sheep from Argissa and the moufflon of the western Mediterranean (*Ovis musimon*), the northern form of the *orientalis* group, or with the ammon sheep of mid Asia. A little more similarity was found with the southern *orientalis* group. Hence Boessneck concludes that the large Argissa sheep belong to the *vignei* type known from Anau and Tepe Siyalk. The smaller animals compare in size with those of the later neolithic in Europe.

A large sheep's cranium was found at La Adam (cave of Adam V) in Rumania, and was well preserved with definite characteristics of domestication (Radulesco & Samson 1962). It has been compared with two types of wild sheep but not with domesticated animals. It was found to be dissimilar to both the European moufflon (*Ovis musimon*) and to a representative of the ammon sheep, as were the two large cores from Argissa. When the description of the La Adam and Argissa cores are compared, it is seen that they both have a similar cross-section and also have no definite frontal surface. If in fact they represent the same species, this implies the presence of the mountain sheep (*Ovis vignei*) in a domestic form in both Greece and Rumania.

Both sheep and goat have been found at Khirokitia in Cyprus (Dikaios 1953). They are more common than any other domestic animal and are found in all parts of the site, particularly the graves. Wild sheep and goat are also known from this site and have been identified as *Ovis orientalis* and *Capra hircus aegagrus*, and it is from these two species that the/
the domestic animals originate.

Sheep form the basis of the economy during the Aceramic Neolithic in Europe. There is evidence that a large sheep, probably a domesticated form of the mountain sheep *Ovis vignei* was present in Greece, and it is possible that this breed was also present in Rumania. Somewhat smaller sheep are also present in Greece, and in this connection the evidence from Anau is recalled. Here Duerst found evidence for the evolution of the turbary sheep from the mountain sheep, and this is probably what was happening at Argissa.

**Pigs**

Pigs were domesticated at Argissa and Khirokitia. They are the second most frequent animal at Argissa where they are much less numerous than sheep (Milojčić 1962; see Fig. 4 & Table No. 13). There were also a few larger bones which could originate from either a wild or a large domestic animal. Only a few pig remains were found at Khirokitia (Dikaios 1953). It is probable that they were domesticated but this cannot be established with certainty.

Pigs were domesticated during this period, but they were only present in small proportions relative to ovicaprids.

**Dog**

The only record of a dog comes from Argissa (Milojčić 1962; see Fig. 4 & Table No. 13). Two of the bones found fall within the range of a small turbary/
turbary-sized animal, and the other is a little larger. Dogs do not appear to have been known at Khirokitia in Cyprus (Dikaios 1953).

Cultivated Plants

Wheat

Evidence for the cultivation of wheat has been found at Argissa, where examination of daub revealed the presence of two different types (Milojčić 1962). These are einkorn and emmer. There were also a few impressions of a glumed wheat which could not be accurately identified. Only a handful of carbonised grain was found and nearly all of this is attributable to einkorn.

Wheat was more frequent than barley, and einkorn and emmer are present in approximately equal quantities at Argissa.

Barley

Two impressions and a single carbonised grain supply the evidence for barley cultivation at Argissa (Milojčić 1962). Both of the impressions belong to the glumed variety and one was identified by Hopf as belonging to the four-rowed species. The cultivation of barley does not appear to have been of much importance to the economy.

Millet

A single small, carbonised round seed of millet was found at Argissa (Milojčić/
Hopf thinks that it probably belongs to the broomcorn variety (*Panicum miliaceum*).

**Lentils**

A few carbonised lentil seeds were present in the aceramic strata at Argissa (Milojčić 1962). It was not possible to say whether they were cultivated or not since they are few in number and vary in size. If they were cultivated, they were still in the early stages and close to the wild species.

**Summary**

Sheep were the chief domestic animal to be found at Aceramic sites, and cattle, pigs and dogs were present in small numbers, as was the goat. The sheep from at least one site seem to belong to the mountain sheep *Ovis vignei*, and it is probable that the turbary sheep was being evolved from this species in Greece. In Cyprus the local sheep and goats were being domesticated. Einkorn and emmer were the chief cereals, and four-rowed barley and perhaps millet and lentils were being cultivated.
TRANSITIONAL SITES

European mesolithic sites at which domestic animals other than the dog have been identified are considered in this section, together with instances of sheep and small cattle in the same context.

The cultures involved are those of Azilian, Tardenoisian, Sauveterrian and Asturian. The first two are discussed in the section on European Mesolithic dogs. The Sauveterrian culture is slightly earlier than the Tardenoisian culture and occurs in western Europe between 7000 and 4900, according to available carbon 14 dates. Small narrow flint flakes in the shape of elongated triangles are characteristic, and trapeze shapes occur occasionally. The bone industry is poor in comparison with other late Mesolithic cultures. Red and roe deer, elk and aurochs were the basis of the hunting economy and fishing was also practised.

The Asturian culture supercedes the Azilian culture along the coasts of northern Spain and Portugal. The basic tool was a chipped pebble and shell fish occur in profusion. This culture continued until well into the neolithic period and dates as late as 3000 have been obtained.

Domestic Animals

Cattle

Small cattle are reported from sites of the Sauveterrian, Tardenoisian and Azilian cultures, as well as from a few other apparently mesolithic sites (see Table No. 14).

Small/
Small cattle are present in a Sauveterrian context at Unang in France (Paccard 1956). These bones were separated from the neolithic levels of the site by 40 cm. of sterile soil, and there is no record of large cattle. Both Sauveterrian and Tardenoisian cultures have been found at Moita do Sebastião in Portugal (Roche 1960). It was in the context of these cultures that bones of a small-sized bovine were found. Bones of the much larger aurochs were also found, and the dentition of the two animals is said to be completely different. After a careful examination Zbyszewski came to the conclusion that these smaller bones belonged to domestic animals (Roche 1960).

There are three instances of cattle in a purely Tardenoisian context. These occur at the two French sites of Belloy-sur-Somme and Cuzoul-de-Gramat and at the Russian site of Kamennaia Mogila. The osteological remains from the first site are certainly of domestic animals (Salomonsson 1960), whereas those from Cuzoul-de-Gramat are said to be small-sized and comparable to those from Er Yoh (Lacam 1944). These bones were found in the second and third Tardenoisian levels together with other domestic animals. They are definitely not of bison, as they are too small, although it is possible that some remains of bison are present in the large bovine category. Kamennaia Mogila lies in the northern Crimea and is classed as Tardenoisian by Radulesco & Samson (1962), who report the presence of cattle in a domestic state. No further details of this find are given.

The Azilian instances of cattle occur at Colomb à Meaudre and Balme de/
de Glos in France and Saleve in Switzerland. A bovine of very small size together with one of normal size is recorded at Colomb à Meaudre (Bouchud 1956) and also at Balme de Glos (Bouchud 1956). The size is so diminished that it cannot be accounted for by sexual dimorphism, and presumably it is too small to represent bison as was the case at Cuzoul de Gramat. The remains from Saleve are assigned to the turgary breed (Bos taurus brachyceros) by Studer (Schenk 1912, 122). These remains agree well with neolithic finds identified by Studer, so there can be no doubt of their domesticity.

The exact context of the small cattle reported from Er Yoh, Le Ferrey, Maastricht and Ringneill is not known. Bones of small cattle at Er Yoh are said to be abundant and more frequent than those of large individuals (Pequart 1926). Together with flints, bones and shells of a mesolithic industry, a few fragments of pottery were found. The cattle at Le Ferrey are again reported to be definitely domesticated, but at this site there was no sign of any pottery or other neolithic influence (Cayeaux 1960; 1962). The domestic cattle recorded at Maastricht are present in an industry similar to that of the Danish Maglemose and Ertebølle sites (Forrer 1908). Two bones of a small bovine were found at the Irish site of Ringneill (Jope 1955). It is said to be almost indistinguishable from the modern domestic ox, but is recorded in a mesolithic deposit. These two bones do not belong to bison, and there seems to be no doubt of their authenticity.

Small cattle are recorded at sites of the Sauveterrian, Tardenoisian and/
and Azilian industries in Europe. Some are claimed to be definitely
domesticated, and others are reported as being too small for a female
aurochs, and also not of bison origin.

Ovicaprids

Ovicaprids are recorded at sites of the Sauveterrian, Tardenoisian,
Azilian and Asturian cultures (see Table No.14).

The only instance of sheep or goat in a Sauveterrian context comes
from Three Holes Cave in Devon where Zeuner identified a few bones of
sheep (Zeuner 1964, 193). Nothing further is known of this find.

Sheep or goats have been found at six Tardenoisian sites. Some of
the most interesting evidence comes from Châteauneuf les Martigues in
southern France. Here Ducos (1958) found over sixty bones of a small
sheep which shows close agreement in both size and character with the
turbary sheep, Ovis aries palustris. The rabbit was by far the most
frequent animal found at this stage at Châteauneuf, but was followed by
this small sheep (see Table 15, Fig. No. 5). It is not, however, stated
whether this sheep had any definite characteristics of domestication.

Teeth of sheep are known from the third Tardenoisian horizon at Sauveterre
(Coulonges 1935), and remains of sheep or goat occur in all three
Tardenoisian levels at Cuzoul-de-Gramat (Lacam 1944). A bone from the
second level is thought to originate from a sheep, and a tooth from the
earliest level is reported as originating from a domestic animal. All of
these bones are in the same state of preservation as the other osteological
remains/
remains of Tardenoisian origin. No indication of the size of these animals is given. A single ovicaprid tooth survived at Téviec (Péquat 1937), and several bones survive at Belloy-sur-Somme in level 3 (Salomonsson 1960). The latter are said to be domesticated. The only other occurrence of ovicaprids in a Tardenoisian context comes from Kamennaia Mogila in the Crimea. Radulesco and Samson (1960) report that both sheep and goat are domesticated at this site.

The two French Azilian sites to be considered are L'Abri Pages and Balme de Glos. Bones of sheep have been found at both sites and in each case are described as representing animals which were very small in size (Bouchud 1956a & b). Bouchud reports the majority of bones of palaeolithic sheep known from Europe as being similar to those of the Asiatic moufflon in length, but the bones from the two Azilian sites are similar to the European neolithic sheep, and so probably approach the size of the turbarry animals. Sheep are also known from Saleve in Switzerland (Schenk 1912) and amongst the ovicaprid bones found at Baie Herculane, Bokonyi was able to distinguish a horn core of a goat (Nicolaescu-Plopsor 1957).

Sheep also occur in an Asturian context in Spain, and ovicaprids are known from Mugem in Portugal. These finds all occur in the coastal shell mounds, and are reported by Obermaier (1924). The exact sites at which sheep have been found in southern Spain are not mentioned.

There are six other instances of ovicaprids in an apparently mesolithic context. In the second post-glacial level at La Adam the osteological remains were found to consist almost entirely of sheep (Radulesco/...
(Radulesco & Samson 1962). These bones were very fragmentary and so have not been assigned to any definite species. Bones of sheep are present throughout the palaeolithic and also in the early mesolithic according to Radulesco and Samson, but it should be noted that Bökonyi found a certain amount of contamination amongst the osteological remains (Personal communication). The bones of the second mesolithic level are very slightly smaller than those from the preceding palaeolithic, and Radulesco and Samson consider that they are in the initial stages of domestication. They found two different types of sheep in the palaeolithic levels, the first is described as being similar to Ovis orientalis but not identical to it, and the second is smaller and they suggest that it may be a new sub-species. It is this second sheep that is present during the late palaeolithic, and was the possible object of domestication during the late mesolithic.

The goat is reported to be present in a Maglemose/Kitchen midden type of settlement at Maastricht (Forrer 1908) and also at Remouchamps (Clark 1936). The nature of the evidence that enabled the distinction between sheep and goat to be made is unknown. A number of bones of either sheep or goat are known from Rousselier (Fournier 1901), and in his list of animals found in the Basse Province during the Azilian period Fournier includes the goat. The possibility that these goat bones could in fact belong to a small goat-like sheep as known from other mesolithic sites should be considered. Sheep are reported from the mesolithic at Le Ferrey (Cayeaux 1960, 1962) and turbary sheep are frequently found at Er/
Er Yoh (Pequart 1926).

There is ample evidence for the presence of sheep in late mesolithic cultures in Europe. The contexts in which they have been found include those of the Sauveterrian, Tardenoisian, Azilian and Asturian cultures, and in most cases the sheep appear to be small in size. Some of them compare well with the bones of the turbarry sheep.

**Pig**

Small pigs have been found in both Tardenoisian and Azilian sites (see Table No. 14).

The bones found at Belloy-sur-Somme and Kamennaia Mogila are thought to originate from domestic animals (Radulesco & Samson 1962; Salomonsson 1960). There is also a possibility of a centre of pig domestication in the region of the Crimea, where the second site lies. The fauna of the Azilian and Tardenoisian sites in this area have been examined by Gromova and more recently by Stoliar (1959). He examined the osteological remains from the caves of Fatna-Koba, Kilyse-Koba, Kra-Kush-Koba, Murzak-Koba, Shan-Koba, Shpan-Koba, Sjuren II, Yusup-Koba and Zamil-Koba II, and found that the fauna of the Tardenoisian levels appeared to be more specialised than that from the Azilian levels. In the former context bones of the large pig *Sus scrofa attila ferus* were common. Stoliar doubts whether this was the local habitat for this species, and suggests that it was possible that the inhabitants confined this animal and did not allow it to run wild. Gromova says (according to Stoliar) that there is an/
an abundance of pig remains at mesolithic sites in the Crimea, and that
the majority were remains of suckling pigs. These could form as much as
three-quarters of the pig remains. The pig bones from other Tardenoisian
sites and also from Sauveterrian sites are all of wild animals.

The only claim for a domestic pig in an Azilian context comes from
Saleve in Switzerland where Studer identified the turbary pig (Schenk 1912).
Domestic pigs occur at both Er Yoh and Le Perrey and it is probable that
both belong to the turbary breed (Pequart 1926; Cayeaux 1960, 1962). No
claim for domestication is made by Jope (1955) for the bones found at
Ringneill in Ireland. They originate from a small-sized pig.

There are a few claims for pig domestication from sites of the
Tardenoisian and Azilian cultures. They are present in both France and
Switzerland, but the Crimea provides evidence of a possible independent
centre of pig domestication.

Dog

Remains of dogs associated with other domestic animals have been
found at six sites (see Table No. 14).

They occur in a Tardenoisian context at Sauveterre and Téviec in
France and at Kamennaia Mogila in the Crimea. Some teeth were found in
the third Tardenoisian horizon at Sauveterre (Coulorges 1935) and several
jaws are reported from Téviec (Pequart 1937). Some of these belonged to
small individuals which could imply the presence of the turbary breed.
Nothing is known of the dogs found at Kamennaia Mogila (Radulesco & Samson
1962)/
1962). Lacam (1944) was uncertain whether bones he found in Tardenoisian levels at Cuzoul-de-Gramat originated from a large dog or a wolf.

Dogs also occur at Mugem in Portugal in an Asturian context (Obermaier 1924). The other instances of dogs occur at Le Perrey (Cayeaux 1960; 1962) and Maastricht (Forrer 1908). The bones from the first site are of a medium-sized animal, which Cayeaux thinks could belong to the *intermedius* family.

Dogs have been identified at sites of the Tardenoisian and Asturian cultures, but are absent from Azilian and Sauveterrian sites. Both small and medium-sized animals have been found, and in this respect the evidence compares well with that from the mesolithic sites of Denmark.

**Cultivated Plants**

**Barley**

No authentic remains of carbonised cereal have been found at mesolithic sites, but there is a single instance of a site at which impressions of grain occur. This is at Belloy-sur-Somme in France where two impressions of barley were identified on sherds found in level 3. Salomonsson (1960) suggests that one of the imprints was perhaps of naked barley and the other of a glumed variety. No closer identifications were possible.

**Summary**

Remains of small cattle, sheep, pigs and both small and medium-sized dogs/
dogs have been found in mesolithic contexts throughout Europe. The most common of these four animals was the sheep which has been found at several Tardenoisian and Azilian sites in France. It is described as being very small in comparison with the Asiatic moufflon and some bones compare exceptionally well with those of the turbarry sheep known from the neolithic. There is a possibility of a centre of pig domestication developing in the Crimea during the Azilian and Tardenoisian periods. One French site provides evidence of contact with cereal cultivating communities during the Tardenoisian period.
The Ertebølle culture is found along the coasts of Denmark and southern Sweden and the Ellerbek culture is the German counterpart. Isotopic dating places these cultures between 3800 and 2900. Initially they were contemporary with the north European mesolithic communities, but latterly the TRB culture is found in the same area.

The pottery is coarse and consists of pointed-based pots. The stone industry includes flake and greenstone axes which occasionally are ground to shape, and arrow heads represent the microlithic element. The bone and antler forms of the mesolithic were to a large extent replaced by flint, but perforated axes, antler sleeves for stone axes and bone combs are found. Fish were caught with bone hooks and a line rather than harpooned.

The coastal settlements are characterised by shell heaps, or 'køkkenmøddinger'. The sources of food are basically fishing, shellfish collecting and hunting. The dog is present at several of these sites, and at a few late settlements cattle, sheep, goat and pig occur. Amongst the hunted animals were red and roe deer, elk, aurochs, pig, seals (greenland, gray and ringed), horse, otter, badger, beaver, bear, marten, fox, wolf, lynx, wild cat, polecat, squirrel, hare, hedgehog, dolphin and killer whale. There were also many types of fish caught, including bottom feeders, and many species of birds (see Table No. 16).

There has been some dispute as to whether this culture is best regarded as mesolithic or neolithic, but since it is usually considered mesolithic/
mesolithic (as the greater part of it clearly is), it is considered at this stage.

**Domestic Animals**

**Cattle**

Bones of domestic cattle have been recorded at four or five Danish sites, possibly one Swedish site and three German sites (see Table No. 17).

At the Danish site of Braband, Thomsen and Jessen (1906) identified 31 bovine bones, 16 of which could be easily attributed to aurochs. The remaining 15 come from smaller-sized animals, which they feel could well be regarded as being domesticated. Relatively small animals were also found at Dyrholmen and Degerbøl (1942) thinks that they also may be domesticated. However, in his conclusion Degerbøl stated that in the light of knowledge in 1942 it would be best if these questionable bones were regarded as originating from wild animals. The possibility of these belonging to wild female animals has been excluded by Degerbøl's investigation of museum material, where he found that it was impossible to distinguish the sexes on the basis of the length of the bone. The actual thickness of the bone is much more characteristic.

Unmistakable bones of domestic cattle are reported from Muldbjerg (Troels-Smith 1958), and this animal is again recorded at Strandegaard (Mathiassen 1940). Many cattle bones have been found at Langø, and as they are of medium size they are attributed to domestic animals. However, Broholm (1928) thinks that the bones represent animals that were too small to/
to have originated from an Ertebølle context, and so says that he thinks they belong to the later period of the site. Whether there is any evidence for them being in an Ertebølle horizon or not is not known.

There is also a possibility of domestic cattle at the Swedish site of Limhamn, but no details of the remains were available (La Baume 1949).

Domestic cattle are reported from three German sites in an Ellerbek context. On the basis of an analysis of the size of shoulder blades Nobis (1962) was able to identify domestic cattle at Bregentwedt–Forstermoor. There was one example of a medium-sized domestic animal, and two further instances of animals that could be either domesticated or wild. At Kiel–Ellerbek the bones of wild and domestic cattle were the second most frequent next to those of red deer (WESTORF 1904; see Fig.91 & Table No. 18). Amongst the aurochs remains were found a few bones which represent smaller domesticated animals and there appears to be no reason for assuming that they are not contemporary with the rest of the osteological finds. The bones of wild animals are a third as large again as those of domestic animals, and the cranial remains confirm the presence of captive animals. Domestic cattle are also known from Movenberg, where they are said to be still fairly large in size (Requate in Schwabedissen 1962).

Domestic cattle are known with certainty from several Ertebølle–Ellerbek sites, and their presence at other sites is also likely. It must, however, be emphasised that this is an unusual occurrence rather than a usual one. The main question arising from this conclusion is whether these cattle were domesticated by the Ertebølle people themselves, or/
or whether they represent contact with a true neolithic community.

Ovicaprids

Sheep or goats have been identified at two sites in Denmark, two in Sweden and two in Germany (see Table No. 17).

Teeth of sheep have been found at Muldbjerg and are known to have definitely come from the Ertebølle levels (Troels-Smith 1953), but it is not certain in which level the remains from Langø originate (Broholm 1928). Sheep are also recorded at the Swedish site of Limhamn, (La Baume 1949), and either sheep or goat are known at Rorvik (Henrici 1936). Sheep occur again in an Elkmork context at Kiel-Elverbek (Mestorf 1904; see Fig. and Table No. 18) and ovicaprids are present at Moenborg (Schwabedissen 1962).

The presence of sheep during this culture has been established at a few sites, and it is clear that these animals could not have been domesticated by the inhabitants of the Ertebølle sites. They must represent contact with an external neolithic community, which from archaeological considerations must be the TRB people.

Pig

The domestic pig occurs at two sites in Denmark, three or four sites in Sweden and one or two in Germany (see Table No. 17).

The bones from Drøsselholm have been carefully examined by Degerbol and he came to the conclusion that they belonged either to animals that were/
were in the process of being domesticated or to fully domesticated animals (Degerbøl 1942). The pig remains from Langød lie within the maximum for domesticated animals, but there has been some doubt as to which level the bones come from (Broholm 1928).

The osteological remains from Ånderod were first examined by Frodin in 1906 and he identified the pigs as "Sus scrofa ferox" and said that both large and small animals were present. Pira (1909) reinvestigated these finds and he also could not decide to which group these animals belonged since the remains were very fragmentary. This site is thought to be contemporary with the early Passage Grave period (Frodin 1906).

Domestic pigs are known with certainty from Limhamn (La Baume 1949) and Ringsjón (Pira 1909). Most of the bones from the last site are attributable to wild pig, but there are a few which Pira places in his group II (see p.23). One jaw fragment found at this site is of particular interest. It included the crista, which was so much reduced in size that the possibility of the animal being castrated must be considered. The great reduction in size of the Crista alveolaris is characteristic of castrated pigs (Pira 1909). The domestic form of pig occurs again at Rörvik (Henrici 1936).

Pigs are probably present at two German sites. They have been identified at Novenberg (Schwabedissen 1962) and Nobis (1962) believes he can distinguish remains of these animals at Kiel-Ellerbek. He bases this view upon certain measurements made by Luttschwager. In both cases the pig was close to its wild ancestor.

The domestic pig appears to have been known by both the Ertebølle and Ellerbek/
Ellerbek people. In several cases these animals are known to be still close to the wild prototypes.

**Dog**

There are 36 instances of dogs amongst the sites considered (see Table No. 17). In the majority of cases, however, an actual racial identification was impossible. At 28 of the 36 sites the dog is the only domestic animal known to be present.

Amongst the dog remains at Blocksberg two races of dog have been distinguished (Hauck 1950). These are the turbary dog, *Canis f. palustris* and a larger dog which is either *Canis f. inostranzewi* or *Canis f. matris optimae*. The turbary breed occurs again at Brabant Sø where a skull of a young animal had a basal length of 144 mm., implying an adult basal length of 155 mm. This represents the size of a large turbary dog (Winge 1904; Brinkmann 1924; Degerbøl 1927; Hauck 1950; Thomsen & Jessen 1906). The type site of Ertebølle also revealed dog bones, the majority of which can be attributed to the turbary breed (Brinkmann 1924). The presence of a larger race was indicated by teeth and a few bones, but no characteristic remains were found. Brinkmann described it as being a cross between the turbary and the *inostranzewi* dogs. A single bone from Fannerup has been attributed to *Canis f. intermedius* and amongst the finds from Hadsund were jaws of a turbary dog as well as one of a very small dog which would have had a skull of basal length 123 – 126 mm. (Brinkmann 1924). This represents the miniature dog of Strobel, *Canis f. spaletti.*
A single jaw of a large dog found at Havelse has been assigned to *Canis f. intermedius* and it agrees completely with the original find in Bohemia (Brinkmann 1924). Large dogs are recorded at Kassemøse (Brinkmann 1924), Krabbesholm (Brinkmann 1924), Havelse (Brinkmann 1924) and Søjlager (Winge 1904). The large dog at Klintesø is thought to be probably *Canis f. matris optimae* (Degerbøl 1927; Winge 1904). *Canis f. inostranzewi* has been identified at Langø but the bones of *Canis f. palustris* were more frequent (Broholm 1928). The large dog was completely absent at Mejlgaard where remains of typical turbary animals have been found (Brinkmann 1924). Degerbøl (1928) also examined these remains and he found evidence for the presence of the *ladogensis* variant of the turbary dog, which compared well with the bones from Christiansholm.

Dogs occur at three Swedish sites, and those from Rörvik (Henrici 1936) are medium-sized animals. This probably implies that the turbary breed is represented. Nothing is known of the dogs from the other two sites.

The turbary dog is also known from Germany. A complete skeleton was found at Klausdorf associated with Ellerbek implements (Dahr 1939). The skull found at Kiel-Ellerbek on the other hand is thought to originate from a slightly larger animal (Westorf 1904) as is that from Husum (Dahr 1939).

It is clear that the dog was a common domestic animal at most Ertebølle and Ellerbek sites. There were two main breeds. The smaller is the turbary dog, of which a miniature form has been recorded, and the larger has been identified as *Canis f. intermedius*, *Canis f. inostranzewi* and *Canis/
Canis f. matris optimae.

Cultivated Plants

Wheat

This is the main grain to appear in impressions on sherds from Ertebølle sites. There is one instance of einkorn, either one or two of emmer, one of club wheat and two of an unidentified wheat.

Einkorn has been identified at Braband (Rydbeck 1938), and emmer at Sølager (Rydbeck 1938) and possibly at Aamosen (Helbaek 1954; Troels-Smith 1953). Club wheat is known from Aamosen (Helbaek 1954; Troels-Smith 1953) and an unspecified type of wheat occurs at Muldbjerg (Troels-Smith 1953) and Øgaarde (Rydbeck 1938). These are all pottery impressions and there has been no trace of carbonised grain at any of the carefully excavated Ertebølle settlements.

However, all these impressions occur only on sherds of TRB pottery and so do not bear any relationship to the agricultural practices of the Ertebølle culture. They merely illustrate the already known fact that wheat was cultivated by the TRB communities. Helbaek conducted a thorough investigation of the Ertebølle sherds themselves and was unable to find any indication of cereal impressions.

Barley

There are two cases of impressions of barley, and they both occur at Aamosen (Helbaek 1954). The barley can be assigned to the naked variety and/
and the impressions occur on TRB A sherds.

Summary

There is evidence for the presence of domestic cattle, ovicaprids and pigs in an Ertebølle context, but they only occur at a very small proportion of the sites, whereas the dog is a much more common feature. The cattle include medium-sized and large animals, most of the pigs are still fairly close to the indigenous wild boar, and both large and small dogs were bred. There is little doubt that the dogs were actually domesticated by the Ertebølle people, but it is obvious that the sheep could not have been domesticated by them. The main problem to arise from the above conclusions is whether the cattle and pigs were being bred by the Ertebølle inhabitants, or whether they are actually animals of the TRB communities.

There is ample evidence for the connection between these two cultures, and this is particularly well illustrated at Muldbjerg where four-fifths of the pottery sherds belonged to TRB pottery and only a fifth represent true Ertebølle pots. The claim that the Ertebølle culture was a plant-cultivating society has been seen from the above evidence to be untrue. These impressions of wheat and barley represent the activities of the TRB culture.

Since there was close contact between these two cultures it is apparent that the Ertebølle people would have come into contact with domestic animals other than the dog. If the Ertebølle folk did in fact domesticate/
domesticate cattle and pigs the TRB culture must have been the impetus behind this action. It seems probable that the medium-sized animals do in fact belong to TRB stock, and it is possible that the large cattle and pigs represent attempts of the Ertebølle culture to copy the economy of the TRB culture.
INITIAL COLONISATION

1. STARČEVO-KÖRÖS AND ALLIED CULTURES

The Starčevo-Körös culture occurs at tell settlements in Greece, Bulgaria, Yugoslavia, Rumania and Hungary. In Greece the allied culture has been dated to as early as 6200 B.C., and to the north it occurs between 5100 and 4200 B.C.

There are three classes of pottery. The first is rough, rusticated with fingertip impressions and is found mostly in south-east Hungary and Rumania. The second is plain burnished ware, which is buff or yellow in colour. The last is fine, hard painted pottery, usually fairly thick, with a red or white slip. The former is the more common background. The painted design is curvilinear, and black or white, or black and white on a red ground, and occasionally black and red on a white ground. The flints are generally of medium length, thin, and have retouched edges. There are no perforated axes, but thin unperforated axe/adzes occur. The bone industry is not rich. The houses are square, rectangular or trapeze-shaped, and are grouped to form settlements which are usually found at the base of the tells in eastern Europe.

Hunting was not of great importance to the economy of this culture. It generally forms less than a fifth of the food supply, and as little as a fiftieth has been recorded in Greece (see Tables Nos. 21 - 24). The most interesting fact to arise from the examination of the bones of wild animals is the presence of the donkey (*Equus Asinus* cfr. *hydruntinus*).
This particular equoid was thought to have been extinct on the European mainland since the Pleistocene. Recently, however, there have been various reports of its presence in a neolithic context, so that its survival until at least the early neolithic must now be accepted. In this context it occurs at Nódmezovásárhely-Bodzaspart and Lebo (Bokonyi 1954, 1959). Other wild animals known from Starčevo-Koros sites include red and roe deer, pig, aurochs, horse, otter, beaver, polecat, cat, fox, wolf, badger, hare, turtle, tortoise, fish and birds (see Table No. 19).

Domestic Animals

Cattle

Domestic cattle have been identified at all of the sixteen sites considered (see Table No. 20).

The osteological remains from Otzaki magula (Vor-Sesklo layers) show that cattle were the second most common animal, being slightly more numerous than pigs (Milojčić 1962; see Fig. 6 & Table No. 21). They exhibit clear affinities with the aurochs, although there is some variation in the size of the animals. The majority of the horn cores appear to have been of medium length. A similar situation is observed at Nea Nikomedea. Here cattle are slightly less frequent than pig (Rodden 1962; see Fig. 7). There were a large proportion of immature animals, and as a whole the cattle are said to be larger than the modern Ayrshire breed and smaller than the aurochs.

Nothing is known of the nature of the cattle found at the Bulgarian sites/
sites of Devetaki (Mikov & Dzambzov 1960), Golemata (Gaul 1948) and Karanovo I (Gaul 1948; Georgiev 1961), or from Verbiţa in Rumania (Berciu, personal communication) and Gornja Tuzla (Benac 1961) and Starčevo (Garašanin 1954) in Yugoslavia.

Evidence as to the nature of the cattle at Hódmezővásárhely-Bodzaspart was obtained from the investigations of Bokonyi (1954; see Table No. 23). Comparison of these remains with those of the aurochs shows that these cattle could not have been domesticated for a very long period since some of the bones are of the same thickness as those of the aurochs. There was no trace of the small turbary cattle. The same type of stock was again present at Maroslele-Pana, where there were also several bones that could originate from either wild or domesticated animals, and may imply that local domestication of the aurochs was being practised (Bokonyi 1964). Cattle were the second most common animal at this site (see Fig. 8 & Table No. 22).

Cattle were also less frequent than ovicaprids at Szarvas-Szappanos (Kutzian 1947, 10), but their frequency at Obessenyo (Kisleghi-Nagy 1911) and Opoljenik (Kutzian 1947) is not known. They are the most common animal at Lebo, but since this applies to the neolithic of the site as a whole, it cannot be regarded as reflecting the economy of the Starčevo-Köröö culture (Bokonyi 1959; see Fig. 9 & Table No. 24). The only site at which cattle can be regarded as exceeding sheep and goat in frequency is that of Tiszaug-Topart, where Kutzian reports them as the most important of the domestic animals. However, the actual number of bones upon which this/
this statement is based is not known.

The evidence from the Starčevo-Körös culture indicates that cattle were of secondary importance to the economy, and were approximately as numerous as pigs in some areas. They are generally large in size, with no indication of the turbary breed. There is a possibility of local aurochs domestication in Hungary.

Ovicaprida

Remains of sheep or goats have been found at fourteen of the sixteen sites considered (see Table No. 20).

At Otzaki bones of ovicaprids account for half of the osteological remains, and so they are the most important of the domestic animals (Milojčić 1962; see Fig. 6 & Table No. 21). Three differing forms of horn cores have been found. These represent strong horns, weak horns and hornless sheep. The majority of these animals are of medium size, although there are some large and some small individuals. Goats are also quite well represented, and one fairly strong core was found indicating a large animal. Sheep and goat are also the most frequent of the domestic animals found at Nea Nikomedeia and many of them were still immature when killed (Rodden 1962; see Fig. 7). Amongst the horn core remains was one of a scimitar horned goat which bore many similarities to the bezoar goat. No evidence for twisted cores has yet been found at this site.

Ovicaprids are again present at three Bulgarian sites, one Yugoslavian and one Rumanian site (see Table No. 20). Their absence at Bukovapusza
in Hungary is probably due to the small amount of bones recovered (Bokonyi 1959). No racial identification of the sheep found at Hódmezővásárhely-Bodzaspár was possible, nor are the breeds at Lebo, Obessenyő and Tiszapár known (Bokonyi 1959; Kisleghi-Nagy 1911; Kutzian 1947). At the last site ovicaprids were less frequent than cattle, but the number of animals involved is not known. Sheep alone have been identified at Opoljenik, and at Szarvas-Szappanos they are the most important of the two domestic animals (Krecsmarik 1915; Kutzian 1947).

The bones found at Maroslele-Pana are of interest (Bokonyi 1964). Amongst the remains of sheep (which are of small size), there are two portions of skulls of hornless sheep, and also a very small core. This occurrence of hornless sheep is the earliest known on Hungarian soil, and agrees well with the finds from Otzaki in Greece. Ovicaprids are the most frequent animal to be identified at this site (see Fig. 8, Table No.22).

The last point of discussion in this section is the alleged presence of the wild moufflon Ovis musimon at Opoljenik (Kutzian 1947, p.10). The two alternative explanations are that it is either a wild moufflon or else is a large domestic animal which closely resembled the wild prototype. It is well known from other sites that there is a wide range of variation in the size of the domestic stock, with some animals approaching the size of the wild sheep or goat. On this basis the latter explanation would be the most reasonable for this animal's presence. However, bearing in mind the fact that moufflon are known on the Mediterranean islands of Corsica and Sardinia, the former possibility cannot be completely discarded. Should/
Should wild sheep have in fact survived until the late mesolithic or early neolithic in certain areas of France, it is possible that they might have done so in other climatically suitable regions. If this is so, it would mean reconsidering many finds of exceptionally large domestic sheep in Europe.

Ovicaprids were the basis of the economy of the Starčevo-Koros culture. Considerable variation in the size of the animals has been observed, with both large and small animals together with hornless sheep known in Greece and Hungary.

**Pig**

There are eight sites at which the domestic pig has been identified (see Table No. 20). It is not known whether the pig remains from Karanovo, Gornja Tuzla and Obessenyo are of wild or domestic origin (Benac 1961; Gaul 1948; Kisleghi-Nagy 1911).

Pigs are the least important of the domestic animals found at Otzaki, and all appear to be of the turbary type, as is the case throughout the site (Milojčič 1962; see Fig. 6 & Table No. 21). There is only a very small proportion of wild pigs at this stage. The majority of pig remains found at Nea Nikomedelia were of immature animals, and they were again of secondary importance, being about as common as cattle (Rodden 1962; see Fig. 7). These remains compare best with those found at Jarmo.

Domestic pigs are present at Devetaki (Mikov & Dzambzov 1960), Golemata (Gaul 1948) and Verbiţa (Beroiu, personal communication), but although/
although wild pigs are recorded at Starčevo, there is no mention of their domestication (Garašanin 1954). Only two of the Hungarian sites have definite evidence of pig domestication in this context. These are Tiszaug-Topart (Kutzian 1947, p.10) and Maroslele-Pana (Bokonyi 1964).

At the last site only three pig bones could be identified, making them as numerous as dogs (see Fig. 8 & Table No. 22). Pigs also occur at Lebo, but since remains of the Linear Pottery and subsequent cultures are included in the investigation, it does not follow that they were definitely present in a Starčevo-Koros context. The only indication of size comes from Maroslele-Pana, where they are known to be small (Bokonyi 1964; see Fig. 9 & Table No. 24).

Pigs were clearly less common as domestic animals than cattle or ovicaprids. In certain areas they may have been entirely absent and at others they are about as numerous as cattle. Most of these pigs seem to have been of small size.

**Dog**

Dogs occur at eight of the sixteen sites mentioned (see Table No. 20). The jaw found at Otzaki is thought to be of a turbary dog, and agrees well with one from the Dimini level of this site. Nothing is known of the breed of dog found at Devetaki (Nikov & Dzambzov 1960), Golemata (Gaul 1948), Verbiţa (Berciu, personal communication) or Starčevo (Garašanin 1954). Small-sized animals were, however, detected at Maroslele-Pana in Hungary, although nothing is known of the dogs from the remaining Hungarian/
Hungarian sites (Bokonyi 1964; see Fig. 8 & Table No. 22).

The turbary dog is the only breed known in this context, although it is possible that another larger type was also present.

**Cultivated Plants**

**Wheat**

The cultivation of wheat is attested at Nea Nikomedeia, Banyata, Karanovo I and perhaps at Salcuța (see Table No. 25).

The species of wheat grown by the inhabitants of Nea Nikomedeia is not yet known (Rodden 1962), but both einkorn and emmer are recorded at Banyata (Garašanin 1958) and Karanovo I (Georgiev 1961). Although no relative quantities are known, it is probable that wheat was the main crop since Gaul (1948) reports the find of ten bushels of wheat from Karanovo. No large quantities of barley are reported.

**Barley**

Barley is known from Nea Nikomedeia (Rodden 1962), Karanovo I (Georgiev 1961) and perhaps Salcuța (Berciu 1961). The type of barley grown is not known nor is its importance. However, it was probably less common than wheat.

**Millet**

The only instance of this cereal comes from Biserna Obala in Yugoslavia. It was first reported by Sulman, but its authenticity has been/
been questioned by various authors (Garašanin 1958).

**Legumes**

Legumes were cultivated at Nea Nikomedeia where lentils are recorded in large quantities. Peas were also present but it is not thought that they were cultivated (Rodden 1962). Vetch is thought to have been cultivated at Karanovo (Georgiev 1961) and a bean was present at Banyata (Garašanin 1958).

**Summary**

The economy of the Starčevo-Koros culture was centred upon the breeding of sheep and goat. Both large and small animals were present and so were hornless sheep. There is also a report of the moufflon from Hungary. The cattle are generally large in size and there is a possibility of local aurochs domestication. There is no evidence for the turbary breed. In some areas pigs are as numerous as cattle and in others they are entirely absent. The turbary pig is known to have been bred, as is the turbary dog. Wheat, barley, lentils and millet are all known in this context. It is probable that wheat was the main crop, and both einkorn and emmer have been identified.
2. - IMPRESSED WARE

The Impressed Ware culture has an essentially coastal distribution and is found to the west of the Starčevo-Koros culture along the coast of the Adriatic and Mediterranean Sea. Isotopic dating places it between 4700 and 3800 B.C.

The most characteristic feature of the pottery is the occurrence of impressions of the cardium shell. This gives the culture its other name of Cardial Ware. In appearance this pottery is similar to some of the rougher Starčevo pots, and in Greece fingertip impressions occur in both cultures. Although the pottery is not so well executed, both the flint and bone industries are richer than those of Starčevo-Koros.

There is evidence for the hunting of red and roe deer, aurochs, pig, chamois, wolf, badger, lynx, cat, rabbit, fox, hare and fish (see Table No. 26). In some areas of France the rabbit was the chief source of food (Châteauneuf; see Table No. 15) and in others the pig was more important (Roucadour; see Table No. 28). From the small amount of evidence available hunting appears to have been of greater importance than domestication.

Domestic Animals

Cattle

Cattle have been found at two, possibly four, of the six sites mentioned (see Table No. 27).

Strobel (1890) reports both large and small domestic cattle from Stentinello/
Stentinello in Sicily. The small cattle are attributed to the turbary breed, but the larger variety were the more frequent. These two types of cattle are also found at Châteauneuf-Les-Martigues (Ducos 1958). The turbary breed appears for the first time at this stage and remains present throughout the neolithic at this site. Nevertheless the proportion of cattle remains small and they are far less numerous than sheep (see Fig. 10 & Table No. 15).

It is not clear whether Ducos (1957) considers the cattle bones from Roucadour as belonging to wild or domestic animals (level C; see Table No. 28). One very large animal was present and there were also two slightly smaller individuals. There is a report of small cattle from Unang, but it is not stated whether they are of domestic or wild origin. The Sauvetterrian levels of this site also contained a small-sized bovine (Paccard 1952).

Both large and small cattle were bred by the inhabitants of Impressed Ware sites, but these do not seem to have been of much importance to the economy.

Ovicaprids

Sheep or goat are recorded at all six sites (see Table No. 27). The domestic goat is present at Crvena Stijena, level II, in Yugoslavia (Benac 1958; 1961). They occur only sporadically and appear to be of little importance to the economy. Their presence in the earlier level IV has been discarded in favour of chamois (Benac 1961). Both sheep and/
and goat were found at Stentinello (Strobel 1890) and sheep are known from Arene Candide (Brea 1946).

The ovinocaprid remains from Châteauneuf-Les-Martigues consist almost entirely of sheep. The turbary sheep *Ovis aries palustris* is present throughout, with no indication of a larger variety (Ducos 1958). This sheep is far more frequent than any other domestic animal (see Fig. 10 & Table No. 15). Sheep are also present at Roucadour, but it is not known to which type they belong (Ducos 1957; see Table No. 28), and at Unang (Paccard 1952).

From the small amount of evidence available it appears that the sheep was the most frequent of the domestic animals. A large quantity of turbary sheep are known from at least one site, and sheep are more frequent than goats.

Evidence for pig domestication is found at Stentinello in Sicily and Unang in France. Many bones of turbary pig were found at the first site but there was no indication of the larger variety (Strobel 1890). Nothing is known of the size of the pigs from Unang (Paccard 1952). The largest quantity of pig bones was found at Roucadour, but it is not known whether these are remains of wild or domestic animals (Ducos 1957). In all, they form just under half of the total fauna. The proportion of pigs found at Châteauneuf-Les-Martigues was much smaller, and they are known to be of definite wild origin (Ducos 1958; see Table No. 15).
Turbary pigs were being bred during this culture, but they do not occur at as many sites as do cattle and ovicaprids. Wild pigs were hunted, sometimes in large quantities.

**Dog**

The only instance of dog in this context comes from Stentinello (Strobel 1890). Two breeds, the turbary dog *Canis f. palustris* and its miniature form *Canis f. spaletti*, have been distinguished.

The dog was present at Roucadour but it is not known from which levels of the site the finds come (Ducaes 1957).

**Summary**

The turbary sheep was the main animal bred, with goats, cattle, pigs and dogs present in lesser quantities. It should, however, be remembered that hunting was still of much importance. So far no evidence of plant cultivation has been found, but a detailed analysis of the pottery might reveal impressions of cereals.
3. - LINEAR POTTERY

The Linear Pottery culture has the widest distribution of the three Initial Colonisation cultures. It is found in Hungary, Rumania, western Russia, Poland, Czechoslovakia, Austria, Germany, Holland and in France. As well as its wide space distribution, the Linear Pottery culture has a large time distribution. The earliest phase is dated to around 4800 B.C. and the latest to 3700 B.C.

The characteristic pottery is incised and can be divided into three phases. The earliest is found in the Alfoldi area of Hungary, from where it spreads to the north-east and west of Hungary, to south-west and east Slovakia, Moravia, Bohemia, south-east Germany, west Germany and hence to the Rhine valley and Holland. The pottery contains much organic material, is orange in colour and bears thick incised lines which form curvilinear and linear patterns. The shapes of the pots at this stage are more sophisticated than during the later stages.

The mid phase of this culture has the widest distribution. It has spread up to Holland by this stage, and is also found in Poland and north-east Rumania. In the eastern area of its distribution the Tisza and Bukk cultures have emerged. In the central area the 'Notenkopf' style of ornamentation has evolved, and in the west the 'Filled-in band' style developed. The former is similar to incised musical notes, and the latter consist of parallel lines which are filled in with dots.

The late phase is characterised by the development of these two types of patterns, and has a similar distribution to the mid phase. The 'Notenkopf' /
'Notenkopf' design degenerates into 'Stichbandkeramik', and the filled-in band leads to the emergence of the Rössen and Altheim cultures. The flint industry varies in the geographical sense rather than with the differing phases. In the central area the blades are long, and have only a little retouching, and in the north-west large wide blades with more retouching are found. Arrowheads occur in this last area but never in the central area. They are also absent in Poland and the Ukraine where large end scrapers appear. There are also some microlithic elements. In the central area shoe last high-backed axes are found. The bone industry is usually poor, and very little survives. The Linear Pottery settlements are composed of large rectangular houses, averaging 25 by 100 feet, constructed out of solid timber posts covered with daub. Occasionally these houses are grouped together in an ordered pattern. The settlements were occupied for a period of time, perhaps ten years, and then abandoned and re-inhabited at a later date. At Bylany in Czechoslovakia several such occupations have been found and the site probably had a life-span of between 600 and 900 years. In other areas, such as Holland, the occupation seems to have been more permanent. It has been suggested that this semi-migratory system may have been carried out owing to local soil exhaustion, so that by the time of re-occupation the environment would once again be fertile, and suitable for raising crops and animals. These settlements are usually found on the loess soil of central Europe, and pollen analysis shows that these were forested, or at least lightly/
lightly wooded. The trees would have to be cleared and the most probable method would be that of slash-and-burn, with the ash enriching the fertile loess.

The animals that were hunted include red and roe deer, elk, aurochs, pig, horse, bear, beaver, badger, wolf, fox, hare, hamster, turtle, birds and fish (see Table No. 29). There was also an unidentified equid at a Hungarian site, which raises the possibility of the presence of the donkey. Of these animals the most frequent to occur were the aurochs and the red deer. The wild fauna usually accounts for between a tenth and a fifth of the total, but at one or two late sites proportions as high as a half have been noted. Most of the German material has been examined by Müller (1964) and unless otherwise stated the sites considered are to be found in this reference.

**Domestic Animals**

**Cattle**

Domestic cattle are known to occur at 97 of the 115 sites considered (see Table No. 30). There is also a possibility of their presence at a further five sites.

Two of the five Hungarian sites contain a large selection of animal bones from which their relative importance can be ascertained. At both Gyor-Pápai vám and Pomáz-Zdravlyák cattle are seen to be considerably more important than any other domestic animal (Bokonyi 1959; see Figs. 11, 12 & Tables Nos. 31, 32). At Lebo and Szegvár-Tuzkoves remains of other cultures/
cultures were found and the bones considered as a whole (Bokonyi 1959). Cattle, however, are still the basis of the economy (see Figs. 9, 13 & Tables Nos. 24, 33).

At the Rumanian site of Glvanestii Vechi the large variety of cattle is said to be dominant amongst the domestic animals (Comsa 1959) and at Danegti both large and small animals were found (Necrasov & Haimovici 1962). Amongst the bones found at the last site were two complete metatarsals of adult animals. One of these is large and the other smaller and considerably more slender and both are assigned to domestic cattle. Cattle are again the main species of animal encountered at Traian, and most of the bones belong to large individuals (Necrasov 1959; see Fig. 14 & Table No. 34).

Cattle are also present at the four Russian sites. Two sets of statistics are available for Florești, and in each case they are more common than ovicaprids and pigs (Chernush 1963, p. 32; see Figs. 15, 16 & Table No. 35). The presence of cattle at Luka-Vrublevetskaia is shown by Bibikova (1946), and their numbers are included in the statistics for the Tripolye culture (see Table No. 156).

None of the Polish sites gives a description of the type of cattle present, but they form a larger proportion of the remains than any other animal at Strzelce (Krysiak 1959). At Bylany in Czechoslovakia cattle were far more frequent than any other domestic animal (Tringham, personal communication).

Most of the evidence for animal domestication was found in Germany,
but in the majority of cases too few bones survived to make a statistical analysis of the relative importance of the different animals (see Tables Nos. 36-63). The majority of animals appear to have been of medium size, as shown by the remains at Aschara, Bad Frankenhausen, Cochstedt, Dammendorf, Erfurt, Hohlstedt (Muller 1961), Jersleben, Kothen Geuz, Köln-Lindenthal (Butler 1936), Weimar-Ehringsdorf, Westerhausen, Zehbitz and Zorbau. In addition to these medium-sized animals, powerful individuals which were still close to the aurochs were found at Ballenstedt, Bruchstedt, Cochstedt, Erfurt, Gatersleben (Muller 1961), Hohlstedt (Muller 1961), Jersleben, Kothen-Geuz, Sommerda, Sonderhausen, Weimar-Ehringsdorf and Zauschwitz. The instances of small animals are fewer, namely at Bruchstedt, Hohlstedt (Muller 1961), Jersleben, Schraplau, Sommerda and Zehbitz. At sites where several sizes of animals can be distinguished it is usually the medium size which is dominant, with some very large animals and a few small individuals. In one or two instances complete metatarsals or metacarpals have been found and this enables the height of the animal to be calculated. At Gatersleben the average height of the animals was 140 cm. (Muller 1961), at Wulfen there was an animal of 146 cm., and other examples of animals of 130 cm. (cow), 137 cm. (one cow and one ox), 124 cm. (cow), 140 cm. (ox), 146 cm. (bull) and 152 cm. (ox) have been found at various sites.

In most cases cattle are the dominant domestic animal, but there are a few instances where relatively few bones have been found where ovicaprids are more common. At Gatersleben more bones of cattle were found/
found than of any other domestic animal (Müller 1961). However, when
the minimum number of individuals was ascertained it was found that they
were slightly less frequent than ovicaprids (see Fig. 17 & Table No. 44). Two sites were found at Barleben. The first, Barleben-Schweinemasterei
contained remains of both a settlement and graves, and cattle were the
most common animal in each case (see Figs. 18, 19 & Table No. 38). At
the other site, Barleben-Huhnerfarm, ovicaprids were more common than
cattle; however, less bones were found here (see Fig. 20 & Table No. 39).
Remains from the graves and settlement at Bruchstedt showed cattle to be
the most common animal (see Fig. 21 & Table No. 40). Amongst the remains
of horn cores, which include both large and small examples, some large
but thin walled pieces were found which are assigned to oxen. There is
also a possibility of the presence of the ox at Dammendorf, where cattle
were outnumbered by ovicaprids (see Fig. 23 & Table No. 42). The first
site at which the presence of castrated cattle was demonstrated in a
Linear Pottery context was Hohlstedt (Müller 1961). Amongst the horn
cores was one which was very strong and powerful, yet possessed an
extremely thin wall, between 2 and 4 mm. thick. Two further cores with
these characteristics were also found, and all three are attributed to
oxen by Müller.

Three settlements were found at Erfurt, Rankestrasse, Steiger and
Stolzestrasse, and in all cases cattle were the dominant feature in the
economy (see Figs. 24 – 26 & Table No. 43). They were also the main
animal at Grossörner (see Fig. 27 & Table No. 45). A similar situation
is encountered at Halle-Trotha (see Fig. 28 & Table No. 46), Hausneindorf (see Fig. 29 & Table No. 47), Kothen-Geuz (see Fig. 32 & Table No. 50) and Magdeburg-Prester (see Fig. 33 & Table No. 51). There is a possibility of oxen being present at this last site. Amongst the remains there was a metacarpus that originated from either a bull or an ox, and also several long bones which appear to be too large for young animals, but have the epiphysse detached. Since castration slows up the fusion of the epiphysse and diaphysse it is probable that these bones belong to oxen. Cattle were more common than ovicaprids and pigs at Muddersheim (Schietzel 1965; see Fig. 34 & Table No. 52) and also at Regensburg-Furkelgut (Boessneck 1958; see Fig. 36 & Table No. 54). At the last site remains of the Rossen culture were also found, and the bones come from the local museum and two private collections, so that they are not as representative as the other site collections. There was no evidence for distinguishing two breeds of cattle at this site (Boessneck 1958).

At Trobsdorf cattle were fractionally less important than sheep and goat (see Fig. 35 & Table No. 53). A few pieces of horn cores survive, and amongst these were three thin walled fragments of a single core that belonged to a castrated animal. Cattle were the most frequent animal at Weimar-Ehringsdorf (see Fig. 37 & Table No. 55), Zauschwitz (see Fig. 38 & Table No. 56) and Zehbitz (see Fig. 39 & Table No. 57), but this does not apply to Zorbau (see Fig. 40 & Table No. 58).

The only direct evidence for the presence of domestic cattle in Holland comes from a badly preserved tooth found at Sittard (Modderman 1959)/
The settlements of Elsloo, Beek, Geleen and Stein are all within 5 to 10 km. of Sittard, and almost certainly these inhabitants will have been breeding cattle too.

Cattle are also thought to be present at the four French sites. At Sablière du Petit Vaux all the bones have been attributed to turbary cattle by Josien (Baillod, Kapps & Josien 1961).

Müller (1964) amalgamated his material from the Magdeburg-Halle-Erfurt area of central Germany, and found that for the Linear Pottery culture as a whole cattle account for between three-fifths and half of the domestic stock (see Fig. 44 & Table No. 64). The evidence also indicates that as the culture progressed cattle rose in importance from half of the domestic stock during the early and mid phases to nearly three-quarters during the late phase (see Figs. 41 - 43 & Table No. 64). Amongst the osteological remains collected by Müller were many examples of bones which lay just beneath the aurochs variation in size, or else within it, but with definite domestication characteristics. This is best illustrated by histograms he compiled from the length and width of the talus (see Fig. 46). From this and other similar evidence he demonstrates the domestication of the local aurochs, which formed an important part of the domestic stock. Where possible Müller (1964) has determined the sex of the animals, and the result shows that the relation between male and female was 16 : 17. This is about the natural level. Out of this, oxen account for nearly half of the male total, which is surprisingly high (see Fig. 45). This method of controlling the size of the stock and making certain animals more manageable/
manageable has been attested from the earliest settlements, as has aurochs domestication.

From the above evidence it can be concluded that cattle were more common than any of the other domestic animals. Most of the animals were of medium size, but large and small individuals are also present. Both aurochs domestication and castration were of much importance to this cattle breeding culture.

**Ovicaprids**

Sheep or goats have been found at 77 of the 115 sites considered (see Table No. 30). They may be present at two more sites as well.

Ovicaprids occur at both of the Hungarian sites of Győr-Pápai vám and Pomáz-Zdravlyák (Bokonyi 1959). In each case they come second to cattle in importance (see Figs. 11, 12 & Tables Nos. 31, 32). They also occur at Lebo and Szegvár-Tuzköves where remains of later neolithic cultures were found (Bokonyi 1959). In these cases ovicaprids are less important than both cattle and pig (see Figs. 9, 13 & Tables Nos. 24, 33).

At Traian sheep and goat form only a very small proportion of the remains, and are about a third as frequent as pigs (Necrasov 1959; see Fig. 14 & Table No. 34). Of the four Russian sites, both sheep and goat have been identified at Torskie (Sveshnikov 1954), but only goat at Luka-Vrublevetskaia (Bibikov 1949). Only a very small proportion of ovicaprids were found at Florești (Passek 1958; Chernush 1963, p.32; see Figs. 15, 16 & Table No. 35). They were entirely absent from the remains of the 1955-1958/
1958 excavations. Only one of the Polish sites revealed bones of sheep or goat, namely Strzelce (Krysiak 1959). They only account for a very small proportion of the remains. The same applies to the Czecho-Slovakian site of Bylany, where together with pig and dog they form a tenth of the remains (Tringham, personal communication).

The distinction between sheep and goat has been made at several German sites. Sheep have been found at Aschara, Barleben-Schweinemasterei, Braunsheda, Bruchstedt, Cochstedt, Dammendorf, Erfurt, Esperstedt, Frauenpriesnitz, Gatersleben (Muller 1961), Halle-Trotha, Hausneindorf, Heilgenthal, Helstedt, Hohlstedt, Keutschen, Korner, Kothen-Geuz, Magdeburg-Prester, Polleben, Quedlinburg, Rieser, Rossleben, Schlotheim, Schraplau, Stossen, Trobsdorf, Weimar-Ehringsdorf, Wengelsdorf, Westerhusen, Zauschwitz and Zehbitz. Goat on the other hand are known from Ahlsdorf, Bad Durrenberg, Bad Frankenhausen, Barleben-Schweinemasterei, Cochstedt, Dammendorf, Erfurt, Gatersleben, Grossgabe, Halle-Trotha, Hausneindorf, Hella, Hellstedt, Hohlstedt, Korner, Magdeburg-Prester, Mullersheim, Schlotheim, Trobsdorf and Zehbitz (Muller 1961, 1964; Schietzel 1965). From this it is seen that sheep occur at more sites than do goats. When Muller considered the material he examined from the Magdeburg-Halle-Erfurt district of central Germany as a whole, he found that sheep were approximately twice as frequent as goat (201 bones of sheep, 92 of goat). The horn cores of these animals were, however, present in about equal numbers (27 of sheep, 23 of goat). The horn cores of goats represent both strong and weak horned animals, whereas those of sheep are all relatively powerful. For this/
This reason Muller raises the possibility that the female sheep were hornless, which would account for the fact that there were no small horned sheep, and that horns of goats and sheep were found in equal numbers, although the indication is that sheep were more common. This, however, disagrees with the sub-fossil material, and no direct evidence of the presence of hornless sheep was found in this context (Müller 1964, p.37).

It should be noted, however, that the majority of skulls were in small fragments, so that hornless sheep could not easily be detected. Hornless sheep occur in a Starčevo-Koros context in both Hungary and Greece.

Many characteristic horn cores were found at these German sites. Amongst the remains at Bad Frankenhausen was a weak scimitar-shaped horn core, reminiscent of the bezoar goat; and powerful cores of both sheep and goat have been found at Cochstedt, and those of a ram were found at Erfurt. Amongst the bones found at Halle-Trotha was a sheep's cranium. The skull was very thin, with the sutures still open indicating a young animal, and the cores were only 60 mm. long, spear-shaped and diverging from each other, and so are like those of the turbary sheep. A large core belonging to a scimitar-horned goat was also found. The sheep horn cores from Heilgenthal indicate powerful animals, and the same is true of those at Hohlstedt where both weak and powerful goats were found. Part of a sheep's cranium from Gatersleben bore evidence of the horn cores having been broken off at the base, and a second was found with only the very base of the core present; both powerful and slender scimitar horns of goat were found here (Müller 1961). Robust horn cores of sheep have also been/
been found at Köthen-Geuz, Quedlinburg and Zehbitz and those of goat are known from Zorbau.

At the site of Barleben-Schweinemasterei bones were collected from both the settlement and the graves. At the first ovicaprids come second in importance behind cattle, and at the other they come third. Less bones were found at Barleben-Hühnerfarm where they were more frequent than the other animals (see Figs. 18 - 20 & Tables Nos. 38, 39). At Bruchstedt they are less important than cattle and equal with pigs (see Fig. 21 & Table No. 40). At Cochstedt they come second (see Fig. 22 & Table No. 41) and at the three sites at Erfurt they come either second or third (see Figs. 24 - 26 & Table No. 43). Ovicaprids come second again at Grossorner (see Fig. 27 & Table No. 45), Halle-Trotha (see Fig. 28 & Table No. 46) and Hohlstedt (see Fig. 31 & Table No. 49). The situation at Gatersleben is slightly different, with ovicaprids second on one account, and first (a little ahead of cattle) on the other (Muller 1961; see Fig. 17 & Table No. 44). At Dammendorf they are also more important than either cattle or pigs (see Fig. 23 & Table No. 42), and the same applies to Hettstedt (see Fig. 30 & Table No. 48). Sheep and goat are once more of secondary importance at Köthen-Geuz (see Fig. 32 & Table No. 50) and come third at both Magdeburg-Frester (see Fig. 33 & Table No. 51) and Müddersheim (Schietzel 1965; see Fig. 34 & Table No. 52). The bones identified at Regensburg-Pürkelgut derive from the Rössen as well as the Linear Pottery levels. Ovicaprids are less important than both cattle and pigs (Boessneck 1958; see Fig. 36 & Table No. 54). At Zehbitz they are more important than pigs, but less important/
important than cattle, and at both Trobsdorf and Zorbau they are more frequent than both of these animals (see Figs. 39, 35, 40 & Tables Nos. 57, 53, 58). However, the difference at Trobsdorf is so slight that they may be considered as of equal importance to cattle.

The only other country in which possible evidence for ovicaprid domestication comes is France. A bone of sheep was found at Pfettisheim (Stieber 1960) and an ovicaprid horn at Eckbolsheim (Stieber 1960).

From the above evidence it is seen that ovicaprids are usually of secondary importance to cattle, alternating with pig in frequency, although there are a few cases in which they come first. The latter situation occurs at Barleben—Huhnerfarm, Dammendorf, Hettstedt, possibly Gatersleben and Trobsdorf, and Zorbau. All of these sites belong to either the early or the mid phase of the Linear Pottery culture, and none to the late phase. In order to examine the instances in which ovicaprids come second or third, the sites with the largest number of bones are chosen, since they are the most representative. The ten statistically optimum sites are listed below together with the phase to which they belong, the position of importance of sheep and goat and the total number of bones found.

<table>
<thead>
<tr>
<th>Site</th>
<th>Phase</th>
<th>Ovicaprids</th>
<th>Bones</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gyor-Papai vám</td>
<td>Early/Mid</td>
<td>2nd.</td>
<td>842</td>
</tr>
<tr>
<td>Hohlstedt</td>
<td>Early</td>
<td>2nd.</td>
<td>341</td>
</tr>
<tr>
<td>Halle-Trotha</td>
<td>Early</td>
<td>2nd.</td>
<td>366</td>
</tr>
<tr>
<td>Barleben-Schweinemasterei A</td>
<td>Early/Mid</td>
<td>2nd.</td>
<td>231</td>
</tr>
<tr>
<td>Gatersleben</td>
<td>Mid</td>
<td>2nd.</td>
<td>307</td>
</tr>
<tr>
<td>Trobsdorf</td>
<td>Early/Mid</td>
<td>1st/2nd.</td>
<td>377</td>
</tr>
<tr>
<td>Traian</td>
<td>Late</td>
<td>3rd.</td>
<td>337</td>
</tr>
<tr>
<td>Florești</td>
<td>Late</td>
<td>Absent</td>
<td>298</td>
</tr>
<tr>
<td>Barleben-Schweinemasterei B</td>
<td>Late</td>
<td>3rd.</td>
<td>294</td>
</tr>
<tr>
<td>(graves)</td>
<td>Late</td>
<td>3rd.</td>
<td>769</td>
</tr>
</tbody>
</table>

From/
From this table it is apparent that ovicaprids are more important than pigs at all sites of the early and mid phases of the Linear Pottery Culture, but that they are less important than pigs at the late sites.

When the statistics constructed by Muller (1964) for the various phases of the Linear Pottery culture in part of central Germany are examined, this same decline in ovicaprid breeding is at once apparent (see Figs. 41-43 & Table No. 64). Amongst the vast material assembled by him were a few metatarsals and metacarpals from which the height of the animals could be calculated. The results show that the sheep varied between 50 and 60 cm. in height and the goats between 55 and 65 cm. A few powerful male animals may have been slightly taller than this.

Both sheep and goats were of importance to the Linear Pottery Culture, the former being the more frequent of the two. They were more common during the early and mid phases than they were during the late phase, and their average position of importance is second and third respectively. Both large and small animals occur, and there are several instances of animals resembling the wild sheep and goats from which they were domesticated.

Pig

Bones of domestic pig have been found at 70 of the 115 sites mentioned (see Table No. 30). They may also be present at another four sites.

At the Hungarian sites of Győr-Pápai vár and Pomáz-Zdravlyák pigs are less important than cattle and ovicaprids, and can be related osteologically to the local wild pigs (Bokó 1959; see Figs. 11, 12 & Tables Nos. 31, 32).
The pigs from the mixed sites of Lebo and Szegvár-Túzkoves are of the same type, but are second to cattle in importance (Bo\konyi 1959; see Figs. 9, 13 & Tables Nos. 24, 33). This pig is found again at Traian in Romania, where it is substantially more important than sheep and goat (Necrasov 1959; see Fig. 14 & Table No. 34).

Pigs are more numerous than sheep or goat at Floresti in Russia. It is not known whether these animals were large or small (Chernush 1963, 32; Passek, 1958; see Figs. 15, 16 & Table No. 35). Bones of a large pig were found in a niche in the foundations of a house at Postoloprtty in Czechoslovakia (Soudsky 1955). It presumably formed part of the sacrificial rites before the building of the house. There is no full report from Bylany as yet, but together with ovicaprids and dog, pig accounts for only a tenth of the domestic animals (Tringham, personal communication).

Nearly all the German sites contained remains of a medium-sized domestic pig. There were, however, several cases of large animals, which were still close to the local boars, and also of animals which were transitional between the wild and domestic types. Some of these must represent local domestication of the indigenous boars. Powerful pigs have been identified at Barleben-Schweinemasterei, Bruchstedt, Erfurt, Esperstedt, Grossörmer, Halle-Trotha, Gatersleben, (Müller 1961), Köln-Lindenthal (Buttler 1936), Köthen-Geuz, Magdeburg-Prester and Zauschwitz. The medium-sized animals identified by Müller (1964) fall within the range of the turbary pig found at Egolzwil II in Switzerland. Hilzheimer also reports/
reports their presence at two sites (Heutingsheim and Köln-Lindenthal). He describes them as small turbary-like north German pigs and designates them by the name *Sus scrofa nannus* Nehring. Nehring was the first to identify these pigs in Germany, and noted their similarity to the turbary pigs of Switzerland, but thought that they were descended from the local wild pigs, and so used the above name rather than *Sus palustris*. Müller (1964) reports animals smaller than these at Bosenburg, Braunshedra, Bruchstedt, Erfurt, Grossörner, Hohlstedt and Rehmsdorf.

Pigs do not attain the proportion of cattle at any of the sites mentioned. They are less important than both cattle and ovicaprids at Barleben-Schweinemasterei (settlement, see Fig. 18 & Table No. 38), Barleben-Huhnerfarm (see Fig. 20 & Table No. 39), Cochstedt (see Fig. 22 & Table No. 41), Grossörner (see Fig. 27 & Table No. 45), Halle-Trotha (see Fig. 28 & Table No. 46), Hohlstedt (see Fig. 31 & Table No. 49), Gatersleben (Müller 1961; see Fig. 17 & Table No. 44), Dammendorf (see Fig. 23 & Table No. 42), Hettstedt (see Fig. 30 & Table No. 48), Köthen-Geuz (see Fig. 32 & Table No. 50), Zehbitz (see Fig. 39 & Table No. 57), Trobsdorf (see Fig. 35 & Table No. 53) and Zorbau (see Fig. 40 & Table No. 58). At the three sites near Erfurt pigs come either second or third in importance (see Figs. 24 - 26 & Table No. 43), and they are equal to ovicaprids at Bruchstedt (see Fig. 21 & Table No. 40). Pigs are more frequent than ovicaprids at Barleben-Schweinemasterei (graves; see Fig. 19 & Table No. 38), Magdeburg-Prester (see Fig. 33 & Table No. 51), Muddersheim (Schietzel 1965; see Fig. 34 & Table No. 52), Regensburg-Furkelgut (Boessneck/
(Boessneck 1958; see Fig. 36 & Table No. 54). None of these last sites have been assigned to either the early or mid phases of this culture. The position of pigs relative to cattle and ovicaprids at the ten sites with the largest quantity of bones is now considered.

<table>
<thead>
<tr>
<th>Site</th>
<th>Phase</th>
<th>Pigs</th>
<th>Bones</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gyor-Papai vám</td>
<td>Early/Mid</td>
<td>3rd.</td>
<td>842</td>
</tr>
<tr>
<td>Hohlstedt</td>
<td>Early</td>
<td>3rd.</td>
<td>341</td>
</tr>
<tr>
<td>Halle-Trotha</td>
<td>Early</td>
<td>3rd.</td>
<td>366</td>
</tr>
<tr>
<td>Barleben-Schweinemasterei A</td>
<td>Early/Mid</td>
<td>3rd.</td>
<td>231</td>
</tr>
<tr>
<td>Gądersleben</td>
<td>Mid</td>
<td>3rd.</td>
<td>307</td>
</tr>
<tr>
<td>Trobsdorf</td>
<td>Early/Mid</td>
<td>3rd.</td>
<td>377</td>
</tr>
<tr>
<td>Traian</td>
<td>Late</td>
<td>2nd.</td>
<td>337</td>
</tr>
<tr>
<td>Floresti</td>
<td>Late</td>
<td>2nd.</td>
<td>298</td>
</tr>
<tr>
<td>Barleben-Schweinemasterei B (graves)</td>
<td>Late</td>
<td>2nd.</td>
<td>294</td>
</tr>
<tr>
<td>Magdeburg-Frester</td>
<td>Late</td>
<td>2nd.</td>
<td>769</td>
</tr>
</tbody>
</table>

From the above Table it can be seen that during the early and mid phases of the Linear Pottery culture pigs were less numerous than cattle and ovicaprids, but that during the final phase they increased in numbers to become the second most common animal.

Hence it can be concluded that the position of pigs varied during the culture, and that they increased in numbers during the late stage, to become more frequent than ovicaprids. Most of these animals were of medium size and similar to turbary pigs, but there were also some large individuals. The evidence suggests that local domestication was practised.

**Dog.**

Remarkably few bones of dog have been found in a Linear Pottery context. They have been identified at 21 of the 115 sites considered (see Table/
Dogs form a very small proportion of the remains at Gyor-Pápai vám and Pomáz-Zdravlyák in Hungary, and the breed is unknown (Bokonyi 1959; see Figs. 11, 12 & Tables No. 31, 32). Some bones survive at the Russian site of Luka-Vrublevetskaia (Bibikov 1949), but none are known from Rumania or Poland. A more or less complete skeleton was, however, found at Hurbanovo in Czechoslovakia (Ambros 1953). It belongs to the turbary breed (basal length of the skull was 132 mm.), and was accompanied by a pot in the late Linear Pottery style.

A large turbary dog is recorded at Muddersheim (Schietzel 1965) and Regensburg-Purkelgut (Boessneck 1958). Out of the vast quantity of bones identified by Muller there were only nine dog bones. A dog the size of a fox-terrier was found at Zauschwitz and slightly larger animals are known from Bruchstedt and Nerkewitz. This last size of dog occurs again at Weimar-Ehringsdorf, and may be classed as belonging to the ladoga variety of turbary dog. A somewhat more powerful dog was present at Grossgrabe, approaching a small sheep dog in size, and either a very large dog or a wolf was present at Regensburg-Purkelgut (Boessneck 1958).

Despite the absence of bones, Muller observed some indirect evidence for the presence of dogs at several sites. On many of the animal bones he identified, he found teeth marks which were not of human origin. Since these could not belong to cattle, ovicaprids or pig they could only come from dog or a wild carnivore. The latter, however, would most likely have taken the bone and flesh away and not gnaw it within the area of the settlement.
settlement. These bones therefore must bear the marks of dogs' teeth.

Dogs only occur rarely at sites of the Linear Pottery culture, and are never present in large numbers. Most of the animals agree in size with turbary dogs, with one or two larger species also present.

Horse

Claims for the domestication of the horse during the Linear Pottery period are based on the finds of red deer antler 'Trensenknebel' at Goldbach near Halberstadt in Austria (Barthold 1912). Since sherds of Bronze Age pottery were found in the same pit as these cheek-pieces of bits and Linear Pottery sherds, the most reasonable explanation is that they originated from the later period. Their shape and general appearance is also similar to known examples from the Bronze Age. A similar claim made for finds from Zauschwitz (Hančar 1956) is discounted by Muller (1964, p.53).

Amongst the seventeen horse bones examined by Muller (1964) from central Germany there was no indication of domestication. No osteological evidence has been found at other sites in Europe either.

Cultivated Plants

Wheat

Five different species of wheat have been identified at Linear Pottery sites. These are einkorn, emmer, bread wheat, club wheat and hard wheat.

Einkorn occurs at four or five sites (see Table No. 65). The number of/
of impressions found at Glvanestii Vechi in Rumania are unknown, but at Mohelniče einkorn is twice as frequent as emmer (Comsa 1959; Kuhn 1960; see Table No. 66). At this site there were also a large quantity of grains that could belong to either einkorn or emmer. At Tesetiče there was one possible occurrence of einkorn, but its identification could not be made with certainty (Kuhn 1960; see Table No. 66). Einkorn is also present at the German sites of Tröbsdorf (Schmidt 1956) and Zilgendorf (Hopf, personal communication). At the last site it is known to be less common than emmer.

There are many more instances of emmer than there were of einkorn. It has been found at 11 of the 26 sites mentioned (see Table No. 65), and it may be present at a further site as well. A large quantity of emmer was found at Nezvicka in Russia (Chernush 1963, 31). The only other grain present in appreciable quantities is bread wheat, and the proportions of emmer and bread wheat are not given. The only Polish site at which a species of wheat could be determined was Strzelce where emmer was identified (Klichowska 1959). This wheat is again encountered at Bylany (Soudsky 1963), Mohelniče (Kuhn 1960) and Tesetiče (Kuhn 1960) in Czechoslovakia. A large quantity of wheat was recovered at Bylany, and nearly all of this can be attributed to emmer. The other types of wheat present have not yet been identified. Emmer is outnumbered by einkorn at Mohelniče, but there were several grains which could belong to either species. There was a single instance of emmer at Tesetiče (see Table No. 66). There are seven instances of emmer in Germany. The presence of emmer at Köln-Lindenthal was detected by microscopic examination of the daub, and remains/
remains of a carbonised porridge was found at Nahermemmingen (Nordlingen 1934) and Herkheim (Frickhinger 1932). This porridge was composed of grains of emmer; no other cereal could be detected. The majority of the grains found at Zilgendorf also belong to emmer (Hopf, personal communication).

In addition to the two main types of wheat, bread wheat is recorded at Nezwicka where it was present in large quantities (Chernush 1963, 31) and hard wheat is also present at this site in small quantities. The only site at which club wheat has been identified is Wien-Vosendorf (Werneck 1961). An unspecified species of wheat was present at nine sites, and wheat or barley is known from a further five sites (see Table No. 65).

Einkorn and emmer were the main wheats cultivated by the Linear Pottery culture, the latter being present at more sites than the former. Bread wheat, club wheat and hard wheat are also known, but were not of great importance at most sites.

Barley

Barley is known from six sites and may be present at a further seven (see Table No. 65).

A multi-rowed form of barley was cultivated at Strzelce in Poland (Klichowska 1959) and there is a possibility that naked barley was present at Köln-Lindenthal (Buttler 1936). At the remaining four sites Hordeum sp. was the only identification possible (Kotowania, Chelmza, Opatów and Erfurt-Steiger).

Although barley is present at several Linear Pottery sites, it never occurs in large quantities, and the species involved is not known.

However/
However, comparison with other neolithic cultures suggests that it is probably the six-rowed variety.

Other Cereals

Apart from wheat and barley, millet, rye and oats have been identified in a Linear Pottery context.

The northern variety of millet, Panicum miliaceum, is present at Zofipole (Klichowska 1959; Burchardówna 1952) and possibly at Mohelnice (Kuhn 1960). There was only a single instance of it at each site.

Rye is known from Wien-Vosendorf (Werneck 1961), Strzelce (Klichowska 1959) and Lauingen (Kellner 1958). It is only at Wien-Vosendorf that rye is claimed to be an important cereal crop. Rye grows wild in the Carpathians, the western extension of which lies in Niederösterreich. In his conclusion Werneck says that it is impossible that rye was only a weed at this site, and that it was an important cereal crop. Other botanists think that rye came to Europe as a weed in the wheat and barley fields from the Near East where two forms of the wild species are known (Helbaek 1960). The presence of rye at this stage is striking since it was originally thought to appear in Europe during the climatic changes of the Late Bronze Age – Hallstatt times.

Impressions of oats have been found at Chelmza (Kostrzewski 1929; Burchardówna 1952) and Strzelce (Klichowska 1959). It occurs in its wild state in central and northern Europe, and it is unlikely that these finds represent anything other than a weed amongst the wheat and barley crops.

This/
This cereal was never cultivated in the Near East, and its cultivation in Europe is assumed to be connected with the La Tène expansion (Helbaek 1960).

Millet, rye and oats are known at a few sites, but it is unlikely that either rye or oats were cultivated.

Flax

The only report of flax comes from Köln-Lindenthal where a large heap of carbonised seeds were found (Buttler 1936). Although it has not been detected at other sites, it was probably present in small quantities.

Pea

There are three instances in which peas have been identified (see Table No. 65). A small quantity of carbonised peas are recorded at Nezwicka by Chernush (1963), and the same legume is present at the German sites of Eisenberg and Tröbsdorf (Butschkow 1935; Schmidt 1956).

Storage

An interesting and important aspect of cereal cultivation is the method in which the crop was stored for future use. The evidence from several sites indicates that large amounts of grain were kept, and the methods of storage are well illustrated at Bylany (Soudsky 1963). The grain may be divided into two categories, namely that used for sowing the following year's crop, and that which is used for consumption. The former is found in granaries or pits, and the latter in large storage vessels.

Both/
Both of these have survived at Bylany. Several large pots occur in the houses, and groups of four storage pits have been found outside the houses. These pits were presumably daubed every year and then burnt to provide disinfection, and this is seen to occur ten or eleven times in each pit. Hence the minimum period for which the pits were used was ten or eleven years.

Ovens were also found outside the houses, and these appear to have been used for parching the grain that was stored for food. When grain is kept for consumption it is necessary that it does not germinate, and in order to prevent this the grain has to be heated or parched. These ovens are usually grouped in threes or fours, and carbonised grain has been found in their vicinity.

The chief forms of evidence for the practice of agriculture are those which are most direct, that is the actual objects of domestication and cultivation. There are, however, several indirect forms of evidence of which the best known is pollen analysis. Research in this field in Holland has shown the arrival of the Linear Pottery colonists into the area by the changes in vegetation (see p.271).

The sickles that were used to harvest the grain can be reconstructed from surviving antler hafts and flint blades. Microscopic examination and chemical analysis has shown that these small flint blades were used for cutting some form of grass, either wild or cultivated. There have been many discussions as to whether or not the shaft hole axes were used as primitive plough shares or not. One of the most interesting of these is/
is by Glob (1939) who gives reconstructions of what he thinks the primitive plough looked like. Many of these shaft hole axes have various markings and are chipped as though they had knocked against something hard such as a stone in a field. They occur in various shapes and sizes, and usually have the pointed end blunted as though from extensive use. These would be the only part of a wooden plough that would survive under normal conditions, and they are fairly common at Linear Pottery sites. In connection with the plough, the castration of cattle must also be mentioned, as it provides docile animals with which the ploughs could be easily drawn. Oxen have been found at both early and late Linear Pottery sites by Müller (1964) and may well have been used as a source of draught power.

Summary

Cattle were the main domestic animal of the Linear Pottery culture and are usually of medium size, but large and small animals also occur. Oxen provide a source of draught power for the plough as well as for wheeled vehicles. Ovicaprids and pigs were also domesticated. Most of these are also of medium size, but large animals similar to the wild prototypes were also found, and there is evidence for the local domestication of pigs as well as aurochs. One important fact to emerge from this investigation is that the agriculture of the early and mid phases of this culture was different to that of the late phase. During the first two stages ovicaprids are more important than pigs at all the sites considered, but during the late stage both sheep and goats fall in importance/
importance, and pigs increase until they are more common than ovicaprids. At this stage the proportion of cattle also increases at the expense of ovicaprids. There were remarkably few dog bones found in this context; the evidence indicates that the turbary breed was probably present.

Emmer and einkorn were the chief constituents in the cereal field, with bread wheat, club wheat, hard wheat, barley and millet also present in smaller quantities. Recent evidence suggests that emmer was more important than einkorn. Rye and oats also occur, but are probably just weeds in the field. Flax and peas have also been found.
1. - SESKLO

This rich culture was developed in Thessaly and central Greece. It survived for a long time, from around 5200 to 4300, and has its origin in the early Chalcolithic of Anatolia.

The pottery is fine, usually red burnished ware, occasionally with black and white rectilinear patterns; the flame design is also typical. Proto-Sesklo pottery on the other hand is monochrome. The stone ware includes vases but it is otherwise mostly a macrolithic blade industry. The settlements are relatively small and consist of the usual rectangular mud-walled houses.

There is evidence for the hunting of red deer, possibly aurochs, and pig but this was not of importance to the economy (see Tables Nos. 13, 21).

Domestic Animals

Cattle

Cattle occur in the Proto-Sesklo levels of Argissa (Boessneck 1962; see Table No. 13) and Otzaki (Boessneck 1955). Several remains were found at the last site and it is seen that cattle were the second most frequent animal present (see Fig. 47 & Table No. 21). Amongst the bones was a strong horn core which indicated the presence of the large form of domestic cattle.

Cattle have been found in the Sesklo phases at Argissa (Boessneck 1962)/
1962), Drakhami (Wace & Thompson 1912) and Otsaki (Boesseneck 1955). The osteological remains from Otsaki show that cattle were the least important of the domestic animals in the earlier phase of this culture, and the second most important during the later stage (see Figs. 48 & 49, Table No. 21). It should be noted, however, that more bones were found in the early stage. Again there is evidence for the breeding of large animals.

The evidence indicates that cattle were more important during the Proto-Sesklo phase than during the Sesklo phase in Thessaly. In neither instance were they of much importance to the economy.

Ovicaprids

The breeding of sheep and goat is attested for both the Proto-Sesklo and Sesklo periods.

They are known from the earlier period at Argissa and also at Otsaki (Boesseneck 1962; 1955). They are seen to be the most frequent of the domestic animals and both sheep and goat are represented (see Fig. 47, Table No. 21). The sheep are medium to large in size and there is evidence for hornless female animals amongst the stock. The goats were well built and strong.

During the Early Sesklo phase ovicaprids fall to second position in importance at the site of Otsaki (Boesseneck 1955; see Fig. 48, Table No. 21). At the later stage they are either third or equal second (see Fig. 49, Table No. 21), and the stock appears to be similar to that of the Proto-Sesklo period. Sheep or goat are also known from Argissa (Boesseneck 1962).

Although/
Although sheep and goats were the basis of the economy of the Proto-
Sesklo period, this is not true of the Sesklo period. The sheep are
medium to large in size and include hornless animals, and the goats are
also robust.

**Pig**

The domestic pig is known from both Argissa and Otzaki (Boessneck
1962; 1955).

They are the least important of the domestic animals during the Proto-
Sesklo period (see Fig. 47, Table No. 21). In the subsequent two phases,
however, they become the chief animal for domestication (see Figs. 48, 49,
Table No. 21). The majority of these animals are small and fall within
the range of variation of the turbary pig, but there are also a few bones
of larger and more primitive-looking pigs. These are probably local
recently domesticated animals. One of the most striking points to emerge
from investigation of the pig remains is that they are nearly all of young
immature animals, with a few adult females. There were no jaws or tusks
of fully grown boars. Boessneck attributes this to the fact that they
were used purely as a meat supply so that the keeping of adult animals
would be uneconomical unless they were used for breeding purposes.

The pig of this period can be compared with modern pigs in the same
area. Papadopoulo (1934) gives a good description of them. The body
was tall and slender with long legs, the head of medium size with a long
and slender snout and medium length horizontal ears. Greece lies within
the/
the distribution of both the large *Sus scrofa ferus* and of the smaller *Sus mediterraneus* and it would seem probable that the smaller pig was domesticated to produce the turbary animals (Boessneck 1955).

Although pigs were of minor importance during the Proto-Sesklo period it is seen that they were the basic domestic animal of the Sesklo period. Both large and small animals were being bred.

**Dog**

The only site at which remains of dogs have been detected is Otzaki (Boessneck 1955). They occur in very small quantities in the Proto-Sesklo and early Sesklo levels, and indicate turbary animals and another slightly larger dog. This larger species approaches the *intermedius* dog in size, but Boessneck does not think that there is any relationship between the two. He favours the view that this dog is just a large version of the turbary animal found at most neolithic sites in Europe.

**Cultivated Plants**

**Wheat**

Carbonised remains of wheat have been found at Drakhami (Wace & Thompson 1912) and Servia (Heurtley 1939). Hard wheat is known to have been cultivated at Servia, and may also be present at Drakhami where Biffen identified the wheat as either hard wheat or bread wheat. There was only one really well preserved grain which agrees best with the form of the bread wheat group. Nothing is known of the relative frequencies of/
of wheat and barley at these sites.

Barley

Barley is only known with certainty from Tsani (Wace & Thompson 1912). Riffen thinks that it probably belongs to the four-rowed variety, *Hordeum vulgare ssp. tetrastichum* L.

Legumes

Lentils occur at Drakhami (Wace & Thompson 1912) and Servia (Heurtley 1939) and peas have been identified at Drakhami (Wace & Thompson 1912). It is probable that both were being cultivated.

Summary

The agriculture of the Proto-Sesklo and Sesklo periods was different. The former was based upon ovicaprid breeding and the later upon pig breeding, with local domestication of the small boar likely. Cattle were never of great importance to the economy. Wheat, barley and probably lentils and peas were being cultivated.
The Boian culture occurs in south east Rumania and north Bulgaria between the period 4100 and 3800. It is divided into five stratigraphical phases. The pottery bears spiral and meander patterns outlined with channelled or incised lines, and from phase III onwards sporadic painted ware occurs. In the northern area of its distribution white on red painted ware is found.

The stone industry contains perforated axes for the first time, but otherwise it follows the Starčevo-Koros tradition. Copper appears occasionally in phases IV and V. The parallels to this culture lie to the north-west in Vinca B2 and C.

Red and roe deer, aurochs, pig, horse, otter, badger, fox, lynx, hare and polecat were all hunted, and many fish bones have also been found at the settlements. This means of procuring food remained unimportant throughout the culture, varying between a fiftieth and a fifth of the osteological remains (see Tables Nos. 68 & 69). On average hunting accounts for a tenth of the bones found.

**Domestic Animals**

**Cattle**

Cattle have been identified at one site in Bulgaria and nine sites in Rumania (see Table No. 67). Four phases of this culture were represented at Bogata where cattle are the most important of the domestic animals (Necrasov/
Two breeds could be distinguished.

Four phases were again found at Tangiru (Necrasov & Haimovici 1959; see Figs. 51 - 55, Table No. 69). The variation during the different phases is small and at all times cattle are the dominant feature in the economy. There were a few bones of domestic animals of large stature and clearly attributable to the *primigenius* group, but much more frequent were the remains of the smaller turbary cattle. A large proportion of the osteological remains belong to young or scarcely adult animals. Cattle are again the chief animal to be identified at Ocna Sibului (Paul 1962).

Two types of cattle were being bred during the Boian culture and together they formed the basis of the economy. The turbary breed was the more common of the two.

**Ovicaprids**

Sheep or goat are known from one site in Bulgaria and eight sites in Rumania (see Table No. 67). There are five instances of sheep and four of goats.

Both sheep and goats are known from Bogata where they are the second most frequent animal, pigs being completely absent (Necrasov & Haimovici 1959; see Fig. 50, Table No. 68). Amongst the remains was a horn core which was scimitar-shaped and has been attributed to the bezoar goat, *Capra aegagrus*. Similar remains have also been found at Tangiru where they were less frequent than the bones of the common domestic goat (Necrasov/
Sheep are also present but the breed could not be determined. For the culture as a whole ovicaprids are slightly less numerous than pigs (see Figs. 51 - 55, Table No. 69). There is some evidence indicating that they dropped in frequency from second position during phase I to third in phase IV (see Table No. 69). Sheep and goat are third in order of importance at Ocna Sibului, but the number of bones involved is not known (Paul 1962).

Both sheep and goats were bred at this time. They never attained the proportion of cattle, but are about as numerous as pigs, and may have dropped in frequency as the culture progressed. Two types of goats have been identified.

**Fig**

Pigs have been identified at five of the ten sites considered (see Table No. 67). Their absence at Bogata is striking, and may indicate that its absence at other sites is not entirely fortuitous.

The pigs identified at Tangiru were small and slender and were seldom allowed to attain maturity (Necrasov & Haimovici 1959). For the site as a whole pigs are slightly more frequent than ovicaprids, and the statistics indicate that they increased in importance from third position in phase I to second in phase IV (see Figs. 51 - 55, Table No. 69). At Ocna Sibului they are the second most common animal.

The evidence available indicates that turbary-like animals were being bred and were the third most common of the domestic animals during phase I and/
and second during phase IV. There were also certain sites at which they were completely absent from the domestic stock.

**Dog**

Dogs occur at one site in Bulgaria and four in Rumania (see Table No. 67). At both Bogata and Tangiru (Necrasov & Haimovici 1959) they form a small proportion of the remains, as expected (see Figs. 50-55, Tables Nos. 68, 69). Nearly all the bones from Tangiru can be attributed to the turbary dog *Canis f. palustris* with the exception of a single bone which Necrasov thinks originated from *Canis f. intermedius*. This may be compared with the situation at Otzaki (Sesklo culture) where Boessneck found remains of a large intermedius-like dog which he finally attributed to the large version of the turbary breed.

**Cultivated Plants**

**Wheat**

Wheat, in the form of einkorn and emmer has been identified at Tangiru (Childe 1957) and Vidra (Gaul 1948). Nothing of their relative importance is known. It is probable that other types of wheat were being cultivated, but have not yet been identified.

**Barley**

There is no evidence for the cultivation of barley. However, it must have been present, at least as impurity in the wheat fields, and its absence/
absence is due to the small amount of evidence available.

**Millet**

Millet has been identified at Tangiru (Childe 1957) and Vidra (Gaul 1948). In neither case is the type specified.

**Summary**

Cattle breeding is the most important element in Boian economy and the turbary and primigenius breeds account for between a half and three-quarters of the domestic stock. Pigs, sheep and goat were also bred as was the dog. Amongst the ovicaprid remains, bones of bezoar goat are of interest and indicate a close connection with the Near East. There is only a little evidence for plant cultivation and the presence of einkorn, emmer and millet has been attested.
3. - HAMANGIA

The Hamangia culture has been divided into four typological phases and it is confined to the low-lying area of Dobrogea in south-east Rumania. It occupies the same period in time as the Boian culture, namely 4100 - 3800.

The pottery has comb or shell impressions, or incised lines, and may be compared with that of the cultures of the southern Bug area. It is generally self-coloured, although in the later stages white on red and graphite painting occur. The stone industry is generally somewhat richer than that of Starčevo-Koros.

Hunting was of little importance to this culture. It accounts for about a twentieth of the food supply and the animals represented include red deer, roe deer, aurochs, pig, donkey, fox, otter, beaver, cat, hare and dolphin (see Table No. 70). The presence of the donkey (*Equus Asinus cfr. hydruntinus*) is of great interest since it was thought to have been extinct during the neolithic until a few years ago.

Domestic Animals

Cattle

There are three instances of cattle in this context. The remains from Techirghiol show that there are two types of cattle present and that they are more frequent than ovicaprids and pigs (Necrasov & Haimovici 1962b; see Fig. 56 & Table No. 70). A careful study of these bones showed that there was a clear transition between the two types with no intermediate animals present. Many bones of cattle were also found at Cernavoda, where again/
again the two species are represented (Necrasov & Haimovici 1959a) and bones of domestic cattle are also reported at the cave of La Adam (Radulesco & Samson 1962).

The evidence indicates that two varieties of cattle were being bred and that they were the chief domestic animal of the Hamangia culture.

**Ovicaprids**

Both sheep and goats have been identified at Cernavoda (Necrasov & Haimovici 1959a) and La Adam (Radulesco & Samson 1962). At the first site they formed a relatively small proportion of the osteological remains. They are, however, well represented at Techirghiol where they are only slightly less frequent than cattle (Necrasov & Haimovici 1962b; see Fig. 56 & Table No. 70). In the cases in which sheep and goat were distinguishable, it is the goat that was the most frequent of the two. The animals are said to agree generally with those found at Traian, Tangiru and Bogata.

Both sheep and goats were bred and are known to have been of importance to the economy at at least one site. The breed is similar to those in other neolithic sites.

**Pig**

There is an extremely small proportion of pigs at Techirghiol, where they are only twice as frequent as the dog (Necrasov & Haimovici 1962b; see Fig. 56 & Table No. 70). This situation recalls the evidence from Bogata (Boian culture) where they were entirely absent. Little is known of the pigs/
pigs from La Adam other than their presence (Radulesco & Samson 1962) but at Cernavoda many remains of pigs are reported (Necrasov & Haimovici 1959a). It is not clear from the preliminary report on this site to what extent these are remains of wild animals.

Pig breeding was probably of diverse importance in this culture as it was during the Boian culture. The remains from Techirghiol indicate a small animal rather than one close to the local wild pig.

Dog

The only site at which dog bones have been found is Techirghiol (Necrasov & Haimovici 1962b). As is seen they account for only a very small proportion of the remains and the breed has not been identified (Fig. 56 & Table No. 70).

Cultivated Plants

Wheat

The only site with evidence for plant cultivation in a Hamangia context is Techirghiol (Necrasov & Haimovici 1962b). Many carbonised grains of wheat have been found throughout the settlement and impressions have also been detected. Various types are said to be represented, but these have not yet been identified. This was the only cereal reported with certainty, and so must be the basic one.

Barley/
Barley and Millet

There is as yet no evidence for the cultivation of either of these cereals. Their total absence is extremely unlikely, and they may be identified amongst the grain from Techirghiol when a more thorough examination has been completed.

Summary

Cattle breeding and wheat cultivation appear to have been the basis of the economy of the Hamangia culture. Ovicaprids were also of importance to the economy but the position of pigs seems to have varied at different sites.
4. **VESELINOVO**

This culture follows that of Starčevo-Koros in the Maritsa valley in Bulgaria around 4400 - 4200. The pottery shows a complete break with the Starčevo-Koros tradition, although there are some similarities to Karanovo II. It is self-coloured, generally buff or grey, occasionally burnished and has characteristic handles.

Axes and adzes occur but are never perforated. Generally the stone industry follows that of Starčevo-Koros. The connections of this culture appear to be more with the Late Chalcolithic of Anatolia than with the rest of Europe.

**Domestic Animals**

There is no evidence for the domestication or hunting of animals in this context but the full range of stock is to be expected from cultural comparisons.

**Cultivated Plants**

**Wheat**

Both einkorn and emmer are known to have been cultivated at Banyata, but there is no indication of their relative importance (Garašanin 1958). There is no evidence for the cultivation of either barley or millet.
5. - RUSSIAN NEOLITHIC

This section can be divided into three parts. These are the Pontic sub-neolithic, Pontic neolithic and North Russian neolithic. The definition of the sub-neolithic given by Gimbutas (1956) is the period in which people continued their semi-nomadic way of life but had learned to make pottery. They may be compared with the Ertebölle culture of Scandinavia. Both the shape and texture of the pottery were similar, and the stone industry was mesolithic in character. Some worked bone has also been found. Red deer, roe deer, aurochs, pig, horse, wolf, beaver, hare, fox, badger, cat, polecat, hamster, small rodents, marsh turtle, tortoise, birds and fish have all been identified. Most settlements also revealed collections of mussels and other shells. Gradually this sub-neolithic period changes its character and more domestic animals, pottery and neolithic stone working techniques appear. There is very little evidence for dating this period, but it can probably be placed somewhere in the late fourth or early third millennium.

The North Russian evidence comes from sites where a mixture of Pitted Ware and Corded Ware occur and so can be dated to 2500 to 2000. Reindeer, roe deer, elk, aurochs, bison, pig, lynx, otter, badger, marten, bear, beaver, polecat, wolf, fox, squirrel, hare and vole as well as seal and fish bones have all been identified. Hunting was of much greater importance than domestication to the economy of these northern sites (see Table No. 71).
Domestic Animals

Cattle

There is no indication of domestic cattle in the earliest sub-neolithic levels, but they occur in the later stages at Igren 8 (Dobrovolskii 1949) and Shulaev (Bodianskii 1949). The nature of these cattle is unknown.

The type of cattle present at the Pontic neolithic sites of Igren 8 (Dobrovolskii 1949), Sobachki (Gimbutas 1956), Kaneva and Pekaryame (Pidoplicko 1956) is again unknown. There is a possibility of the turbary cattle being represented at the north Russian site of Bologoe (Gandert 1930). In the initial report their presence is quoted with a question mark, but in 1903 Winge stated that they were definitely present but did not check the original identifications. In the last report Gandert doubts their authenticity.

Domestic cattle were absent from the early Pontic sub-neolithic, but present in its later stages and in the subsequent neolithic period. They may also be present in the north of Russia at this time.

Ovicaprids

Ovicaprids first appear in the late Pontic sub-neolithic at the site of Shulaev (Bodianskii 1949). The goat is recorded at the neolithic sites of Igren 8 (Dobrovolskii 1949) and Sobachki (Gimbutas 1956) but no remains of either sheep or goat have been reported from the northern area.
**Pig**

No instances of pigs in a sub-neolithic context are known. They do, however, appear at the neolithic sites of Kaneva, Pekaryame (Fidoplicko 1956), and Sobachki (Gimbutas 1956). Nothing is known of their size. The situation at Bologoe in northern Russia is similar to that of the cattle, and again Gandert (1930) thinks that their presence is unlikely. Staffe questioned their presence on the grounds that the turbary pig is not known north of the Alps, but this argument is no longer valid.

Pigs are known from the Pontic neolithic, and may also be present in the northern part of Russia where there is a possibility of the turbary breed occurring.

**Dog**

The dog is known from the earliest sub-neolithic period in the Pontic area. It is known from Igren 8 (Dobrovolskii 1949), Shulaev (Bodianskii 1949) and Surskii (Danylenko 1950). Remains of eight dogs were found at the second site and at Surskii two types could be distinguished on the basis of size. Dogs are also present at the neolithic sites of Igren 8 (Dobrovolskii 1949) and Sobachki (Gimbutas 1956) and in the later sub-neolithic levels at Igren 8 (Dobrovolskii 1949) and Shulaev (Bodianskii 1949).

The dog occurs at four sites in North Russia during the neolithic period. The canine remains from Bologoe are thought to be probably associated with Pitted Ware and two types are recorded (Gandert 1930). These are *Canis f. palustris ladogensis* and *Canis f. inostranzewi*. These
same varieties have been recorded at Ladogasee (Gandert 1930). As many as 14 or 15 dogs were found and they exhibit a considerable variation in size. A complete dog's skeleton was found at Visokoe and in the vicinity a human skeleton was found (Gandert 1930). The skull had a basal length of 166 mm., and it has been assigned to the Canis f. poutiatini breed by Studer. A further more or less complete skeleton was recovered at Volosovo where it was associated with Pitted Ware and Corded Ware (Gandert 1930). This animal was identified as Canis f. palustris ladogensis by Anučin, had a skull of basal length 150 mm., and probably died from a blow on the head. After being killed it was carefully deposited in a pit.

The dog was the most common animal in the areas considered. Several types have been distinguished in northern Russia and there is evidence for the ritual burials of dogs at this stage.

Cultivated Plants

There is no evidence available for plant cultivation for this period. The absence of cereals during the sub-neolithic period in the Pontic area might be expected, but wheat, barley and millet may have been known during the neolithic period and barley during the neolithic period in North Russia.

Summary

The dog is the only domestic animal known during the early sub-neolithic period in the Pontic area. At a later stage cattle and ovicaprids appear and by the Pontic neolithic period cattle, ovicaprids, pigs/
pigs and dogs are known. This change must represent greater contact with other neolithic communities. In northern Russia dogs are the most frequently encountered animal, and it is possible that cattle and pigs were also being bred.
6. CENTRAL EUROPEAN NEOLITHIC

The cultures considered here include those of Vinča, Butmir, Bukk, Szilmeg, Tisza, Herpály and Lengyel. They are either contemporary with or follow the Linear Pottery culture in this area and so may be dated to between 4300 - 3500.

The Vinča culture is the Serbian equivalent of the Veselinovo culture, and so has connections with Anatolia. Generally the pottery has more decoration and finer channelling occurs. It is divided into phases A, B₁, B₂, C and D. Phase A is equivalent to Starčevo-"", the B₁ and B₂ phases are known as Vinča-Tordos and the C and D phases as Vinča-Pločnik. The culture covers a period from 4200 to 3500.

The Butmir culture is basically a Bosnian mixture of Vinča and late Linear Pottery with Adriatic influences. It is dated to around 3500.

The Bukk culture is a Linear Pottery development in east Slovakia and north-east Hungary, and is found in caves and settlements on the upper Tisza river around 4100. A local variant of the Linear Pottery culture in the region of the middle Tisza in Hungary is known as Szilmeg. It contains some painted ware and can be compared with the Alfoldi phase of the Linear Pottery culture.

The Tisza culture is divided into two phases and again it originates as a local development of Linear Pottery in the middle Tisza valley. It extends partly into the Bukk area to the north. Tisza II is contemporary with the late Linear Pottery sites and also with the late Boian culture to the south. It is dated to 3900 - 3700.

The/
The Herpály pottery is usually painted brown on buff, in rectilinear designs and is very thin. It occurs in the Alfoldi area and is slightly later than Tisza II. It developed from late Linear Pottery and the painted pottery of Transylvania.

The main phase of the Lengyel culture is contemporary with Gumelnița in Rumania and Tisza-Polgár in Hungary. The beginning of its development is contemporary with Herpály and so is placed at around 3600. The early pottery was painted after firing in white, red, yellow and black on a grey ground. Later the painting disappears and the pots resemble those of the Tisza-Polgár Culture. Copper is found occasionally.

The wild animals which were exploited for food do not differ notably from those of the Linear Pottery culture, with red and roe deer, aurochs and pig the chief constituents. In certain cultures, however, there is a much higher proportion of wild animals than is usual. This is true of the Herpály culture where the aurochs were hunted in large numbers, and in all hunting accounts for three-quarters of the food supply (see Tables Nos. 77, 78). About half of the osteological remains of the Lengyel culture are also attributable to wild animals (see Tables Nos. 79, 80).

**Domestic Animals**

**Cattle**

The domestication of cattle is attested for all the cultures considered.

Cattle occur in a Vinča context at two sites in Yugoslavia and three sites/
sites in Rumania (see Table No. 72). At Gornja Tuzla they account for two-thirds of the osteological remains and so are the basic animal present; the breed is unknown (Čović 1961; Benac 1961). Cattle are the chief, and possibly the only domestic animal known from Dudești (Comsa 1959a). The site is attributed to the Tordos phase, and as yet there is no detailed report of the bones recovered.

There are six instances of cattle at sites of the Butmir culture (see Table No. 72). The evidence from Butmir (Benac 1961) and Danilo (Benac 1961; Korošec 1958) again shows them to be the dominant domestic animal, and at Smilcić cattle are said to predominate together with ovicaprids over the other animals (Benac 1961). The economy at Lisići on the other hand was orientated towards hunting (Benac 1961). A few bones of cattle were found which probably originate from domestic animals and represent trade or theft from the neolithic communities in the vicinity.

Both large and small domestic cattle have been identified at the BuKk site of Aggtelek. Báro (1881) reports bones of both Bos brachyceros and Bos frontosus and at a later date Rutimeyer disqualified the latter breed as a separate type and regarded it as a cross between the domesticated aurochs and turbary cattle. Some of this material comes from the Early Bukk levels and so may be partially contemporary with the Linear Pottery culture. At the other BuKk site of Borod-Derekęgyházi dűlő cattle were the most frequent of the animals encountered (Bokonyi 1959; see Fig. 57, Table No. 73).

The Szilmez culture has been identified at three of the sites mentioned and/
and in all cases cattle are more frequent than the other domestic animals (Bokónyi 1959; see Tables Nos. 24, 75, 76 & Figs. 9, 59, 60). Cattle are also known from all five of the Hungarian Tisza culture sites, and are seen to be the main domestic animal in all of these cases. However, it is only at Hódmezővásárhely–Gorzsza–Cukortanya (Bokónyi 1959; see Fig. 58 & Table No. 74), Hódmezővásárhely (Gaal 1931) and Folgár–Caszhalom (Bokónyi 1959) that pure Tisza remains were found. Gaal describes the cattle from Hódmezővásárhely as being of medium size and 'probably domesticated from the brachyceros form', which must imply the presence of the turbary breed.

Cattle occur at Berettyószantmárton and Herpály in a Herpály context, and they are seen to be the chief domestic animal in all cases (Bokónyi 1959; see Figs. 61, 62 & Tables Nos. 77, 78). However, at both sites domestic animals account for only a quarter of the total osteological remains and the main animal to be hunted was the aurochs. This animal forms between a third and a half of the bones identified and is between two and four times as common as its domestic counterpart. The most reasonable explanation for the prevalence of the aurochs is that it was in the process of being domesticated at both sites and so was the object of intensified hunting. At the Lengyel sites of Pécsvár–Aranyhegy and Zengovarkony (Bokónyi 1959) aurochs and red deer are the most frequent of the hunted animals (see Tables Nos. 79, 80). Cattle are once more the most common of the domestic animals (see Figs. 63, 64), and about twice as frequent as the aurochs.

The/
The presence of cattle is attested at a further three sites, two in Hungary and one in Austria, but the cultural connections and breed of cattle are both unknown (see Table No. 72).

From the above discussion it is apparent that cattle remain the basis of the economy in the areas occupied by the Linear Pottery colonists. They also become the chief animal to the south of this area in Yugoslavia. In most cases they form between a half and three-quarters of the domestic stock and there is also evidence for the local domestication of aurochs.

Ovicaprids

Sheep or goats are known from all the cultures considered.

There are five instances of ovicaprids in a Vinča context (see Table No. 72). Sheep occur at Gornja Tuzla and are less frequent than both cattle and pigs (Čović 1961; Benac 1961). They are also known from Dealu Ruschi and Nander (Marton & Roska 1941). Of the six cases of ovicaprids in a Butmir context, both sheep and goat occur at four sites and goats alone are known from two (Table No. 72). Goats are slightly more frequent than pigs at Butmir (Benac 1961) and ovicaprids are said to dominate the economy together with cattle at Smilčić (Benac 1961). The inhabitants of Crvena Stijena were primarily hunters but a few bones of goats have been found. These animals need not necessarily have been bred by the occupants but may have been obtained from other neolithic communities, as was the case for the cattle from Lisicici (Benac 1958).

Ovicaprids occur at both of the Bükk sites of Aggtelek (Báro 1881) and Borod/
Borod-Derekegyházi dülő (Bokonyi 1959). They are known to be less common than cattle at the second site (see Fig. 57 & Table No. 73). Of the three instances of sheep or goats in a Szilmeg context, it is only at two sites that statistics for a purely Szilmeg horizon have been obtained (Bokonyi 1959; see Tables Nos. 75, 76). Their numerical importance may be compared with that of the dog (see Figs. 59, 60).

Sheep and goats are known from five sites of the Tisza culture in Hungary (see Table No. 72). They are less important than the dog at Hódmezővásárhely-Gorzsza-Cukortanya (Bokonyi 1959; see Fig. 58 & Table No. 74) and are comparatively insignificant at the other sites. The remains of goats found at Hódmezővásárhely are of interest. Gaal (1931) found some long horn cores which he thinks indicate the presence of *Capra aegagrus*: the bezoar goat. This goat has been claimed to be present in various other Eastern European countries during the neolithic period and indicates close contact with the Near East.

Ovicaprids are known at both Berettyószentmárton and Herpály in a Herpály context (Bokonyi 1959; see Tables Nos. 77, 78). At both sites they are less frequent than cattle and pigs (see Figs. 61, 62). They also account for only a very small percentage of the bones at the Lengyel sites of Pécsvárad–Aranyhegy and Zengóvarkony which is particularly striking at the last site where many bones were identifiable (see Figs. 63, 64 & Tables Nos. 79 & 80). Sheep or goats also occur at another two Neolithic sites, but nothing further is known of these finds (Table No. 72).

The value of oviscaprid breeding remains minimal throughout the period considered/
considered. Where pigs are also present they are nearly always more common than sheep or goats, the latter often being comparable with the dog in frequency. The presence of the bezoar goat is claimed in one instance.

Pig

The pig is known to have been domesticated in the Vinča levels of Csoka (Banner 1960), but it is not clear whether the pig at Gornja Tuzla was domesticated although the numbers of bones are more frequent than those of sheep or goats (Čović 1961; Benac 1961). In both cases it is the scrofa breed which is present. There is also a possibility of pig domestication at Dudeți (Comsa 1959a).

There are four occurrences of pigs in a Butmir context, but it is only at Nebo that the turbary breed and larger scrofa pigs are known to be represented (Benac 1952; see Table No. 72). These two types of pigs are again known from the Bukk levels of the Aggtelek cave (Báro 1881). Pigs are also present at Borod-Derekegyházi dűlő where they are about as common as sheep and goat (Bokonyi 1959; see Fig. 57 & Table No. 73).

There are three instances of pigs in a Szílmeg context (see Table No. 72). They are more common than ovicaprids at both Polgár-Basatanya (Bokonyi 1959; see Fig. 59, Table No. 75) and Szílmeg (Bokonyi 1959; see Fig. 60, Table No. 76), and at the last site they lie close to cattle in frequency.

Pigs are known from four Tisza culture sites in Hungary (Table No. 72), and/
and are approximately two to three times as frequent as ovicaprids at Hódmezővásárhely–Gorzsa–Cukortanya (Bokonyi 1959; see Fig. 58 & Table No. 74) and Szegvár–Tüzköves (Bokonyi 1959; see Fig. 13 & Table No. 33). The larger variety of pig is present at the first site. They are of about the same economic importance at the Herpaly sites of Berettyószántmarton (Bokonyi 1959; see Fig. 61 & Table No. 77) and Herpaly (Bokonyi 1959; see Fig. 62 & Table No. 78), but are more frequent relative to sheep and goat at Pécsvárad–Aranyhegy and Zengővarkony in a Lengyel context (Bokonyi 1959; see Figs. 63, 64, Tables Nos. 79, 80). Although wild animals form a large part of the food supply, the boar was of no great importance in any of these cases.

Pigs also occur at a further two or three Neolithic sites (see Table No. 72).

Pigs were known and bred in all the cultures considered, and they are usually less important than cattle and more important than ovicaprids. There is no indication of local domestication of the wild boar in large quantities.

**Dog**

The dog is known in small quantities from all cultures. They are recorded at three sites of the Vinča culture, two of the Ratmir culture, one of the Bukk culture and three of the Szilmes culture (see Table No. 72). At Szilmes dogs are as common as sheep or goat (see Fig. 60 & Table No. 76). In none of these cases is the breed of dog known. The dog is also recorded at/
at four sites of the Tisza culture, and at Hódmezővásárhely Gaal (1931) was able to identify two individuals assignable to Rutimeyer’s turbary breed. An unspecified breed was also found at both of the Herpály and Lengyel sites in Hungary (see Figs. 61 - 64 & Tables Nos. 77 - 80).

There are a further six instances of dogs at sites where the exact cultural connections are not known, and one which can be assigned to the Lengyel culture. This find comes from Eggendorf and has been attributed to the turbary breed by Hauck (1944). The two dogs from Wien XXI-Aspern are described as being between 40 and 45 cm. high with a skull of basal length 170 - 180 mm. (Hauck 1944, 1950). Nothing is known of the dogs from Ziegelofen-Kargl or Wien XIII (Hauck 1944). Several bones were found at Kufstein and are thought to represent the intermedius breed (Schlosser 1909). No racial identifications were made from the remains of dog found with the crouched burial at Oborin, or from the cave at Chyza (Ambros in Vizdal 1962).

Two types of dog were known during this period. The smaller and more frequent was the turbary dog, but the racial identification of the other has not been established with certainty.

Cultivated Plants

Wheat

Wheat occurs in all the cultures considered. The only occurrence of this cereal in the Vinča culture comes from the type-site, where the species was unidentifiable (Garašanin 1958), and it is also known from four sites of/
of the Butmir culture (see Table No. 81). The species to be identified are einkorn and emmer. One or other is present at Danilo (Korošec 1958) and both occur at Butmir (Bibikov 1953), Lisicici and Lug (Hopf 1958). Several impressions were found at Lisicici where einkorn was the more frequent of the two, but at Lug both wheats were present in about equal quantities (see Table No. 82). Impressions of wheat are more frequent than those of barley, but no remains of carbonised wheat occur whereas a large quantity of carbonised barley was found at Lug.

Einkorn, bread wheat and Triticum sativum are known from a Bukk context at Aggtelek (Báro 1881). Their relative proportions are unknown.

The greatest amount of evidence comes from the Lengyel culture, and again einkorn and emmer are the main constituents. In his final report on the grain from Eggendorf Werneck (1961) identified 30% einkorn as against 70% emmer amongst the carbonised material, and 10 - 15% einkorn and 85 - 90% emmer at Roggendorf (Werneck 1961). The 150 carbonised grains from Kuhnring are assigned to the same two species. The wheat from all three sites was initially assigned to naked wheat but further investigations showed that this was not so (Werneck 1949; 1961). No barley was found in any of these cases. Club wheat is thought to be present in either a Linear Pottery or Lengyel context at Wien-Vösendorf (Werneck 1949; 1961). The other wheat known in a Lengyel context is spelt, which occurs at Zengovarkony (Dombai 1960).

There are two further instances of wheat in a neolithic context (see Table No. 81).
With the exception of a single site in Yugoslavia, wheat appears to have been the main crop cultivated. Its chief constituents were emmer and einkorn in the ratio of approximately 3:1 during the Lengyel culture. Wheat was also cultivated in the Vinča, Butmir and Bukk cultures, and club wheat, bread wheat and spelt are present in small quantities.

Barley

Barley occurs at three Butmir culture sites (see Table No. 81). Two or three impressions were identified at Lisicici and Lug (Hopf 1958), and are attributable to glume barley. The most striking find is that of 110 carbonised grains at Lug, none of which belonged to wheat. The majority of these belong to four-rowed naked barley which is characterised by its asymmetrical grain. The occurrence of this type of barley is of interest since it is regarded as a hybrid between the two and six-rowed forms. There were also some examples of six-rowed barley amongst the remains.

There is a possible occurrence of barley at the Bukk site of Aggtelek (Bárc 1881) and a definite occurrence of two-rowed barley at the Lengyel site of Zengovarkony (Dombai 1960). The cultural context of the barley from Wien/Ober St. Viet is unknown (Werneck 1949; see Table No. 81).

Barley has been identified in a Butmir, Lengyel and possibly Bukk context, but it is only found in quantity at one Butmir site. Two, four and six-rowed forms have been identified in a Neolithic context.

Millet/
Millet

The presence of broomcorn (*Panicum miliaceum*) is attested at the Bukk site of Aggtelek (Báro 1881) and both this and Italian millet (*Setaria italicca*) are known from the type site of the Lengyel culture (Neuweiler 1905). Neuweiler (1905) has identified broomcorn at Ryóiscala and possibly Italian millet at Lobositz. There is no indication that this plant was of importance to the economy during any of the cultures considered.

Rye

There are two occurrences of rye, one at the Butmir site of Danilo (Korošec 1958) and the other in the Lengyel or Linear Pottery levels at Wien-Vösendorf (Werneck 1949; 1961). There is little doubt of the presence of rye, but Werneck's claim for it being a major crop seems to be unfounded as he bases his evidence upon a single grain. Wild rye occurs in the Carpathians and extends southwards into the Balkans.

Oats

There is a possible identification of this cereal at Lengyel (Neuweiler 1905) where it would be present as a weed in the field.

Flax

There is a single instance of flax at Lengyel, but the cultural connections are unknown (Neuweiler 1905). This plant must have been cultivated/
cultivated in most of the cultures considered, but as yet there is no definite evidence for this fact.

**Legumes**

The pea and the bean are known from various sites, and they are assumed to have been cultivated although no definite evidence is given (see Table No. 81).

**Summary**

The tradition of the Linear Pottery culture has been maintained over the area considered, with cattle forming a half to three-quarters of the livestock, and pigs generally more common than ovicaprids. Several sites contain a large number of aurochs' bones which is indicative of local aurochs domestication. Emmer was the main crop with einkorn less common, bread and club wheat as well as spelt have been identified and three types of barley are known. Millet, rye, oats, legumes and flax also occur.
7. - CORTAILLOD

The Cortaillod culture is found in western Switzerland between the period 3200 and 2600 and it is divided into two phases. The pottery is fairly simple in design and usually has a rounded base and resembles leather prototypes. Flat bases can also occur. In the Late phase the designs are rather more sophisticated and Rossen and Michelsberg affinities may be detected. The pots of both phases are often perforated with holes near the rim.

Axes and occasional adzes occur, but otherwise the stone industry could be developed from the mesolithic tradition. Many objects of bone and wood also survive owing to the water-logged conditions of preservation. The settlements consist of groups of rectangular houses, which at first were thought to be raised on piles above the lake. Recently, however, it has been shown that these houses were constructed on relatively dry land beside the lake shore.

At most sites hunting was a valuable part of the economy. Generally wild animals account for about half of the remains, although at the richest site only a quarter of the bones are attributed to hunted species (see Tables Nos. 85 - 95). Of these, red deer is by far the most frequent animal, with roe deer, elk, chamois, aurochs, bison, pig, horse, wolf, fox, badger, otter, pine and beech marten, polecat, beaver, bear, lynx, cat, weasel, hare, hedgehog, mouse and squirrel also represented. Bones of birds and fish are also found (see Table No. 83).

There is also much evidence for the collection of berries and fruit to/
to supplement the diet. These include apples, pears, plums, sloes, cherries, raspberries, blackberries, bilberries, strawberries and elderberries. At one site a large quantity of seeds of white goosefoot were found which could suggest that the fields were allowed to go fallow for a year. Hazel nuts also appear to have been eaten in large quantities.

The Pfyn group of sites is also considered in this section. There are several marked differences between these and the Cortaillod culture, but the flint, wood and bone industries link them with the Cortaillod rather than the Michelsberg culture. They are thought to be contemporary with the Late Cortaillod period. The proportion of wild animals appears to be somewhat smaller than at the average Cortaillod site, and the animals identified include red and roe deer, elk, aurochs, bison, pig, fox, badger, beaver, hedgehog and birds.

**Domestic Animals**

**Cattle**

Bones of domestic cattle have been identified at all of the 22 sites considered (see Table No. 84).

Cattle predominate amongst the large quantity of bones found at Burgaschisee sud-ouest and are found to belong almost exclusively to the small turbary race (see Fig. 66 & Table No. 86). From the age distribution Josien (1956) concludes that these animals were used for work rather than food, since the majority are adult rather than juvenile. However, there is no convincing argument for this supposition. At the other/
other site on Burgaschisee, Burgaschisee-sud, the wild fauna outnumbered the domestic by twenty to one, and cattle are outnumbered by dogs (Stampfli 1962; see Fig. 65 & Table No. 85).

Cattle are the most frequent animal found at Egozwil II and the variation in size is best seen from the range of the basal circumference of the horn cores which lies between 141 mm. and 335 mm. (Herscheler & Reuger 1939; 1942; see Fig. 67 & Table No. 87). The radii and ulnas have been divided up as follows: 71 of turbary cattle, 31 of large domestic cattle and 27 or aurochs. As yet there is no detailed report from Egozwil III, although cattle are known to be present (Guyan 1955).

The sites of Lattringen and Luscherz lie on Bielersee and both large and small animals are known. Studer (1883) reports them as being of equal importance at the first site, but the smaller animal is the more frequent at the second site. Intermediate forms have been noted also. The turbary animals compare well with the Simmentaler cattle of today, and cattle are more important than the other domestic animals to be identified. In connection with this the prevalence of the aurochs must be mentioned; it accounts for the same number of animals as all the other wild species combined (Josien 1956; see Fig. 69, Table No. 89). The importance of cattle is again demonstrated by the finds at Lobsigersee where the majority of animals are adult (Josien 1956; see Fig. 70 & Table No. 90) and at Obermeilen and Meilen where the turbary breed predominates (Kuhn 1935; see Fig. 71 & Table No. 91; Rutimeyer 1861).

There have been several reports on the fauna recovered at St. Aubin (Port/
The final statistics for the 1921-1926 and 1928-1930 material shows cattle outnumbering ovicaprids and pigs (Reverdin 1921a & b, 1923, 1927, 1928, 1930 & 1932b; see Fig. 72 & Table No. 92). The osteological collection from this site is one of the richest in Switzerland and so is of especial value in determining the relative importance of the domestic animals in the Cortaillod culture. On the whole measurements on the cattle bones show agreement with the turbary breed. The remains from Seematte-Gelfingen illustrate the same points (Herscheler & Reuger 1942; see Fig. 68 & Table No. 88). Two types of domestic animals were found, the height to the withers of the smaller is calculated as having been 1150 mm. and the larger was 1360 mm. The aurochs lay within 1450 mm. and 1600 mm.

Studer (1883) reports that cattle and pigs predominate at Schaffis and that a very small race with slender limbs is indicated so that they differ a little from the ordinary turbary cattle. A Cortaillod level was recently found at Auvernier and turbary cattle identified (Josien 1955), and these animals occur again at Neuville where they were identified by Studer (Schenk 1912) and Thun (Stehlin 1930). Cattle were well represented at Cortaillod itself, but the exact proportions are not known (Reverdin 1928).

The group of sites excavated at Wauwilerees, known as Wauwil, consist of Egozwil I & II and Schütz I & II and the bones have been considered as a whole by Herscheler (1920). Turbary cattle are the dominant feature of the economy, although the domesticated aurochs is also represented (see Fig. 73, Table No. 93).
The other two sites to be considered in this section are Niederwil and Pfyn (Classon 1964). These belong to a different cultural group which is analogous to the Cortaillod culture in environment and certain aspects of its industry, but has entirely different pottery. Cattle and pigs were both of much importance to the economy, the former being dominant when the number of bones are considered, and the latter the more frequent on the basis of the number of individuals (see Fig. 74, Table No. 94). There was a high percentage of domestic animals at this site. A much smaller quantity of bones was identified at Pfyn where cattle appear to be dominant (see Table No. 95).

From the above evidence it may be concluded that cattle were the main feature in the economy of the Cortaillod culture. Both large and small animals are known, and generally it is the smaller which is the more common.

Ovicaprids

Sheep or goats occur at all of the sites mentioned (see Table No. 84). Both the turbary breed of sheep and goat have been identified at Burgaschissee-sud ouest where they are less important than cattle and pigs (Josien 1956; see Fig. 66 & Table No. 86). Sheep could be distinguished from goats in 23 cases, and the sheep outnumbered the goats by about 3 : 1. Ovicaprids are also known from Burgaschissee-sud where the economy was based upon hunting (Stampfli 1962; see Fig. 65, Table No. 85).

Sheep and goats are slightly less important than pigs at Egozwil II where/
where the turbary breeds have been identified. The sheep are compared with the Nalpsertal sheep which have recently become extinct (Herscheler & Reuger 1942; see Fig. 67 & Table No. 87). Ovicaprids were also present at Egozwil III, but no detailed report is yet available (Gyman 1955). Gyman conducted a biological examination of the faeces found in Field II, and was able to come to the conclusion that they originated from either sheep or goats owing to the presence of the pollen of Caltha palustris, which cattle and pigs never touch. Microscopic examination revealed the presence of pollen grains which illustrates the diet of these domestic animals. It was composed as follows: Gramineae 22%; Umbelliferae & Alnus 15%; Corylus, Tubuliflorae, Campanulaceae & Filipendula 3 - 6%; Thelypteris, Tilia, Hypericum, Caltha palustris 2 - 3%; Rubus cfr. idaeus, Uritica, Liguliflorae, Cyperaceae, Galeopsis, various legumes 2 - 1%.

Sheep at Lattingen are twice as common as goats and are small in size with long legs (Studer 1883) and sheep are again more common at Lobsigersee (Josien 1956). At this site ovicaprids are approximately as numerous as pigs (see Fig. 70 & Table No. 90). Ovicaprids and pigs are again present in about equal numbers at Luscherz (Josien 1956; Studer 1883; see Fig. 69, Table No. 89). Only turbary sheep are recorded by Josien in a late phase of the Cortaillod culture, but Studer reports goats from the 19th century excavations although sheep were more common.

At Obermeilen goats were slightly more frequent than sheep, but as a whole ovicaprids are less numerous than both cattle and pigs (Kuhn 1935; see Fig. 71 & Table No. 91). At Saint Aubin on the other hand they come second/
second, slightly ahead of pigs, and the presence of the turbary breeds is indicated by the horn cores (Reverdin 1921a & b, 1923, 1927, 1928, 1930, 1932b; see Fig. 72 & Table No. 92). These results are of importance owing to the large quantity of bones that have been identified. Sheep and goat occur in about equal numbers at Schaffis, where the sheep belong to the turbary breed, but the goats were found to have strongly developed horn cores (Studer 1883).

Ovicaprids occupy third position at Seematten-Gelfingen where sheep are again more numerous than goats (Herscheler & Reuger 1942; see Fig. 68, Table No. 88). An interesting fact arose from a sheep's skull, which showed clearly that the animal had been hornless, and from a loose horn core which bore evidence of pressure being applied to the inner and outer surfaces (Herscheler & Reuger 1942, p. 437). From this it seems probable that the inhabitants were trying intentionally to produce hornless sheep in preference to the horned animals.

Turbary sheep and goats are known from the late Cortaillod at Auvernier (Josien 1955), Neuveville (Schenk 1912), Fort (Tschumi 1949) and Saint Léonard (Sauter 1959; 1960), turbary sheep alone occur at Thun (Stehlin 1930) and sheep and goats are known from Cortaillod (Reverdin 1928), Inkwil (Tschumi 1949) and Moosseedorf (Herscheler 1920). At the last site ovicaprids are less numerous than cattle and pigs. Several bones were found in the group of sites known as Wauwil, and goats are nearly twice as numerous as sheep (Herscheler 1920).

Ovicaprids were of minor importance at Niederwil, being far less frequent/
frequent than both cattle and pigs (Classon 1964; see Fig. 74 & Table No. 94). Both sheep and goat have been distinguished, but the species are not yet known. Only a single ovicaprid bone was found at Pfyn (Classon 1964; see Table No. 95).

Ovicaprids and pigs appear to have been of about the same importance to the economy of the Cortaillod culture, some sites favour one and others prefer the other. On the whole sheep are slightly more common than goats, and the turbary breeds predominate. There is, however, evidence for stronger horned goats and for hornless sheep which may have been produced intentionally by the inhabitants of one site.

Pigs occur at 20 of the 22 sites considered.

Adult animals of the turbary breed predominate at Burgaschissee-sud-ouest where they are the second most frequent of the domestic animals (Josien 1956; see Fig. 66 & Table No. 86). This breed occurs again at Burgaschissee-sud (Stampfli 1962; see Fig. 65 & Table No. 85). At this site there were also many bones of pigs which could not be assigned with certainty to either domestic or wild animals, and so may indicate the practice of local domestication.

Pigs are approximately equal to the number of ovicaprids at Egozwil II. There is a high proportion of young turbary animals and no evidence for the larger breed of pig (Herscheler & Reuger 1939; 1942; see Fig. 67 & Table No. 87). Investigation of the osteological remains from Egozwil/
Egozwil III have not yet been completed, but it is known that pigs were well represented amongst the domestic stock (Guyan 1955).

Studer (1883) reports both the large and small domestic pigs from Lattringen, including many bones of young animals. Pigs are of the same importance as ovicaprids at both Lobsigersee (Josien 1956; see Fig. 70, Table No. 90) and Luscherz (Josien 1956; Studer 1883; see Fig. 69, Table No. 70). Studer could only identify the turbary breed, and there were also bones indicating an animal smaller than the usual turbary pig but it is not certain whether this originated from the Cortaillod or later neolithic levels. There was again just the one breed at Obermeilen where these animals occupy second place in importance (Kuhn 1935; see Fig. 71 & Table No. 91).

At St. Aubin on the other hand pigs come third, being slightly less frequent than ovicaprids. Once again only the turbary breed was detected (Reverdin 1921a & b, 1923, 1927, 1928, 1930 & 1932b; see Fig. 72 & Table No. 92). Studer (1883) reports that the pig remains from Schaffis form a high proportion of the finds and are about equal to the number of cattle. Again the characteristics of the turbary race were observed. Pigs come second again at Seematte-Gelfingen and the same results as at St. Aubin and Schaffis were found (Herscheler & Reuger 1942; see Fig. 68, Table No. 88). Sexual identifications made on a large number of lower jaws revealed a preponderance of female animals as would be expected.

Turbary pigs have been found at Auvernier (Josien 1955), Cortaillod (Reverdin 1928), Neuveville (Schenk 1912) and Moosseedorf (Herscheler 1920).
An unspecified breed has been found at Port (Stehlin 1930) and Saint Léonard (Sauter 1959; 1960).

Cattle and pigs were the only important domestic animals at Wiederwil (Classon 1964). Pigs occupy second place on the number of bones, but first when the individuals are considered (see Fig. 74 & Table No. 94). Only a preliminary report has so far been published so that the breed involved is not known. A small proportion of bones of domestic animals were found at Pfyn, where the pig is represented by a few remains only (Classon 1964; see Table No. 95).

Pigs occupied either second or third place in order of importance in the Cortaillod economy. Generally the turbarbreed is far more common than the larger breed, although it too occurs in a few instances, and at one site there is a suggestion of the local domestication of the wild boar. At the Pfyn group of sites on the other hand pigs appear to have been of much greater importance to the economy, being almost as important as cattle, and perhaps even more so.

Dog

The dog is known from all but one of the 22 sites considered, and its absence at Egoswil III is not known for certain since there has not yet been a detailed report on the osteological remains (see Table No. 84). As expected dogs are represented in small quantities only at these sites.

Dogs are relatively important at Burgaschisee-sud, which might be expected since the economy was orientated towards hunting rather than breeding.
breeding (Stampfl 1962; see Fig. 65 & Table No. 85). At the other site on this lake, Burgaschisee sud-ouest, Josien (1956) has identified the turbary dog and none of the bones disagreed with the measurements for this breed (Fig. 66 & Table No. 86). The dog bones at this site were not crushed, and in this fact they differ from all the other bones recovered.

Many bones of dogs were found at Egozwil II, and Herscheler and Reuger (1942) identified remains of both medium and small turbary dogs, whose skulls had basal lengths varying between 125 and 145 mm. (see Fig. 67 & Table No. 87). Turbary animals also occur at Lattringen and Luscherz (Studer 1883; Josien 1956; see Fig. 69 & Table No. 89), as well as Neuvéville (Schenk 1912), Schaffis (Studer 1883), St. Aubin (Reverdin 1927; see Fig. 72, Table No. 92), Seematte-Gelfingen (Herscheler & Reuger 1942), Thun (Stehlin 1930) and Wauwil (Herscheler 1920). The dogs from Schaffis were well preserved and usually adult; they were of more or less constant size, the basal lengths of the skulls only varying between 132 - 134 mm. Amongst the dog bones at St. Aubin there were a few jaws which showed traces of disarticulation. It appears that these animals were forcibly killed and so the high proportion of young dogs was intentional. Reverdin divided the dogs into four groups on the basis of the dentition. The second and third groups lie well within the range of variation of the turbary dogs, but the first was slightly larger and the fourth slightly smaller than the usual turbary animals. Reverdin was uncertain as to whether these should be classed as turbary dogs, or as two new races. This breed of dog occurs again at Obermeilen (Kuhn 1935) and Wauwil (Herscheler/
A slightly larger proportion of dogs than is usual was found at the first site, and nearly all bones can be assigned to the turbary breed, with the exception of a radius which approaches the size for *intermedius* dogs (see Fig. 71 & Table No. 91). This large dog occurred at Otzaki in Greece, and Boessneck gives the same description and decided that it was a large version of the turbary animal.

Dogs also occur at both Niederwil and Pfyn (Classon 1964; see Fig. 74 & Tables Nos. 94, 95). No racial identifications have been made.

Dogs were a common occurrence at Cortailloed sites, and nearly all can be assigned to the turbary breed. The usual variation within this species was observed.

**Cultivated Plants**

**Wheat**

Wheat has been identified at eleven of the thirteen sites considered (see Table No. 96). Einkorn, emmer, club wheat and bread wheat are all known.

By far the most frequent of these was club wheat (*Triticum aestivocompactum*) which has been identified at nine sites (see Table No. 96). The importance of this species is illustrated by the finds from Thun. Rytz (1930) found that the majority of the grain could be attributed to this type of wheat, which often occurred in clusters of adhering seeds. The variation in the dimensions was found to be considerable. Wheat was also found in large quantities at Niederwil, and after a preliminary examination/
examination club wheat was found to be the dominant species (Waterbolk & Zeist 1964). This is the only type of wheat known from Burgaschi (Neuweiler 1905, 1935), Egozwil I (Neuweiler 1924) and Egozwil III (Troels-Smith 1955).

The other naked wheat occurring in this culture is bread wheat (*Triticum aestivum*). It occurs at two sites, namely Burgaschisee sud-ouest (Rytz 1946) and Moosseedorf (Schenk 1912; Tschumi 1949). The remains from the last site are described as forming a 'Pfahlbaupumpernickel'.

The glumed wheats are represented by einkorn and emmer. *Triticum monococcum* occurs at two sites and *Triticum dicoccum* at four sites. At Thun Rytz could only identify a few grains of both species amongst the large quantity of wheat recovered; the proportions at the other sites are unknown (Table No. 96). There are a further two instances of an unspecified type of wheat.

The origin of the naked wheats is interesting. There is no ancestral wild form, and it is thought to have developed as a result of chromosome aberration of emmer. This implies the dominance of emmer and allied wheats in the crops of the Cortaillod people, which agrees with the results of other early neolithic communities. This is the earliest known culture which centres its plant cultivation on naked wheats, and it is suggested here that this chromosome aberration could have taken place in the central Alpine zone of Europe as a result of the environmental conditions.

Barley/
Barley

Barley is known from seven of the thirteen sites considered (see Table No. 96).

There are only two instances in which the species could be determined and these are at Burgaschisee (Neuweiler 1905; 1935) and St. Blaise (Netolitsky 1930; Neuweiler 1905; 1935) where the six-rowed variety, Hordeum vulgare ssp. hexastichum was identified. The importance of barley relative to other cereals has only been determined at Niederwil (Waterbolk & Zeist 1964) and Thun (Rytz 1930). In both cases it forms only a very small proportion of the remains.

Barley was known in the Cortaillod culture, and it was probably the six-rowed variety that was present. However, it remains unimportant in comparison with wheat.

Millet

There are two possible occurrences of millet in this context. Both Italian millet and broomcorn are known from Auvernier, but it is not known whether these remains belong to the Cortaillod or Horgen levels of the site (Neuweiler 1905). A small quantity of broomcorn (Panicum miliaceum) was found at Niederwil. The indications are that millet was of little economic value at this stage.

Flax

Flax is known from nine sites (see Table No. 96). Neuweiler gives the/
the finds he identified the name *Linum austriacum* after the wild species found in Austria and Switzerland, and Heer called his flax *Linum augustifolium* since he thought this was the probable ancestor to the cultivated species. This is now better known as *Linum bienne* and is found wild in the foothills of the Tigris-Euphrates region (Helbaek 1959a). Helbaek conducted a careful examination of the two types of flax, and found that the ring cells of the seed coat of the Austrian flax differed markedly from that of the Pfahlbau flax. In the former they were dark whereas in the latter they were colourless. Also the chromosome number of the Austrian flax was different from that found at the Swiss sites, which in turn agreed with that of *Linum bienne*. Hence it can be concluded that the Swiss Neolithic flax derives from the Near Eastern *Linum bienne*, and it is given the name of *Linum usitatissimum*.

In the majority of cases nothing is known apart from the presence of flax at the various sites. At Niederwil, however, flax is known to have been present in large quantities (Waterbolk & Zeist 1964). Only wheat and poppy seeds are known in these proportions, and the finds include pods and stems as well as the oil-bearing seeds. The presence of flax at Egozwil III is clearly demonstrated in the pollen diagrams (Troels-Smith 1955), and at Burgaschisee sud-ouest a fabric woven from flax was found (Rytz 1946). On microscopic examination this proved to be composed of strands of flax of 2 - 5 µ in thickness.

Flax was clearly of importance to the Cortaillod economy. It would serve both as an oil-producing plant and as a fibre source.
Poppy

There are seven instances of poppy seeds in this context (see Table No. 96).

It usually is fairly frequent amongst the plant remains, and at Niederwil these seeds can be classed along with wheat and flax in importance (Rytz 1946). The pollen of this plant was detected at Egozwil III (Troels-Smith 1955). The exact status of the poppy does not appear to have been thoroughly investigated, but in most cases it is assumed to be cultivated. These seeds must have been of great significance to the people of the Cortaillod culture, judging by their frequency at some sites, as might be expected from parallels of certain modern primitive tribes.

Legumes

Peas and lentils are known in this context (see Table No. 96). Peas are more common, and were found partly mixed with grain at Thun (Rytz 1946). This appears to be the only legume that was definitely cultivated.

Summary

Cattle breeding was the basis of the Cortaillod economy, with ovicaprids and pigs of approximately equal importance. The turbary breeds are dominant in all cases. Pigs are of greater importance in the Pfyn group of sites. Club wheat was the main crop, and einkorn, emmer, barley, millet and flax were also cultivated.
8. - LATER SWISS NEOLITHIC

The Horgen and Michelsberg cultures are considered in this section. The former is dated to 2700 - 2300 and the latter to 2800 - 2500. The Horgen pottery is coarse and badly baked, some vases have splayed bases and others have rounded bases. The stone material is generally local in origin and perforated axes occur. During this period there is a general deterioration in architecture with houses often becoming smaller than in the Cortaillod settlements. The pottery, antler sleeves and arc pendants are reminiscent of the S.O.M. culture of northern France.

The Michelsberg culture occurs to the north of the Cortaillod area in moor villages in Switzerland, and Wurttemberg, and in hilltop camps in south-west Germany. The most distinctive pot form is the tulip-shaped beaker, but pots with round and flat bases, jugs with handles and flat plates also occur. Some similarities with the T.R.B. culture are seen. On the whole the stone industry is typically Neolithic and axes were more common than adzes. Michelsberg settlers are known to have operated flint mines in Belgium. The houses were rectangular and usually divided into two rooms with a hearth in the inner and oven in the outer. Copper occurs at a few late settlements. This culture is partly contemporary with Cortaillod and Rossen in the west, and to the east it supercedes Rossen.

Hunting accounts for two-fifths to half of the osteological remains in both cultures, and there is a noticeable drop in the proportion of wild animals in the late Horgen period. Red and roe deer, elk, aurochs, bison, pig, horse, bear, wolf, fox, marten, lynx, cat, otter, beaver, badger, hare/
hare, squirrel, birds, fish and turtle are all represented (see Table No. 97).

**Domestic Animals**

**Cattle**

There are three instances of cattle in a Horgen context, seven in a Michelsberg context and a further seven from other neolithic sites (see Table No. 98).

Cattle are the second most frequent animal in the Horgen level III at Auvernier (Reverdin 1932b; see Fig. 75 & Table No. 99). Fewer bones were recovered in the more recent excavations at this site, where cattle are the most important animal in level III and the least important in level II (Josien 1955; see Table No. 99). All the remains have been attributed to turbary cattle. Only a small number of bones were found at Horgen (Kuhn 1932), but a very large quantity was identified at St. Aubin (Reverdin 1930; see Fig. 76 & Table No. 100). In both cases it is the turbary breed that is present, and at the latter site cattle come second to pigs in importance.

Typical turbary animals as well as slightly more powerful ones have been identified at the Michelsberg site of Mannedorf (Kuhn 1932) and the cattle from Obermeilen are also of the turbary type (Kuhn 1935). Both kinds of cattle are known at Ossingen and they are the most important of the domestic animals (Kuhn 1932; see Fig. 77 & Table No. 101). The relative frequencies of the different types is best illustrated by the number of first phalanges assignable to the different breeds: 33 were of turbary cattle, 3 of large domestic cattle and 3 were of aurochs. This is/
is the same as the results for other Swiss Neolithic sites. Large cattle occur again at Steckborn (Vogel 1933), and large, small and intermediate cattle have been distinguished at Storren-Wildsberg (Kuhn 1932). There is no osteological report on the remains from Thayngen-Weier as yet, but cattle are known to have been present (Guyan 1955). It seems likely that branches of elm were collected to feed the cattle at this site (Troels-Smith 1955) and it is known to be one of the best cattle foders.

Cattle were the dominant feature of the Michelsberg economy, but this is not true of the Horgen culture where they occupy second position. The turbary breed is the one most commonly encountered, although the large domestic animal is also represented.

Ovicaprids

Sheep or goats occur at two sites in a Horgen context and four in a Michelsberg context (see Table No. 98).

They are known from the Horgen sites of Auvernier III (Reverdin 1932b) and St. Aubin III (Reverdin 1930) where the turbary sheep and goat have been identified, with sheep more frequent than goats at the last site. At Auvernier they lie in third or equal second position (see Fig. 75 & Table No. 99) and at St. Aubin they are again third in importance (see Fig. 76 & Table No. 100).

A small turbary goat was the only ovicaprid to be identified at the Michelsberg site of Mannedorf (Kuhn 1932) and both sheep and goats are thought/
thought to be present at Thayngen-Weier (Guyan 1955). Ovicaprids also occur at Obermeilen (Kuhn 1935) and Luscherz (Studer 1883), but their complete absence at the rich site of Ossingen is striking (Kuhn 1932).

Of the other six instances of ovicaprids in a neolithic context, there are three occurrences of turbary sheep, two of sheep and four of goats.

Sheep and goats were only of minor importance during the Michelsberg culture, and were probably the least important of the three main domestic animals during the earlier Horgen phase. In the late stage of this culture they become much more important and are the main domestic animal. On the whole sheep seem to be more common than goats.

Pig

Pigs occur at all three of the Horgen culture sites mentioned (see Table No. 98). The turbary pig is the most important of the domestic animals at Auvernier III (Reverdin 1932b; see Fig. 75 & Table No. 99), as it is also at the rich site of St. Aubin III (Reverdin 1930; see Fig. 76 & Table No. 100).

Pigs are known from six of the seven Michelsberg sites mentioned (see Table No. 98). The turbary pig occurs at both Mannedorf (Kuhn 1932) and Obermeilen (Kuhn 1935), and at Ossingen there is again no indication of a large form of the domestic pig (Kuhn 1932). At this site they are the second most frequent animal, with ovicaprids entirely absent (see Fig. 77 & Table No. 101). Pigs are about half as numerous as cattle at Storren-Wildsberg/
Wildsberg, where the typical turbary pig is replaced by a slightly larger animal (Kuhn 1932).

The turbary pig is also known to be present at the neolithic sites of Herblingen (Kuhn 1942), Caverne du Bossey and Caverne de la grande Poule (Schenk 1912).

The pig was the basic domestic animal of the Horgen culture. The pig is also known in a Michelsberg context where it was probably the second most frequent animal. The turbary pig is much more frequent than the larger *scrofa* variety.

**Dog**

Dogs occur at three sites of the Horgen culture, three of the Michelsberg culture and at four Neolithic sites.

The turbary dog is known from a Horgen context at St. Aubin (Reverdin 1930b; see Fig. 76 & Table No. 100) and both the turbary dog and its dwarf form *Canis f. spaletti* have been found at Horgen (Kuhn 1932). The dog is also present in small proportions at Auvernier.

The two breeds of dog noted for the Horgen culture have also been found at the Michelsberg site of Obermeilen (Kuhn 1935), and the turbary breed is also present at Ossingen (Kuhn 1932; see Fig. 77 & Table No. 101) and Luscherz (Studer 1883).

Three types of dog occur at the neolithic site of Wangen, but some of these may originate from the early Bronze Age. In addition to the two types noted above, *Canis f. leineri* was identified. The miniature dog had its/
its skull crushed, presumably for the extraction of the brain. The turbary dog also is present at Herblingen (Kuhn 1942).

At least two types of dog were known in the Michelsberg and Horgen cultures, and these are the turbary dog and its miniature form. There is also a possibility of another larger breed, but this cannot be established with certainty.

Cultivated Plants

Wheat

Very little is known of the cultivated plants of the Horgen culture. Grains of wheat have been identified at both Horgen (Neuweiler 1925) and Utoquai (Neuweiler 1930) but the species was indeterminate (see Table No. 102).

A little more is known about the Michelsberg cultivators. There is a single instance of einkorn at Thayngen-Weier (Baer 1959, Guyan 1955), two instances of emmer at this site and Storren-Wildsberg (Netolitsky 1930), and a single case of club wheat at Thayngen-Weier (Baer 1959; Guyan 1955). This naked wheat was found in larger quantities than the other grain at this site. The cultivation of cereals at Thayngen-Weier is also attested in the pollen diagrams, where in fact barley has been identified more frequently than wheat (Guyan 1955). A carbonised crust of grain that had been fused to the base of a pot by heat was discovered and illustrates that the grain was cooked to form some sort of porridge.

Wheat has been identified at a further three sites and the three types of wheat known from Thayngen-Weier were identified at Walm III (Neuweiler/
Wheat is known from both the Horgen and Michelsberg cultures. Emmer and club wheat have been identified in the latter culture, and the evidence indicates that club wheat was probably more frequent than the others.

Barley

There is no evidence for the cultivation of barley in a Horgen context.

Barley occurs at the Michelsberg site of Thayngen-Weier where the six-rowed variety has been identified (see Table No. 102). Its proportion of the carbonised remains is not known, but it is more frequent than wheat amongst the cereal pollen (see Analysis 10, Guyan 1955). Barley also occurs at another two neolithic sites (see Table No. 102).

Six-rowed barley was cultivated during the Michelsberg culture, and some form of barley was probably present at sites of the Horgen culture, but none has yet been identified.

Millet

Italian millet occurs in a Horgen context at Murtensee and broomcorn is known from the Michelsberg site of Thayngen-Weier (Netolitsky 1930; Baer 1959). There are a further two instances of Italian millet, three of broomcorn and two of one or other, at the six other Neolithic sites (see Table No. 102).
Flax

Flax has been identified at seven sites (see Table No. 102). It is known from the type site of the Horgen culture as well as Utoquai (Neuweiler 1930) and Zug (Neuweiler 1905) and at both Obermeilen (Neuweiler 1946) and Thayngen-Weier (Baer 1959; Guyan 1955) in a Michelsberg context. A collection of seeds were found at the last site and identified as *Linum usitatissimum* by Helbaek.

Flax was present amongst the cultivated plants of both cultures as would be expected.

Poppy & Legumes

Poppy seeds have been found at five of the sites considered, and there are three instances of peas, one from the Horgen site of Utoquai (Neuweiler 1930), another from the Michelsberg site of Thayngen-Weier (Baer 1959; Guyan 1955) and the last from Wangen (Neuweiler 1905).

Summary

The economy of the Michelsberg culture was based upon cattle breeding whereas that of the Horgen culture was centred on pig breeding. The turbary breed is the dominant form in all four domestic animals. Wheat, millet, flax and peas were cultivated during the Horgen culture and einkorn, emmer, club wheat, barley, millet, flax and peas during the Michelsberg culture.
9. - ITALIAN NEOLITHIC

The Molfetta, Bocca Quadrata and Lagozza cultures are considered in this section. The majority of sites, however, are of unknown cultural groups. This is chiefly due to the reports of the late 19th and early 20th centuries which described the sites as 'neolithic'.

The Molfetta culture is characterised by red burnished pottery with lightly incised rectilinear patterns. Occasionally it is lighter in colour with red or red and black designs. Black vessels reminiscent of the late neolithic in Greece also occur. The settlements consist of several houses and pasture land within ditched enclosures. This culture is found in Apulia, around 3200 – 2900.

The Bocca Quadrata culture, as its name suggests, is characterised by square-mouthed pots and is found in northern Italy. One site has a carbon 14 date of as early as 3950 – 3800, which is about five hundred years earlier than would be expected.

The Lagozza pottery is similar to that of Cortaillod but is better made and has a more sharply carinated shoulder. This culture occurs in northern Italy around 2900 – 2700. Microlithic elements occur in the stone industry indicating mesolithic survival.

The proportion of wild animals relative to the domestic stock is unknown in all cases. Bones of red and roe deer, elk, aurochs, bison, pig, horse, donkey, fox, wolf, cat, lynx, badger, beaver, otter, marmot, hyena, hare, porcupine, bear and birds have been identified (see Table No. 103). The bones of donkey are attributed to Equus Asinus cfr. hydruntinus/
hydruntinus and have also been found at various other neolithic sites.

**Domestic Animals**

**Cattle**

Cattle occur at the Molfetta culture sites of Murgeccbia (Ridola 1925) and Monte dell'Uccellina (Rellini 1942). They are known to be more frequent than pig at the last site, but their relationship to ovicaprids is not known. There was no indication of domestic cattle amongst the badly preserved remains of the Bocca Quadrata and Lagozza cultures at Arene Candide (see Table No. 104).

Cattle have been identified at a further 26 neolithic sites (see Table No. 104). Out of these the turbary cattle are known from nine sites (Calerno, Campeggine, Capanne del M. Loffa, Caverna di S. Angelo, Caverna Focala, Covolo dell'Orso, Molina alle Scalucce, Reggiano and Vibrata) and the large form of cattle from seven sites (Albinea, Campeggine, Caverna Focala, Grotta dell'Alca, Molina alle Scalucce, Reggiano and Vibrata). As is seen they occur together at five sites. The domestic cattle at Vibrata are known to be more important than any other of the domestic animals (Strobel 1886).

Two breeds of cattle were known during the Italian neolithic and are a common feature at most sites. Cattle are known to have been domesticated during the Molfetta culture, but the type is not known.

Ovicaprids/
Ovicaprids

Sheep occur at the Molfetta culture sites of Murgecchia (Ridola 1925) and Timone (Ridola 1925) and ovicaprids occur more frequently than pigs at Monte dell'Uccellina (Rellini 1942). Their relationship to cattle is not known.

Sheep and possibly goats are known from the Bocca Quadrata levels at Arene Candide, and ovicaprids are also represented in the Lagozza levels at this site (Brea 1946).

There are twenty further instances of ovicaprids at neolithic sites (see Table No. 104). Very small sheep are recorded at Caverna di Pipistrelli (Almagro 1955), and turbary sheep and perhaps a larger type are reported at Reggiano (Strobel 1877). Goats are thought to be more frequent than sheep at this site. Bones of a wild goat are said to be present at Vayes which could imply the presence of Capra aegagrus, which is known from other neolithic sites and would represent a goat that was very similar in appearance to the wild ancestor (Peet 1909).

Sheep and possibly goats were bred during the Molfetta, Bocca Quadrata and Lagozza cultures in Italy. They also occur at the majority of other neolithic sites mentioned. The turbary sheep were present and there is a possibility of both larger and smaller animals as well. At least one of the goats is thought to resemble its wild counterpart very closely.

Pig

Domestic pigs are known at Murgecchia (Ridola 1925), Timone (Ridola 1925)/
1925) and Monte dell’Uccellina (Rellini 1942) in a Molfetta context. The large *scrofa* domestic pig is known from the first two sites. A few fragmentary remains were found in the Bocca Quadrata levels at Arene Candide, but no racial identification was possible, (Brea 1946).

Pigs also occur at a further eighteen sites (see Table No. 104). Many bones of this animal are recorded at Alba (Pigorini 1893), and both large and small pigs are known at Campeggine (Strobel 1877) and Reggiano (Strobel 1877). The large pig is known at two other sites (Capanne del M. Loffa and Vibrata) and the turbary pig from another four sites (Caverna di S. Angelo, Covolo dell’Orso, Molina alle Scalucce and Vaio Campostrini). Pigs were the second most frequent animal at Vibrata but only a large animal appeared to be present (Strobel 1886).

Pigs are present at the majority of sites mentioned, with the turbary breed more frequent than the larger breed. They are known to have been domesticated in the Molfetta and Bocca Quadrata cultures.

**Dog**

Dogs are present at the Molfetta sites of Timone and Setti Ponti (Ridola 1925), and some teeth were recovered from the Bocca Quadrata levels of Arene Candide (Brea 1946). Hauck (1950) also identified *Canis f. intermedius* at this site, but it is not known from which levels this dog originates.

Of the remaining seven instances of dogs (see Table No. 104), the turbary dog is known from Molina alle Scalucce (Strobel 1890), Servirola (Hauck/
(Hauck 1950) and Mariere (Hauck 1950) and a larger animal is said to be present at Marghotto (Hauck 1950).

The turbary dog was bred during the neolithic period, and a larger breed of dog may also have been present.

Cultivated Plants

There is very little evidence for the cultivation of plants during the neolithic period in Italy. Wheat in the form of bread wheat and spelt is known from Capanne del M. Loffa (Coiran 1889), and millet occurs at Cascale (Neuweiler 1905). Seeds of lentils were also identified at M. Loffa. It is probable that other species of wheat were cultivated and also that barley was present.

Summary

Both large and small cattle, ovicaprids, large and small pigs and dogs were being bred at this stage in Italy. As well as turbary sheep there is a possibility of a larger and smaller type being present, and amongst the goat remains are bones of a large animal similar to the wild prototype. There is only a little evidence for plant cultivation, but wheat and probably millet were being cultivated.
10. - CHASSEY-CHALAIN

This culture is found in most fertile regions in France between 3400 and 2300. The pottery is reminiscent of the Cortaillod ware of Switzerland, with simple round-bottomed pots, but these sometimes bear hatched rectilinear patterns unlike their Swiss counterparts. Vase supports are also characteristic and other pot forms include the flat plate as found in the Michelsberg culture, and pots with perforated lugs.

Mesolithic connections are visible in the stone industry and amber and arc-shaped pendants are found at some late sites. The settlements take the form of fortified camps, often on hilltops, and the inhabitants lived in irregular oval huts. The dead were usually buried within the enclosures.

Red and roe deer, aurochs, pig, horse, donkey, wolf, marten, fox, bear, badger, cat, lynx, hedgehog, rabbit, hare, mouse, birds and fish have all been identified, but hunting does not appear to have been of much importance to the economy (see Table No. 105).

**Domestic Animals**

**Cattle**

Cattle are present at a minimum of 18 of the 22 sites considered (see Table No. 106). Small cattle are recorded at Biard (Burnez 1957), Mas d'Azil (Pequart 1941) and Unang (Paccard 1952), both large and small animals are present at Catenoy (Piggott, personal communication) and large at Montes Gassicourt (Piggott, personal communication).
A considerable quantity of bones has been found at Châteauneuf-Les-Martigues (Ducos 1958) and St. Benoit (Audras 1955), and in both instances cattle are only of secondary importance to the economy (see Figs. 78, 81 & Tables Nos. 15 & 109). Most of these remains were uncharacteristic, but the small turbary cattle have been identified, and there is also an indication of a more powerful race. The reports of La Madeleine (Barral 1960) and L'Abri d'Eglise (Paccard 1957) are incomplete, but small ruminants or sheep are thought to dominate the economy rather than cattle.

The sites of Chassey (Perrault 1870), Fort Harrouard (Piggott, personal communication; see Fig. 79 & Table No. 107), Génissait (Sauter 1960; see Fig. 80 & Table No. 108), Lumbres (Prevost 1958), Nermont (Ficatier 1885) and Roucadour (Ducos 1957) all illustrate the fact that cattle were of great importance to the economy. Two sizes of cattle have been noted at Fort Harrouard, the smaller being more frequent in the lower neolithic levels. All cattle from Génissait have been assigned to the turbary breed. Both primigenius and brachyceros domestic cattle are well represented at Roucadour, and the smaller of the two is again slightly more frequent. Ducos (1957) made some dispersion diagrams for astraglae and for the first and second phalanx, plotting the length of the bone against the transverse diameter. On the resultant graphs three areas of maximum density are visible. The one nearest the origin represents turbary cattle, the one furthest away the large domestic cattle, and an intermediate form is also seen to be present. The age distribution shows that most animals were killed whilst they were still young, although some were/
were allowed to live to a relatively old age.

There are two independent strains in the economy of the Chassey-Chalain culture. The first which includes the majority of sites was based upon cattle breeding, and in the other, which is confined to southern France, cattle are only of secondary importance. Both large and small animals are known and the turbary cattle are generally more frequent.

**Ovicaprida**

Sheep or goat are known from twelve, possibly fourteen sites (see Table No. 106). Small ruminants are said to be present at both Grotte du Pertus II (Iaworsky 1960) and La Madeleine (Barral 1960), and they are the predominant feature amongst the bones recovered from the last site. Both sheep and goat occur at Peu Richard (Piggott, personal communication) and Recoux (Piggott, personal communication), and goat has been identified at Mas d'Azil (Pequart 1941).

The sites of Châteauneuf-Les-Martigues (Ducos 1958) and St. Benoit (Audras 1955) had their economies centred upon sheep breeding. They formed about three-quarters of the domestic stock and are mostly within the range of turbary sheep (see Figs. 78, 81 & Tables Nos. 15, 109). A few goats were also found. The age variation at Châteauneuf shows that most animals were killed before they reached two years. At St. Benoit on the other hand many more remains of young animals were recovered. The bones of sheep and goat at L'Abri d'Église are also said to be abundant, but/
but the exact proportions are not known (Paccard 1957).

The remainder of the sites indicate that ovicaprids are only of secondary importance to the economy. They are less frequent than both cattle and pigs at Chassey (Perault 1870; Piggott 1954a) and Fort Harrouard (Piggott, personal communication; see Fig. 79 & Table No. 107) and less frequent than cattle alone at Génissait (Sauter 1960; see Fig. 80 & Table No. 108). It is not known whether they were more or less important than pigs at Lumbres (Prevost 1958) and Nermont (Piggott, personal communication). The position of the sheep and goats at Roucadour (B) is uncertain since it is not known if the pigs were domesticated. However, they are considerably less important than cattle (Ducos 1957; Table No. 28). The sheep is thought again to be of the turbary breed, although this cannot be established with certainty.

The sites in this section are divided into two groups. One is confined to southern France, and had its economy based upon sheep breeding, and the other covers the rest of France and ovicaprids were only of secondary importance to the economy.

**pig**

The domestic pig is present at eight sites, and may occur at a further three (see Table No. 106). Pigs are thought to be completely absent as a domestic animal at Châteauneuf. All bones recovered are considerably larger than those of turbary pig, so Ducos (1958) concludes that they are probably of wild animals. It is not known if the pigs from St. Benoit are of wild or domestic origin, but either way they form only a small/
small percentage of the osteological remains (see Fig. 81, Table No. 109).

Pigs are slightly more frequent than ovicaprids although much less so than cattle at Fort Harrouard (Piggott, personal communication; see Fig. 79 & Table No. 107) and Chassey (Perrault 1870). They are the second most frequent of the animals identified at Génissait where the turbary breed has been distinguished (Sauter 1950; see Fig. 80 & Table No. 108). Pigs are also less important than cattle at Lumbres (Prevost 1958), and it is not known whether the remains from Roucadour are of domestic or wild animals (Ducos 1957).

Pigs are not of much importance to the economy of the Chassey-Chalain culture. There is no definite instance of them in their domestic state in the area of southern France in which sheep were dominant, and they are of secondary importance elsewhere.

Dog

There are eight instances of dogs in a Chassey-Chalain context (see Table No. 106). Nothing is known of the breeds represented at Fort Harrouard (Piggott, personal communication; see Fig. 79 & Table No. 107), Lumbres (Prevost 1958), La Madeleine (Barral 1960) and Recoux (Piggott, personal communication), but the turbary breed is thought to be present at Châteauneuf (Ducos 1958), and one bone found at Génissait has also been attributed to this species (Sauter 1960; see Fig. 80 & Table No. 108). At Roucadour again a good measure of agreement is found between the canine remains and those characteristic of the turbary dog (Ducos 1957; Table No. 28). However/
However it is not known from which levels this dog originates. Several bones were recovered at St. Benoit and all are indicative of small and medium-sized animals, which again probably implies the presence of the turbary breed (Audras 1955; see Fig. 81, Table No. 109).

The dogs from Chalain and Clairvaux have been examined by Hue (1906) and his general conclusion is that the dogs of both sites can be related to Canis f. palustris. There were, however, some slight variations from this breed and Hue has named them Canis f. Le Mirei and Canis f. Girardotii. The first is characterised by a longer but well proportioned skull of basal length 158 mm. and the second is regarded as a further development of Canis Le Mirei and has a skull of basal length 159 mm. A single skull of each of these dogs was found, and in addition there were thirteen other skulls which are attributed to turbary or turbary-like animals. Hue regards both of his new species as having evolved from the turbary dog. On the whole these skulls were well preserved and are thought not to have served as a source of food.

Cultivated Plants

Wheat

Both einkorn and emmer are known from the sites of Chalain (Neuweiler 1905) and Génissait (Sauter 1960). The relative frequencies of these wheats is not known at Chalain, but emmer is the more important of the two at Génissait.

There are also two instances of bread wheat (see Table No. 110). It occurs/
occurs at Chassey (Gillot 1907) and Trou Arnaud (Coquillat 1956). The grain from the last site was divided into three categories on the basis of size, and the small and medium classes have been assigned to bread wheat. This accounts for about nine-tenths of the total quantity of grain at the site. The only wheat with which the large grain bore comparison was spelt, and so Coquillat concludes that most of the crop consisted of bread wheat, with a small proportion of spelt present. There was also a possibility of a few grains of emmer, but this could not be established with certainty. Spelt has also been identified at Génissait (Sauter 1960).

There are also two possible and one definite instances of an unspecified type of wheat in this context (see Table No. 110).

Einkorn, emmer, bread wheat and spelt were all cultivated at this time. At one site emmer is the most common wheat, and at another it is bread wheat. Both einkorn and spelt are known in small quantities only.

Barley

Barley occurs at three or four of the sites mentioned (see Table No. 110), but it is only at Chalain that the species has been identified. Neuweiler (1905) was able to detect a few grains of six-rowed barley amongst a larger quantity of indeterminate barley. Its proportion relative to wheat is unknown.

Millet

There is only a single instance of millet (see Table No. 110).

Panicum/
Panicum miliaceum was easily recognisable amongst the grain found at Chassey (Gillot 1907).

Flax

Remains of cultivated flax have been found at both Chalain (Neuweiler 1905) and Chassey (Gillot 1907). Nothing further is known about these finds.

Poppy & Legume

There is only one occurrence of both of these plants (see Table No. 110). Poppy seeds have been found at Chalain but there is no mention of them elsewhere, and the bean (Vicia faba v. celtica nana) is known at Pinacle in Jersey (Neuweiler 1935).

Summary

The majority of sites of the Chassey-Chalain culture practiced an economy which was based upon cattle breeding, but in southern France there was an area where the communities continued to be sheep farmers as they were in the preceding Neolithic period. The implication is that there was a long tradition of sheep farming in this neighbourhood which did not change with the introduction of a new style of pottery. Wheat was the main crop with emmer and bread wheat its chief constituents, and einkorn, spelt, barley, millet, flax, poppy and legumes are also known.
11. - FRENCH NEOLITHIC

The Lagozaza, Michelsberg and Horgen/S.O.M. cultures are included in this section. The characteristics for the first two are as described in the Swiss and Italian Neolithic sections. The S.O.M. culture originated in the district around the Seine-Oise-Marne rivers in northern and central France between 2500 and 2100. It is essentially an adaptation of the Megalithic 'religion' to the chalk downs of this area. The grave goods include Horgen pottery, a Neolithic stone industry with arc pendants, bone, shell, beads of amber and a few copper finds. Trepanned skulls also occur.

The frequency of wild animals varied, forming up to three-fifths of the osteological remains in one instance. Red and roe deer, pig, horse, fox, wolf, rabbit, hare and birds have been identified (see Table No. 111).

Domestic Animals

Cattle

Cattle occur at three sites in a Lagozaza context (see Table No. 112). Both the brachyceros and primigenius cattle have been identified at Châteauneuf-Les-Martigues (Ducos 1958), and the brachyceros cattle form three-quarters of the domestic fauna at Unang (Faccard 1952). Nothing is known about the cattle found at Gaude (Coquillat 1956).

Cattle are thought to be present at the Michelsberg site of Kertzfeld where they are the only domestic animal mentioned (Stieber 1956).

Large and small domestic cattle are present in about equal numbers in/
in the Horgen/S.O.M. levels of Roucadour and they are more frequent than any other animal (Ducos 1957; Table No. 28). An analysis of the age groups shows that most animals were killed before they reached 2½ years.

Nothing is known of the cattle from Mauvelle (Escalon de Fonton 1956) and Pas de Clavel (Veyrier 1949) other than that they are of Neolithic date.

Cattle are present at Lagozza, Michelsberg and Horgen/S.O.M. sites, and in some instances they are the most important domestic animal. Both turbary and primigenius animals are well represented.

**Ovicaprids**

Ovicaprids occur in a Lagozza context at Châteauneuf-Les-Martigues (Ducos 1958), Gaude (Coquillat 1956) and Unang (Paccard 1952). The turbary sheep accounts for over three-quarters of the domestic stock at Châteauneuf, where the only other domestic animal was cattle (see Table No. 15), and most of these animals were killed between 3 and 24 months. At Unang on the other hand ovicaprids are the second most frequent animal and form only a quarter of the stock. Goats are known to be present at Gaude.

Only a very few sheep bones have been identified at Roucadour, where the turbary sheep is present in the Horgen/S.O.M. levels (Ducos 1957; Table No. 28). Sheep occur in the dolmens of Devezas (Millau 1958) and Sotch de la Gardie (Durand-Tullon 1958) and there are a further four instances of ovicaprids at neolithic sites (see Table No. 112).

The breeding of ovicaprids varied in importance in the different areas in/
in France. In the south near Châteauneuf-Les-Martigues they continue to be the basis of the economy as they were in the earlier neolithic period, but elsewhere they are considerably less important.

**Pig**

Domestic pigs are known from the Lagozza levels at Unang where they are the least frequent of the domestic animals. The pigs at Châteauneuf are thought to be wild and their status at Roucadour is not known (Ducos 1957; see Table No. 15). If they are in fact domesticated they are the second most common animal.

A single bone of pig was found at the other three sites (see Table No. 112).

In general pigs do not appear to have been of great important to the French neolithic economy.

**Dog**

There are no known instances of dogs during this period. Bones of dogs have been found at Roucadour, but it is not known from which level they originate. They represent a turbarly-sized animal (Ducos 1957).

**Horse**

There is no definite evidence for horse domestication during this period. There is, however, a possibility of domestication at Roucadour (Ducos 1957; see Table No. 28). The proportion of horse bones increases suddenly/
suddenly from a twenty-fifth to a quarter of the osteological remains
during the Horgen/S.O.M. culture, and half of the animals found were under
four years in age. There is no explanation of this sudden change and
Ducos thinks that these are still probably wild horses. However, their
increased numbers and abundance of young animals supports Lundholm's theory
that horses were being domesticated at the end of the neolithic period.

Cultivated Plants

There is very little evidence for plant cultivation. Wheat occurs
in a Horgen context at Perte du Cros where emmer and club wheat were found
and grains of naked barley were found at the same site (Galan & Arnal 1956).
Millet in the form of Panicum miliaceum occurs at this site and in the
neolithic at Lac de Bourget (Neuweiler 1905). Peas and lentils have been
identified at Perte du Cros, and beans are known at Lac de Bourget.

Summary

The breeding of cattle, ovicaprids and pig continued during the
French neolithic period, and in southern France where there was a long
tradition of sheep farming this animal continued to be dominant, whereas
to the north cattle were more important. There is also a possibility of
horse domestication in a late Horgen/S.O.M. context. Emmer, club wheat,
barley, millet and legumes were cultivated during the Horgen culture.
The T.R.B. or Trichterandbecher culture occurs on the north European plain in Poland, Germany and Scandinavia. It is placed between 3000 and 2500, and is divided into three phases, A, B and C, of which C is ancestral to the Scandinavian Middle Neolithic.

The main type of pot is the funnel beaker, but amphorae and flat clay discs or baking plates are also common. During phases B and C the necks of the funnel beakers become longer and collared flasks appear. Pots of phase B may have cord impressions beneath the rim and are round bottomed, and during phase C the pots are more fully decorated, with pits, ribs and cord impressions employed to form vertical patterns.

The stone industry includes thin butted polished axes and polygonal battle axes together with mesolithic flake axes. The blade industry is inferior to that of the Ertebølle culture. Amber occurs in this context and copper imports occur rarely in phase C. Many burials of this last phase have been found. These occur in Megalithic dolmens, usually composed of four upright stones and a single large capstone, and are large enough for one extended burial (about 6'6" by 3'). Phase C is sometimes referred to as the 'dolmen' period.

Late offshoots of this culture are also considered here. These are the Walterhienburg-Bernburg and Salzmünder groups. The second developed out of the TRB culture in the Lower Saale and Havelland area and led to the evolution of the first. The pottery is more angular than that of TRB itself, and burials occur in pit graves and megalithic cists. The Dutch sites/
sites of Vlaardingen and Zandwerven are also included in this section as they have some TRB affinities.

Hunting was of marked importance to the economy, ranging from a twenty-fifth to a third of the osteological remains (see Tables Nos. 114 - 120). The animals identified include red and roe deer, aurochs, pig, bear, horse, badger, fox, beaver, otter, cat, marten, seal, polecat, birds and fish.

**Domestic Animals**

**Cattle**

Cattle have been identified at 32 of the 39 sites considered (see Table No. 114), and are seen to be the chief domestic animal at the Polish sites of Ėmielow (Krysiak 1950; see Fig. 82 & Table No. 115), Grodek (Krysiak 1956; see Fig. 83 & Table No. 116), Klementowice (Krysiak 1957; see Fig. 84 & Table No. 117) and Ustowie (Kubaswiecz 1958; see Fig. 85 & Table No. 118). On average they account for well over half of the domestic stock, and the animals from the first three sites seem to be exclusively primigenius in character. The majority of animals at Ustowie are also of this type but there are a few remains that indicate the presence of smaller turbary-like cattle. One of the facts to arise out of the osteological examination of material from Ėmielow was the presence of oxen. This was confirmed by several bones from later excavations at this site, and oxen were again detected at Grodek and probably at Klementowice. There is no mention of castrated animals at Ustowie.
The breed of cattle at most of the German sites is unknown. At Fuchsberg-Sudensee in Schleswig-Holstein (Nobis 1962) and Weissenfels on the Saale (Behrens 1958) however, many bones were found and revealed the type of animals that were being bred. At both sites cattle are by far the most frequent animal, forming about four-fifths of the stock (see Figs. 86 & 87 & Tables Nos. 119 & 120). Cattle at the first site are large in size and are clearly descended from the aurochs, with many examples of animals that could be either wild or domesticated. Nobis raises the possibility of local domestication which seems highly probable from the evidence supplied. An extremely large quantity of bones were identified at Weissenfels, and the general impression is that the stock was basically *primigenius*, with a few *brachyceros* characteristics appearing occasionally. Most animals were killed when they were young adults, and had fairly powerful horns. There are several instances of castrated cattle. In one area alone nineteen skulls of cattle were found, most of which were without the lower jaw, and three of which had damaged foreheads. It is thought that this damage could have been the cause of death. Remains of cattle are also often associated with human burials at this site. The skeleton of a 7 - 8 year old child had some cattle bones nearby, as did that of a 40 - 50 year old man, where the remains include horn cores. Various bones were also associated with the burial of a 5 - 6 year old child. The same economy as has been observed at this site is also said to be present at the TRB sites of Braunsdorf, Wallendorf and Salzmunder (Behrens 1958).
Turbary cattle have been identified at the cemeteries of Rheingewann and Schwabsburg (Schotensach 1908) and six cattle were found at Gehofen together with six human skeletons, three goats, three pigs, seven dogs and a horse (Behrens 1953). Amongst the finds of the Salzmunder variant of this culture at Halle-Wöttlich were two skulls of polled or hornless cattle (Müller 1963). The skulls are slightly narrower than those of the horned cattle at this site, and bone-like 'warts' 5 cm. in height were found where the horns should be. This is probably the earliest find of its kind, with other instances known at Zota and Usatovo. The majority of cattle had average length horns, but there was one instance of an animal with very small and weak horn cores.

Cattle burials occur in a Walternienburg-Bernberg context at the sites of Biendorf (Schwarz 1950) and Tangermünde (Sprockhoff 1938). The first consists of the skeletons of a mother, child and two cattle and the second has cattle bones associated with human and red deer bones and doubtful bones of horse.

The dominant feature in the economy of the Dutch site of Heklingen is again cattle breeding (Moddermann 1959). The cattle have been divided into two groups, the first is thought to be probably composed of wild animals, and the second represents turbary cattle. Cattle are also present at Vlaardingen (Glasenberg 1961) and Zandwerven (Regtersch 1958). The possibility of local aurochs domestication is raised by the finds from Heklingen.

Various/
Various finds of animal bones associated with TRB pottery have been made in Danish bogs. At Gammellung three skulls of cattle were found, one with the frontal portion smashed in (Becker 1947) and pollen analysis by Iversen confirmed their association with this culture. Another ox skull with the frontal bone smashed was found at Jordløse (Becker 1947) and part of a scapula with a pot was discovered at Hundssøen (Becker 1952). A small platform made from twigs and branches and supported by vertical piles was found at Salpestermøsen. On this platform were bones of cattle and sheep, a TRB beaker and axes of flint, greenstone and slate (Becker 1947). These bones had been split open, and the site is situated six metres from firm ground.

The settlement site of Havnelev revealed many bones, of which the majority could be attributed to cattle. The animals varied a lot in size and both the primigenius and brachyceros cattle are clearly represented. Nearly all the bones found at Ørnekul have been attributed to cattle by Degerbøl (Becker 1952), and these animals have again been identified at Ørting and Østrup (Becker 1952).

The economy of the TRB culture was based upon cattle breeding, which accounted for between a half and three-quarters of the domestic stock. Large animals predominate, but a few turbary cattle and hornless cattle have also been noted. Castration was practised at several sites.

Ovicaprids

Sheep or goat have been identified at 20 of the 39 sites mentioned (see/
Ovicaprids were less important than cattle and pigs at Ómielow (Krysiak 1950; see Fig. 82 & Table No. 115), Grodek (Krysiak 1956; see Fig. 83 & Table No. 116), Klementowice (Krysiak 1957; see Fig. 84 & Table No. 117) and Ustowie (Kubaswiecz 1958; see Fig. 85 & Table No. 118). In general they are about half as frequent as pigs. Two types of goat are reported from Ómielow. The first is *Capra prisca* with drill-like horns and the second has scimitar-shaped horns and is said to resemble *Capra aegagrus*. The better preserved bones of sheep indicate the presence of the turbary breed, *Ovis aries palustris*. Both sheep and goat were found at Grodek and Ustowie, sheep being dominant at the first site, but only sheep could be distinguished at Klementowice.

Only goat is known with certainty from Fuchsberg-Sudensee (Nobis 1962). Ovicaprids are again less numerous than cattle and pigs, and over half of these remains are known to originate from goats (see Fig. 86 & Table No. 119). The proportion of sheep and goat at Weissenfels is again very small (Behrens 1958; see Fig. 87 & Table No. 120). Together with pigs they account for only a tenth of the domestic stock, and hornless turbary sheep and large scimitar-horned goats have been identified. A similar economy is thought to exist at Braunsdorf, Wallendorf and Salzmunder (Behrens 1958).

Ovicaprids are also known in a Salzmunder context at Halle-Motslich (Müller 1963), where sheep have been identified, and in a Baalberg context at Ammendorf (Grimm 1938) and Ichstedt (Schmidt 1961). In none of these cases were their bones found in large numbers.
Sheep or goat have been identified at five Danish sites, including the bog sites of Gammellung and Salpetermøsen (Becker 1947). At the first site remains of a sheep were found together with three oxen, a pig, birds and a child's skull and at the second site bones of a lamb were associated with cattle, axes and pottery. At Havnelev sheep were identified as belonging to the turbary breed, and they are less numerous than cattle (Mathiassen 1940). No evidence for the presence of goats was found. Sheep are also known to be present at Øgaard (Mathiassen 1943) and Ørnekul (Becker 1952) and both sheep and goat are known from the Swedish site of Mollehusen (Forssander 1941).

Both sheep and goat were bred in small quantities by the TRB farmers. They are less important numerically than both cattle and pigs, and turbary sheep and at least two types of goat, both descended from the bezoar goat, were bred.

Pigs

Pigs are known to have been bred at 15 or 17 of the 39 sites considered (see Table No. 114).

Pigs are considerably less important than cattle at the four Polish sites of Ómiolew (Krysiak 1950; see Fig. 82 & Table No. 115), Grodek (Krysiak 1956; see Fig. 83 & Table No. 116), Klementowice (Krysiak 1957; see Fig. 84 & Table No. 117) and Ustowie (Kubaswiecz 1958; see Fig. 85 & Table No. 118). At all sites it is the large form of the domestic pig that is present and at Ómiolew in particular much similarity to the indigenous wild population is apparent. Apart from Klementowice where many bones of pig/
pig belonged to one animal, pigs are two to three times as common as ovicaprids. Bones of pig were found at the Czechoslovakian site of Štolmir, but it is not known whether these originate from a wild or domestic animal (Šneidrůva 1955).

A large variation in the size of pigs is seen at the German site of Fuchsberg-Sudensee. Some animals are very similar to the local wild pigs whereas others are seen to be much smaller (Nobis 1962). They are the second most frequent animal, and are about a fifth as numerous as cattle (see Fig. 86 & Table No. 119). A few bones of pig are also reported from Weissenfels where together with sheep and goat they account for a tenth of the domestic stock, (Behrens 1953; see Fig. 87 & Table No. 120). On the whole they appear to be extremely close in character to the local wild pigs. The economy of Braunsdorf, Salzmunder and Wallendorf is similar (Behrens 1953) and Gandert (1930) also reports that the pigs found at Braunsdorf are of a purely scrofa form.

Three pigs were found at Gehofen during Spengler's excavations (Behrens 1953) together with other domestic animals, and from Schwabsburg comes the only definite report of turbary pigs in a TRB context (Schotensach 1908).

No remains survive at any of the three Dutch sites, but pigs have been identified at the three Danish sites of Gammellung, Havnelev and Ørnekul. At the bog site of Gammellung, Becker (1947) reports bones of pig together with those of cattle and sheep. Pigs were less frequent than cattle at Havnelev and are probably of the large form (Mathiassen 1940). Pigs/
Pigs also occur at the Swedish site of Mollehusen (Forssander 1941).

Pigs were fairly common as domestic animals during the TRB culture and usually come between cattle and ovicaprids in importance. Nearly all animals are attributable to the *Sus scrofa* pig and related to the indigenous wild animals, and there is only a single instance of the *Turbary pig*. Local domestication must have been practised in many areas.

**Dog**

Dogs have been found at 17 or 18 of the 39 sites mentioned (see Table No. 114). They are present in small numbers at the Polish sites of Ćmielow (Krysiak 1950; see Fig. 82 & Table No. 115), Grodek (Krysiak 1956; see Fig. 83 & Table No. 116) and Ustowie (Kubasiewicz 1958; see Fig. 85 & Table No. 118). The turbary breed is known to be present at Ćmielow. Most of these bones were burnt and split, and the state of the cranial remains suggests that the brains may have been extracted at both Ćmielow and Grodek. The absence of dogs at Klementowice is notable.

A medium-sized turbary dog is again present at Fuchsberg-Sudensee and in addition the miniature dog *Canis f. spaletti* has been identified (Nobis 1962; see Fig. 86 & Table No. 119). Many bones of dog were found at Weissenfels and often complete skeletons occur (Behrens 1953; see Fig. 87 & Table No. 120). They represent a tenth of all osteological remains, and all dogs appear to be of the same breed, namely *Canis f. palustris ladogensis*. The majority of the remains come from the same area as the large quantity of cattle skulls, and some are associated with the same burials/
burials as were cattle, namely that of a 7 to 8 year old child, a 40 to 50 year old man and another child of 5 to 6 years. In all some twenty dogs are represented of which nine are more or less complete skeletons.

Turbary dogs are also present at Rheingewann (Schotensach 1908) and Schwabsburg (Schotensach 1908), and a larger dog thought to be Canis f. inostranzewi is also present at the last site. Seven complete dogs' skeletons are also known from the cemetery at Gehofen together with human and other animal skeletons (Behrens 1953). The dog is also known from Braunsdorf (Gandert 1930), Halle-Mützlich (Muller 1963), Latdorp (Niklausson 1925) and Plotha (Schmidt 1963).

There is a possibility of dog being present at the Dutch site of Vlaardingen (Glasbergen 1961), but none are known from the Danish sites. A few bones are reported from Møllehusen in Sweden (Forssander 1941).

A relatively uniform breed of dog is known throughout the whole area of the TRB culture. This is Canis f. palustris and the larger version of this dog Canis f. palustris ladogensis. Very occasionally larger and smaller dogs are noted.

Horse

The horse is generally thought to have been hunted in this context, but there is one claim for definite domestication. This occurs at the Polish site of Ustowie (Kubasiewicz 1958). Fragments of the cranium as well as teeth show that this horse was of a relative large domestic form, and no bones of wild horses are recorded. The horses from Ćmielow (Krysiak 1950/
1950; see Table No. 115) and Grodek (Kryziak 1956; see Table No. 116) are assigned to small, wild tarpan-like animals, Equus caballus gmoline.

The horse represented at Fuchsberg-Sudensee is known to be wild (Nobis 1962) but Behrens (1953) could not decide whether the remains at Weissenfels were of wild or domestic animals. Horse burials are reported from Tangermünde (Sprokhoff 1938) and Calbe (Niklausson 1925) in the context of the Walternienburg-Bernburg culture, but Behrens (1962, 1964) thinks that it is more likely that these horse skeletons are in fact cattle.

Cultivated Plants

Wheat

Several varieties of wheat are known in a TRB context, including einkorn, emmer, club wheat, bread wheat and spelt. The cultivation of einkorn and emmer is considered first.

There are nine certain instances of einkorn cultivation and eleven of emmer cultivation amongst the 26 sites considered (see Table No. 121). The Polish evidence comes from pottery impressions and nothing is known of the relative frequency of these two species. Einkorn occurs at Ksiąznica Wielkie (Klichowska 1952; 1959) and emmer is known from this site, Ćmielow (Klichowska 1959; Gimbutas 1956) and Złota (Burchardówna 1952).

Einkorn is known at Lietfeld and Schraplau in Germany, and emmer at Lietfeld, Derenburg and possibly Weissenfels. The remains from both Schraplau (Behrens 1952) and Derenburg (Schwarz 1950) are carbonised and no trace of other cereals was found. Some carbonised grain as well as impressions/
impressions were identified at Weissenfels and thought to be attributable to emmer (Behrens 1953). The largest quantity of grain was discovered at Lietfeld (Hopf 1957). Several thousand carbonised grains were involved, and the results show that einkorn was twice as frequent as emmer (see Table No. 122). Together these wheats form the essential part of the crops, with only a very small proportion of barley and other remains. In comparison with recent grain that from Lietfeld seems to have been a little shorter, but just as wide, and in some cases wider than modern grain.

Impressions of einkorn occur at Store Valby and possibly Havnelev in Denmark (Helbaek 1954; Mathiassen 1940). At the first site about 70 impressions of einkorn and emmer were found, but since they are so similar morphologically their relative quantities could not be determined. These remains were more frequent than those of club wheat or barley. Emmer also occurs at Barkaer (Helbaek 1954), Havnelev (Mathiassen 1940) and possibly Aamosen (Helbaek 1954). These finds are all imprints.

Impressions of einkorn have been identified at Limhamn (Hjelmqvist 1955), Linved (Hjelmqvist 1955), Mogetorp (Schiemann 1958), Østra Vra (Hjelmqvist 1955; Schiemann 1958), Oxie (Hjelmqvist 1955) and possibly Vatteryd (Hjelmqvist 1958) in Sweden. The date of the imprint from Limhamn has been disputed, but after careful examination of the pottery Becker placed it in period C of the TRB culture (Rydbeck 1928; Schiemann 1940; Becker 1947; Hjelmqvist 1955). Originally Rydbeck claimed it to be of mesolithic origin. Several characteristic impressions were found at Mogetorp, as well as some which were larger than is usual. Again there were/
were several instances in which einkorn and emmer could not be distinguished (Schiemann 1958).

Emmer occurs at Kogetorp (Schiemann 1958), Östra Vrå (Schiemann 1958; Hjelmqvist 1955), Toltorp (Schiemann 1958; Hjelmqvist 1955) and possibly at Oxie (Hjelmqvist 1955) and Vatteryd (Hjelmqvist 1958). Eleven characteristic impressions were found at the first site, which according to Schiemann are slightly smaller than those from Toltorp and Östra Vrå.

Club wheat is known from Ksiaznica Wielkie in Poland (Klichowska 1952; 1959), and at the Danish sites of Aamosen (Helbaek 1954), Store Valby (Helbaek 1954) and possibly Hovnevle (Mathiassen 1940). It is also present at Kogetorp in Sweden (Schiemann 1958). Club wheat is known to be less frequent than einkorn and emmer at Store Valby. The absence of this wheat at Lietfeld is particularly striking since such a vast quantity of material was identified. The rachis or axis of club wheat was much straighter than in modern European club wheat and as a result its length was considerably greater. This is illustrated by the finds from Store Valby. These impressions have also been compared with those from the Michelsberg levels at Thayngen-Weier and it was found that the latter were much closer to the modern wheat.

There is only one instance of the other naked wheat, bread wheat, which occurs at Ksiaznica Wielkie in Poland (Klichowska 1952; 1959), and two instances of spelt at this site and Zberzkow (Klichowska 1962).

From the above evidence it appears that einkorn and emmer were the main species of wheat to be cultivated, and at one site einkorn is known to/
to be the more frequent of the two. Club wheat, bread wheat and spelt have also been identified at TRB sites.

**Barley**

Barley has been identified at three sites in Poland, at least two in Germany, four in Denmark and seven in Sweden (see Table No. 121).

Klichowska (1962) reports multi-rowed barley at Pietrzykow and Gimbutas (1956) reports barley from Ėmielow and Ksiąznica Wielkie. There is a possibility of barley being cultivated at Hohlenstedt (Behrens 1955) and Salzmunder (Grimm 1938) in Germany, and it is definitely present at Lietfeld (Hopf 1958) and Weissenfels (Behrens 1953). A single impression of barley was identified at the last site by Rothmaler, but there did not appear to be any grains of carbonised barley amongst those of wheat.

Amongst the large quantity of grain preserved at Lietfeld a small amount of barley was identified. It represents approximately a fortieth of all the grain found (see Table No. 122). Both naked and glumed barley have been distinguished, and the first is assigned to the six-rowed variety and the second to the four-rowed variety.

Barley has been identified at all of the Danish sites mentioned. Of the seven impressions found at Aamosen, two were of naked barley (Helbaek 1954), and impressions of barley were also found at Barkaer (Helbaek 1954) and Havnelev (Mathiassen 1940). Naked barley was also detected at Store Valby, where the grain is described as being well developed, and it corresponds to the largest impressions found at Bundsø. The spike-type could/
could not be identified since no pales or internodes were found.

Hjelmqvist (1955; 1958) reports naked barley from Fredriksborg, Maglarp-Albacksborg, Østra Vrå, Oxie, Rosenlund-Hjulberg and Vatteryd. Again it is not known whether it is two, four or six-rowed barley that is present. At Mogetorp, Schiemann (1958) was able to identify 65 impressions and three ears of barley as opposed to only 24 identifications of wheat. Closer examination revealed the presence of naked barley, and the fact that at least some of the naked type was six-rowed. There were several cases in which it was uncertain as to whether the barley was naked or glumed, but these grains were always associated with naked barley. Indeed, there are no certain instances of glumed or four-rowed barley in Sweden during this period, despite the fact that the material has been thoroughly examined by Hjelmqvist.

Barley was of much greater importance in Scandinavia than in the remaining area of the TRB culture. The evidence indicated that it was negligible to the economy in Germany but that it was more frequent than wheat in both Denmark and Sweden. Both six-rowed naked barley and four-rowed glumed barley were cultivated, although only the former is known in Scandinavia.

Millet

There is only one instance of millet, and this occurs at the German site of Weissenfels. Netolitsky (1930) reports the presence of Panicum miliaceum, but no trace of this cereal was found during the more recent excavations.
excavations (Behrens 1953).

Flax

Flax is known from Ėmielow in Poland (Klichowska 1959; Gimbutas 1956) and Lietfeld in Germany (Hopf 1957). At the last site flax formed only a very small proportion of the remains, with barley two or three times as frequent as flax seeds. The absence of flax at the other sites is probably due to the small amount of plant remains that survive rather than its total absence, but it should be remembered that this is not the only oil-producing plant to be found in this area.

Summary

The economy of the TRB culture was based upon cattle breeding with pigs second and ovicaprida third. Cattle account for between a half and three-quarters of the livestock and were basically primigenius in character, with a few turbary animals only. The sheep and dogs are chiefly of the turbary breed, but large pigs and two types of goat have been identified. Einkorn and emmer were the main crop in Germany and Poland, with club wheat, bread wheat, spelt, barley, millet and flax also present. In Scandinavia, however, barley becomes the chief crop with the six-rowed naked variety the only type known with certainty. This is probably due to local climatic conditions.
13. Polish Neolithic

The cultural context of the finds considered in this section is unknown. Most of the sites have been definitely assigned to the neolithic period, and some probably belong to the TRB culture or to the Single Grave Complex.

Domestic Animals

Cattle

Cattle have been identified at eight sites (see Table No. 123). The neolithic date of the seven cattle skulls found at Gdansk has been questioned. Three of these are of the primigenius type and the other four belong to the brachyceros domestic cattle (Bokonyi & Kubaswiecz 1961). The skulls found at Krzeszowice and Famiatkowo are described by Admetz (1925) as belonging to wild brachyceros cattle, and primigenius cattle are recorded at Prosna (Bokonyi & Kubaswiecz 1961) and Włostow (Hilzheimer 1920). The breed of cattle at the remaining three sites is not known.

It is interesting to note that when Bokonyi and Kubaswiecz examined the Polish Neolithic material (including TRB and Corded Ware finds), they found certain differences between the contents of graves and of settlements. The remains from the first were chiefly of medium-sized animals whereas those cattle from settlements are much larger and closer to the aurochs in appearance.

Ovicaprids/
Cvicaprids

Sheep or goat have been found at four sites (see Table No. 123). Both sheep and goat are reported from the Maszycha cave and sheep alone is known from the Minchow cave (Hoernes 1903). Two further instances of goat are known as a result of the work of Admetz (1928). The neolithic date of both is questionable since the accompanying pottery was lost but Nieszabitowski thinks that the finds are genuine. The first is the skull of a female goat found at Wiechow in 1883, and the second is the skull of an adult male goat from Wyszkowce. This last animal is said to be a domesticated bezoar goat, but Admetz said that he could not decide whether the former find was of this species or Capra prisca, since the female horns were the same in both cases. However, it is now known that Capra prisca is just a variant of the ordinary domestic goat and so is also descended from the bezoar.

Pig

Bones of the domestic pig have been found in the caves of Maszycha and Mnikow (Hoernes 1903). Nothing further is known about these animals.

Dog

Hauck (1950) reports bones of dog from a cave near Krakow. Woldrich also examined these remains and identified four breeds, namely Canis f. intermedius, Canis f. matris optimae, Canis f. palustris and Canis f. mikii. The last mentioned is a new species determined by Woldrich. These are/
are all thought to be of neolithic origin, but this is by no means certain and no convincing evidence for this fact is given.

Cultivated Plants

Wheat

Einkorn has been identified at two sites, namely Ojców (Klichowska 1959) and Kozlowska (Netolitsky 1930), club wheat is known from Ojców (Klichowska 1959) and Kwieciszewo (Klichowska 1959), and bread wheat and spelt occur at Ojców (Klichowska 1959). Beyond the actual presence of these four types of wheat nothing is known about them.

Barley

Some form of multi-rowed barley is known to have been cultivated at Odolanow and Sierakowo (Burchardówna 1952). No other cereals were found at either of these sites.

Rye

There is a possibility of rye being present at Ojców (Klichowska 1959). This plant is also known from the Austrian neolithic and was probably present only as a weed in the wheat or barley fields.

Summary

Both large and small domestic cattle were being bred during the Polish neolithic/
neolithic, and sheep, goat, pigs and dog are also known. The relative quantities of these animals is unknown. Wheat in the form of einkorn, club wheat, bread wheat and spelt was cultivated, and barley was also present.
14. - L A T E R G E R M A N  N E O L I T H I C

The Rossen and Michelsberg cultures are considered, together with some sites of which the neolithic cultures are not known. The Rossen culture, placed between 3500 and 2900, originated in western Bohemia and Saxo-Thuringia and spread to Switzerland and eastern France. It evolved from the late phase of the Linear Pottery culture. The pots are usually round based, and bear rectilinear patterns reminiscent of basketry. Rings which serve as vase stands also occur. Stone arrow heads, mace heads are often found together with antler axes.

The Michelsberg culture in Germany may be considered to be slightly earlier than its Swiss counterpart, namely around 3100 to 2600. Its characteristics are described in the Swiss Neolithic section.

The wild fauna identified at sites includes red and roe deer, elk, aurochs, pig, bear, horse, donkey, badger, otter, marten, wild cat, lynx, wolf, fox, beaver, hedgehog, hare, turtle, fish and birds (see Table No. 124). Although no exact statistics are available, hunting appears to have been more important as a source of food than was domestication. The most common animal was red deer.

**Domestic Animals**

**Cattle**

The three instances of cattle in the Rossen culture occur at Heilbronn (), Nauendorf (Niquet 1937) and Regensburg-Kumpfmühl/
Kumpfmühl (Boessneck 1958). All the cattle bones from the last site belong to large domestic animals and it was often difficult to distinguish the wild from the domestic. Nothing is known of the cattle from the other sites and insufficient quantities of bones were found to determine the importance of cattle to the economy.

Cattle are known from seven of the eight Michelsberg sites that are considered (see Table No. 125). The large primigenius cattle are known at Ehrenstein, and although exact statistics are not given, it is known that cattle were less numerous than pigs at this site (Faret 1955). This breed together with turbary cattle were present at Unter-Grombach (Schotensach 1908). The turbary breed of cattle has been identified at Riedschachen (Reinerth 1929) but no further information is available from the remaining sites (Cannstatt, Goldberg, Hutberg and Vaihingen). It should be mentioned that the bones found at Hutberg may include some of the late TRB culture (Benesch 1941).

There are a further nineteen or twenty-one cases of domestic cattle at neolithic sites where the cultural connections are not known (see Table No. 125). At Berlin cattle are slightly less important than pigs to the economy (Nobis 1955; see Fig. 88 & Table No. 120) and two breeds of cattle have been distinguished at Einhornhöhe (Schotensach 1908). Of these the larger was the more frequent. The number of bones involved is not known, but the bones of sheep and goat were more frequent than those of cattle (see Fig. 89 & Table No. 126). Both large and small cattle are also recorded at Monsheim, Neuenheim and Osthofen (Schotensach 1908). Cattle were/
were the most frequent of the domestic animals at Neuenheim and there were several instances of animals that lay between the *primigenius* and *brachyceros* forms. This intermediate group is more often encountered than either the large or small groups. Both large and small animals were identified at Osthofen (Schottenbach 1908), but Vogel (1935) could only detect turbary cattle at the site of Reute OA Waldsee.

Werth and Baas (1934) report skulls of turbary cattle from Gluchstadt and a horn core of the same type from Hohenzahden. The skull from the first site was found at a depth of four metres in a marsh. When a pollen analysis of the skull was compared with an analysis carried out at Kehdingen Moor, 13 km. away, the date of the skull was fixed as very early neolithic or even late mesolithic and placed at around 5000 B.C. The same conclusion was reached about the horn core from Hohenzahden. Werth and Baas claimed that this was the earliest known domestic ox in Germany.

Cattle were clearly of importance during the neolithic period. They are known from both Rossen and Michelsberg sites, and in one instance are not as frequent as pigs in a Michelsberg context. Both large and small cattle were being bred, and intermediate forms also occur.

**Ovicaprids**

Ovicaprids are present at the Rossen sites of Heilbronn, Nauendorf and Regensburg-Kumpfmühl (see Table No. 125). A few bones of both sheep and goat were found at Regensburg-Kumpfmühl (Boessneck 1958), and goat has been identified at Nauendorf (Niquet 1937).
Sheep and goat were less important than pigs at the Michelsberg site of Ehrenstein (Paret 1955). Large scimitar-shaped horn cores of goat were recovered as well as other cores which could be ascribed to turbary sheep. The goats are clearly related to the bezoar of the Near East. Ovicaprids are known from a further six Michelsberg sites, including the graves at Jechtingen (Sydow & Kimmig 1962) and the settlements of Cannstatt (Paret 1924), Goldberg (Dehn & Sangmeister 1954), Hutberg (Benesch 1941) and from both the upper and lower levels at Riedschachen (Reinerth 1929). At Unter-Crombach both large and small sheep as well as large goats were found (Schotensach 1908).

There are a further fourteen instances of sheep and goat in a neolithic context, but in most of these cases the presence of ovicaprids is all that is known (See Table No. 125). Ovicaprids are the least important of the domestic animals found at Berlin (Nobis 1955; see Fig. 88 & Table No. 120). Sheep outnumber goat by 32 to 2. At Einhornhohle on the other hand they are the most frequently encountered of the domestic animals (Schotensach 1908; see Fig. 89 & Table No. 126). Sheep are again more frequent than goat, this time in the proportion 17 to 12. Both large and small sheep occur at Neuenheim together with the large domestic goat (Schotensach 1908). Amongst the sheep remains were some of animals that represent an intermediate form between the two main types. As a whole sheep are more common than goat. The turbary sheep is also encountered at Monsheim (Schotensach 1908).

Sheep and goat were bred during both the Rossen and Michelsberg cultures/
cultures. They were less frequent than pigs in the latter context.
Large and small sheep are known together with intermediate sized animals,
and bezoar-like goats. At most sites the sheep seem to be considerably
more numerous than the goats.

**Fig**

The domestic pig has been identified at three sites of the "Rossen
culture, namely Regensburg-Kumpfmühl (Boessneck 1958), Nauendorf (Niquet
1937) and Heilbronn ( ). They also occur at six or
seven sites of the *Michelsberg* culture (see Table No. 125). The doubtful
site is that of Jechtingen where bones of either wild or domestic pig were
associated with the Michelsberg burials. At Ehrenstein the turbary pig
was the most important of the domestic animals (Paret 1955). There is a
strikingly large proportion of young animals, and adult boars are rare as
would be expected. The turbary breed is more common than the large *scrofa*
pig at Unter-Grombach (Schotensach 1908) but it is not known which species
of pigs are present at the remaining sites.

Pigs are the most frequent of the domestic animals at the neolithic
site of Berlin (Nobis 1955; see Fig. 88 & Table No. 120), but are less
frequent than cattle and ovicaprids at Einhornhöhle (Schotensach 1908; see
Fig. 89 & Table No. 126). Both the turbary and *scrofa* domestic pigs are
present at Neuenheim where a cross between the two types is recorded
(Schotensach 1908). The *scrofa* variety is encountered at the Rauberhöhle
(Lindner 1961), and Schelmengraben (Schotensach 1908), and the turbary
breed/
breed is known from Monsheim (Schotensach 1908), Reute OA Waldsee
(Vogel 1935), and at the Bavarian sites of Roseninsel and
Wurmsee (Pira 1909).

Both Nehring (1884) and Pira (1909) report bones of pig from
Triebsee. Nehring described them as being of the same dimensions of the
turbary pig, but because of some slight cranial differences he considered
them as belonging to a different breed, and gave them the name Sus scrofa
nannus Nehring. He considered that they were derived from the local
wild pigs, and said that they could have originated either naturally, or
by insufficient nourishment owing to the primitive domestic conditions
or as the result of an unsuitable climate.

Two types of pig were being bred during this period and there is
also ample evidence for various intermediate animals. It is not known
what type of pigs were being bred during the Rossen culture, but turbary
pigs were the main domestic animal at at least one Michelsberg site.

Dog

No remains of dog were found at the Rossen sites where other domestic
animals are known. However at the site of Bissinger Pfad, Vogel
identified the skull of a turbary dog although no other animals are known
to be present ( ).

Dogs are known from three of the Michelsberg sites (see Table No. 125).
Both small and medium-sized animals are present at Ehrenstein, and most
of the remains are attributable to the turbary breed. One or two bones,
however/
however, approach the size of *intermedius* dogs (Paret 1955). Dogs are also present in both the upper and lower levels at Riedschachen (Reinerth 1929), and a medium-sized dog is recorded at Unter-Grombach (Schöntensach 1908).

There are seventeen other identifications of dogs amongst the sites mentioned. The breed represented at Berlin is not known, but Schöntensach (1908) reports bones of *Canis f. matris optimae* from Einhornhöhle. Hauck (1950) thinks that the *inostranzewi* dog is probably present at Hildesheim, although he was uncertain of the breeds found at Nickelsdorf and Westerregeln. The turbary dog is known from the undisturbed levels of the Jungfernöhle (Kunkel 1955), Klein-Wanzleben (Nowothing 1937), Reute OA Waldsee (Vogel 1935) and Volpke (Nowothing 1937). The dogs at Neuenheim are described as being of medium size, and so probably belong to the turbary breed (Schöntensach 1908) whilst the dog from the Rauberhöhle is reported to be *Canis f. matris optimae* (Lindner 1961).

The turbary dog was the breed most frequently encountered during the neolithic in Germany. However, the *intermedius*, *inostranzewi* and *matris optimae* dogs have also been reported by various authors.

**Horse**

There is a possibility of the horse having been domesticated at Riedschachen, but nothing is known about the remains and no reason for domesticity is given. They were found in the upper levels of the site (Reinerth/
(Reinerth 1929). The only claim for domestication comes from Berlin where Nobis (1955) identified bones of a domestic horse. The cultural context of these remains is not known. A horse burial is reported at Engers, but it is more likely that an ox is involved (Behrens 1964).

Cultivated Plants

Wheat

Wheat was cultivated at the majority of sites considered (see Table No. 127), being known from the Rossen culture sites of Heilbronn, (Netolitsky 1930), Ur-Fulerum (Schiemann 1954), Wahlitz (Hopf 1957) and Winzinger Strasse ( ). Einkorn is known from three of these sites and emmer from at least two. Einkorn is said to occur frequently at Winzinger Strasse, but its proportion at the first site is not known. Nearly 50,000 cereal grains were identified at Wahlitz but einkorn accounted for only a very small proportion of the total (0.2%). Emmer is notably absent from this site, and einkorn is absent at Ur-Fulerum which is also striking. At this last site emmer accounts for a third of the cereal remains and the only grain to exceed it in frequency is barley. Emmer also occurs at Winzinger Strasse, and may be present at Heilbronn.

The other type of wheat known in a Rossen context is club wheat. It has been found at Heilbronn (Netolitsky 1930), Wahlitz (Hopf 1957) and Winzinger Strasse ( ), but is absent at Ur-Fulerum (Schiemann 1954). At Wahlitz it is the most common of all the grain and forms/
forms over two-thirds of the cereal remains.

Einkorn, emmer, club wheat and spelt are all known in a Michelsberg context. The first two cereals have been found at Ehrenstein (Bertsch 1955) and the first three at Riedschachen (Bertsch 1931) and Taubried (Bertsch 1931). Both einkorn and emmer account for about a sixth of the cereal remains identified at Ehrenstein. At this site there were also a few grains of club wheat and spelt, which has not been found at the other sites. The remains from Reute OA Waldsee are thought to belong to the Michelsberg culture also, and here einkorn was more frequent than emmer or club wheat, but wheat was less frequent than barley, as was the case at Ehrenstein.

The cultivation of wheat is attested at a further nine sites in a neolithic context. Einkorn occurs at seven of these, and its proportion at five sites is not known (Bockingen, the Passage Grave of Dotlingen, Ohringen, Riekofen and Steinsburg). At both Kleinbardorf (Hopf 1958) and Tauberbishofsheim (Wahle 1930) it is thought to be the only cereal known with certainty.

Emmer is present at six or seven sites, but its importance is not known at any of these (Bockingen, Dotlingen, Heidelberg, Ohringen, Riekofen, Worms and possibly Kleinbardorf; see Table No. 127). Wheat as a whole, however, is known to be less important than barley at the Passage Grave of Dotlingen (Patzold 1958). Club wheat has been identified at two sites (Bockingen and Dotlingen).

The cultivation of grain in the Rossen culture does not appear to have followed/
followed any particular pattern. At one site club wheat is the dominant
species, and at another emmer is of importance with barley the main cereal
cultivated. The evidence available from the Michelsberg culture suggests
that barley was of greater importance than wheat. Einkorn, emmer, club
wheat and spelt are all known from the neolithic period in Germany.

**Barley**

Barley is known from the four Rossen sites of Heilbronn (Netolitsky
1930), Ur-Fulerum (Schiemann 1954), Wahlitz (Hopf 1957) and Winzinger
Strasse (. A large quantity of grain is involved at
both Wahlitz and Ur-Fulerum, and at the first site barley accounts for a
third of the remains whereas at the second it forms two-thirds of the
remains. Three types have been distinguished at Ur-Fulerum, namely four-
rowed glumed barley which accounts for over half of the crop, four-rowed
naked barley which forms about a tenth, and six-rowed glumed barley which
only forms a fiftieth of the remains. Six-rowed barley is also thought
to be present at Winzinger Strasse.

Barley is the most frequent of the cereals found at the Michelsberg
site of Ehrenstein. It accounts for two-thirds of the plant remains.
Only the six-rowed species is known with certainty, and Bertsch (1955)
thinks it may be the only type present. Barley also occurs at Riedschachen
and Taubried in this context (Bertsch 1931). The most frequent of all the
grain encountered at Reute OA Waldsee is again barley, and the finds are
thought to belong to the Michelsberg culture. The grain was identified
by/
by Bertsch ( ) and the six-rowed variety was once more detected.

Both naked and glumed barley were found at the Passage Grave of Dotlingen (Patzold 1958), and the six-rowed species is thought to be present at Bremer (Werth & Baas 1934). However, the neolithic date of the last find has not been satisfactorily established. The type of barley at the remaining four sites is not known.

The importance of barley varied during the Rossen culture, and sometimes it was the most frequent of the crops cultivated. It appears to be the main crop of the Michelsberg culture, and in both cases the six-rowed species is the most common. Both naked and glumed types occur as does four-rowed glumed barley.

Flax

The absence of flax from the Rossen culture sites of Wahlitz (Hopf 1957) and Ur-Fulerum (Schiemann 1954) is striking, and consequently this plant may not have been cultivated in this context. Flax does, however, occur at the Michelsberg sites of Riedschachen and Taubried (Bertsch 1955) as well as at Reute OA Waldsee ( ).

In connection with the cultivation of flax it is interesting to note that examination of the interior of sherds found at Dotlingen revealed that they originated from vessels which had served as containers for plant oil (Patzold 1958). The two main plants that yield oil are flax and dogwood/
wood. This last-mentioned plant was identified in quantity at Ehrenstein, and it is possible that it replaced flax as an oil-producing plant.

Legumes

The only instance of legumes comes from Reute OA Waldsee ( ) where peas have been identified.

Summary

Cattle, ovicaprids and pigs were bred in both the Rossen and Michelsberg cultures. In one case the evidence indicates that pigs were the main domestic animal in a Michelsberg context. Large and small cattle, ovicaprids and pigs are all known as well as various intermediate sized animals. Bezoar-like goats have been noted. The turbary dog was the breed most frequently encountered although larger types were known and there is a possibility of horse domestication in a late Michelsberg context. Six-rowed barley was the main crop of the Michelsberg people, but the Rossen culture does not appear to have followed any particular pattern of plant cultivation, with wheat dominant at one site and barley at another.
15. - SCANDINAVIAN MIDDLE NEOLITHIC

The Scandinavian Middle Neolithic, dated to 2600 - 2200, is characterised by large passage graves and a series of settlement sites. The graves replace the earlier dolmens to a great extent and are also constructed of large stones. The tomb is entered by a narrow passage and the burials occur in chambers placed at the end of the passage and symmetrically on either side. As many as a hundred skeletons may occur in one tomb.

The pottery includes the earlier funnel beakers and may bear vertical arrangements of cord impressions as in the earlier TRB C phase. Deep incisions also occur as a form of decoration. Pedestal bowls, angular vases similar to those of Walternienburg-Bernburg, and later more rounded forms all appear.

Stone elements include double axes, daggers, arrowheads and mace heads as well as specialised tools. Metal was imported from central Europe and amber was the main export. Many settlements have been found in Denmark, and they include both apsidal and rectangular buildings.

Hunting was of very little importance, and at one important site accounts for less than a fiftieth of the osteological remains. The animals exploited include red and roe deer, elk, aurochs, pig, seal, horse, otter, badger, marten, bear, wolf, fox, cat, polecat, squirrel, hedgehog, hare, turtle, birds and fish (see Table No. 128).
Domestic Animals

Cattle

Bones of cattle have been recorded at eleven of the thirteen sites considered (see Table No. 129).

The most detailed information comes from Bundsø (Degerbøl 1939). Nearly all the horn core and cranial remains indicate the same breed of cattle, namely the turbary. These bones compare well with Swiss examples and the difference in size between this domestic animal and the aurochs is well illustrated by the basal circumference of the horn cores. That of the small domestic animals was around 130 mm., whereas that for the aurochs found at Bundsø reached 335 mm. There were, however, three further cranial remains which do not comply with the turbary characteristics and represent more powerful animals. These cattle were less robust than the aurochs, and have been assigned by Degerbøl to domesticated aurochs. Several distinctive domestication features are visible in the shape and form of the horn cores. When the total number of bones from this site are considered, which is around ten thousand, cattle are seen to be the dominant feature in the economy.

Cattle were also more frequent than any other animal at the settlement of Blandebjerg (Winther 1943). Bones of this animal were also found amongst the sacrifices at this site. The turbary breed of cattle occurred frequently at Lejre Aa and Ørum Aa (Degerbøl 1928; Winge 1904), but nothing is known of the cattle at Lindø (Winge 1904), Lindskov (Winge 1904), Svendborg/
Svendborg (Winge 1904), Signalbakken (Lidén 1940), Trelleborg (Mathiassen 1944), Troldebjerg (Lidén 1940) or Verup Mose (Degerbøl 1943). In several of these last cases, only a few bones survived.

Cattle were the most important animal during the Scandinavian Middle Neolithic Period. The stock appears to have been almost exclusively turbary, with only a few instances of large domesticated animals.

Ovicaprids

Sheep or goat have been identified at at least ten of the thirteen sites considered (see Table No. 129). There is also a possibility of their presence at Svendborg (Winge 1904).

Ovicaprids are less frequent than both cattle and pigs at Bundsø (Degerbøl 1939). There were several characteristic bones of sheep amongst the remains, most of which can be assigned to the slender turbary breed. Degerbøl gives tables of comparison between these finds and those of known palustris sheep from Switzerland, and it is seen that the agreement is very close. Several distinctive small compressed horn cores have been found. There is, however, another breed of sheep also present at this site. Comparative measurements show that it is the Copper sheep, Ovis aries studeri, which is characterised by large outswept horns with a triangular cross-section. This type of sheep is rare during the neolithic period, but has been identified at sites of the Single Grave Complex in Switzerland. Single Graves and Corded Ware appear in Denmark during the second half of the Passage Grave or Middle Neolithic Period, so that/
that the occurrence of these large sheep is connected with the Single Grave Complex. They are another example of the contact between the two cultural groups. Goats have also been found at Bundsø, but only very few bones can be attributed to them.

Both sheep and goat are present at Blandbjerg (Winther 1943), turbary sheep are known from Lejre Aa (Winge 1904; Degerbøl 1928), and Grum Aa (Winge 1904), sheep from Hesselø (Winge 1904), and there is a possibility of sheep being present at Svendborg (Winge 1904). Goats occur at the late site of Gundsølille (Brønsted 1957), sheep occur at Lindø (Winge 1904; Winther 1928) and either sheep or goat is present at Lindskov (Winge 1904; Brønsted 1957).

Ovicaprids were of less importance to the economy than both cattle and pigs, and sheep were much more frequent than goats. The turbary breed of sheep is dominant, but the large Copper sheep known from the Single Grave Complex in Switzerland is also present.

Pigs

Pigs have been identified at eight or nine of the sites considered (see Table No. 129).

They are the second most frequent animal to be identified at Bundsø and they show close agreement with the turbary pigs from Swiss and Danish sites (Degerbøl 1939). No intermediate examples between the turbary and wild pigs were found. Nearly all these animals are under two years old, and there is only one example of a pig over four years. These turbary pigs/
pigs have also been identified at Lejre Aa (Winge 1904; Degerbøl 1928) as well as Ørum Aa (Winge 1904).

The breed of pig found at both settlement and sacrifices at Blandebjerg is not known (Winther 1943). Winge (1904) has identified the pigs from Hesselø, Lindø, Troldeberg, Signalbakken and possibly Svendborg as Sus scrofa domesticus. However, he applied the same description to the animals from Lejre Aa and Ørum Aa, which on re-investigation Degerbøl found to belong to the turbary breed.

There is definite evidence for the breeding of turbary pigs, which although of value to the economy were not as important as cattle. They were, however, substantially more important than sheep and goat.

Dog

There are only four instances of dog in this context (see Table No. 129).

Several individuals have been found at Bundø, and in one locality as many as seven skulls were found. The most powerful of these is attributable to Canis f. palustris ladogensis, and the others all belong to Canis f. palustris (Degerbøl 1939). The basal lengths of the skulls all lie between 134 and 154 mm. and all are well preserved. Most of the other bones found agree with these results, although one or two of the long bones show some inostranzewi characteristics. However, since no other indications of this breed were found, the bones are most likely attributable to the ladogensis dog.

Both/
Both a large and a small dog are thought to be present at Ørum Aa (Winge 1904), and a small type of dog is recorded at Lejre Aa (Winge 1904; Degerbøl 1928) and at the late site of Lindø (Winge 1904; Winther 1928).

The turbary dog was the main breed during the Scandinavian Middle Neolithic. The *ladogensis* variation is known to be present and it is probable that a larger dog was also known in small numbers.

Horse

Bones of horses have been identified at various sites, but it is only at the late sites of Lindø and Lindskov that there is thought to be a possibility of domestication (*Brønsted* 1957, 268). No further details of these bones are available.

Horses, wild or domestic, are recorded at the sites of Blandebjerg (Winther 1943), Hesselø (Winge 1904), Ørum Aa (Winge 1904), Troldebjerg (Liden 1940), Ordrup Næs (*Brønsted* 1957), Stenstrup (*Brønsted* 1957) and from the Swedish Passage Graves of Vastra Torp, Oernas and Knaggegarden (*Brønsted* 1957; Lundholm 1949). The authenticity of some of these finds has been questioned. Winge regarded all the horse bones that he identified as belonging to domestic animals of a period later than the neolithic. It is not clear whether they are known to come from later levels of the sites, or whether they are regarded as intrusive elements on grounds of their domesticity alone. It is clear that the horse was relatively well known to the inhabitants of Scandinavia at this time.

The/
The numbers of horses increase greatly towards the end of the neolithic period and it is thought that this coincides with their domestication. It is generally felt that the Single Grave people brought the idea of horse domestication to Denmark, but if this is so they domesticated the indigenous wild horses and did not bring their own stock with them (Lundholm 1949). Since the Single Grave Complex appears in Scandinavia during the Middle Neolithic, the occurrence of domestic horses at late Passage Grave sites is perfectly feasible.

**Cultivated Plants**

**Wheat**

Wheat is known from 44 of the 54 sites considered (see Table No. 130).

Einkorn, emmer and naked wheat are all known to have been cultivated in Denmark. Brønsted (1957, p.390) reports many instances of impressions and carbonised grain of wheat, but although the above species are known to have been cultivated, the actual types of wheat at individual sites is not known. These sites include Aarby, Bistrup, Ejby, Flintinge Byskov, Folleslev, Gundestrup, Gundsølille, Hammer, Hjelm, Himmelev, Killerup, Kulby, Lindeskov, Lundvorlund, Ørum Aa, Sodervidinge, Stenstrup, Strandholm, Tjærby, Uggerslev and Vellerup.

Einkorn is known to occur at the Danish sites of Blandebjerg (Winther 1943), Bundsø (Jessen 1939), Lindskov, Skørbaek and Vedskølle (Brønsted 1957). Emmer also occurs at Bundsø (Jessen 1939) and Lindskov (Brønsted 1957) as well as at Hegum, Hjortegaardene, Lejre Aa and Lindø (Brønsted/
A large quantity of carbonised grain was recovered at Blandebjerg, and the only species of wheat to be identified was einkorn. This accounted for nearly all of the cereal crop (94.6%). Similar results were obtained from Bundsø (Jessen 1939). Wheat formed nine-tenths of the cereal remains, and einkorn was the most frequent of the three species identified (see Table No. 130). Emmer is about half as frequent as einkorn at this site. There were, however, nearly four hundred cases in which the distinction between einkorn and emmer could not be made. The relative frequencies of einkorn and emmer at the remaining sites are not known.

Both of these species of wheat are known from Sweden (Hjelmqvist 1952; 1955). In all there are eleven sites at which einkorn is known and thirteen sites at which emmer is known (see Table No. 130). The richest site considered is that of Vastrahoby and here there are three times as many impressions of einkorn as there are of emmer (84:29; see Hjelmqvist 1955). The Swedish material as a whole shows that there are 163 definite impressions of einkorn, and 64 of emmer, so that einkorn is between two and three times as common as emmer, as was the case in Denmark.

Apart from the cultivation of einkorn and emmer there is also evidence for the presence of naked wheat. It occurs at three Danish and one Swedish site (see Table No. 130). Club wheat is thought to be present at Bundsø, where it represents only a fiftieth of the cereal remains (Jessen 1939). It is particularly difficult to distinguish a short-eared club/
club wheat from a small-grained version of the more straight-eared bread wheat. For this reason there may be some bread wheat amongst those found at Bundsø. At this site club wheat is the least important of the three species of wheat identified, and einkorn is well over eight times as common. Barley on the other hand is four or five times as frequent as the naked wheat (see Table No. 131). The size of the naked wheat from Bundsø was found to agree very well with that from some Swiss sites. Modern club wheat is slightly thinner but otherwise very similar (Jessen 1939). Bread or club wheat is also thought to be present at Lejre Aa and Lindskov (Brønsted 1957), and there was one definite instance of club wheat at Vastra Hoby and three that were either of bread or club wheat. These impressions show that einkorn was over twenty times as frequent as naked wheat, and that barley was twice as frequent (see Hjelmqvist 1955).

Although all the species of wheat found at Troldebjerg and Lindø are unknown, it is apparent that wheat formed over three-quarters of the cereal crops (Helbaek 1952).

From the above evidence it may be concluded that wheat was the main crop and that einkorn was the most frequent species to be identified, followed by emmer and club wheat. Bread wheat may also be present but this has not been established with certainty.

Barley

This cereal has been found at twelve sites in Denmark and thirteen in Sweden (see Table No. 130).
There are many cases of cereal identifications at both Blandebjerg and Rundsø, but barley only forms a twentieth of the remains at the first site and a tenth at the second (Winther 1943; Jessen 1939; see Table No. 131). The variety at Blandebjerg has been ascertained as glumed barley, whereas that at Rundsø is known to be six-rowed naked barley. Brønsted (1957, 390) reports naked barley from Aarby, Flintinge Eyskov, Fredsgaarde, Øster Krusegaard and Lindeskov, and the glumed variety from Øster Krusegaard and Lindeskov. This cereal only forms a twentieth of the remains at Troldebjerg, but two-fifths of the crop at Lindø (Helbaek 1952).

There are five instances of glumed barley and eight of naked barley in Sweden (Hjelmqvist 1952, 1955). At Vastra Hoby barley accounts for only a fifteenth of the wheat-barley impressions (Hjelmqvist 1955), and for the Swedish material as a whole barley forms about a tenth of the cereal crops.

Barley was clearly less important than wheat during the Scandinavian Middle Neolithic. Both naked and glumed barley are present, and the former is known to be of the six-rowed type.

Summary

The agriculture of the Scandinavian Middle Neolithic was based upon cattle breeding and the cultivation of einkorn. The cattle stock appears to have been almost exclusively turbary, with only a few instances of larger animals. The turbary pig has also been identified and is more common/
common than either sheep or goat. Amongst the ovicaprid remains which include goats and turbary sheep, are bones of the Copper Sheep. This is of especial interest as this breed of sheep is very rare during the neolithic period, and is only known from Switzerland in a Single Grave context. Its occurrence in Denmark illustrates the contact between the Passage Grave and Single Grave complexes, which took place during the second half of the Middle Neolithic, and is probably the result of trade between the two cultural groups. The main breed of dog was the turbary dog, and there is a possibility of a larger breed also being present.

It is probable that horse domestication first appeared at a few late sites of the Middle Neolithic, and was introduced by the Single Grave Complex, although indigenous wild animals were domesticated. The main crop cultivated was clearly einkorn, and emmer was about half as frequent. Club wheat and barley occur in small quantities only.
16. - SCANDINAVIAN NEOLITHIC

Sites of the Pitted Ware culture and Late Neolithic are considered as well as others of which the neolithic period is not known.

The Pitted Ware culture was present in Scandinavia and along the Baltic coast between 2400 and 2200. The pots have rounded bases and are ornamented with rows of pits and comb impressions. In the western part of its distribution the pots may have a concave neck profile. Adzes, chisels, celts, maceheads, slate knives and darts are all present and in nearly all areas Maglemose harpoons and bone points illustrate the strong mesolithic background.

Evidence for animal breeding is only found in Sweden, and at the majority of sites hunting was of much importance. The animals identified consist of red deer, roe deer, elk, aurochs, pig, seals (greenland, ringed and gray), horse, bear, otter, beaver, badger, marten, wolf, fox, wild cat, lynx, hare, fish, birds and porpoise (see Table No. 132). Of these the wild pig and the seal are the most frequent, and some sites may have their economy based upon one or other of these animals. The foxes found at Stora Karlebo are of interest since they are all small in comparison with modern animals and only rarely attain medium size. These may be compared with some Swiss finds. Zeuner has said that several of the Swiss foxes were of small size and many show traces of arthritis, which only occurs as a result of domestication (Figgott, personal communication). This raises the possibility that some of these foxes in Sweden may have been domesticated.

The/
The Middle Neolithic and Single Grave communities form the basis of the Late Neolithic in Scandinavia. This period is characterised by extremely fine flint daggers, and axes, sickles, and arrowheads also occur. The basic pot is of a flower pot shape and decorated with zig-zag bands. Long stone cists and upper ground and bottom graves form the methods of burial. Bronzes from Italy, central Europe and Britain are found in the stone cists, and amber was exported. Pins and other ornaments of Unetice type link this period with the Bronze Age of central Europe.

Domestic Animals

Cattle

Cattle are known from the Pitted Ware culture as well as various other neolithic sites (see Table No. 133).

There are nine or ten instances of cattle in a Pitted Ware context. Frödin (1910) was unable to decide whether the cattle remains from Alvastra were of wild or domestic animals. Numerous bones were found, most of which belonged to large animals, but there was also an indication of a smaller race. From the evidence available it seems probable that at least a small proportion of the bones originate from domestic animals. Very few bones were found at Jonstorp (Liden 1940, p.194), and cattle are thought also to be present at Rolfsaker, Humlekarshult, Gumslöv and Visby (Liden 1940, p.194). At Siretorp cattle are the second most frequent animal, being slightly less important than pigs (Bagge & Kjellmark 1939, 242). The only evidence for domestic cattle at Sjoholmen was/
was a single tooth, which was discovered after the re-investigation of the osteological material (Althin 1954).

The second most common animal to be found at Stora Karslo was the ox, which was far less numerous than the remains of pigs (Pira 1927). Nearly all of the bones lay within the range of variation of the turbary cattle, but there were a few examples of animals which must be domesticated but still are close to the aurochs. A similar situation to that at Stora Karslo was found at Vasterbjer. Here cattle are only of minor importance to the economy, being far less numerous than pigs, and only half as common as dogs (Stenberger, Dahr & Munthe, 1943; see Fig. 90 & Table No. 134).

The absence of cattle at the two sites of the Late Neolithic is of no consequence since only a few bones are involved. Nothing is known of the nature of the cattle at the remaining four neolithic sites.

Cattle were bred during the Pitted Ware culture in Sweden, but appear to have been less important than pigs. Turbary cattle were known and there are also a few instances of the larger breed. Cattle also occur at other neolithic sites.

Ovicaprids

Sheep or goat occur at seven or eight sites of the Pitted Ware culture and at another two neolithic sites in Denmark (see Table No. 133).

The most detailed information about the ovicaprid stock comes from the Pitted Ware site of Stora Karslo (Pira 1927). Both sheep and goat have been identified, and the former is more frequent than the latter. All of/
of the identifiable goat bones appear to belong to the turbary breed. However, the sheep bones show very clearly that the turbary breed of sheep is not present. All these bones show a close agreement with each other, and they resemble those of the moufflon closely. The remains at this site were compared with bones of the Sardinian moufflon, and some measurements agreed completely, whereas others showed slight divergences which Pira says could arise as the result of primitive domestication. They are in no way genetic in origin. According to Pira (1927) these sheep belong to a race in which the males were horned and the females hornless, which is the case with moufflons. The main difference between the moufflon and the sheep found at Stora Karalö is in the horn cores, which are slightly weaker although of the same shape in the Stora Karalö examples. From the description that Pira gives and from what Degerbøl (1939) says about the large sheep found at Bundsø in Denmark, the two types of sheep appear to be closely related. Hence it seems that both can be ascribed to the Copper sheep of Duerst, Ovis aries studeri, which was first found in the late neolithic lake-side settlements in Switzerland.

Both sheep and goat are present at Alvastra (Frodin 1910), and ovicaprids are known from Humlekarrshult, Rolfsacker, probably at Gumslov as well as at Vistby (Lidén 1940, p. 194). At the two remaining sites of Siretorp (Bagge & Kjellmark 1939, 242) and Västerbjer (Stenberger, Dahr & Munthe 1943) ovicaprids are less important than both cattle and pigs (see Fig. 90 & Table No. 134).
Both the proportion and breed of sheep at the remaining sites are unknown (see Table No. 133).

Sheep and goat were both kept at Fitted Ware sites, and sheep were more common than goat. Turbary goats were present, as well as a large breed of sheep which is probably the Copper Sheep which is also known at Bundsø. There is no definite evidence for the presence of the turbary breed of sheep.

**Pig**

Pigs have been identified at most of the sites considered (see Table No. 133).

The pig was the most frequent of the domestic animals found at Stora Karslö (Pira 1927). Two types have been observed, the turbary and the larger scrofa pig, and the smaller is the more numerous of the two. Transitional types are also present, and there were many bones of young animals. The pig is also the most important animal found at Gullrum and Hemmor (Pira 1909; Forssander 1941). At Hemmor pig remains account for over nine-tenths of the total fauna identified, the only other domestic animal being the dog. Pira studied the bones from these two sites in detail, and he placed them all in his group II of domestic animals. The pig bones were divided into five groups, group I representing wild animals, and the following four groups animals at their various stages of domestication. The last group, number 5, is the most advanced and most turbary pigs fall into this category. Hence it seems that the pigs from Hemmor/
Hemnor are all in the initial stages of domestication, and that this area was a centre for local pig domestication.

Both cattle and ovicaprids are less numerous than pigs at Siretorp, but it is not known to what extent bones of wild animals are present amongst these remains (Bagge & Kjellmark 1939, 242). However, pigs were relatively unimportant to this site, since the economy was based upon seal hunting. The *scrofa* form of domestic pig occurs at Sjoholmen (Forssander 1930), and pigs are also known from Gumslov, Humlekarrshult and Rolfsaker (Lidén 1940, 194).

The position of the pigs at Alvastra is uncertain (Frodin 1910). Many bones were found, most of which belong to powerful animals and Frodin thinks it probable that a large proportion of these represent wild animals. A few smaller individuals were also found. The possibility that some of the pigs were in the initial stages of domestication must be considered. It is not known whether the pigs from Danielalund were wild or domesticated (Althin 1954).

Although over four-fifths of the fauna at Vasterbjer is composed of pig bones, Dahr found that it was impossible to say with certainty whether these were wild or domestic animals (Stenberger, Dahr & Munthe 1943; see Fig. 90, Table No. 134). The pig was also the most frequent animal found at Visby (Lidén 1940, 194).

Domestic pig remains are also recorded at the Late Neolithic site of Kiaby (Jarbe 1950). The site is a stone cist, beneath which was found the burial of four people, two being placed in each of two canoes.

Pigs/
Pigs were the most important of the domestic animals at Pitted Ware sites. Many of the animals are in the initial stages of domestication, and many of the others could be either wild or domesticated, so it appears that the Pitted Ware people domesticated animals from the local wild boars.

**Dog**

Dogs occur at eleven of the twenty four sites mentioned (see Table No. 133).

There are five instances of dogs in a Pitted Ware context. Both a medium-sized and large dog have been recorded at Alvastra (Frodin 1910). The large dog is close to the wolf in size. The dog is the only domestic animal apart from pig at Hemmor (Stenberger 1943), and many bones of dog including an almost complete skeleton were found at Sjoholmen (Althin 1954; Forssander 1930). The species has not been ascertained. The dog is well represented at Vasterbjes, where it is more frequent than both cattle and ovicaprids (Stenberger, Dahr & Munthe 1943; see Fig. 90 & Table No. 134). The remains from this site cannot be distinguished into two races; there is only a variation on the turbary dog present and the majority of the animals can be described as belonging to large turbary individuals.

Dogs have also been ascertained at Stora Karslön (Pira 1927). Apart from the turbary dog, of which a few characteristic bones were found, there is a possibility of first generation domesticated wolves. The variation in the size of jaws of wolves was just inside the lower limit for such animals, and Pira observed some indications to suggest that these animals/
animals were reared in captivity. A result of the wolves being held captive is a reduction in the length of the molar series, and this occurs already in the first generation of such animals. This was visible amongst the Stora Karslø jaws. A shortening of the jaw also causes a slight displacement of the teeth, which was also apparent.

Dogs are also known from Aalberg (Winge 1904), Christainsholm (Degerbøl 1927), and Hauck (1950) reports those from Dyrehavegaard, Hasmark, Stigehave and Voldtøfte.

As well as the turbar dog, it is probable that wolves were domesticated during the Pitted Ware culture. In one or two cases dogs are more important than cattle and ovicaprids to the economy of the settlements.

Horse

Lundholm (1949) mentions the probable occurrence of a domestic horse at Ulltorpsbach, where the skull of a horse was found with a flint dagger embedded in the suture of the forehead. The dagger dates the find to the Stone Cist or Late Neolithic period, and pollen analysis confirms this. Osteologically Lundholm found that it was impossible to tell whether the horse was in the initial stages of domestication or whether it was still wild. Since horses become increasingly common at this time, he favours the theory that this animal was kept in a confined area by man and then sacrificed. Further horse remains of this period in Sweden have been found at Torske in Schonen and Ranten in Västergötland (Lundholm 1949). They/
They also occur at the Pitted Ware sites of Hemmor (Forssander 1941; Lundholm 1949) and Gullrum (Rydbeck 1938; Lundholm 1949). Horses have also been found at Stora Karslo, which is of interest since the site lies on a small island (Pira 1927). The horse also occurs at Vasterbiers, and Stenberger thinks that it was probably introduced at this time as a direct result of the influence of the Single Grave Complex (Stenberger, Dahr & Munthe 1943). The absolute measurements of the teeth that were found are, however, smaller than those of both wild horses and several domesticated horses of the Early Bronze Age (Lundholm 1949). Lundholm gives two alternative explanations of this fact. Either these animals became smaller as a result of domestication, or they are wild horses native to the island and are a dwarf representative of the mainland race. This has been known to occur to island populations in historical times (Lundholm 1949, Ch. IX). Lundholm calculated that it would take at least a hundred years to reduce the size of the mainland horses to that observed at Vasterbiers. For this reason and because they form only a very small percentage of the total osteological remains, Lundholm thinks that these are probably wild horses.

It is likely that domestic horses were known during the Late Neolithic Period. There is also a possibility of their presence at an earlier stage, although this cannot be proved. Their occurrence at Pitted Ware sites can be linked with the arrival of the Single Grave Complex, as can their presence at the late Passage Grave sites.
Cultivated Plants

Wheat

Wheat has been identified at three sites of the Pitted Ware Culture, three neolithic sites and seven sites of the Late Neolithic period (see Table No. 135).

Einkorn occurs at the Pitted Ware site of Jonstorp (Hjelmqvist 1955), and emmer has been found at both this site and Torslunda (Hjelmqvist 1955). Only one or two impressions occur at both sites. Lidén (1940, p.189) also investigated the sherds from Jonstorp for impressions, and found evidence for the presence of club or bread wheat as well as emmer. This is the only instance of naked wheat in a Pitted Ware context. Wheat also occurs at Fagervik (Hjelmqvist 1955).

Wheat is known from four Danish and three Swedish Late Neolithic sites (see Table No. 135). Emmer has been identified at Borreby and bread or club wheat at Ty (Brønsted 1957, p.393), but the species of wheat at both Herslev and Langø is unknown (Brønsted 1957, p.390). It should be mentioned that Brønsted records an impression of einkorn which occurs on a sherd of this period, but the site from which it originated is unknown (Brønsted 1957, 393). The Swedish evidence shows that einkorn is present at S. Bogarden and emmer at both L. Lund and Torpet (Hjelmqvist 1955).

Einkorn, emmer and club or bread wheat were cultivated during the Pitted Ware culture and Late Neolithic period. There is insufficient evidence to draw conclusions about their relative frequencies.

Barley/
Barley

Barley is known from all of the eight sites of the Pitted Ware culture, as well as four neolithic and four or five Late Neolithic sites (see Table No. 135).

Many carbonised cereal grains are reported from the Pitted Ware site of Alvastra, and all have been assigned to barley (Frodin 1910). Only the six-rowed naked version is known with certainty. Hjelmqvist (1955) also examined grain impressions from Alvastra, and found twelve instances of naked barley, and none of wheat. The material from the earlier excavations yielded impressions of glumed barley as well as the naked species (Hjelmqvist 1955). On the basis of the spikelets Hjelmqvist was able to decide that both four and six-rowed barley was represented. A few impressions of naked barley have been found at Fagervik, Jonstorp, Norrshog, Sater II, Siretorp and Stora Karlsö (Hjelmqvist 1955) and glumed barley occurs at Torslunda (Hjelmqvist 1955).

Naked barley occurs at the Late Neolithic sites of Borreby and Frihedalund in Denmark (Brønsted 1957, 393) and either naked or glumed barley is present at the Swedish sites of Kvarnby (Schnittger 1910) and naked barley at Utbogarden (Hjelmqvist 1955). Only a small number of impressions are involved in all cases.

Barley is also known from the neolithic sites of Aalborg and Emmedsbø in Denmark (Rydbeck 1938), Nosaby in Sweden (Hjelmqvist 1955) and Ruskennesset in Norway (Faegri 1944). The latter case is the only known instance of cereal impressions from a neolithic site in Norway.
Barley was the chief crop of the Pitted Ware culture. Both naked and glumed barley are known, with the former the more common of the two, and both four-rowed and six-rowed types appear to be present. Naked barley is also known from Late Neolithic sites and from the neolithic in Norway.

Summary

The economy of the Pitted Ware culture was based upon pig-breeding. The pigs are both large and small in size and there are strong indications of local domestication of wild boars at various sites. Cattle and ovicaprids are of much less importance and the dog is sometimes more frequent than either of these animals. Turbary cattle are more common than the larger species, and amongst the ovicaprid remains turbary goat and a large breed of sheep have been identified. This large sheep is of much interest as it compares well with the Copper Sheep of Duerst, and is found at Bundsø in Denmark in a Middle Neolithic context, and at Swiss sites of the Single Grave Complex. The Single Grave folk reached Denmark during the latter half of the Middle Neolithic, and Sweden during the time of the Pitted Ware culture, so that both Scandinavian instances of this sheep may be connected with the expansion of the Single Grave Complex. There is another possible link between the late neolithic of Scandinavia and the Single Graves. This occurs with the probable presence of a domestic horse at a late neolithic Swedish site.

Barley was of greater importance than wheat at Pitted Ware sites, with/
with naked barley more common than glumed. Einkorn, emmer and naked wheat are also known. These cereals also occur at sites of the Late Neolithic, but their relative frequencies are not known.
17. - Windmill Hill

The earliest immigrant neolithic culture in Britain is that of Windmill Hill, and it is found in southern England, mainly in Wessex. It is dated to between 3200 and 2600.

The pots are well made, dark and often burnished, and usually have round bases. Plain bowls are common, but shoulders also occur as do lugs. Various flint mines have been found and can be associated with this culture, and both chipped and chipped and polished axes are frequently encountered. Leaf-shaped arrowheads, scrapers and flake knives also occur.

Many sites of this culture are the so-called causewayed camps. These earthworks are constructed from broken concentric rings of a bank and ditch and range in diameter from 250 ft. to 1000 ft. It is clear that these were not settlement sites, and recently it has been suggested that they may have been a rallying point for various tribes in the vicinity. Another characteristic monument of this culture are the earthen long barrows, covering in many instances wooden chambers for collective burial at the proximal end of trapezoid or sub-rectangular earth mounds, which vary in length from 100 ft. to 400 ft. The material for this mound is usually derived from flanking ditches.

The wild animals that were hunted include red deer, roe deer, aurochs, horse, pig, badger, fox, cat and hare. The few statistics that are available suggest that hunting was unimportant to the economy (see Table No. 136).
Domestic Animals

Cattle

Domestic cattle have been identified at all of the fifteen sites considered (see Table No. 137).

They are known from the causewayed camps of Hembury (Iddell 1931 - 1935), Knap Hill (Jackson 1934), Maiden Castle (Jackson 1943), The Trundle (Curwen 1931), Whitesheet Hill (Piggott 1952), Whitehawk (Jackson 1934), and Windmill Hill (Smith 1965). In general cattle appear to be the dominant animal (see also Trow-Smith 1957), but statistics are available in only one instance. At Windmill Hill cattle are the main domestic animal for both the pre-enclosure occupation and from the primary levels of the enclosure ditch (see Fig. 92 & Table No. 138). All appear to be large in size and there is no indication of the turbary breed, as is the case at all of the other sites mentioned. Histograms and graphs to illustrate the size of the Windmill Hill cattle relative to the wild cattle found at Star Carr and Danish Maglemose sites can be seen in Fig. 94.

Cattle are also a common occurrence in the earthen long barrows, and they are found at Badshot (Piggott 1954b), Heytesbury I (Piggott 1954b), Nutbane (Morgan 1959), Thickthorn Down (Drew & Piggott 1936), Tilshead 5 (Piggott 1954b) and Wor Barrow (Pitt-Rivers 1898). Nearly all the bones are large and it is often difficult to distinguish the wild from the domesticated animals. These bones occur in all parts of the sites including the ditches, forecourts, mortuary enclosures and the mound material itself. At Heytesbury I five skulls were found placed under the central/
central cairn.

Cattle are more common than either ovicaprids or pigs at sites of the Windmill Hill culture, and all animals appear to have been large in size. It is also probable that many animals were in the process of being domesticated from the local aurochs.

**Ovicaprids**

Sheep or goat are known from eight of the fifteen sites mentioned, including the causewayed camps of Hembury (Liddell 1931-1935), Maiden Castle (Jackson 1943), The Trundle (Curwen 1931), Whitehawk (Jackson 1934) and Windmill Hill (Smith 1965). From Jackson's description it seems probable that the turbarv sheep is present at Maiden Castle, and this species is known to be present at Windmill Hill. The turbarv goat also occurs at the last site. Ovicaprids are less important than pigs in the pre-enclosure 'settlement' at Windmill Hill, but are more important than pigs in the later phase (see Fig. 92 & Table No. 138). Their increase could be due to increased land clearance activity between the two settlements, so that pasturage conditions became more favourable to sheep and goat.

Ovicaprids also occur at three long barrows, namely Nutbane (Morgan 1959), Thickthorn Down (Drew & Figgott 1936) and Wor Barrow (Pitt-Rivers 1898). Bones have been found in most parts of the sites, as was the case with cattle, and sheep are known from both Thickthorn Down and Wor Barrow. There have been no identifications of goat.
Ovicaprids were of secondary importance to the Windmill Hill economy, but both turbarry sheep and turbarry goats have been identified. The evidence from one site suggests that they became of greater importance as more land was cleared and conditions became more suitable to ovicaprid breeding.

**Pig**

Domestic pigs are known from at least seven of the sites considered (see Table No. 137). They have been identified at the causewayed camps of Hambury (Liddell 1931-1935), Maiden Castle (Jackson 1943), The Trundle (Curwen 1931), Whitehawk (Jackson 1934) and Windmill Hill (Smith 1965). The pig found at Windmill Hill is said to be fairly large, whereas the remains from Whitehawk were of smaller animals (Trow-Smith 1957). They always appear to be less important than cattle, and at Windmill Hill they are more frequent in the pre-enclosure 'settlement', than in the enclosure 'settlement' (see Fig. 92 & Table No. 138).

Pigs also occur at Thickthorn Down (Drew & Piggott 1936) and Wor Barrow (Pitt-Rivers 1898). Those from the first site are relatively small in size. There is also a possibility of domestic pigs at Nutbane, but Morgan (1959) was unable to decide whether the bones originated from wild or domesticated animals.

At Hanging Grimston there was an indication of a pig-cult (Piggott 1954b). A deposit of twenty jaws were found, and in one ritual hole behind the facade of the tomb a pig's scapula was found placed on its end.
Figs were not of great importance to the Windmill Hill culture, and are clearly less numerous than cattle. Both relatively large and smaller animals have been found.

Dog

Dogs are known from two causewayed camps and one long barrow (see Table No. 137).

Two almost complete skeletons were found at Maiden Castle, and both are similar to the turbary dog of Rutimeyer (Jackson 1943). The only difference is that they are slightly larger than the average turbary dog, and this situation was encountered again at Windmill Hill (Smith 1965; see Fig. 92 & Table No. 138). The majority of dog bones from the last site lie within the turbary variation, and are similar to the fox-terrier in size.

The dog from Wor Barrow can also be assigned to the turbary breed, although it was slightly smaller than the examples from the causewayed camps (Pitt-Rivers 1898). Its height is estimated at 15" as opposed to 17 or 18" at Maiden Castle.

The turbary dog is the only breed known from the Windmill Hill culture, and the finds compare well with those from the Swiss neolithic.

Cultivated Plants

Wheat

The cultivation of einkorn, emmer, bread wheat and possibly club wheat has been attested for this culture (see Table No. 139).
Einkorn is only known with certainty from Windmill Hill, where it formed a very small proportion of the remains (see Table No. 140). It is less frequent than barley, although there were a large number of impressions that could belong to either einkorn or to emmer (Helbaek 1952; Smith 1965). It could not be decided whether some of the impressions found on sherds at Hembury and Maiden Castle were of einkorn or emmer (Helbaek 1952).

Emmer on the other hand is known to occur at Hembury, Maiden Castle and Windmill Hill (Helbaek 1952; Smith 1965). The evidence from the last site shows that emmer was the main crop, and together with einkorn it accounts for over nine-tenths of the cereal remains (see Table No. 140). On a statistical basis it is probable that nearly all the ambiguous einkorn or emmer impressions belong in fact to emmer.

Naked wheats were rare in this context, with only a single instance of bread wheat at Hembury (Jessen & Helbaek 1944; Percival 1934) and a possible occurrence of either bread or club wheat at Maiden Castle (Helbaek 1952). In addition to the above evidence, an unspecified type of wheat was found at Haldon (Jessen & Helbaek 1944).

Wheat was more important than barley to this culture and the chief crop appears to have been emmer. Einkorn and bread wheat were present in small quantities only.

**Barley**

Barley is known from three sites in this context. Both naked and hulled barley have been identified at Maiden Castle (Helbaek 1952) and Windmill/
Windmill Hill (Helbaek 1952; Smith 1965). A further instance of naked barley occurs at Whitehawk (Helbaek 1952). The type-site of Windmill Hill shows that barley accounts for less than a tenth of the cereal crops, and that the naked variety is encountered more frequently than the hulled (see Table No. 140). In Helbaek's opinion, all finds are probably of the six-rowed variety *Hordeum hexastichum*.

**Flax**

Two impressions of flax were found at Windmill Hill and are probably of the *Linum usitatissimum* variety (Helbaek 1952; Smith 1965). This plant was cultivated in limited quantities.

**Summary**

The agriculture of the Windmill Hill people was based upon cattle breeding and emmer cultivation. All of the cattle are fairly large in size, and it is probable that the local aurochs were being domesticated. Turfary sheep and goats as well as medium and large pigs were kept and it is probable that the importance of ovicaprines increased as the culture progressed and more land was cleared. Turfary dogs found at Windmill Hill sites compare well with those from Switzerland. Apart from emmer, einkorn, bread wheat, possibly club wheat and both naked and hulled barley and flax were cultivated. They were, however, of minor importance in comparison with emmer. From the size of these emmer grains Helbaek was able to conclude that the crop was well suited to its environment, and that the farming techniques were highly skilled.
The cultures considered in this section include those of Abingdon, Ronaldsway, Rinyo-Clacton and Knockadoon, together with several sites of unknown neolithic cultures. All of these cultures may be placed in the third millennium.

Abingdon pottery is found in the Upper Thames valley. A bowl with a flattened horizontal rim is the most common form. A fair amount of white grit is usually present in the clay.

The Ronaldsway culture is found in the Isle of Man and is characterised by deep pots of Windmill Hill type, which may be up to three feet deep. There are two areas in which the Rinyo-Clacton culture occurs, namely Orkney and Shetland, and southern England from Wessex to the east Anglian coast. The pottery is decorated with channels or grooves which form geometric patterns. They may have either flat or round bases.

The Irish version of the Windmill Hill culture is known as Knockadoon. Its characteristics are similar to those of Windmill Hill.

Red and roe deer, aurochs, pig, horse, bear, otter, fox, pine marten, cat, weasel, hare, vole, birds and fish were all hunted (see Table No. 141). Apart from these animals, bones of whale were found at Skara Brae in Orkney where the vertebrae were used as vessels and the jaws were probably used to support the roof. The porpoise has been identified in Ireland.

**Domestic Animals**

Cattle/
Cattle

Cattle have been identified at the type-sites of the Abingdon and Ronaldsway cultures. At the causewayed camp of Abingdon bones of cattle were more frequently encountered than those of ovicaprids or pig (Case 1956), and the animals found at Ronaldsway are closer to turbary cattle than to the primigenius stock of the Windmill Hill culture (Piggott 1954).

Cattle also occur at four sites of the Rinyo–Clacton culture (see Table No. 142). At Durrington Walls cattle were the second most frequent animal; there was a high proportion of pigs at this site (Stone, Piggott & Booth 1954; see Fig. 93 & Table No. 143). A few cattle bones were discovered at Ratfyn, and all indicate the presence of large animals (Stone 1935). The same applies to the bones found at Woodhenge (Cunnington 1929). The other site at which cattle have been found is Woodlands, and here they were slightly more abundant than pigs (Stone 1958; Stone & Young 1948).

Cattle are known in a Knockadoon context at Lough Gur, where they have been found at sites A, B, C, D, F and G (O’Riordain 1954). They are the most frequent of the domestic animals, with over a thousand bones found at site A. It is not known whether large or small cattle were present. These animals were also found in the early excavations at this site when they were identified by Studer.

The remains of cattle found at the Orkney site of Skara Brae are said to differ from any other neolithic cattle found in Britain. Childe (1931) reports bulls, cows and oxen as being present, although the occurrence of the/
the last group could not be established beyond doubt. It has in fact been questioned. The majority of bones belong to young animals and include newborn calves. The evidence from complete skulls suggests that these animals had been pole-axed, and in some instances the fragments of bone that would have been driven inwards by the blow have been found inside the skulls. On the whole these animals are large in size but are said to differ from the usual domestic aurochs. Also present were polled or hornless cattle, which are a rare occurrence during the neolithic period.

Cattle were clearly of importance to the economy of the Later British Neolithic. However, in the Rinyo-Clacton culture there is a possibility that pigs were of greater importance. Both large and small animals are recorded in different contexts.

Ovicaprids

Both sheep and goat are recorded at Abingdon, where they are less numerous than cattle (Case 1956), and at Ronaldsway (Piggott 1954). They also occur at the Rinyo-Clacton sites of Durrington Walls (Stone, Piggott & Booth 1954; see Fig. 93, Table No. 143), Woodhenge (Cunnington 1929) and Woodlands (Stone 1958, Stone & Young 1948). They are known to be the least important of the domestic animals at all three of these sites.

Ovicaprids have also been found at the Knockadoon site of Lough Gur, where they were clearly less numerous than cattle (O'Riordain 1954).

The horns of the animals found at Skara Brae are described as being heavy, widely divergent and strongly curved and are all ascribed to sheep (Childe/
(Childe 1931). The limb bones are said to be very long and slender. Bones of sheep are said to be very common, although less abundant than those of cattle. These remains have not been compared with those found at Quoyness (Zeuner 1951), Stora Karsslo (Fira 1927) or Bundsø (Degerbøl 1939), but large sheep have been found at all three sites. Those from Bundsø are known to belong to the Copper Sheep. Both sheep and goat were bred during the Neolithic in Britain, but do not appear to have been of great importance to the economy.

**Pig**

Only a single pig bone was found at Abingdon (Case 1956), and none are reported from Ronaldsway (Piggott 1954). Domesticated pigs, however, do occur at the Rinyo-Clacton sites of Durrington Walls (Stone, Piggott & Booth 1954), Ratfyn (Stone 1935), Woodlands (Stone 1958; Stone & Young 1948) and Woodhenge (Cunnington 1929). At the first site they are nearly twice as common as cattle and are the most important single element in the agricultural economy (see Fig. 93 & Table No. 143). They are small in size and are said to be similar to other Neolithic pigs found in England. Many bones of pig were found at Ratfyn, but no statistics are available. Pigs are slightly less abundant than cattle at both Woodlands and Woodhenge.

The domestic pig also occurs in a Knockadoon context at Lough Cur (O'Riordain 1954). They occur in small numbers at sites B, F and G and are much less frequent than cattle. There is also a possibility of domestic pigs at The Sanctuary (Trow-Smith 1957; Cunnington 1931), Sutton (Mitchell/
(Mitchell 1956) and Skara Brae (Childe 1931). At the last site Watson was unable to decide whether the small proportion of pig remains found were of wild or domesticated animals.

Pigs were well known as a domestic animal in most cultural contexts, but it is only in the Rinyo-Clacton culture that they become an important feature in the economy.

**Dog**

The dog is known from a few sites only (see Table No. 142). Its absence at most of these sites is probably due to the small amount of bones found, although this does not apply to Durrington Walls. The breed of dog at the Rinyo-Clacton sites of Woodlands and Woodhenge is not known (Stone 1953; Stone & Young 1948; Cunnington 1929). O'Riordain (1954) reports the canine remains from a Knockadoon context at Lough Gur as being either of a large dog or a small wolf. Hauck (1950), however, thinks that these bones are definitely of a dog. Studer also identified dog remains at this site and attributed them to Canis familiaris intermedius.

The dog identified at the Irish kitchen midden site of Rockmarshall is similar to a sheep-dog in size (Mitchell 1947), but the type of dog found at Sutton has not been ascertained (Mitchell 1956). The only definite instance of a dog in Scotland comes from Oban, since none were found at Skara Brae (Turner 1895).

Very little can be said about the state of dog breeding in Britain at this time. A fairly large dog was being bred in some areas, but there is/
is no evidence for the presence of the turbary dog.

Cultivated Plants

Wheat

There is only a small amount of evidence of wheat cultivation in this context (see Table No. 144). A single impression of emmer was found at Abingdon (Helbaek 1952), and an unidentified species of wheat is thought to be present at Townhead (Jessen & Helbaek 1944). Although no further evidence is available, wheat was almost certainly the chief crop to be cultivated.

Barley

The only two instances of barley come from Whitepark and Easterton of Roseisle where the naked variety has been identified (Jessen & Helbaek 1944).

Summary

Cattle were of much importance to the British Neolithic economy. In a Binyo-Clacton context there is a suggestion that pigs were also of significance, and may have been more numerous. Sheep and goat were also bred as was the dog, and wheat and barley were being cultivated.
Chambered tombs are found in many areas of the British Isles. Those considered in this section belong to the Severn-Cotswold, Derbyshire, Clyde-Carlingford, Boyne, Caithness-Zetland and allied tombs. Of these, the Severn-Cotswold and Clyde-Carlingford groups are the earliest. Their time-span is considerable and is estimated at 2900 - 2200. Pottery of both early and late neolithic cultures and sometimes even beakers are found in the same tomb.

There are two distinct groups from which these tombs may be derived, namely gallery-graves and passage-graves. There is no clear structural distinction between the corridor and chambers in gallery-graves, but there is a definite distinction between these in passage-graves. Gallery-graves are usually covered by long cairns and passage-graves by round mounds. The former probably resulted in the Severn-Cotswold, Derbyshire and Clyde-Carlingford tombs and the latter in the Boyne and Caithness-Zetland groups. These tombs are usually constructed of large stone slabs, and in a few instances in Ireland and Scotland they are built of smaller horizontal slabs.

Once the tombs were built, and the appropriate skeletons, often in a state of disarticulation, placed inside, the chambers and passage were rammed full of earth in which there was a mixture of sherds, flints and bone.

Apart from the remains of domestic animals, bones of wild animals were often found in these tombs. Those identified include red deer, roe deer/
deer, aurochs, pig, horse, fox, cat and possibly wolf (see Table No. 145). In the north of Scotland a very large selection of bird bones have been found as well as several types of fish, and squirrel, otter and vole.

**Domestic Animals**

**Cattle**

Domestic cattle are the most frequent animal to occur in the British Chambered Tombs. They have been identified at sixteen Severn-Cotswold tombs, one Derbyshire tomb, three Clyde-Carlingford tombs, two Boyne tombs and at twenty of the Caithness-Zetland and allied tombs (see Table No. 146).

In general there is very little information available other than the presence of the individual animals at the various sites. There has been no racial identification of the cattle remains from the Severn-Cotswold group, although the animals from Notgrove are thought to be relatively small in size (Clifford 1937). This could imply the presence of the turbarry breed. Many bones were recovered at West Kennet, and cattle and pig are the most frequently occurring animal; it is not known whether the cattle were large or small in size (Piggott 1962).

Cattle have also been identified at the Derbyshire site of Ringham Low (Piggott 1954a) and at the three Clyde-Carlingford tombs of Ballyalton, Goward and Loughcrew (Piggott 1954a).

The osteological remains from the Boyne tomb of Bryn Celli Ddu are of interest (Piggott 1954a). The skeleton of an ox was discovered in the forecourt, placed centrally to the entrance of the cairn. It is thought that/
that the turbary breed is present. This is of interest, since this breed has not been recorded at Windmill Hill and allied sites, and Bokonyi and Kubasiewcz (1961) noted a similar occurrence in Poland, namely that the cattle remains from the tombs were smaller than those from the settlements.

Ritchie (1920) carried out an investigation of the animals identified at the Scottish tombs of Camster, Garrywhin, Hill of Bruan, Loch Stennis and Ormiegill. In considering the neolithic of Scotland as a whole, of which these sites form the basis, he found that the cattle were fairly small and bore similarities to the turbary race. He thought none of these animals originated from indigenous wild stock, which he attributes to 'an exceptionally wild strain in the Scottish race'.

Most of the work on the Scottish material, however, has been done by Henshall (1963). The cattle remains from Blackhammer are known to be less frequent than those of sheep (Henshall 1963, p.185), skulls of young animals were found at Knowe of Rowiegar (Henshall 1963, p.215), and most of the bones identified at Lower Dounreay are attributed to cattle (Henshall 1963, p.281). Cattle were again the most frequent animal found at Midhowe, and the remains include many bones of immature animals (Henshall 1963, p.225).

These animal bones have been found in all parts of the tombs. They occur on the chamber and passage floors, at the entrance and forecourt as well as in the rammed filling. In one instance, at Holm of Papa Westray, they are recorded between layers of stone (Henshall 1963, 201). The bones can be either burnt or unburnt.

Cattle have been identified at more Chambered tombs than any other domestic/
domestic animal. Although little information of their nature is available, the indications are that they were fairly small in size.

**Ovicaprids**

Either sheep or goat have been found at eleven tombs of the Severn-Cotswold group, one of the Clyde-Carlingford and sixteen or seventeen of the Caithness-Zetland tombs (see Table No. 146).

Again there is very little information from the Severn-Cotswold tombs. Bones of ovicaprids occur in all parts of the sites, and only goat is known with certainty. This animal has been identified at Ffostyll and Poles Wood East (Crawford 1925). Bones of ovicaprids have been found at various locations within the tomb of West Kennet, but they are less frequent than both cattle and pigs (Piggott 1962).

It is not known whether sheep or goat were present at the Clyde-Carlingford tomb of Ballyalton (Piggott 1954b), but there are many instances of sheep in the Caithness-Zetland group of tombs. There is no definite occurrence of goat. When Ritchie (1920) made his examination of the Scottish material he came to the conclusion that the turbary sheep was the only animal that was represented. The only detailed investigation since then comes from the tomb at Quoyness. Zeuner (1951) did an analysis of ovicaprid cranial remains which proved to be of sheep. These sheep showed close agreement with semi-wild and undeveloped breeds, and Zeuner came to the conclusion that they belonged to a primitive race with some moufflon characteristics. Many similarities to the Soay sheep were noted, but/
but the two were not identical.

Sheep were the most frequent of the animals found at Blackhammer in Orkney (Henshall, 1963, 185). In all, bones of at least eight adult sheep were found in the eastern-most chamber, and sixteen were represented in the stony filling of the chambers. The breed is not known. Sheep also occur at Embo in Sutherland (Henshall 1963, 102n), Lower Dounreay in Caithness (Henshall 1963, 281), Midhowe (Henshall 1963, 225) and from the Orkney sites of Holm of Papa Westray, Knowe of Ramsay, Knowe of Yarso, Isbister, Unstan and Wideford Hill (Henshall 1963, p.201, 206, 213, 218, 243, 246).

Ovicaprids are not known from as many sites as are cattle, and sheep appear to be more common than goat. This is particularly true in the north of Scotland, where two breeds of sheep, one the turbary sheep and the other a moufflon-like animal are known, but there is no indication of the presence of goats.

Pig

The domestic pig is known from at least four Severn-Cotswold sites, one Clyde-Carlingford, and probably two of the Caithness-Zetland tombs (see Table No. 146).

As well as being present at five Severn-Cotswold tombs, there is a possibility of domestic pigs at a further four sites. These occur at Burn Ground (Grimes 1960), Pfoystyll (Crawford 1925), Notgrove (Clifford 1937) and Nymsfield (Crawford 1925). In most of these cases the osteological/
osteological remains come from large animals, and the investigators could not be sure if they originated from wild or domestic species. It is not known whether large or small pigs were present at the remaining sites. Pig bones occur frequently in all parts of the West Kennet monument, and together with cattle they are the most numerous of the animals found (Piggott 1962).

Pigs are also reported from the Clyde–Carlingford tomb of Ballyalton (Piggott 1954b) and are probably present at the Orkney tombs of Midhowe and Wideford Hill (Henshall 1963, p. 225, 246). Their exact status is unclear from earlier excavations, but there are many instances of wild pigs (see Table No. 145).

Pigs were less common in the Chambered Tombs of Britain than both cattle and oviscaprids. There are several cases of large animals which could be either domestic or wild, but no known instances of turbary pigs occur.

**Dog**

Dogs are well represented in all groups of the Chambered Tombs that are considered (see Table No. 146).

There are seven cases of dogs in the Severn–Cotswold tombs. The race of dog is unknown in all cases, but in one instance remains of a large dog or wolf were found. This occurs at Notgrove and Bates (Clifford 1937) thinks that the former is more likely. The dog is also known from the Derbyshire tomb of Ringham Low (Piggott 1954b) and the Clyde–Carlingford tomb/
tomb of Ballyalton (Piggott 1954a).

Amongst the Scottish material, the remains from Burray and Cuween Hill are of especial interest. A dog's skull was carefully deposited in each of the seven chambers at Burray, and also in the passage (Henshall 1963, 188). Only one of these skulls is preserved (see Pl. ). On the floor of the tomb at Cuween Hill twenty-four dogs' skulls were found, and further bones were found in the stony filling of the chambers. The dog is the only animal known from the floor level of this site (Henshall 1963).

There are a further seven instances of dog in the Caithness-Zetland tombs, but in none of these cases has the species been identified (see Table No. 146).

The dog is present in many of the tombs considered, but no racial identification has been made. There is a probable occurrence of a large dog at a Severn-Cotswold tomb, but one would also expect the turbary breed to be represented.

Cultivated Plants

Wheat

There is no identification of wheat amongst the Severn-Cotswold tombs, but impressions have been found at two Clyde-Carlingford sites and one Boyne site.

The only species known to be present are einkorn and emmer. Both of these have been identified at Dunloy Cairn (Jessen & Helbaek 1944). An unidentified wheat was present at the other Clyde-Carlingford tomb of Mull Hill on the Isle of Man (Megaw 1939; see Table No. 147).

The/
The only other known instance of wheat comes from the Boyne tomb of Baltinglass Hill (Piggott 1954b).

Although there is no case of wheat from a tomb in the south of England, it is known that wheat was cultivated there at this time from the evidence of other cultures. There is evidence for the cultivation of einkorn and emmer in Ireland, and the absence of wheat in Scotland may be expected owing to the climatic conditions, and the small amount of evidence.

Barley

There are three instances of barley, one from the Severn-Cotswold area and two from northern Scotland (see Table No. 147). At each of these sites only a single impression was found.

Helbaek identified the cereal impression from West Kennet as six-rowed naked barley (Helbaek 1952). It was found on a sherd of Peterborough ware. The barley from the Scottish sites of Calf of Eday and Unstan are reported as naked and hulled respectively (Jessen & Helbaek 1944).

Barley occurs at tombs in southern England, and northern and southern Scotland. The six-rowed naked variety was cultivated, and there is also one case of glumed barley.

Summary

The most frequent animal in the Chambered Tombs of the British Isles were cattle. Although no definite evidence is available, the indications are that they were fairly small in size. Sheep and goat have also been found/
found, and sheep were more common than goat, particularly in Scotland. In this area two breeds appear to be present. One is turbarly like in appearance, and the other has moufflon characteristics. No comparisons between this sheep and the Copper Sheep of Switzerland and Scandinavia have been made, but since the Copper sheep is very close to the moufflon there must be some relationship between the two. The pig is the least frequent of all the domestic animals, and there are many cases of dogs. In Scotland ritual deposits of dogs' skulls have been noted at two sites.

Both wheat and barley were cultivated, the only species of wheat known with certainty are einkorn and emmer. Barley was probably the main crop in Scotland where both naked and glumed types occur.
20. - POLLEN ANALYSIS

The technique of using pollen analysis to illustrate the proximity of a farming community in a certain area was first discussed by Iversen (1941). These communities first appear at the zone VIIa/b transition. Zone VIIa is known as the Atlantic period and zone VIIb as the sub-Boreal period. Half way through zone VII some important changes were noted in the mixed oak forests in Denmark. These took the form of a rapid fall in *Ulmus* (elm) and *Hedera* (ivy) and an increase in *Fraxinus* (ash). These changes appear to have taken place over the whole of Denmark on both fertile and infertile land. Iversen shows that this vegetational change could not be the result of a sudden decrease in temperature since there is a sudden increase in the pollen of herbaceous plants, nor could it be the result of the lowering of the ground water level after a dry period. It was entirely due to man's influence. The evidence also indicates that fire was the method by which the dense forests were cleared. Charcoal deposits were found just beneath the level of the fall in elm pollen.

Troels-Smith (1960) also considers the various possibilities for the cause of an elm decline. The presence of an elm disease, as in recent years in America, would be possible, but difficult to prove and rather unlikely. The decline cannot be due to soil deterioration since this would produce a gradual fall and not the rapid one that is observed. Troels-Smith also dismisses the idea of a climatic change, which is substantiated by the finds of grape vine pollen in Denmark. He comes to the/
the conclusion that the change in the pollen diagram must be due to human interference. He found two elm declines, and attributed the first to the feeding of cattle, and the second to cattle feeding and cultivation. This interpretation has been questioned, and a different explanation is given for this phenomenon in Britain.

After the decline in the forest, regeneration took place fairly rapidly. The first to appear were Betula (birch) and Alnus (alder). These have a greater power of dispersal than Quercus (oak) and are also attracted by light open areas in the forest. Their prevalence is probably slightly exaggerated since they take only 10 - 12 years to flower and produce pollen whereas oak takes between 30 and 40 years. After this, Betula falls in frequency as more trees come into the cleared area. At the minimum in the mixed oak forest there is a corresponding maximum in the Plantago (plantain) curve and herbaceous plants are more frequent than before. At this stage there was also an increase in certain weeds, which are known as the weeds of cultivation. These include Artemisia, Rumex and the Chenopodiaceae. The presence of these weeds is often the best guide to the presence of cereals since wheat and barley are self-pollinating and so do not produce very much pollen.

Sometimes, however, cereal pollen has been detected. Fribas (1937) pointed out that it could be distinguished from wild grasses, both on the pollen structure and on size (Iversen 1941). Cereal pollen is thick-walled, has a large pore and well marked ring and on the whole is larger than that of grasses. The value taken for the minimum size of cereal pollen varies/
varies, but Iversen regards pollen with a diameter greater than 35 \( \mu \) as being that of cereals.

Denmark

Pollen diagrams have been constructed for many Danish sites. One of the first at which this was done was Ordrup Møse near Blocksberg. A thin layer of charcoal was detected, and immediately above this was a marked \textit{Ulmus} decline, together with a slight maximum in herbaceous plants. The presence of \textit{Plantago} was noted for the first time. After the minimum in the mixed oak forests the trees increase rapidly, particularly birch, hazel and alder. The bone of a domestic ox was found between the level of the charcoal and the minimum of the mixed oak forest.

The pollen analysis from the Ertebølle site of Braband Sø showed a clear decrease in \textit{Ulmus} and \textit{Hedera} together with an increase in \textit{Fraxinus}. \textit{Plantago} also appears at the zone transition and attains its maximum at the oak forest minimum. The transition at Bøling Sø is again distinct with an \textit{Ulmus} decrease and \textit{Fraxinus} increase. \textit{Hedera} is less frequent than usual. \textit{Plantago} first appears at this point and is continuous from then onwards.

The same features are again observed at Hostrup Sø in south Jutland. \textit{Plantago} appears at the mixed oak forest minimum, but decreases rapidly in the upper portion of the diagram. Both \textit{Plantago} and \textit{Artemisia} are frequent at Korup Sø, the former attaining its maximum at the minimum of the mixed oak forest. The same maximum and minimum coincide at Snarup Møse in Funen.
Funen, and Hedera declines and Fraxinus becomes more common. The Ulmus
decline almost amounts to its disappearance at Soborg Sø. There is a
strong maximum in Plantago about a third of the way through the sub-Boreal
period. At Tinglev Lake in south Jutland, on the other hand, the minimum
of the mixed oak forest is very indistinct, and the birch maximum is
completely absent. There is a low maximum for Plantago, but no other
indication of forest clearance (Iversen 1949).

The 'landnam' phase is exceptionally well marked at Saekkedam in north
Zealand. There is a strong Plantago maximum at the mixed oak forest
minimum, as expected. At the Passage Grave site of Bundsø (Middle
Neolithic) there is a well marked minimum in the mixed oak forest,
corresponding to the level of the settlement. Birch and hazel are the
first to appear afterwards, followed by a second minimum in the forest, but
there is no birch maximum. The diagram for the site of Troldebjerg was
made at Gammellung bog. The Betula and Corylus maximae are both missing
on the diagram, but the other characteristics are as before. There is
also evidence for land clearances at Aamosen and Dyrholmen (Troels-Smith
1960). At the latter site the clearance was maintained for some time.
Clearance by fire is suggested at Troldebjerg, and similarly at Blandebjerg
and Lindø (Iversen 1949).

The utilisation of elm leaves and branches as fodder has been
described by Troels-Smith (1954, 1955, 1960). The lower branches of the
elm trees would be collected, stored and fed to the stalled cattle, or
alternatively be eaten directly by the cattle. The elm would take seven
to/
to eight years to produce pollen again, by which time the new pollen bearing twigs would have been reaped. The result is that the trees continue to thrive but produce no pollen. Both Iversen (1949, 1960) and Troels-Smith (1954, 1955, 1960) report this method of husbandry still being practiced in several areas of Europe. These include Norway, Switzerland, Italy, Rumania and Bosnia. Troels-Smith believes that these early neolithic cattle were kept in stalls rather than allowed to wander free, since plants such as Allium would be eliminated immediately by untethered cattle. He also concludes that the pasture area was small since the Gramineae curve does not rise appreciably and there is still a relatively small quantity of Plantago.

Troels-Smith also shows that ivy was probably used as fodder in both Denmark and Switzerland. In the Praesto area of Denmark it falls to a seventh of its frequency in Atlantic times, and a considerable drop has been observed elsewhere in Scandinavia. The fact that cattle eat ivy has been recorded in classical literature (Theophrastos in 286 B.C.), in Egypt ivy was consecrated to Osiris, and as recently as 1953 Iversen saw a farmer gathering a basket of ivy for his cattle near San Cataldo in Italy.

There is also a possibility that mistletoe was used as fodder, perhaps in winter when food was scarce. This method of nutrition was used in antiquity (Theophrastos 286 B.C.; Pliny 23 - 79 A.D.) and today some Greek peasants feed it to both cattle and goats to make them fertile and to keep away illness. It was also used as fodder in France, Belgium, Austria and Germany earlier this century. It is said to have increased the milk yield, and/
and to turn the butter 'a nice yellow colour'.

**Holland**

The same zone-transition features as have been observed in Denmark have been found in Holland. A detailed analysis of Linear Pottery sites (Bodemonderzoek Berichten 1955, Palaeohistoria VI–VII, 1958–1959) show the clear minimum in the mixed oak forests accompanied by the maximum in plantain and grasses. There is also much evidence for the presence of *Plantago lanceolata* in burial mounds of the TRB, Single Grave and Bell Beaker cultures. This pollen has been detected in the old land surface under the mounds at Buinen, Emmen, Wapse, Steenbergen, Diever and Noordlaren in a TRB context (Groenman-van Waateringe 1961). In the second context they occur at Eext, Havelte, Hijken, Ruinen, De Eeae Spier and Havelte and plantain pollen has also been found at the Bell Beaker sites of Odoorn and Oudemolen. It is present at three late neolithic sites near St. Walrick in Overasselt as well (Groenman-van Waateringe 1961).

**Sweden**

The pollen analysis carried out at Falbygden (Troels-Smith 1960), Mogetorp (Florin 1958) and Vatteryd (Hjelmqvist 1958) is discussed. At the late neolithic site of Falbygden in central Sweden the characteristic Ulmus decline together with increases in *Plantago* and *Gramineae* have been observed. Cereal pollen has also been detected. The Ulmus minimum and Gramineae maximum are again present at Vatteryd. *Plantago* has also been identified/
identified, as has cereal pollen.

Two phases of land occupation have been found at Mogetorp. The second of these is more marked although elm declines continually after the beginning of the first phase, reaching its minimum during the second phase. Shortly after the commencement of the first occupation there is a notable change in the composition of the forest, similar to that found in Denmark, and an increase in the pollen of herbaceous plants. It is at this stage that Plantago pollen and cereal pollen occur for the first time. Weeds of cultivation were also present. During the second phase it was possible to identify some of the cereal pollen as belonging to Triticum. There is also a slight maximum in the Gramineae curve at this point, as well as one in Pteridium followed by one in Betula. Both are regarded by Florin as a direct result of forest clearance by fire. A sample of pollen grains were also sent to Troels-Smith in 1951 for identification, and he found that Plantago, Artemisia and Chenopodiaceae were all present. A second series of samples were taken by Florin from another area, and they echo these results.

Norway

Paegri (1944) and Hafsten (1960) have done most of the work on pollen analysis in Norway. Hafsten (1960) gives evidence for the introduction of agriculture into the Oslo area in the zone VIIa/b transition. Plantago appears for the first time at this point and there is an increase in Rumex and Artemisia. The characteristic minimum in the mixed oak forest occurs at/
at the point of the maximum of the weeds of cultivation. The expected charcoal layers are also present. Hafsten attributes these changes to an immigration in the Dolmen period (TRB C). There is also an increase in the pollen of weeds at a slightly later stage, which is probably connected with expansion during the Flint Dagger period of the late neolithic. These results also apply to the Mjøsa region (Hafsten 1960).

Pollen indicative of cultivation is also present at the sub-zone transition in Åstjern in Helgøya. Hafsten attributes this to the island's good defensive position and to its soil which is fertile and easy to work. A clear elm regression is seen on all the diagrams (Åstjern, Helgøya and Hedmark), accompanied by cereal pollen and weeds of cultivation.

Faegri (1944) considers the evidence for the introduction of agriculture to western Norway. The main diagram considered is that from Lassetjern. Here, no evidence for the presence of agriculture was found before the Norwegian sub-zone Xb. At this stage cereal pollen (diameter greater than 40 μ), and plantain occur together with a small maximum in Rumex. Both the Plantago and cereal curves show that agriculture was not very extensive in this part of Norway. This result is to be anticipated since there is not much evidence for the neolithic period in this area. Pollen analysis carried out at Lego, well known for Noatvet-type settlements, shows that agriculture was not introduced there until sub-zone Xb also (Faegri 1944).

The transition between the Dolmen period (TRB C) and the Passage Grave period (Middle Neolithic) took place in zone Xa, so that the earliest evidence/
evidence for agriculture in western Norway cannot occur before the end of the Passage Grave period. It is conceivable that it did not happen before the Stone Cist period. Faegri concludes that the Nostvet hunter-fisher culture came to a sudden end all along the coast of western Norway, and was quickly followed by a farming culture in Jaeren (the Vespestad culture), which did not reach Bømlo until a few centuries later. These two cultures do not appear to be contemporary, unlike the Danish Ertebølle and TRB cultures. It is probable that agriculture was never very intensive, and that the economy was basically that of hunter-fishers who cultivated plots of land and bred cattle. The site of Ruskennesset near Bergen illustrates this situation (see p.241). It should be noted that the soil in this area of Bømlo is not suited to intensive farming since it is both shallow and scarce; the situation in Jaeren is much more favourable to agriculture.

Germany

Müller (1947) carried out an investigation of the pollen analysis of the areas around the Federsee and Bodensee settlements. Three profiles were obtained at Federsee. They show the change in Ulmus, the appearance of Plantago and the increase in Corylus followed by the occurrence of cereal pollen. On the basis of these profiles Müller comes to three conclusions. These are that agriculture was well known in the area of the Federsee before the late neolithic settlements, that there was very little activity after these until the early Bronze Age and it is possible that/
that the region was uninhabited. At a later date it was re-inhabited until the Middle Ages.

There is a slight trace of cereal pollen in the Bodensee diagrams before the late neolithic, but the chief occupation seems to have been during this period as expected. Plantago has also been detected (Müller 1947).

Investigation carried out at Gatersleben (Linear Pottery site) and Kommerner See near Brux (Linear Pottery and Baden) revealed the presence of exceptionally early cereal pollen (Milojić 1960). At the first site this pollen, accompanied by Plantago, was found in zone VI (early Atlantic), and at the second site cereal pollen was found in zone Vb (Boreal). On the basis of these two finds it has been claimed that cereal cultivation was already practiced during the Mesolithic. Plantago was, of course, present in open areas during the mesolithic period so that its presence does not imply the practice of agriculture, and in order to be sure that the pollen of cereals was present it is necessary to examine the structure of the pollen grain as well as its size.

Switzerland

Pollen analysis has recently been carried out at the Michelsberg site of Thayngen-Weier (Troels-Smith 1955). The mixed oak forest dominates the landscape and the decline in Ulmus is very clear. There is definite evidence for the proximity of cultivated plants. A few grains of Polygonum cfr. aviculare were identified and their position coincides with a lesser maximum/
maximum in weed pollen (Analysis 10). *Plantago* has been identified in many profiles. Its presence in Analysis 4 is of importance since it indicates that it grew as a result of the agriculture of the Michelsberg settlement. A decline in *Hedera* is also apparent.

Troels-Smith uses the figure of 40 μ as the border line between grass and cereal pollen. Cereal pollen occurs first in Analysis 9, and a considerable quantity is found in Analysis 10. A microscopic examination of this pollen shows that it was nearly all barley pollen, with a small amount of wheat present.

After the beech maximum the curve falls evenly and steeply. Troels-Smith shows this is not due to climatic conditions and concludes that it is due to man's influence. Since ash and lime do not rise but remain constant Troels-Smith thinks that they were used as fodder. This method of feeding animals would involve an enormous quantity of foliage, and it is estimated that two thousand bundles would be needed per cow per annum.

The presence of agriculture at Burgaschisee is not as clear as that at Thayngen-Weier (Troels-Smith 1955). A slight elm decline is visible and the first signs of cultivated plants come with the presence of *Polygonum persicaria* (Analysis 9) and later with *Plantago* (Analyses 9 & 13).

**France**

Pollen diagrams have been constructed for the region of south-west France near Biarritz, and also at two places in Brittany. In most cases this is the best evidence for the spread of agriculture over France.
The first analysis comes from a coastal mud bed 3 km. south of Biarritz at a place called Mouligna. The Atlantic/sub-Boreal transition is clearly represented and has a carbon 14 date of 3150 ± 130 B.C. (Q 314). Originally it was identified as an Asturian site, and until recently was regarded as representing the expansion of mesolithic Iberian cultures. In 1953 Laplace-Jauretche recorded finds of western neolithic pottery associated with this Asturian industry. The obvious conclusion was that the two were in fact contemporary. Four soil samples were taken and in each of these there was a high percentage of Pteridium (Bracken) in the level corresponding to the Asturian flints. There were also low values for Pinus and Corylus at this point. Pteridium pollen has been found at many British sites and is nearly always associated with Plantago and other weed pollen, and indicates deforestation. At Mouligna, however, it is found alone. Charcoal has been found in many of the samples from this site, and it is known that bracken thrives in areas that have been cleared by burning. It therefore seems probable that land clearance was being carried out at the time of the Asturian settlement at Mouligna.

Two bogs in Brittany have also been examined. The Ulmus decline and Plantago increase are present at St. Michel de Braspart and Spezet (Radiocarbon 1963). The carbon 14 date for these occurrences at the first site are 3460 ± 60 (GRN-1983), and 1830 ± 55 (GRN-2175) respectively. The last date is said to mark the arrival of herdsmen in the area. The date for the Plantago increase at Spezet is 1990 ± 75 (GRN-2161) and this presumably also marks the arrival of herdsmen.
British Isles

Pollen analysis has been carried out at several localities in the British Isles. These include Cambridgeshire, Norfolk, Yorkshire, the Lake District, Lanarkshire, Perthshire, Co. Derry, Co. Limerick, Co. Antrim, Co. Derby and Co. Galway.

Excavations at Peacock's Farm, Shippea Hill revealed traces of mesolithic, neolithic and Bronze Age occupations. An Ulmus decline was visible at the zone VIIa/b transition, and it is dated to 3400 B.C. (C 14 dates for the neolithic occupation are 2910 ± 120 (Q 525/6) and 2990 ± 120 (Q 527/8); Clark & Godwin 1962). The Gramineae curve remains unchanged at this point, and this is attributed to one of three alternatives. These are that either the area of human occupation was small, or that the area from which the pollen was collected was only slightly affected by the clearance, or that the local pollen productivity of the fen woods obscured the effect of the clearance on the dry land. Other evidence for human activity in the area include the presence of Plantago for the first time, and of Pteridium, Compositae and Ranunculus. The last two are indicative of a vegetational change. Plantain is present from the beginning of the neolithic until recent times, and its maximum occurs at the point where the bracken appears. Further proof of farming comes with the discovery of a sheep's metacarpal in the neolithic level.

A distinct Ulmus decline was again observed at Hockham Mere in Norfolk, where it is accompanied by an increase in the pollen of grasses and herbaceous plants (Godwin & Tallantire 1951). Plantago is also present in/
in small quantities. This activity is to be expected in this area since the flint mines of Grimes Graves are only a few miles away.

The evidence for vegetational change in Yorkshire is described by Dimbleby (1952, 1954, 1961). There is no evidence for a neolithic occupation in this area, but there are various mesolithic and Bronze Age sites. Comparison of the pollen samples from above and below the flint layer at Blackamore showed that the forest was becoming more open, and an abundance of charcoal suggests that this was caused by fire. Also Plantago was detected above the mesolithic flints but was absent beneath it.

Bronze Age barrows on Hackness moor were sectioned and the old land surface upon which they were built was examined. The pollen shows that the vegetation then was different to that of the present day. There was a high percentage of tree pollen indicating that it was not open country, and Plantago, Chenopodiaceae and Sceleranthus were identified and indicate that there was probably some land clearance in the vicinity of the barrows. Further into the moors at Silpho, there was no trace of weeds of cultivation, which Dimbleby interprets as implying that cultivation never extended over the main area of the present day moor. The Bronze Age barrows of Burton House also show the change in vegetation. When barrow 4D was built the area was largely forested, but by the time IA was built the forest had receded.

Recently there have been several pollen diagrams constructed for the Lake District. Scaleby Moss, near Carlisle, shows the subzone boundary clearly and it is dated to around 3,000 B.C. as expected (3030 ± 119 (Q 172), 2975/
2975 ± 134 (Q 171); Godwin, Walker & Willis 1957). At this point there is a rapid decline in the proportion of Ulmus, accompanied by discontinuity in the Pinus curve and followed by a maximum in Alnus. Also Fraxinus appears shortly after the decline for the first time. At many sites in this area two elm declines have been distinguished. The primary decline is accompanied by a small amount of Plantago pollen but the secondary decline is much more marked, with greater amounts of Plantago pollen, the appearance of Artemisia and Rumex in significant quantities and an increase in the pollen of Gramineae (Oldfield 1963). This is taken to represent the true Landnam phase. The sites considered by Oldfield include Urswick Tarn, Ellerside Moss, Thrang Moss, Witherslack Hall, Nickols Moss and Hawes Water. At Thrang Moss a steady increase in the pollen of Hedera was observed until the second elm decline, at which point it disappears completely from the diagram. High frequencies of Alnus are also observed at this stage in all the diagrams. Pennington (1964, 1965) also investigated several sites in the Lake District, including Devoke Water, Seathwaite Tarn, Goatswater, Blind Tarn, Blea Tarn, Red Tarn, Mockerkin Tarn and Burnmoor Tarn. Similar features have been found at these sites. These are to be expected, since there is known to have been neolithic activity in the area. Both Red Tarn and Blea Tarn lie close to the Langdale axe factories, and the elm decline was more intense in these diagrams.

The two Scottish sites at which pollen diagrams have been constructed are Peelhill near Strathaven, Lanarkshire, and Dalnaglar in Glen Shee, Perthshire/
Perthshire (Durno 1965). The base of the Peelhill diagram shows a low percentage of tree pollen, combined with high values in Plantago and Gramineae. This forest clearance appears to have been temporary since the tree pollen increases shortly afterwards, and Plantago disappears and Gramineae declines sharply. At a later stage there was a second clearance, and a few instances of Pteridium are recorded. Dalnaglar covers a longer period in time, and shows the start of the landnam phase at the beginning of zone VIIib. At this point the elm decline coincided with the first record of Plantago, and later in zone VIIib there is a more marked elm decline accompanied by more plantain pollen, and followed by an alder maximum and then a birch maximum. This is placed somewhere in the middle neolithic period.

The major part of the work on Irish material has been done by Mitchell, Morrison and Smith. Mitchell (1954) constructed the diagram for Lough Gur, Co. Limerick. A short distance beneath a Beaker occupation there was a sharp decline in Ulmus and an increase in the pollen of weeds and herbaceous plants. Plantago occurs for the first time, and some large grass pollen which could be that of cereals was present. These conditions last for a short period only, after which the proportion of tree pollen increases. This occupation phase is again well represented at Littleton Bog, Co. Tipperary (Mitchell 1965). At the zone VIIa/b transition there is a distinct decline in Ulmus, followed by a maximum in Corylus, a lesser maximum in Betula and the appearance slightly later of Fraxinus. There is also an increase in the pollen of Gramineae, and after the elm decline cereals/
cereals, Chenopodiaceae, Plantago, Rumex and Pteridium have been identified at various stages.

A decline in Ulmus is also seen at Lough Kilrea, Co. Derry (Smith 1961). It occurs at the sub-zone boundary and immediately afterwards Plantago appears and there is a small maximum in the Gramineae curve. Smith considers that grass pollen with diameters greater than 60μ can be regarded as belonging to cereals. On this basis he identified cereal pollen after the maximum in Plantago and Gramineae. Various weeds have also been found. After the Ulmus minimum there is a gentle increase in Betula. Smith also obtained a diagram for Fallahogy in Co. Londonderry (Smith 1958; Smith & Willis 1962). It is clearly shown that at the transition from the Atlantic to the sub-Boreal period, farmers arrived in the vicinity. There is a rapid fall in Ulmus, which almost amounts to its disappearance, accompanied by a maximum in Corylus and a slight maximum in Alnus shortly afterwards. During the period for which these maximae and minima coincide there is a marked maximum in Plantago pollen, together with that of Gramineae, Urtica and Rumex. Various carbon 14 dates were obtained for this period all of which place it around 3300 B.C.

Morrison identified Plantago together with Gramineae at the Ulmus decline at Parkamore, Co. Antrim (Morrison 1959). There was an increase in Corylus and Alnus at this point. There is a slight indication of an elm decline at an earlier level, but there are no indications of a distinct agricultural phase. Mitchell encountered a similar situation at Leigh in Co. Tipperary and at Agher, Co. Meath. He regards the earlier horizon as representing/
representing the sub-zone transition, and the later as representing the arrival of agricultural communities in the area. This is similar to the situation encountered by Oldfield and others in the Lake District, and also by Troels-Smith in Denmark.

Jessen (1951) examined the blanket bog of Glenballyemon, Co. Antrim and found a decline in both Ulmus and Pinus at the VIIa/b boundary. Plantago appears at this point. Pollen of this last plant was also found at Rievebulliagh in Co. Antrim in the upper part of zone VIIb. The Ulmus curve is low at this point. Plantago is found for the first time in the middle of zone VIIb at Ards Beg, sporadically in this zone at Roundstone I & II, and also at Cloonlara (Jessen 1951). The Ulmus curve is lower than usual when Plantago is present.

In addition to the above evidence, Godwin (1956) reports Plantago lanceolata from zone VIIb at the sites of Bartletts Trackway (Somerset), Drakes Drove (Somerset), Coumarare (Co. Kerry), Rathjordan (Co. Limerick), and Ravensdale Park (Co. Louth).

From the above evidence it is seen that the presence of farmers can be traced by means of pollen analysis through Switzerland, Scandinavia, France and the British Isles. They cleared the forest, probably by fire, cultivated the fertile soil and used it as pasture land. Elm foliage was probably used as fodder together with that of other trees and plants. The result was that the proportion of tree pollen decreased, particularly that of elm, and that of herbaceous plants, plantain and certain weeds and grasses increased. This took place at the sub-zone VIIa/b boundary in most areas, and occasionally a little later in sub-Boreal period.
LATE NEOLITHIC/COPPER AGE
AGRICULTURE

1. - GREEK LATE NEOLITHIC/COPPER AGE

The evidence from the Dimini and Larissa cultures is considered in this section. The first is confined to eastern Thessaly and the second lies to the west in Thessaly, Macedonia and central Greece, during the period 4200 - 3600. The Larissa culture is usually considered to be a little later than that of Dimini.

Characteristics of the Dimini culture include painted pottery with spiral and meander patterns which are sometimes tri-coloured, but the pots are generally inferior in quality to those of Sesklo. It bears some similarity to the Gumelnița pottery further to the north. The patterns are usually white, black or incised on a buff, brown or red background. Perforated axes rather than adzes are used for the first time and a small amount of copper and gold imports occur.

The Larissa pottery on the other hand is either white and black painted ware or black burnished ware, and when decoration occurs it is usually in the form of rectilinear patterns rather than spirals.

Red deer, roe deer, aurochs, pig and either water or marsh turtle have been identified in this context, but their proportion relative to domestic animals remains small (see Figs. 95-98, Tables Nos. 13,21).

Domestic Animals

Cattle/
Cattle

Domestic cattle occur at three sites in a Dimini context. They are known from Arapi (Boessneck 1955, 1962; see Fig. 96, Table No. 21), Argissa (Boessneck 1955, 1961; see Fig. 95, Table No. 13) and Otzaki (Boessneck 1955; see Fig. 97, Table No. 21), and as is seen, they are the least important of the three main domestic animals in every instance. There is no indication of animals over 115 cm. in height, and some of the osteological remains compare well with those from Proto-Sesklo levels.

The only definite instance of cattle in a Larissa context comes from Otzaki where remains were found of a late phase (Boessneck 1955). Here a change is visible from the preceding cultures, and cattle become the dominant feature for the first time in Greece (see Fig. 98, Table No. 21). This dominance of cattle continued during the Early Bronze Age period of this site (Boessneck 1955).

Cattle also occur at the site of Kritsana (Heurtley 1939) and Olynthus (Mylonas 1929).

It appears that cattle were the least important of the domestic animals during the Dimini culture, but that this situation changed during the late Larissa phase when their numbers increase greatly. This trend is continued into the Early Helladic period.

Ovicaprids

Sheep or goats occur at the Dimini sites of Arapi (Boessneck 1955, 1962; see Fig. 96, Table No. 21), Argissa (Boessneck 1955, 1962; see Fig. 95, Table/
Table No. 13) and Otzaki (Boessneck 1955; see Fig. 97, Table No. 21). In each case they are the chief domestic animal. Remains of goats were slightly more frequent than those of sheep at Arapi, but at Otzaki only sheep could be identified with certainty. Most of the animals were of medium-size although considerable variation on either side of this has been noted (Boessneck 1955).

During the Larissa period at Otzaki ovicaprids come a close second to cattle in the order of importance of the domestic animals (Boessneck 1955; see Fig. 98, Table No. 21). They occupy a similar position during the Early Helladic phase.

Sheep are known to occur at Kritsana (Heurtley 1939) and either sheep or goats at Olynthus (Nylonas 1929).

Sheep and goats were the dominant feature in the Dimini economy but their importance fell during the Larissa phase when they were exceeded by cattle.

Fig

The domestic pig has been identified at the Dimini culture sites of Arapi (Boessneck 1955, 1962; see Fig. 96, Table No. 21), Argissa (Boessneck 1955, 1962; see Fig. 95, Table No. 13) and Otzaki (Boessneck 1962; see Fig. 97, Table No. 21). In every case they are the second most important animal, being slightly less frequent than sheep or goats. The bones from both Arapi and Otzaki illustrate the fact that these pigs are of small and medium size and are comparable with the central European turbary pig.
The few remains that lie beyond this maximum could originate from the small indigenous wild pig. As was the case during the Sesklo phase, a large proportion of these animals are either young or sub-adult.

In the Larissa context at Otzaki pigs are probably less important than both cattle and ovicaprids (Boessneck 1955; see Fig. 98, Table No. 21), as they were during the subsequent period. Adult animals are again in the minority.

The pig is also known at Kritsana (Heurtley 1939).

The late neolithic and copper age pigs of Greece appear to be all of the turbary variety. They were the second most frequent animal during the Dimini culture and fell to third place during the Larissa and Early Helladic periods.

**Dog**

Very few remains of the dog are known. They are entirely absent from Arapi and Argissa although a few bones were found at Otzaki in both the Dimini and Larissa levels (Boessneck 1955; see Figs. 97, 98 & Table No. 21). A jaw from a Dimini context originated from a very small turbary animal, whose basal length of the skull has been calculated to be in the region of 115 mm. (Brinkmann's method), and further skull fragments of slightly larger turbary dogs were found.

**Cultivated Plants**

Wheat/
Wheat

The cultivation of wheat is attested at the sites of Dimini (Wace & Thompson 1912), Olynthus (Mylonas 1929) and Sesklo (Wace & Thompson 1912). In all instances these remains were carbonised and there has been no identification of the species involved.

Barley

Carbonised grains of barley were recovered at both Dimini (Wace & Thompson 1912) and Sesklo (Wace & Thompson 1912). The variety has again not been determined and there is no indication of the frequency of barley relative to wheat.

Millet

Two instances of millet are known. Remains have been found at Marmariani (Tsundas 1899) and Olynthus (Mylonas 1929), and although the species has not been identified, it is probably the Italian millet, *Setaria italicata*, which occurs wild in western Asia and southern Europe that is involved.

Legumes

Peas are known from Dimini (Wace & Thompson 1912) and Sesklo (Wace & Thompson 1912) and it is probable that they were cultivated.

Summary/
Summary

Ovicaprid breeding was the dominant feature in the Dimini economy. Turbary pigs were the second most frequent animal and cattle the least important. The dog was also known. Wheat, barley, millet and probably peas were cultivated. During the Larissa phase at Otzaki there was a change in favour of cattle breeding and this continued into the Early Bronze Age.
The Gumelnita culture develops in Bulgaria and Wallachia and the Salcuta culture is found chiefly in Oltenia. Both cultures are divided into four phases which are contemporary and are placed between 3700 and 3200. The Gumelnita pottery continues in the late Boian tradition, namely painted ware with spiral meander patterns, but is of better quality. The flint and stone industry is also derived from Boian, with many long blades occurring, and the bone industry is much richer although also similar. Much copper is found for the first time.

The Salcuta culture is not as rich as that of Gumelnita. It has basically the same characteristics, but the pottery is a little different. There is very little painted decoration and instead graphite painting, fine rustication and wave impressions occur.

Both cultures are contemporary with Vinča–Pločnik in east-central Europe, and with late Tripolye A, Tripolye B and Ci in Russia.

The evidence indicates that hunting and fishing played only a small role in the economy of these cultures, probably forming under one twentieth of the whole meat supply. The animals hunted include red deer, roe deer, aurochs, pig, bear, horse, chamois, marten, badger, wild cat, lynx, beaver, wolf, fox, hare, tortoise, polecat, stoat, weasel, birds and fish (see Table No. 148). Of these animals, red deer is the species most frequently encountered.
Domestic Animals

Cattle

Cattle occur at sixteen of the twenty-four sites considered (see Table No. 149). They may also be present at another four sites. They are known from the Bulgarian sites of Karanovo (Gaul 1948; Georgiev 1961), Loveć (Dzambzov 1963), Madara (Bibikov 1953), Okol Glava (Gaul 1948), Pod-Grada (Bibikov 1953), and Sveta Kyrillovo (Gaul 1948). Cattle are more common than ovicaprids or pigs at the cave of Devetaki, but they do not attain the proportions of the dog (Mikov & Dzambzov 1960). In all cases the type of cattle bred is unknown.

The only instance of a statistical analysis of the bones comes from Tangiru where cattle are seen to be the most important element in the economy (Necrasov & Haimovic 1959; see Figs. 99 - 102, Table No. 69). It can be seen from the Figs. 99 - 101 that the proportion of cattle early in the culture (Gumelnita I) was probably similar to the proportion of ovicaprids, but that in the later stages (Gumelnita II & III) their dominance becomes established as the proportion of ovicaprids declines. Two different types of cattle are easily distinguished, the one reminiscent of the aurochs, and the other considerably more slender and with shorter horns. The latter is the more frequent of the two, and young animals account for a large proportion of the remains. Cattle are also the most frequent animal at Luncavita (Comsa 1962). They are again encountered at the sites around La Adam (Radulesco & Samson 1964), Aldeni (Stefan & Comsa/)
Comsa 1959), Cernavoda (Necrasov 1959; Berciu 1961), and Malul Rosu (Paunescu 1962).

Two types of cattle have again been distinguished at the Salcuta site of Vadrăsta (Berciu 1961; Mateescu 1962). Ghetie (Mateescu 1959) also reports the presence of castrated animals, as indicated by a large metacarpus and humerus. Thickening in certain areas of the bone is taken as evidence for traction. Many bones of cattle are found at the type site of Salcuţa (Berciu 1961). Final statistics are not yet available, but Berciu indicates that cattle occupy the second or third position of importance during Salcuţa I-IIb, third position during IIc, but that during Salcuţa IV they are the chief element in the economy. Bones have been found all over that site and include the ritual deposit of a bull's cranium in a pit of phase I. The majority of these bones indicate an animal of small stature.

Two types of cattle were being bred during this period and there is evidence for castration. Cattle were the basic domestic animal during most of the Gumelnita culture but this only applies to the final phase of the Salcuţa culture.

Ovicaprida

Sheep or goats have been identified at twenty of the twenty-four sites mentioned (see Table No. 149).

They are known to be less frequent than cattle at Devetaki (Mikov & Dzambzov 1960) and they also occur at Denev (Gaul 1948), Deve Bargan (Gaul 1948/
1948), Karanova (Gaul 1948; Georgiev 1961), Kodza Dermen (Gaul 1948), Loveč (Dzambsoy 1963), Madara (Bibikov 1953), Morovica (Gaul 1948), Okol Glava (Gaul 1948), Pod-Grada (Bibikov 1953) and Rusé (Gaul 1948).

The most detailed report comes from the Rumanian site of Tangiru (Necrasov & Haimovici 1959; see Figs. 99-102 & Table No. 69). For the culture as a whole, sheep and goats are less important than cattle although more frequent than pigs. When the individual phases are examined it is seen that their proportion falls from approximately the proportion of cattle down to the number of pigs. Where the distinction was possible, goats appear to outnumber sheep, and two types of the former species have been identified. These are *Capra hircus* and *Capra aegagrus*, with the first being much more frequent. The breed of sheep could not be ascertained. Ovicaprids also occur at the sites of La Adam (Radulesco & Samson 1964), Aldeni (Stefan & Comsa 1959), Cernavoda (Necrasov 1959; Berciu 1961), and Malul Rosu (Paunescu 1962).

At the Salcuta site of Vadrasta both sheep and goat have been identified. Mateescu (1958) reports that some of the goats were slender and others probably belong to the Black Goat species. At the site of Salcuta itself ovicaprids occupy second or third place in importance during phases I - IIb, become the dominant animal in phase IIc, then decline a little in importance with the rise in cattle during phase IV. In particular, many goat horns have been identified throughout this site (Berciu 1961).

Sheep and goats were important to both cultures. Generally they lie second/
second to cattle during the Gumelnița culture, but their importance varies
during the Salcuța culture. Two types of goat appear to be known but
there is no evidence as to the nature of the sheep that were bred.

**Pig**

The domestic pig is known at fourteen sites and may be present at a
further seven Bulgarian sites (see Table No. 149).

This animal has been identified with certainty at Devetaki (Nikov &
Dzambzov 1960), Karanovo, (Gaul 1948; Georgiev 1961), Loveți (Dzambzov 1963),
Madara (Bibikov 1953) and Pod-Grada (Bibikov 1953).

The evidence from Tangiru shows that pigs are the least important of
the three main domestic animals (Necrasov & Haimovici 1959; see Figs. 99 -
102, Table No. 96). However, as the Gumelnița culture progresses they
become more frequent until they attain the proportion of ovicaprids in
phase III. The increase in the number of pigs is largely at the expense
of the ovicaprids whose numbers appear to fall throughout the culture.
These pigs are all small and slender in appearance and the predominance of
young animals is marked. Pigs also occur at La Adam (Radulesco & Samson
1964), Aldei (Stefan & Comsa 1959) and Cernavoda (Necrasov 1959; Berciu
1961). At Iuncavita pigs are the second most frequent animal (Comsa 1962)
and the indigenous *Sus scrofa* pig is known to have been domesticated at Malul
Rosu (Fauneescu 1962).

Pigs are the third most frequent animal in the Salcuța culture at
Vadrâșta (Mateescu 1962), but at Salcuța pigs are the dominant feature of
the/
the economy of the Salcuța I - IIb phases. After that their numbers fall so that they occupy second position during phase IIc and third by phase IV (Berciu 1961).

The role of the pig was different in the Gumelnița and Salcuța cultures. In the first pigs start by being the least important animal and gradually increase until they are equal to the number of ovicaprids; for the culture as a whole they are less important than both cattle and sheep or goats. The economy of Salcuța I - IIb was based upon pig breeding. They then decline in importance.

Dog

The dog is represented at nearly all sites at which domestic animals have been recorded; it occurs at eighteen sites (see Table No. 149).

Of the Bulgarian sites, the remains from Devetaki (Nikov & Dzambzov 1960) are the most interesting. Here the dog was the most numerous of all the domestic animals. In all, thirty lower jaws were found, many with teeth in situ, and there were also many other bones. It should be noted that the economy of this site was based upon hunting and not breeding. Two different types of dog have been distinguished at the Rumanian site of Tangiru where a small proportion of dogs were identified (Necrasov & Haimovici 1959; see Figs. 99 - 102, Table No. 69). The first is small in size and is the turbary breed of Rutimeyer, and the larger is of an indeterminate race. This larger dog was identified as Canis familiaris intermedius from the Boian levels of this site. Two races of dog are again/
again present at Salcuţa, but they have not yet been identified.

Both the turbar dog and a larger breed are known at this stage, and it is probable that the larger individual belongs to the *intermedius* type of Wolfrich.

**Horse**

There are three possible instances of the domestic horse. Claims are made from evidence from Madara and Pod-Grada (Bibikov 1953) and also at Cernavoda (Berciu 1961). The nature of the evidence at the first two sites is not known. From the upper levels of Cernavoda come hooves which Berciu says belong to domestic animals. These come from a context slightly later than the classic Gumelnita culture, and has been termed the Cernavoda culture. These upper levels are contemporary with the later phases of the Cucuteni and Tripolye cultures. Since horses are known to have been domesticated in the latter context, their presence at Cernavoda need not be surprising. Horses are known in a wild state at the sites of Tangiru (Necrasov & Haimovici 1959), Rusé (Gaul 1948) and Hissarlik (Gaul 1948).

**Cultivated Plants**

**Wheat**

The evidence available indicates that wheat was the main crop; it has been identified at all of the sixteen sites considered (see Table No. 150). The species could not be determined at the sites of Karnobat (Gaul 1948), Janka Kubrat (Gaul 1948), Rasev (Gaul 1948), Rusé (Gaul 1948), Neckur (Gaul 1948/
1948), Yunatsita (Bibikov 1953) in Bulgaria, and at the Rumanian sites of Aldeni (Stefan & Comsa 1959), Brailita (Hartuchi 1957), Cascioarele (Gaul 1948) and Vidra (Gaul 1948). Investigations at Salcuța have not yet been completed (Berciu, personal communication).

Einkorn is known to have been cultivated at Banyata (Bibikov 1953), Karanovo (Gaul 1948; Georgiev 1961) and Yasa Tepe (Piggott, personal communication). Emmer also occurs at these three sites (see Table No. 150). The only other species of wheat to be identified was bread wheat and it occurs at Kodza Derment (Gaul 1948) and Sveta Kyrillovo (Gaul 1948). Nothing is known of the relative importance of the different species of wheat.

Einkorn, emmer and bread wheat were all cultivated and probably formed the basis of the cultivated plants of this period.

**Barley**

Barley occurs at the Giumelnița sites of Banyata (Bibikov 1953) and Karanovo (Gaul 1948; Georgiev 1961) and at the type site of Salcuța (see Table No. 150). There have been no closed identifications and nothing further is known of the cultivation of this cereal.

**Millet**

Grains of carbonised millet have been recovered at Salcuța. As yet they have not been closely identified so that it is not known whether it is *Seteria italica* or *Panicum miliaceum* that is present (Berciu, personal communication).

Evidence/
Evidence for grain storage comes from Salcuța (Berciu 1961). Many large pottery vessels were found inside houses, and often grain was found around them. There were also several mattocks which would serve as hoes, usually made from red deer antler. These occur throughout the site. In all cases they have been perforated, and were probably strapped onto a wooden shaft with leather bands. A single stone hoe was also found.

Summary

The economy of the Gumelnița and Salcuța cultures was different. However, it must be emphasised that the evidence for the Salcuța culture comes basically from a single site from which a large quantity of bones are reported. Gumelnița farming is based upon the breeding of two types of cattle with the knowledge of castration, and also on ovicaprid and pig breeding which appear to complement each other. Sheep and goats are on the whole more common than pigs.

During the first stage of the Salcuța culture (I-IIb) pigs were the dominant animal, and their place is taken by ovicaprids in phase IIc and cattle in phase IV. This pattern is strongly reminiscent of Greece. During the Sesklo culture the pig was the dominant feature, to be followed by sheep and goats in the Dimini culture and cattle in the late Larissa and Early Helladic levels.

Wheat and barley were cultivated in both cultures, but millet is only known in a Salcuța context. It is also known in the Dimini culture in Greece.
3. - CUCUTENI

The Cucuteni culture is essentially the north-east Rumanian equivalent of the Russian Tripolye culture. It is divided into three phases, Pre-Cucuteni, Cucuteni A and B which equate with Tripolye A, B and C respectively. This culture is generally regarded as being slightly earlier than the Russian counterpart, and is very difficult to distinguish from it. The painted pottery declines in quantity and quality in the later phases of the Cucuteni culture.

The wild fauna identified at sites of this culture include red and roe deer, pig, bear and beaver as well as a few bones of aurochs, wolf and otter (see Table No. 151). Hunting appears to have been of greater importance in the latter stages of the culture. During the Pre-Cucuteni phase it accounted for between a fifth and a third of the bones identified, but in phases A-B for as much as two-fifths to a half.

Domestic Animals

Cattle

Cattle have been identified at each of the eight sites considered (see Table No. 152).

The nature of the herd is best seen from the evidence of Hăbăsești and Traian. At the first site a considerable variation in both size and age of the animals is seen (Dumitrescu 1954). Small and medium-sized animals are the most common, but an ox of gigantic stature is also reported, and/
and is said to be closely related to the wild aurochs. The majority of animals were slaughtered between four and seven years of age, but some young and one of as much as fifteen years is reported. Cattle are the most frequent of the domestic animals, as is the case at Traian (Necrasov & Haimovici 1959, 1962). Here they appear to be more frequent during the Pre-Cucuteni phase than during Cucuteni A-B, although in all cases they are more than twice as frequent as any of the other domestic animals (see Figs. 103 – 105, Table No. 34). Two breeds of cattle are again clearly identified, with the larger the more frequent. A size comparison is best seen from the find of two metacarpals, of which the smaller is 0.7 times the size of the larger. Unlike the animals from Năbăsești, many here were between two and three years in age.

Cattle breeding is also said to be the most important element in the economy at Valea Lupului (Dinu 1959), and they also occur at Mindrisca (Bichir & Dogan 1962), Trusești (Petrescu-Dimbovitia 1957), Petreni (Passek 1949), Izvore (Vulpe 1957), and Ruptura-Foltești (Berciu 1961).

Cattle are the most important element in the economy of the Cucuteni culture, with two breeds clearly represented and forming well over half of the domestic stock.

Ovicaprids

Sheep or goats are known from seven of the eight sites mentioned. Their absence at Petreni is not certain since the original report was unavailable (see Table No. 152).
Both animals occur at Hăbășești, where they are again of greater age than is customarily found at settlement sites (Dumitrescu 1954). Sheep are more common than goats, and both a large and a small breed are reported. The smaller is described as similar to the tzuroana (long wool) sheep. One goat's horn core is of interest since it was both large and long and could not be assigned with certainty to a domestic animal. In the Pre-Cucuteni levels of Traian on the other hand, goats were more common than sheep (Necrasov & Haimovici 1959, 1962; see Fig. 103, Table No. 34). Ovicaprids are slightly less frequent than pigs and so come third in importance for both this stage and the 1957 Cucuteni stage. The results of 1959 make ovicaprids slightly more frequent, but not so many bones were found (see Figs. 104, 105). The sheep are thought to be larger than the turbary breed and have been identified as Ovis aries.

Nothing further is known of the ovicaprids from the remaining sites.

Both sheep and goats were bred during this culture, with two different types of sheep being reported. Information from Traian suggests they were slightly less important than pigs and formed between a tenth and a fifth of the domestic stock.

The domestic pig is known with certainty from five of the eight sites; its absence at the remainder may be due to lack of detailed reports (see Table No. 152).

Two distinct types have been reported from Hăbășești, where again adult/
adult and old animals predominate (Dumitrescu 1954). The smaller is said to be characteristic of the swamp or marsh type of pig and the larger has a long tusk and is presumably closer related to the local wild pig. At Traian on the other hand, only one type could be ascertained, and it could be related to the local wild pig, although it was more slender than the latter (Necrasov & Haimovici 1959, 1962). Pigs were more frequent than ovicaprids during the Pre-Cucuteni phase, and on average the same is true for the Cucuteni A-B phases (see Figs. 103 – 105, Table No. 34). Both ovicaprids and pigs increase slightly in numbers as the culture progresses.

The breed of pig identified at the other three sites is not known.

For the culture as a whole pig breeding was sufficiently advanced for two types to be represented. They accounted for between a tenth and a fifth of the domestic stock, and are slightly more frequent than sheep and goats.

Dog

Dogs have only been identified at Hăbăseştii and Traian. The bones from the first site include those of a small dog, presumably turbary, and others with wolf-like characteristics (Dumitrescu 1954). No exact species identification was possible at Traian, although the probability that the remains are those of the turbary breed is high (Necrasov & Haimovici 1959, 1962; see Figs. 103 – 105; Table No. 34).

Horse

The only definite instance of a domestic horse occurs at Ruptura-Folteştii
in a Cucuteni B context (Berciu 1961). Nothing further is known of these finds. There is a possibility of horse domestication at Traian.

Necrasov placed a number of horse bones recovered in 1957 in an 'Uncertain' category together with remains of pigs, and these horse bones total about a quarter the number of sheep. Only a single bone was found in 1959 and this could be safely attributed to a wild animal (Necrasov 1959, 1962).

It seems probable that the horse was being domesticated at this stage, although it remained of diverse importance as its absence at Habăsești shows. Its presence at this stage ties in with evidence from Tripolye C and the late Cucuteni or Cernavoda cultures.

Cultivated Plants

Wheat

This is the only cereal to have been identified in this context. It occurs at all five sites considered (see Table No. 153), and naked wheat is the only kind to be identified. Both the bread and club wheat varieties are known from Frumusica and Habăsești (Dumitrescu 1954). Nothing of their relative importance is known. A few grains from the latter site have been assigned to the 'globiforme' variant of club wheat. The wheat species at the other sites is unspecified. The cereal at Casolt-Boita was found in a large pot together with animal bones, and the whole was deposited in a pit (Macrea 1958). A large amount of carbonised wheat is recorded at Izvore (Vulpe 1957), but nothing is known of the wheat from Bontești. (Dumitrescu 1954).
Wheat was the main crop to be cultivated. Bread wheat and club wheat are both known, and it is probable that other types were also present although they have not yet been identified.

Vetch

Vetch is reported from Habasești (Dumitrescu 1954). It is thought to have been cultivated, although this has not been definitely established.

Summary

The agriculture of the Cucuteni culture was based upon cattle breeding with ovicaprids and pigs of about equal importance. There is a strong possibility of domestication of the horse in the latter stages of this culture, and the dog is also present in small numbers. Wheat is the only crop known to have been cultivated.
4. - TRIPOLYE

The Tripolye culture developed on the fertile black earth of the Ukraine during the period 3800 - 2900 B.C. It equates with the Rumanian Pre-Cucuteni and Cucuteni period. The pottery shows sophisticated geometric designs which are painted on red or white bases and outlined by either channelled grooves, red, black or white paint; occasionally three colours occur on the pottery. This culture is sub-divided into phases A, Bi, Bii, Ci, and Cii on the basis of stylistic variations in the geometric designs. Stone implements from sites are characteristically neolithic and are generally local in origin. Metal is found in association with the earliest phase and implements of metal become more common in later phases. Gold trinkets have been found, and in phase C amber finds suggest a contact with the Scandinavian neolithic cultures.

The average Tripolyan village consists of between thirty and forty long rectangular houses arranged on arcs of concentric circles of between 200 m. and 500 m. in diameter. Occasionally much larger villages comprising of 150 houses are encountered.

As is seen from Tables Nos. 156 - 164 and Figs. 107 - 117 there is no consistent factor for the importance of hunting relative to domestication as a means of food supply. During phase A hunting accounts for a half to three-fifths of the meat supply, during phase B for a twentieth to a third, during phase Ci the range of variation is from an eighth to a third and during phase Cii from a forty-fifth to a third. The animals hunted include red deer, roe deer, elk, aurochs, boar, bear, badger, beaver, otter, wolverine/
wolverine, marten, polecat, wild cat, wolf, fox, lynx, hare, squirrel, hedgehog, rodents, European marsh turtle, river tortoise, birds and fish (see Table No. 154).

**Domestic Animals**

**Cattle**

Bones of domestic cattle have been found at 24 of the 25 sites considered. They are absent only from Kosilovcy where the ovis caprids were the subject of a special investigation and the other animals were not mentioned (see Table No. 155).

**Stage A** This stage is illustrated by the remains from Bernova-Luka, Lenkovcy, Luka-Vrublevetskaia and Grenovka. The most detailed information comes from Luka-Vrublevetskaia (Bibikova 1956). Cattle come second to pig in importance and are about half as numerous (see Fig. 107, Table No. 156). This site is of special importance since nearly 8,000 bones were found and so a reasonable idea of the economy can be constructed. Bibikova demonstrates that the range of measurements of these cattle overlaps those of both primigenius and brachyceros cattle (p.483, Table No. 26). In a number of cases the characteristic short, broad skull of turbary cattle was identified, and horn cores of both species have been found.

Only a small proportion of bones were found at Grenovka (Hančar 1956; see Table No. 165) but more were recovered at Lenkoutsa (Hančar 1956; Passek 1961). Both large and small cattle were known, but Passek indicates that they were less important than pigs. It is the turbary breed that was/
was the most common. A large early Tripolye settlement was found at Sabatinovka, section I (Mdanyleiko & Makarevych 1956; Passek 1949). Crushed bones of cattle are reported and a model of a bull's head was also discovered.

At Bernova-Luka cattle were the most important of the domestic animals. They account for half of the domestic stock and include a large proportion of immature animals (Hausler 1956; see Table No. 155). Osteological investigations have not yet been completed at Gorodnica-Gorodisce, but after some preliminary work Miskovskij reports a great quantity of cattle bones (Hančar 1956).

**Stage B** The importance of cattle is shown by evidence from Kolomiischina, Korytnoye, Krinicki, Chalep'je, Krimitchek, Ljubuska-Posad, Podolsk, Polinanov-Jar, Sabatinovka and Vladimirovka. The largest quantity of bone material comes from Sabatinovka (Makarevych 1952, 1956; see Table No. 157). Both on the basis of the number of bones and on the number of individuals cattle are the most important domestic animal (see Fig. 108). Both *brachyceros* and *primigenius* cattle are known, with the large horned variety being the more frequent. During the 1949 excavations the frontal part of a domestic bull's skull was found with the horn cores purposely cut off. It lay inside a house and close to it was a female figurine. Both Bi and Ci phases were distinguished at Chalep'je. During the earlier stage cattle are the basic domestic animal on the number of bones but equal to pig when the number of individuals are considered (Bibikova 1953, Hančar 1956; see Fig. 109, Table No. 158). Both the large and small horned animals/
animals were present and Hančár calculated their live weight to have been 5500 kg.

Cattle are the only domestic animal recorded at Korytnoye (Bibikova 1953; see Table No. 165), and they are also known from Krinicki (Hančár 1956; see Fig. 110, Table No. 159). They are the chief domestic animal at both this site and at Ljubushka-Fosad where all the remains are of the small brachyceros cattle (Bokonyi 1954, Hančár 1956 p. 58, 63; see Table No. 165). They are again the dominant animal at Podolsk (Hančár 1956; see Fig. 112, Table No. 159). Only 285 bones were found at Vladimirovka, one of the largest Tripolyan sites known, and amongst these cattle appear to be dominant although the actual proportion is not known (Hančár 1956). At Polivanov-Jar on the other hand, many bones were found within a relatively small area, and the two breeds of cattle are the basic feature in the economy (Hančár 1956, Passek 1961).

Stage C The osteological remains from Kolomiischina come from houses of period B with a continuation into period C. The bones reported by Hančár (1956) come from a house of period C and half of them belong to cattle (see Table No. 165). Cattle are also known from the site of Andrejevka where large and small animals occur and are of about the same frequency as sheep (Hančár 1956; Bibikova 1953; Pidoplicko 1956; see Fig. 114, Table No. 162). These two breeds are again encountered at Pavloc (Bibikov 1953; Makarevych 1952) and are also featured at Sandraki (Bokonyi 1959; Lahodovska 1956) and Suskovka (Hančár 1956; see Fig. 113, Table No. 161), where they are an important element in the economy.

The/
The two sites which belong to period Cii are Gorodsk and Usatovo. At the first of these cattle are more frequent than both ovicaprids and pigs (Hančar 1956; see Figs. 116 – 118, Table No. 164). Nearly 5,000 bones were identified at Usatovo and amongst these cattle were found to come second to ovicaprids in importance (Lahodova 1952; Hančar 1956; see Fig. 115, Table No. 163).

Cattle are also known from Kiev, Kiev City, Bilogrudička, Kriposnoma and Scorbatovo (Bibikov 1953, Hančar 1956, Pidoplicko 1956; Samoilovskii 1952; Pidoplicko 1956; see Tables Nos. 160, 165, Fig. 111). Hančar records several models of cattle from sites of the Tripolye culture, and one of these from Kosilovcy has a unique feature. Bands of paint occur around the neck and abdomen of the animal and Hančar interprets these as evidence for the use of cattle for draft power. This model is assigned to period Cii.

During the early stages of the Tripolye culture there appear to have been two different strains in the economy. The first concentrated on pig breeding and the second on cattle breeding. In the second phase (B) there was a shift at all sites towards the exploitation of cattle, which continued in phase Ci. During Cii there is yet another change, this time in favour of sheep and horse with cattle occupying a secondary position.

Ovicaprids

Sheep or goats are known from 23 of the 25 sites that are discussed (see Table No. 155).
Stage A  The most detailed information comes from the site of Luka-Vrublevetskaia. Bibikova (1953) identified remains of sheep only during the last two seasons' work. The presence of goats on the other hand, was established at an early stage by many surviving horn cores. These appear straight when viewed from the front and curved when viewed from the side, and are attributed to Capra hircus, and said to be derived from Capra prisca. The sheep remains include skulls of hornless animals. Sheep and goats are of lesser importance than both cattle and pigs to the economy (see Fig. 107, Table No. 156). Ovicaprids are known to have been of less importance than cattle at Bernova-Luka (Hausler 1956, Hančar 1956, p.60) and their presence has also been attested at Lenkoutsa (Passek 1961), Grenovka (Hančar 1956; see Table No. 165) and Sabatinovka, section I (Mdanylenko & Makarevych 1956).

Stage B  The site with the greatest number of bones analysed in this phase is Sabatinovka, and here ovicaprids lie third to cattle on the basis of the individuals, and second on the number of bones identified (Hančar 1956; see Fig. 108, Table No. 157). Sheep are known to have been represented but the position of goat remains doubtful (Mdanylenko & Makarevych 1956). Sheep and/or goats are known from Kolomiischina (Hančar 1956), Krinicki (Hančar 1956; see Table No. 159), Podolok (Hančar 1956; see Table No. 159) and Vladimirovka (Hančar 1956). At the second and third sites they are known to be less frequent than both cattle and pigs (see Figs. 110 & 112), and the same is true at the site of Polivanov-Jar (Hančar 1956, Passek 1961).

The/
The osteological remains from Chalep'je belong to the Bii period and have been identified by Bibikova (1953) and include both sheep and goats. These animals are less important than cattle on the basis of the number of bones, and also less important than pigs when the individuals are considered (Hančar 1956; see Fig. 109, Table No. 158). The sheep are known to have well developed horns and are unlike the small turbary sheep of Usatovo. Ovicaprids also occur at the Bii site of Ljubuska-Posad (Hančar 1956; see Table No. 165).

Stage C According to Bibikova (1953) both sheep and goats are known from the Ci site of Andrejevka. The number of ovicaprid bones identified are the same as the number of cattle bones, but ovicaprids exceed them on the basis of the individuals (see Fig. 114, Table No. 162). Hančar (1956) worked out the live weight of the sheep and goats as being 200 kg. A few bones of sheep or goats were found in house II at Kolomiischina (Hančar 1956; see Table No. 165), and goats and possibly sheep are also known from Pavloc (Bibikova 1953) where they are more frequent than pigs and less numerous than cattle. Sheep or goats are also known from Sandraki (Lahodovska 1956) and Suskovka where they take third position (Hančar 1956; see Fig. 113, Table No. 161).

The ovicaprid remains from Koszylowce were the subject of a special investigation by Admetz (1928). On the basis of various cranial remains he identified the goat as Capra prisca, a new sub-species with screw-horns. More recently it has been shown that this is just a variation of the more common Capra hircus and so is derived from the wild bezoar goat Capra aegagrus.
The economy of the Cii period is illustrated by remains from Gorodsk and Usatovo. Fewer bones were found at the first site where ovicaprids were less common than either cattle or horse (Hančar 1956, Pidoplicko 1956; see Figs. 116 - 118 & Table No. 164). At Usatovo ovicaprids become the dominant feature in the economy for the first time in a Tripolyan context. Where distinguishable, the majority of these bones belong to small goat-horned sheep which were more numerous than all the other domestic animals combined (Hančar 1956, Lahodovska 1952; see Fig. 115, Table No. 163).

Ovicaprids are also known from the sites of Bilogrudivka, Kiev, Kiev City and Scerbatovo (Pidoplicko 1956; Bibikova 1953; Samoilovskii 1952; Bibikova 1953; see Fig. 111 & Tables Nos. 160, 165).

During the initial stage A of this culture sheep and goats stay in the background never rising to the proportions of either cattle or pigs. Their status remained unchanged during stage B, where nearly all the evidence places them in third position closely behind pigs. This situation continued during the initial part of stage C, but in Cii there is a very clear break with tradition, and, as shown at Usatovo, sheep come to the forefront to form half of the domestic stock. The turbary breed is known with certainty for the first time at this stage. In connection with this, the finds of amber illustrating connections with Scandinavia are recalled. These turbary sheep are the common breed of the Scandinavian neolithic.

Bones of domestic pigs have been identified at 19 of the 25 sites mentioned.
Stage A  The domestic pigs at Luka-Vrublevetskaia are more than twice as frequent as any other domestic animal (Bibikova 1956; see Fig. 107, Table No. 156). Comparative measurements of these pigs with members of the wild species that were identified at this site show an overall reduction in the size of teeth of between 1 in 14 and 1 in 5. From Table No. 7 (Bibikova 1956, p.445) it is seen that these pigs fall within the range of variation of the palustris breed. They are of a particularly small type and were usually killed when juvenile. The presence of the large domestic pig cannot be established with certainty. It is also interesting to note that there were many clay models of pigs, which have a finely modelled snout, eye sockets and holes for insertion of tusks.

The pig was also the most frequent animal at Lenkoutsa where they form at least half of the remains of domestic animals (Passek 1961). The absence of pigs at Grenovka can be explained by the small number of bones found (Hančar 1956; see Table No. 165). Crushed bones of domestic pigs are also reported from Sabatinovka section I (Mdanylenko & Makarevych 1956).

Pigs have also been found at Bernova-Luka but here they are known to have been less frequent than cattle; the exact proportions were unavailable (Hančar 1956, Häusler 1956).

Stage B  The greatest number of bones in this context have been found at Polivanov-Jar, where pig come second to cattle in importance. The exact numbers were not available (Hančar 1956; Passek 1949). Pigs occupy the same position at Podolsk (Hančar 1956; see Fig. 112, Table No. 159) and at Krinicki (Hančar 1956; see Fig. 110, Table No. 159). At Sabatinovka section/
section II, however, they come third on the number of bones and second on
the number of individuals (Hančar 1956; see Fig. 108, Table No. 157).

Two breeds of pigs are known from the Bii site of Chalep'je, namely
the wild Sus scrofa ferus and the domestic Sus palustris. They are the
third most frequent animals when the bones are considered but are equal to
cattle on the basis of the individuals (Bibikova 1953, Hančar 1956; see
Fig. 109, Table No. 158). Only wild pigs are known with certainty from
Vladimirovka, the absence of the domestic variety is striking (Passek 1946).

Stage C

Only a few bones of the pig survive at the Ci sites of
Andrejevka (Hančar 1956; see Fig. 114, Table No. 162), Kolomiischina (Hančar
1956; see Table No. 165), Pavloc (Bibikova 1953), Sandraki (Pokonyi 1959;
Lahodovska 1956) and Suskovka (Hančar 1956; see Fig. 113, Table No. 161).
Where their position relative to the other animals has been determined, it
is either second or third. The large quantity of wild pigs at Sandraki
should be mentioned, as some may be in the process of being domesticated.

Pigs only form a very small proportion of the remains from the Cii
site of Gorodak where they are less important than both cattle and
ovicaprids (Hančar 1956; Fidoplicko 1956; see Figs. 116 - 118, Table No. 164).
They are also negligible to the economy at Usatovo, although there were a
large number of bones of both cattle, ovicaprids and horse (Hančar 1956;
see Fig. 115, Table No. 163). At this site they are about twice as
frequent as dogs. The breed of pig represented is, on the whole, large
and still very close to the wild animals, although according to Hančar
there was also an indication of the turbary pig.

Pigs/
Pigs also occur at the sites of Kiev (Bibikova 1953; Hančár 1956; Pidoplicko 1956), Kiev City (Samoilovskii 1952) and Bilogrudivka (Pidoplicko 1956; see Fig. 111 & Table No. 160).

The role of the pig changed considerably throughout the Tripolye culture. During stage A it was the basis of the economy for a large proportion of the sites. During stage B the position of the pig falls at these sites and occupies second place to cattle, with slightly greater numbers than the ovicaprids. Domestication continued during Ci and Cii, but at this final stage there is a clear drop so that they become negligible to the economy. Both turbary and large locally domesticated animals have been distinguished.

**Dog**

The domestication of the dog is attested for all stages of the Tripolye culture (see Table No. 155).

**Stage A** Amongst the canine remains from Luka-Vrublevetskaia, Bibikova (1956) identified four skulls of *Canis familiaris palustris*. One of these is a little larger than the others in some respects and shows a measure of agreement with *Canis familiaris ladogensis*. These remains are about three times as frequent as those of horse, although unimportant in comparison with the three main domestic animals (see Fig. 107, Table No. 156). The dog from Lenkoutsa is also known to be of the turbary breed (Pasek 1961) and dogs, breed unspecified, are known from Bernova-Luka (Häusler 1956) and Grenovka (Hančár 1956).
Stage B  The turbary breed of dog has been identified at Chalep'je (Hančar 1956), at Polivanov-Jar (Hančar 1956, Passek 1949) and the dog is also known from Sabatinovka (Hančar 1956) where several types are reported. They attain only a small proportion of the finds throughout, and also occur at Krinicki and Podolsk (see Figs. 108 - 112).

Stage C  During this phase the dog is known from Andrejevka (Bibikova 1953; Hančar 1956), Kolomiischina (Hančar 1956), Pavloc (Bibikova 1953; Makarevych 1952) and Sandraki (Lahodovska 1956; Bokonyi 1959). No definite bones of dog could be ascertained at Gorodsk, although they are known from the other Cii site of Usatovo (Hančar 1956).

Bones of dogs were also found at Bilogrudiivka (Pidoplicko 1956), Kiev (Bibikova 1953, Hančar 1956) and Scerbatovo (Bibikova 1953). Traces of marks made by dogs' teeth are reported on the animal bones from Vladimirovka (Passek 1961).

That the dog is of some 'ritual' significance is demonstrated by two finds from Luka-Vrublevetskaia. Under the north wall of a house was found the intentional burial of two dogs' heads. These were placed side by side and each was without the lower jaw, and covered with a layer of burnt clay. Bibikova (1956) identified them as Canis familiaris palustris.

There is little change in the position of the dog throughout this culture; the evidence from Luka-Vrublevetskaia and Usatovo indicates a slight drop in frequency between stage A and stage Cii. The only breed to be identified is the small turbary type.

Horse/
Horse

The question of horse domestication during this culture is a complex one, although it is clear that the domestication of this animal had been mastered by the final Cii stage. In many cases the status of the equid bones remains uncertain, or has simply not been specified.

Stage A  The most interesting remains from this stage come from Luka-Vrublevetskaia. Bibikova (1953) carried out a careful examination of these remains and came to the conclusion that they originated from domestic stock. Gromova also reached the same verdict. In appearance this early domestic horse was small and sturdy with a relatively large head, and its remains were less than half as common as those of dog (see Fig. 107, Table No. 156). Bibikova also examined the equoid remains from Bernova-Luka and Lenkoutsa but could not say with confidence that they were of domestic stock. The bones from Grenovka are said to agree morphologically with those from Luka-Vrublevetskaia, and so may originate from domestic animals (Hančar 1956).

Stage B  The question of the status of the horse appears to be unresolved in the majority of cases. This is true at Polivanov-Jar (Passek 1949), Podolsk (Hančar 1956), Krinicki (Hančar 1956), Chalép'je (Bibikova 1953; Hančar 1956), Sabatinovka II (Makarevych 1952, 1956; Hančar 1956) and finally at Vladimirovka, where the horses are known to be of a small race (Passek 1946). Hančar considers all the remains of horses together with the domestic stock, but with the exception of Sabatinovka the proportion is small throughout, and no definite evidence for their domestic status is tendered.
tendered. The greatest percentage of horse remains come from Sabatinovka where they are more frequent than ovicaprids and pigs when the bones are considered, but this is not true on the basis of the individuals (see Fig. 108, Table No. 157). These are also known to be of a small size and their domestication seems probable.

Stage C. The horse occupies a similar position during phase i of stage C as it did during stage B. Bones have been identified at Andrejevka (Bibikova 1953; Hančar 1956; see Fig. 114, Table No. 162), Kolomiischina (Hančar 1956; see Table No. 165), Pavloc (Bibikova 1953, Makarevych 1952), Sandraki (Lahodovska 1956, Bokonyi 1959) and Suskovka (Hančar 1956; see Fig. 113, Table No. 161).

It is during the Cii phase that a notable change takes place. At Gorodsk more bones of horses were found than of any other animal (Hančar 1956; see Figs. 116-118, Table No. 164), and they are only slightly less frequent than cattle on the number of individuals. At Usatovo they are the third most frequently occurring animal, exceeding the proportions of both pigs and dogs (Hančar 1956; see Fig. 115, Table No. 163). Hančar also reports the find of a bone bit from this site, a figurine of a horse from Kosilovcy, and several representations of horse-like animals on pottery. In some of these cases it is thought to be the half-ass that is represented and not the true horse.

Further remains of horses are known from Bilogrudivka (Fidoplicko 1956), Kiev (Bibikova 1953; Hančar 1956) and Scerbatovo (Bibikova 1953). Their status is unknown.
Horse domestication is known from the early stages of this culture at Luka-Vrublevetskaia and from the final stages at Gorodsk and Usatovo. Most sites do contain evidence for the presence of the horse, but in the majority of these instances their exact status could not be determined. Domestication was probably sporadic during the initial stages of the culture, but during the Cii phase increased greatly as domestication became widespread.

**Camel**

Hammar (1956) reports the presence of a single bone of a camel from Gorodsk. The camel is also known from the Near East during the Chalcolithic period at Tepe Siyalk (approximately 700 years earlier), Shah Tepe and Anau II (about 300 years earlier). It is thought to be the Bactrian camel that is represented, so this is probably the variety known at Gorodsk. It has been identified also at Verem'je (Bibikova 1953).

**Cultivated Plants**

Plant cultivation was widely practised in the Tripolye culture. The crops show considerable variety in their constituents and wheat, barley and millet were all cultivated. There is also evidence for the collection of acorns at Kolomischina, though whether they were used for human consumption and ground into flour, or employed as pig fodder cannot be decided.

Some interesting evidence comes from female figurines which were found to/
to be stuffed with grain of all kinds. The best known of these come from Bernova-Luka and Luka-Vrublevetskaia. There were 248 female figurines at the last site, six of which were broken and showed traces of grain throughout their bodies. A further sixty bore evidence of grain impressions on their surface. These were X-rayed by Silchenko in order to ascertain the density of grain in the clay and it was discovered that the specimens that showed only a few grain impressions on the surface, were in fact stuffed with grain. As a result of these investigations the question arose as to whether or not the figurines which showed no grain impressions on the surface had been made of a clay that had been tempered with flour. Some twelve to fifteen fragments of figurines were examined and found to be made of a very porous clay. In addition they had small hollows in their surface and in one of these figurines an impression of a broken grain was found. Bibikov thought that these figurines were in fact made of a clay that had been tempered with roughly ground flour. He is of the opinion that a Rumanian find published by Dumitrescu bore traces of a grain impression similar to those from Luka-Vrublevetskaia. Although only a few instances of grain or flour tempered figurines are known, if a systematic investigation were carried out that included the use of X-rays, evidence ought to be found of this custom being practised in several other areas.

Bibikov (1951) quotes several contemporary primitive tribes amongst whom fertility rites are still being practised. The folklore of several European countries provide evidence for this type of ritual, particularly amongst/
amongst the Slavonic races.

Another characteristic of these clay models is their roughly-made appearance. It has been suggested that this is because they were made hurriedly and perhaps used for a short time only (Bibikov 1951). Bibikov suggests that, a) the figurines were thrown into the fire almost immediately after their manufacture whilst the clay was still wet, and b) that these activities took place during specific seasons of the year, probably just before the arrival of spring.

The evidence from Bernova-Luka also indicates rapid manufacture and firing (Häusler 1956). These statuettes were also X-rayed, revealing the presence of grain inside, and some had fifteen impressions of grain on the surface. Häusler calculated that these figurines had to be fired within three minutes of the grain being mixed with the damp clay since, if the grains had been lying longer in damp surroundings, they would have swollen and their transverse furrows would not have been preserved.

There is also evidence for the methods of cultivation and harvesting. Hoes of antler are reported from several sites including Vladimirovka, Pavloc and Sandraki. 144 flint sickle blades are reported from Luka-Vrublevetskaia and examination showed that they had the high gloss obtained from cutting some form of grass. Retouched flint sickle blades are also known from the earlier settlement of Polivanov-Jar. Slobodin proposed the theory that 'Hackbau' was practised in the vicinity of the houses, particularly during the early stages of the culture. He states that the ground was more likely to be fertile in these areas than at a distance from/
from the habitations (Häusler 1956).

**Wheat**

Wheat has been identified at all of the eighteen sites considered, and four different species are known (see Table No. 166).

Emmer has been identified at Luka-Vrubblevetskaia (Bibikov 1953). Its presence here is important, since there is no other instance of this type of wheat within a Tripolye context.

Hard wheat is known from Kolomiischina, Luka-Vrubblevetskaia and Vladimirovka where both carbonised material and impressions were identified (Passek 1949; Bibikov 1953).

The most frequently encountered of the varieties of wheat is bread wheat. It has been found at Luka-Vrubblevetskaia (Bibikov 1953), Schervaneika (Bibikov 1953), Stayikach (Bibikova 1953), Tripolye (Bibikov 1951, 1953) and Verem'je (Bibikov 1953). All these identifications were made amongst the grain collected by Chroyiko. These remains together with the wheat from Suskovka and Kolodistoye weighed approximately 21 gm. and totalled 1530 grains. There is also a single instance of the other variety of naked wheat, namely club wheat, at Luka-Vrubblevetskaia.

The proportion of these various kinds of wheat relative to each other is not known. In addition to these sites, unspecified wheat is recorded at Bernova-Luka (Häusler 1956), Chalop'je (Bibikov 1953), Chernyachenye (Bibikov 1953), Koretnoye (Bibikov 1953), Krinicki (Bibikov 1953), Krutoborodintsy (Passek 1949), Novoselkach (Bibikov 1953), Semeniv (Bibikov 1953/...
1953) and Zhukovskii (Bibikov 1953).

Barley

This cereal has been identified at nine of the eighteen sites considered. Six-rowed barley is the only variety to have been identified and this is known from Kolomiischina and Vladimirovka (Passek 1949). It is the dense-eared erect variety in both cases. It seems probable that this barley is the type cultivated where Hordeum vulgare has been identified, namely Luka-Vrublevetskaia, Suskovka, Kolodistoye and Veremje (Bibikov 1953). The carbonised remains found at all four sites originate from the collection of Chroyiko made in 1909 and preserved in the Kiev museum. These were re-examined by Bibikova (1953) together with the grain impressions from Luka-Vrublevetskaia. Hordeum vulgare occurs again at Bernova-Luka (Hausler 1956).

Barley, species undetermined, is known also from Krutoborodintse (Passek 1949) and Semeniv (Bibikov 1953; Sudakov 1952).

Millet

Millet played an important role in the agriculture of this culture. It has been identified at eleven sites and so is a more frequent occurrence than barley. In none of these cases is it stated whether it is Panicum miliaceum or Setaria italica that is present.

Millet has been identified in the figurines at Bernova-Luka and Luka-Vrublevetskaia, and carbonised remains were collected by Chroyiko from Schervaneka/
Sohervanska, Stayikach, Tripolye and Veremje. Further remains were identified at Kolodistoye, Kolomiischina, Suskovka and Vladimirovka (Fassek 1949).

This is the first European Neolithic culture in which the importance of millet can be established, and it appears that it must be considered as an essential ingredient in the Tripolyan economy.

Summary

During the initial stage A of the Tripolye culture there were two different strains in the economy. The first was based upon pig breeding and the second upon cattle breeding. Horses were possibly sporadically domesticated at this stage. In the second phase (B) cattle were the chief domestic animal with pigs second and ovicaprids third, as during the second group of stage A. This situation continued during the initial stages of phase C. During Cii there was, however, a complete change in the economy and ovicaprids become the dominant feature, with cattle of secondary importance and pigs being almost negligible to the economy. It was at this stage that the horse increased greatly in frequency and was in the process of being widely claimed as a domestic animal. This situation compares well with the later stages of the Cernavoda culture. It was also at this stage that the presence of the turbary sheep was established for the first time, which, combined with the finds of amber, link the final phase of this culture with the Scandinavian neolithic. The camel also made an appearance.

Wheat/
Wheat, barley and millet were all cultivated. Bread wheat is encountered at more sites than club wheat, hard wheat or emmer. Millet appears to have been of much importance to the economy, and six-rowed barley is also known.
5. - HUNGARIAN COPPER AGE

The Hungarian Copper Age is composed of three cultures known as Tisza-Folgár, Bodrogkeresztur and Baden. The Tisza-Folgár culture is contemporary with the Gumelnita culture and so can be placed at 3600 - 3200, the Bodrogkeresztur is contemporary with Cucuteni B and so is around 3300 - 3100, and the Baden culture is dated to 3200 - 2900. The first two cultures are confined to Hungary, but the Baden culture also occurs in eastern Austria, and through east and central Czechoslovakia northwards to the Elbe.

The Bodrogkeresztur culture developed from the Tisza-Folgár culture and both are known from large cemeteries and some settlement sites. The pottery continues in the late Lengyel tradition, with the characteristic "milk jug" developing by the late Bodrogkeresztur period. Decoration only occurs rarely, and consists of cross-hatched meander patterns. The stone industry can also be assigned to a Lengyel ancestry. Large copper axes/adzes with their blades perpendicular to each other at either end of the implement head are most distinctive of these two phases. Hammer-ended axes, knives, spiral armbands, copper and gold decorative discs have also been found.

Baden pottery is usually self-coloured, fairly dark, and has distinctive large ribbon handles rising above the level of the rim of the pot. Channelled decoration is common and gives the culture its other name of Channelled Ware. Amongst various clay models that have been found, one of a waggon with four solid disc wheels is of especial interest, and represents/
represents the earliest evidence for wheeled vehicles in central Europe. The stone and metal industries do not differ much from the preceding cultures, although copper neck rings now occur.

The wild fauna found at both settlements and cemeteries is composed of red and roe deer, aurochs, pig, horse, hare, cat, turtle, fish and birds (see Table No. 167). At all sites the domestic animals are much more frequently represented than are the wild.

**Domestic Animals**

**Cattle**

Cattle have been identified at five sites of the Tisza-Polgár culture (see Table No. 168). At most of these sites only a small quantity of bones was found (Hajduszoboszlo, Hódmezovásárhely-Tatársánc-Zalay Téglagyár see Table No. 169; Tiszaigar see Table No. 169; Fusztaföldvár-Bakimalom see Table No. 169). At the cemetery of Polgár-Basatanya, however, many bones were recovered, but cattle account for only a small proportion of the remains (Bokonyi 1959; see Fig. 106, Table No. 75).

At the two settlement sites of the Bodrogkeresztur culture, Derecske-Téglagyár and Tarnabod (Bokonyi 1959), cattle are the main domestic animal (see Figs. 119 & 120, Tables Nos. 170 & 171). Fewer bones could be identified at Székely-Zoldteltk, where cattle are less numerous than sheep or goat (Bokonyi 1959; see Fig. 121, Table No. 172). At the cemetery of Polgár-Basatanya on the other hand, cattle are considerably less important than both ovicaprids and pigs (Bokonyi 1959; see Fig. 122 & Table No. 75).

The/
The best illustration of the type of cattle bred comes from the Baden burial ground of Alsonemedi (Bokonyi 1951). One grave contained the skeleton of a 6 year old cow and 10 - 12 month old calf, and the other an 8 year old cow and 15 - 18 month old calf, and Bokonyi is of the opinion that all four can be related to the wild aurochs. He bases this on the shape and size of the head and horn cores. The legs of these animals are thin and relatively short, the chest long and deep with narrow ribs, and the back and loins are also long and rather narrow. The neck is similar and shows no strong muscular attachments. The height of the 8 year old cow was 130/133 cm., and the 15 - 18 month old calf was 120 cm., both of which are considerably less than that of aurochs. Variation within this general picture is seen, particularly in the width of the skull and feet, and length of the legs. Cattle are also important at the other cemetery of Polgár-Basatanya (Bokonyi 1959; see Fig. 123 & Table No. 75) and a complete skeleton was found beneath a pot at Ulo (Bokonyi & Kubasiewicz 1961).

At the settlement sites of Budapest-Andor utca (Bokonyi 1959) and Székely-Zolteltk (Bokonyi 1959) cattle are slightly less frequent than ovicaprids, although more common than pigs (see Figs. 125 & 124, Tables Nos. 172, 173).

There is only a little evidence from the Tisza-Polgár culture which indicates that cattle were not particularly important sacrificially. During the Bodrogkeresztur culture, however, cattle are the main domestic animal at the settlements although they were not of any particular ritual value/
value. Their numbers decrease at the Baden settlements in favour of sheep and goat, although their ritual importance increases greatly.

Ovicaprids

Sheep or goats have been identified at three of the five sites of the Tisza–Polgár culture (see Table No. 168). At the cemetery of Polgár–Basatanya they are less frequent than pigs (Bokonyi 1959; see Fig. 106, Table No. 75) and at the other sites only a small number of bones were identified (Hódmezővásárhely–Tartársánc–Zalay Tégagyár, Fusztafoldvár–Baki malom; see Table No. 169).

Derecske–Téglegyár and Tarnabod, settlements of the Bodrogkeresztur culture, both contain remains of sheep and goats, and in three instances they are less important than cattle and pigs and in one they are more frequent than pigs (Bokonyi 1959; see Figs. 119 & 120, Tables Nos. 170, 171). It should be noted that many more bones were discovered at the last site. At the site of Székely–Zöldteltk ovicaprids were more frequent than the other domestic animals, but fewer bones could be identified here (Bokonyi 1959; see Fig. 121, Table No. 172). At the cemetery of Polgár–Basatanya sheep and goats are again the most frequent animal (Bokonyi 1959; see Fig. 122, Table No. 75). Nothing is known of the relative frequency of sheep versus goat; or of the breed that is involved.

The evidence from the Baden culture settlements indicates that ovicaprids were the basis of the economy. This is true of both Budapest–Andor utca (Bokonyi 1959; see Fig. 125 & Table No. 173) and of Székely–Zöldteltk/
Zöldteltk (Bokonyi 1959; see Fig. 124 & Table No. 172). Sheep are also recorded at Polgár-Basatanya where they come second or third in importance amongst the sacrificed animals (Bokonyi 1959; see Fig. 123 & Table No. 75).

**Pigs**

Pigs were the most frequent domestic animal at the Tisza-Polgár cemetery of Polgár-Basatanya (Bokonyi 1959) and they are known in small numbers from a further three sites (see Tables Nos. 106, 168, 169).

At the settlements of the Bodrogkeresztur culture, Tarnabod and Derecske-Tőlegyár, pigs are the second most frequent animal in three instances, and the third in one, (Bokonyi 1959; see Figs. 120 & 119, Tables Nos. 171, 170). Pigs are the second most frequent animal recovered from the graves of Polgár-Basatanya (Bokonyi 1959; see Fig. 122 & Table No. 75), and the third most frequent at the graves of Székely-Zöldteltk (Bokonyi 1959; see Fig. 121 & Table No. 172).

Pigs were the least important of the three main domestic animals at the Baden sites of Budapest-Andor utca and Székely-Zöldteltk (Bokonyi 1959; see Figs. 125 & 124, Table Nos. 173 & 172). They are also known at the cemetery of Polgár-Basatanya, where although more bones were found than of any other animal, the pig was the least frequent when the individuals are considered (Bokonyi 1959; see Fig. 123 & Table No. 75).

Nothing is known of the nature of these pigs apart from the fact that they can be related to the wild European pig.

The pig was the most common animal at one Tisza-Polgár cemetery but
lies second or third at both settlements and graves of the Bodrogkeresztur culture. They appear to be less important than both cattle and ovicaprids during the Baden culture.

Dog

Dogs occur in a Tisza-Polgár context at Hódmezővásárhely-Tartársánc-Zalay Téglagyár and Polgár-Basatanya (Bokonyi 1959). Only two bones were found at the settlement site (see Table No. 169), but many more occur in the cemetery of Polgár-Basatanya (see Fig. 106 & Table No. 75). A very small proportion of dog bones are known from the Bodrogkeresztur settlement of Tarnabod (Bokonyi 1959; see Fig. 120 & Table No. 171) and the Baden settlement of Budapest-Andor utca (Bokonyi 1959; see Fig. 125 & Table No. 173).

The dog was known as a domestic animal during the Copper Age of Hungary, but the breed or breeds present are not known.

Horse

The only occurrence of the domestic horse is at Dezsők, where a worked distal end of a metacarpus was found (Bokonyi 1959). The animal was small and slender and is the first instance of a domestic horse in Hungary. A tooth was found in the Bodrogkeresztur period graves at Polgár-Basatanya, but since the grave had been opened its authenticity is doubtful. There is no evidence for the hunting of wild horses during this period.

Summary

The sites considered here must be divided into two groups, the bones from/
from the settlements reflecting the economic value, and those from the 
graves the ritual value, of a particular animal. Nothing can be said of 
the economic value of the different species during the Tisza-Folgar period, 
although there is a slight indication that pigs were more important in a 
ritual sense. Cattle dominate at settlements of the Bodrogkereszťur 
culture with ovicaprids and pigs of about equal importance. During the 
Baden culture there is a rapid rise in the numbers of ovicaprids and they 
attain the position of prime importance. Ritually, cattle appear to be 
the most important animal at this stage.

No evidence for plant cultivation is available, but it is probable 
that plants similar to those of the neolithic period were still being 
cultivated.
6. - AUSTRIAN COPPER AGE

The Mondsee-Altheim and Baden cultures are considered here. The former is a little later than the Baden culture and is found to the west in Austria and Bavaria. The pottery is coarse, and decorated with incised concentric circles with the incisions filled in in white paste in the Mondsee region, and with cordons elsewhere. Stone axes, adzes, mace heads, daggers and arrow heads as well as flat copper axes and rhomboid daggers and ornaments occur.

The wild fauna consists of red and roe deer, wild pig, chamois, wild cat, bear, lynx, fox, beaver and wolf. Various fish have also been identified (see Table No. 174).

Domestic Animals

Cattle

Cattle have been identified at Attersee in a Mondsee-Altheim context (Amscheler 1949). Measurements of both the teeth and long bones indicated that this animal belonged to the turbary breed, but no cranial remains were found to confirm this. Cattle also occur at the Baden site of Ossarn where they are known to be less important than both ovicaprids and pigs (Bayer 1928), and at Priesterhugel where they are said to be similar to those found in the mountains in that area today. They are small in size, but have horn cores reminiscent of primigenius animals (Teutsch 1903).

Ovicaprids/
Ovicaprids

There is no instance of sheep or goats in a Mondsee-Altheim context, but at the Baden site of Ossarn they are the main domestic animal (Bayer 1928). The sheep at Priesterhugel have been attributed to the moufflon variety rather than the turbary, and the goats to the bezoar (Teutsch 1903).

Pigs

A single pig bone was found at the Mondsee-Altheim site of Attersee. Amscheler (1949) attributes it to the *scrofa* breed. Pigs are the second most frequent animal at Ossarn in a Baden context (Bayer 1928), and the large breed of pig is known at Priesterhugel (Teutsch 1903). There is also a possibility of the domestic pig being present at Merkstein-Felsensitz (Hauck 1950).

Dog

Dogs occur in a Mondsee-Altheim context at Mondsee and Attersee (Hauck 1950). Four skulls of the turbary breed were found at the first site (basal lengths 134 mm., 135 mm., 125 mm., 145 mm.) together with other bones, and there is a possibility of the Ladogensis variant of the turbary breed being present. This is suggested by a skull that is rather longer (147 mm. basal length), larger and with more powerful muscular attachments.

At the Baden sites of Ossarn (Bayer 1928), and Merkstein-Felsensitz (Hauck 1950) dogs are known. At the last site the skeleton of a dog was found together with sherds of a Baden pot; the animal was about 40 cm. high, and/
and had a skull of basal length 160 mm.

Turbary dogs are known at the Copper Age sites of Mauthausen and Ziegelei Reisetbauer (Hauck 1950), and an unspecified type occurs at Priesterhügel (Teutsch 1903). Hence it is seen that the turbary dog was still being bred and was probably the most common breed, although a larger dog was also known.

Horse

Bones of horses are included amongst the domestic animals of the Baden site of Ossarn by Bayer (1928). They are said to be extremely rare and there is no description or reason for domestic status given.

Cultivated Plants

Wheat

The only instance of wheat in a Mondsee-Altheim context comes from the site of Mondsee. At first the species was unspecified (Much 1876, 1879; Buschan 1895), but later Hofmann (1924) identified emmer and Werneck (1949) identified club wheat. A quantity of carbonised grain was found in a Baden pot at Ossarn. Initially there was some confusion over the quantity of grain involved since Bayer (1928) reported it to be 30 kg., but more recently it has been shown that this was the combined weight of the pot and grain (Werneck 1949). The wheat alone weighed between 25 and 30 gm., and consisted of 95% einkorn and 5% emmer. There was no other cereal present.

Emmer/
Emmer and club wheat are known in a Mondsee-Altheim context and einkorn and emmer in a Baden context. In the latter case einkorn appears to have been the main crop.

**Barley**

The only instance of barley in this period comes from the Mondsee-Altheim site of Mondsee (Hofmann 1924). Both six and four-rowed varieties have been distinguished, and there were further remains which could not be attributed to any particular group.

**Millet**

Again the only instances of millet occur in a Mondsee-Altheim context. Italian millet was identified at Gmunden (Netolitsky 1914; Werneck 1949), but the type present at Mondsee is not known (Much 1876; 1879; Buschan 1895; Hofmann 1924; Neuweiler 1905).

**Flax**

Flax occurs at the Mondsee-Altheim site of Mondsee (Buschan 1895; Hofmann 1924; Much 1876; 1879; Neuweiler 1905) and also at Wolfgangsee (Neuweiler 1905). These are the only two instances and in neither case has the species been specified, although it is almost certainly the Asian variety *Linum usitatissimum* (see Helbaek 1959a).

Summary/
Summary

The evidence of agriculture for the Baden culture in Austria agrees with the results from Hungary. Sheep and goat are the main domestic animal with cattle and pigs also present. There is also a possibility of horse domestication. Einkorn and emmer are known to have been cultivated, with the former the main constituent of the crops. Nothing can be said of the domestic animals of the Mondsee-Altheim culture other than that cattle, pigs and dogs were known. The entire absence of ovicaprids seems unlikely. Both emmer and club wheat were cultivated as well as four and six-rowed barley, millet and flax.
Sites assigned to the Copper Age period in Czechoslovakia are considered here. The only culture known to be represented is that of Baden, described in the Hungarian section.

**Domestic Animals**

**Cattle**

Cattle are encountered at three sites. They are the most frequent animal found at the grave site of Brandýsek, but the race of cattle has not been identified (Zikmundova 1962). They have also been found in many areas of the fortified village of Homolka (Ehrlich 1956) and at the site of Šarovce (Ambros 1958; Novotny 1958). At the last site the headless burial of a calf was found associated with remains of the Baden culture. The ritual burial of cattle is interesting and reminiscent of those at Alsonmedi and Úllő in Hungary.

**Ovicaprids**

Ovicaprids have been identified at three sites. They occur in the graves at Brandýsek (Zikmundova 1962), at the settlement of Homolka (Ehrlich 1956), and at Šarovce (Ambros 1958; Novotny 1958). The last instance belongs to the Baden culture; nothing further is known about these animals.

Pig/
Pig

Brandýsek (Zikmundova 1962) and Homolka (Ehrlich 1956) both contained bones of the domestic pig. Only a few bones were recovered at Šarovce so its absence there is not significant.

Dog

Dogs occur at Brandýsek (Zikmundova 1962) and Nitriansky Hrádok (Vllec 1953), the latter in a Baden context. At this site one dog's skeleton was found in a pit with human remains, and a further three were found associated with about twenty human skeletons; the race involved is not known. The burial of a dog was also discovered at Šarovce (Behrens 1964).

Horse

The status of the horse found at Homolka remains uncertain (Ehrlich 1956). It is thought to be probable that it was in fact domesticated, but no detailed report has yet been published. There are several other instances of domestic horses at this time, so its presence here would not be improbable.

Cultivated Plants

Wheat

Both einkorn and emmer are known to have been cultivated during this period. Eleven impressions of einkorn were found at Brno–Lísen (Kühn 1960), and a probable one occurs at Šarovce (Kühn 1960). Emmer has been identified/
identified in 21 instances at the first site and one at the second. There were a further four impressions of either species, and five of an unspecified wheat at Brno-Lisén.

**Barley**

The evidence for the cultivation of barley rests upon two possible impressions at Brno-Lisén (Kuhn 1960). Although the presence of this cereal cannot be definitely proved, it must have been present in the fields, if only in small quantities.

**Summary**

Cattle, ovicaprids, pigs and dogs were bred during this period. There is evidence indicating the importance of ritual burials of cattle in a Baden context, so linking the finds in Czechoslovakia to those in Hungary. There is also the possibility of horse domestication. Wheat in the form of einkorn and emmer was being cultivated, and barley was also probably present.
8. - ITALIAN COPPER AGE

The sites considered in this section have all been assigned to the Copper Age period in various regions of Italy. No closer cultural connections are given so that the evidence cannot be associated with any of the other Copper Age cultures in Europe.

During this period red and roe deer, wild pig, bear, fox, wolf, beaver, badger, otter, marten, polecat, hare, fieldmouse and mole were all hunted as the evidence from Pescale shows (Malavöti 1953). Nothing is known of the relative importance of hunting and domestication.

Domestic Animals

Cattle

Cattle have been identified at four sites (see Table No. 175), but it is only at La Starza that further information is available (Trump 1960). These bones have been found at all levels and occur less frequently than those of ovicaprids (see Fig. 127 & Table No. 176).

Ovicaprids

Sheep and goats are known at La Starza (Trump 1960) and Pescale (Tongiori 1956). In both instances it is the turbary breed of sheep that has been identified, and at the first site ovicaprids are the most important of the domestic animals (see Fig. 127 & Table No. 176).

Pig/
Pigs occur at all four sites considered (see Table No. 175). At Caverna di Sapendol the large scrofa breed is represented (Battaglia 1959), and at La Starza pigs are less frequent than cattle and ovicaprids (see Fig. 127 & Table No. 176).

The dog is known at three sites (see Table No. 175), but it is only at Pescale that the breed has been determined (Tongiorgi 1956). A few characteristic bones have been attributed to *Canis familiaris intermedius*.

**Cultivated Plants**

**Wheat**

The only instance of cereals occurs at Mezzaogiorno (Tongiorgi 1956). The identification in question is that of club wheat, but it is not clear whether this originated from the Copper Age or Early Bronze Age levels.

**Summary**

Cattle, ovicaprids, pigs and dogs were being bred at this stage, and the evidence available indicates that sheep and goats were the basis of the economy. It is possible that club wheat was being cultivated.
9. SWISS COPPER AGE

The majority of sites which contained copper implements are associated with Corded Ware in Switzerland. There are a few sites which do not fall into this category, but are attributable to the Copper Age rather than the Neolithic. These sites are considered here.

The wild fauna hunted is similar to that of the Neolithic, and the only instance of statistical analysis indicates that it accounted for just over a third of the meat supply.

Domestic Animals

Cattle

Cattle are known from three of the four sites considered (see Table No. 177). Small cattle were being bred at Uerikon (Rüger 1944), and most of the cattle at Concise were also of the turbary breed (Rutimeyer 1860). At the last site there is also a possibility of a large domestic animal being bred. The evidence from Uerikon shows that they were the most important of the domestic animals (see Fig. 126 & Table No. 178).

Ovicaprids

Sheep and goats are known from all four sites (see Table No. 177). At Uerikon they lie behind both cattle and pigs in frequency, with sheep more common than goats (Rüger 1944; see Fig. 126 & Table No. 178). Sheep are also more common than goats at Concise where the turbary breed has been identified (Rutimeyer 1860).
Pig

The domestic pig was bred at all the sites considered (see Table No. 177), and those from Concise (Rutimeyer 1860) and Roseaux (Schenk 1912) are known to be of the palustris form. No cranial remains were found at Uerikon for racial distinction, but they are known to be the second most frequent animal (Räuger 1944; see Fig. 126 & Table No. 178).

Dog

Dogs have been identified at Concise (Rutimeyer 1860) and Uerikon (Räuger 1944; see Fig. 126 & Table No. 178). At the first site it was not the usual turbary dog that was found, but instead a larger animal, comparable to the present day German 'Fleischerhund'. The turbary dog was present at Uerikon, and there were also remains of either a large dog or wolf.

Cultivated Plants

Wheat

Wheat has been identified at three of the five sites considered (see Table No. 179). Both emmer and club wheat are known. The first has been identified at St. Blaise (Neuweiler 1905; 1935; Netolitsky 1930), and the second at St. Blaise (Neuweiler 1905; 1935; Netolitsky 1930) and Montiller (Schenk 1912). The wheat present at Uerikon is also assigned to club wheat (Neuweiler 1946).

Barley/
Barley

Six-rowed barley has been identified at St. Blaise (Neuweiler 1905; 1935; Netolitsky 1930) and Montiller (Schenk 1912), and in addition it is thought to be present at Uerikon (Neuweiler 1946). Nothing is known of the relative importance of wheat and barley.

Millet

Both types of millet have been identified in this context. *Setaria italica* occurs at Montiller (Schenk 1912) and Nidau (Neuweiler 1905), and *Panicum miliaceum* has been identified at Montiller (Schenk 1912).

Flax

Neuweiler (1905) identified the flax from Niederwil and St. Blaise as *Linum cf. austriacum*; however, it now seems more likely that this is in fact the Asian species *Linum usitatissimum* (Helbaek 1959b). The same species is probably present at Uerikon (Neuweiler 1946).

Poppy

Poppy seeds are known from Niederwil (Neuweiler 1905), St. Blaise (Neuweiler 1905; 1935; Netolitsky 1930) and Uerikon (Neuweiler 1946). These seeds were common at most neolithic sites.

Summary

Cattle, ovicaprids, pig and dog were all domesticated, and at one site cattle are the dominant feature. Emmer, club wheat, six-rowed barley, two types of millet, flax and perhaps poppy were cultivated.
10. - FRENCH COPPER AGE

The cultural connections of many of these Copper Age sites is unknown. A few, however, are known to belong to the Peu Richard culture which is characterised by channelled and incised ware, and occasionally contains small amounts of copper. This culture has been dated to 2600 - 2200.

Bones of red and roe deer, aurochs, pig, horse, fox, badger, hare, rabbit, squirrel and hedgehog have been identified as well as a possible bone of wolf. These usually account for a tenth to a fifth of the total fauna, although in one instance the wild animals form well over half of the remains (see Tables Nos. 180, 182 - 186).

Domestic Animals

Cattle

Cattle occur at three sites in a Peu Richard context (see Table No. 181). The remains from Biard are reported to be of small cattle (Burnez 1957) as are those from Garde de Barzan (Colle 1959).

There are a further seven instances of cattle, and also a possible one at Fertus II (Iaworsky 1960), in a Copper Age context (see Table No. 181). The most information comes from four sites examined by Josien (1957). These are Anis-Deux-Hortus, Bergerie Neuve, Gimel and La Paillade. On the whole it is seen that cattle are the second most frequent animal, being less numerous than sheep or goat (see Figs. 128 - 131, Tables Nos. 182 - 185). These cattle are described as being very weak and small in size and so attributable to the turbary race, and there is a predominance of adult/
adult animals at all four sites. The complete absence of cattle at
Trache Deux is striking, since a large quantity of bones were found
(Josien 1962; see Fig. 132 & Table No. 186).

Cattle are well known as a domestic animal during the Copper Age in
France. The evidence available indicates that in importance to the
economy they lay behind ovicaprids.

Ovicaprids

Sheep or goats have been identified at the three Peu Richard sites
mentioned (see Table No. 181). Both animals have been distinguished at
Garde de Barsan (Colle 1959) and Peu Richard (Piggott, personal communication),
but nothing is known of their importance relative to the other animals.

Evidence from the remaining Chalcolithic sites shows that ovicaprids
are present in twelve instances (see Table No. 181). Again the most
information comes from Anis-Deux-Hortus, Bergerie Neuvo, Gimel and La
Paillade (Josien 1957). In all cases sheep and goat are seen to be the
most important of the domestic animals (see Figs. 128 - 131, Tables Nos.
182 - 185). The breed of sheep has been ascertained as turbary, and they
are more frequent than goats. Again adult animals predominate.

Sheep are seen to be slightly more frequent than pigs at Trache-Deux;
there is no indication of the presence of goats (Josien 1962; see Fig. 132
& Table No. 186). The breed has been identified as Ovis aries and there
is no evidence for the presence of the turbary animal. Again adult
animals are more common than young.

Ovicaprids/
Ovicaprids were the basis of the economy during the Copper Age in France. Sheep are more common than goats, and in most instances it is the turbary breed that is represented.

Pig

The only possible instance of the pig in a Feu Richard context comes from Biard, but this is not definite (Burnez 1957).

Pigs occur at the sites of Anis-Deux-Hortus, Bergerie Neuve, Gimel and La Paillade (Josien 1957). In all instances they were less important than cattle and ovicaprids and they were all of poor size, although it is not certain that they are turbary animals (see Figs. 128 - 131, Tables Nos. 182 - 185). Their small stature could be attributed to the local vegetation which does not favour pig breeding.

The pig identified at Trache-Deux on the other hand is of a large size (Josien 1962). These bones account for a large proportion of the osteological remains and are only slightly less frequent than ovicaprids (see Fig. 132 & Table No. 186).

At most sites pigs are less numerous than cattle and ovicaprids, and they are absent at more sites than these other animals (see Table No. 181).

Dog

Dogs have been identified at five sites (see Table No. 181). Teeth of dog, both perforated and unperforated, have been found at the dolmens of Ferussac and Liquisse (Constantini 1953), possibly at Monna (Constantini 1957)/
1957), and at Gimel (Josien 1957) and Trache-Deux (Josien 1962). The last two instances are of dogs fairly large in size and not attributable to the turbary breed (see Fig. 132, Table No. 186).

It is clear that dogs were being bred at this time, but nothing is known of the different types kept.

Cultivated Plants

There is no evidence for plant cultivation, although it is likely that wheat and barley were being cultivated.

Summary

The evidence indicates that ovicaprids were the basis of the economy and in southern France a long tradition of sheep breeding is known to have existed. Cattle, pigs and dog were also reared.
11. - IBERIAN COPPER AGE

The evidence considered in this section comes from the Los Millares culture and from a few other sites which are known to be of the Copper Age period. The Los Millares pottery can be derived from the preceding Almerian neolithic ware. The shapes include pots with rounded or pointed bases which were undecorated during the neolithic. Now, however, some vases have incised patterns which include oculli motives, which are occasionally painted in black on a light background.

Extremely fine flint work was being done, and small objects of bone and ivory such as V-perforated buttons and toggles appear. Metallurgy was also of importance with copper, silver and gold all being worked. The basic form was a fairly simple copper dagger with a rib down the centre of one face.

Nothing is known of the importance of hunting as opposed to domestication, but it may be assumed that the usual wild animals were being killed to supplement the food and to provide skins.

Domestic Animals

Cattle

Remains of domestic cattle have been found at two sites in Spain. Staffe (1943) reports bones from Grotte Joan d'Os and Mina del Milagro. These finds include skulls of turbary cattle, the better preserved of which was found at the first copper mine site. Although no other domestic animals have been identified, this does not of course imply their total absence/
absence in Spain, as there has been no systematic investigation of this period. Cattle also occur in a Copper Age pit at Vila Nova San Pedro in Portugal (Behrens 1964).

Ovicaprids

The goat is also known from this Portugese site (Behrens 1964), and there is no evidence for its presence in Spain.

Pig

The only known instance of pig in the Iberian Peninsular comes from Vila Nova San Pedro in Portugal (Behrens 1964).

Cultivated Plants

Wheat

Wheat occurs at all seven sites considered (see Table No. 187). In the majority of cases the species of wheat has not been ascertained. Most of the other identifications are of naked wheat.

There is a single instance of emmer which occurs at Almizaraque and is mixed with carbonised grains of club wheat and barley (Neuweiler 1935; Santa-Olla 1946; Tellez 1954). It is found in several of the chambered tombs. One of the instances identified by Netolitsky has, however, been questioned by Tellez, who thinks that the grain in question is bread wheat.

At this same site there has been found many grains of both club and broad wheat (Neuweiler 1935; Santa-Olla 1946; Tellez 1954). Both occur in/
in abundance, with the former slightly more frequent than the latter. Club wheat also occurs at Assentas (Blance 1960), bread wheat at Lugarico Viejo (Tellez 1954) and club wheat at Baleal (de Paco 1957). Three types have been distinguished at the last site on a statistical basis, but de Paco thinks that they all belong to *Triticum sphaerococcum* v. *globiforme*, the spherical version of club wheat. The carbonised grain from Monte Bersella has again been divided into three groups on the basis of size (de Paco 1954). At least one of these belongs to naked wheat, but there is no definite identification of the species.

Wheat was the main crop during the Copper Age in the Iberian Peninsula. Club wheat, bread wheat and emmer were all known, with club wheat the most common of the three varieties.

**Barley**

Barley has been identified at four sites (see Table No. 187). Glummed barley was found at Baleal (de Paco 1954). The barley at Assentas is known to be multi-rowed (Blance 1960) and that at Almizaraque was six-rowed (Cifferi 1954; Neuweiler 1935; Tellez 1954).

Barley was known in this context but does not seem to have been of great importance. The six-rowed species is the only one to be definitely identified.

**Flax**

The only instance of flax comes from Almizaraque, where small seeds of/
of *Linum usitatissimum* were found in one of the chambers (Neuweiler 1935; Santa-Olla 1946; Tellez 1954).

**Legumes**

The bean (*Vicia faba v. celtica nana*) seems to have been the most common of all the legumes. It has been identified at three sites (see Table No. 187), including Almizaraque where many seeds were found (Neuweiler 1935; Santa-Olla 1946; Tellez 1954). A large variation in size of these seeds is seen particularly at Baleal (de Paco 1957) where most measurements vary by as much as 50% either way of the mean. Lentils are known from Campos (de Paco 1954).

No other legumes have been identified, and it seems probable that the bean was cultivated.

**Summary**

Cattle is the only domestic animal identified, although others must have been present. Wheat was the main crop with club and bread wheat its chief constituents. Emmer was also present, and barley, flax and beans were cultivated.
12. POLISH COPPER AGE

A single site is to be considered in this section, and it belongs to the Baden culture. The characteristics are as for this culture in Hungary and Austria.

Domestic Animals

Cattle and ovicaprids are known to have been domesticated at Wyciaze in a Baden context (Nosek 1956, p.10). The horse was also represented but it is not known whether or not it was domesticated.

Cultivated Plants

There is no evidence for plant cultivation in this context in Poland.
13. GERMAN NEOLITHIC/COPPER AGE

The Altheim and Horgen cultures are considered, together with other sites which belong to this period. Both cultures are present in southern Germany, and the Altheim culture is regarded as being an eastern extension of the Horgen culture (Childe 1957, p. 296). They may be placed around 2700 - 2300. The pottery is fairly rough, decorated with cordons and includes handled jugs. There is none of the decoration that is found in the Mondsee region in Austria. Other elements such as the stone and metal industries are similar to those described in the Austrian Copper Age section.

The settlements take the form of either fortified hilltop camps or lakeside villages. Hunting was practised and the animals exploited include red and roe deer, elk, aurochs, bison, pig, bear, horse, beaver, otter, badger, wolf, fox, cat, turtle, birds and fish. On the whole hunting accounts for less than a quarter of the osteological remains (see Table No. 188).

Domestic Animals

Cattle

Cattle are represented at five sites of the Altheim culture, and may be present at a further three (see Table No. 189). At Altenriedingen, Altheim and Pesternacker they are seen to be the most important of the domestic animals (Boessneck 1956; see Figs. 133 - 135, Tables Nos. 190 - 192). Very few bones found at Polling could be safely assigned to domestic/
domestic animals, but the evidence available indicates again that cattle are probably the main domestic animal (Boessneck 1956; Muller-Karpe 1961; see Table No. 194).

The majority of these animals were of medium to small size, although there were a few isolated examples of large animals some of which were near the aurochs variation in height. Remains of horn cores confirm these results. Definite evidence for the castration of cattle was found at Altheim (Boessneck 1956). The most certain way to determine whether or not bones belong to castrated animals is to examine the bones of which the epiphys has not fused. If the bone in question is not fused over the whole area and does not belong to a young animal, but is large and slim in size, it originates from a castrated animal. One such example was found at Altheim.

Cattle have been identified at all three sites of the Horgen culture which are considered here (see Table No. 189). Turbary cattle have been identified at both Dullenried (Reinerth 1929) and Ravensburg ( ). Vogel (1933) describes the cattle from Sipplingen as lying between the turbary and recent Simmental cattle in appearance. There is, however, considerable variation within this general picture, although no typical turbary or primigenius animals appear to have been found. Two cultural levels were found, and the average for both places cattle in second position of importance behind pigs (see Fig. 136 & Table No. 193). This agrees with the Swiss Horgen results.

Domestic cattle occur at a further three or four sites (see Table No. 189).
Amongst the remains from Bodman was a skull of an animal with primigenius characteristics which had been pole-axed (Vogel 1933). This feature was found on other skulls. The turbary breed of cattle was also represented, as were animals resembling the Simmentaler race. A similar variation in size of the domestic stock occurs at Unterruhldingen (Vogel 1933).

Cattle were the basis of the economy of the Altheim culture, but this does not apply to the German Horgen culture, which agrees with the Swiss results.

**Ovicaprids**

Sheep or goats are known in five instances in an Altheim context, and in all cases they come second or third to cattle (see Tables Nos. 189 - 192, Figs. 133 - 135). Both sheep and goats have been identified at Alte-nerdingen and Altheim although they could not be distinguished at Pesternacker and Polling (Boessneck 1956). For the four sites as a whole Boessneck says that an exact size determination was not possible, although there were no very large or small animals present. The sheep seemed to be smaller than the present day German 'Landschaf', and the goats were a little smaller than the 'Frankenziege' and 'Saanenziege'.

Both sheep and goats are known at Dullenried (Reinerth 1929) and Sipplingen (Vogel 1933) in a Horgen context (see Table No. 189). At the last site sheep are more frequent than goats and all remains indicate the turbary breed. These animals are less important than both cattle and pigs (see Fig. 136 & Table No. 193).
Of the remaining three sites to be considered, sheep and goats have been identified at Bodman (Vogel 1933) and Nussdorf (Vogel 1933), and may also be present at Unterruhldingen (Vogel 1933). The turbary sheep has been identified at the first site by several characteristic bones, and the scimitar-horned goat is known from this site and also from Nussdorf.

Ovicaprids were not of great importance to the economy of either of the cultures considered, although they are represented at most sites.

Fig

The domestic pig occurs at five sites of the Altheim culture, and may also be present at a further three sites (see Table No. 189). Boesanck (1956) reports the osteological remains from Altenrderingen, Altheim, Pesternacker and Polling and found pigs to be less important than cattle in every instance, (see Figs. 133 - 135, Tables Nos. 190 - 192, 194). These bones have been divided into two categories. At Altenrderingen the turbary category is the largest with only a few bones of larger animals, whose domestic status was uncertain. This situation is reversed at Altheim where the large animals can be safely said to be domesticated. The turbary breed occurs again at Pesternacker.

The presence of two breeds is seen again at the Horgen site of Sipplingen (Vogel 1933). Here pigs are the most important domestic animal, and the majority lie within the maximum boundary of the turbary animals. There were also a few of the larger variety present and it is notable that less than a quarter of the animals were slaughtered when they were adults (see Fig. 136, Table No. 193). The pig is also reported from Riedschachen (Reinerth/
Pigs occur at at least a further three sites of this period (see Table No. 189). The large domestic pig is known from Bodman (Vogel 1933) and both this and the turbary breed occur at Nussdorf and Unterruhldingen, where the smaller type is more frequent (Vogel 1933).

The pig was the most important animal in the economy of the Horgen culture, but comes only second or third at sites of the Altheim culture. Two types of pig were known at the majority of sites, and local domestication is indicated.

Dog

Dogs occur at the Altheim sites of Altenerdingen, Altheim, Pesternacker and Polling (Boessneck 1956; see Figs. 133 - 135, Tables Nos. 190 - 192, 194). In all cases they form only a small proportion of the remains, and the major part of them can be assigned to Canis familiaris palustris. Other bones indicate the ladogensis version of this dog, and Canis familiaris intermedius.

An intermedius-sized dog is reported from Dullenried (Reinerth 1929), and a turbary animal is known at Ravensburg ( ). These two types occur again at Sipplingen together with a miniature dog, Canis f. spaletti (Vogel 1933). The majority of dogs belong to the large turbary breed. All these finds have been assigned to the Horgen culture.

The comparatively rare miniature dog also occurs at Bodman where skulls of 127 mm. and 119 mm. in basal length were found (Vogel 1933).
Also present was the turbary dog and a larger type ascribed to Canis f. leineri. Nearly all dogs from Nussdorf are of the turbary variety, with one instance of an intermedius-sized animal and a few transitional types (Vogel 1933). Both the palustris and leineri dogs are known from Unterrühldingen (Vogel 1933).

There is considerable variety in the types of dogs being bred at this period. The turbary breed is still the main form, with both larger and smaller animals being known.

Horse

There are three instances of the domestic horse during this period. They occur at the Altheim culture sites of Pesternacker and Altenerdingen (Boessneck 1956), and at the Horgen site of Dullenried (Reinerth 1929).

A comparatively large proportion of horses are known from both of the Altheim sites (see Figs. 133, 135 & Tables Nos. 190 & 192), and they are about as numerous as oviscaprids or pigs. These animals are described as being of medium size, 140 - 145 cm. to the withers, robust, but not of the cold-blooded stock. Boessneck thinks the forerunner was the Przewalski horse, and that their domesticity is highly probable, although it cannot be stated with absolute certainty.

It seems probable that the horse was being acquired as a domestic animal during this transitional period, as seems to be the case in other areas of Europe.

Cultivated/
Cultivated Plants

The only site with evidence for the cultivation of plants is Ravensburg ( ). Emmer, barley and the broomcorn variety of millet are all known to have been present in a Horgen context, but nothing of their relative frequencies is known.

Summary

Cattle were the most frequent domestic animal of the Altheim culture with ovicaprids and pigs of approximately equal importance. There were several types of dog present, and domestic horses were probably known. The economy of the Horgen culture was different. It was based on pig breeding as was the Swiss version of this culture, with cattle the second most frequent animal and ovicaprids third. Several dogs are known and there is a possibility of horse domestication. Emmer, barley and millet have been identified.

The different economies of the Altheim and Horgen cultures is striking since the former culture is regarded as being an eastern extension of the latter (Childe 1957, p. 296).
14. SINGLE GRAVE COMPLEX

The Single Grave Complex is composed of several cultures which have many features in common. Included here are the Corded Ware sites of Germany, Poland and Switzerland, the Swedish Boat-Axe culture and the Single Graves of Jutland, Germany and Holland. The time span of these groups is considerable, with Corded Ware overlapping the late Baden culture, and extending into the Early Bronze Age. The Complex as a whole may be dated to 2900 - 2000.

The elements in common to these cultural groups include single contracted skeletons in all early graves, a beaker-shaped pot decorated with cord impressions, stone battle-axes and necklaces of bored teeth. The earliest Single Graves are those below ground level, called Bottom or Flat Graves, they are followed by Ground Graves which are constructed on the land surface, and Upper Graves which are in mounds above ground. These last graves are contemporary with the Danish Stone Cist period and may be placed at around 2000.

Corded Ware originated in central Germany and Bohemia and from there spread as far west as Switzerland. The pot forms include long-necked beakers and amphorae both of which are richly ornamented with cord impressions around the upper portion of the pot. The cemeteries include flat graves and barrows. Small copper rings and spirals, amber objects and trepanned skulls are all known.

The other cultural group considered here is that of Globular Amphorae. This culture is concentrated in Germany with extensions to the south, east and/
and west and is largely contemporary with the Corded Ware sites in this area. The pots have a rounded base and vertical-sided neck with two small handles. It resembles a squat beaker, and has incised cross-hatching around the upper half of the vessel. Flint, stone and bone implements, amber beads, bone ring pendants, a few copper and occasionally bronze objects have been associated with Globular Amphorae.

The animals that were hunted include red and roe deer, elk, aurochs, pig, beaver, badger, otter, bear, wolf, fox, marten, wolverine, cat, hare, seal, porpoise, tortoise, various fish and birds. A large quantity of wild animals is represented at one of the northern Polish sites, but in Switzerland where the greatest number of bones have been found the wild fauna accounts for about a quarter of the osteological remains (see Tables Nos. 195, 197 - 199).

In connection with the evidence for agriculture in Single Grave communities it must be mentioned that there is no evidence for this period in Denmark. This is because no settlement sites have been found as yet, and that in the graves themselves not even the human skeletons have survived. This is a result of the local soil conditions, and the only indication of human burials is a dark stain outline of the skeleton.

**Domestic Animals**

**Cattle**

Cattle have been identified at 20 of the 43 sites of the Single Grave Complex that are considered (see Table No. 196). They may be present at a further/
further site also. Their most notable absence occurs in Sweden, where the osteological remains are extremely fragmentary and scarce. Cattle also occur at 21 or 22 of the 27 sites of the Globular Amphorae culture (see Table No. 196). The evidence from the Single Grave Complex is considered first.

The two Polish sites which supply the most evidence are Nowy Daromin (Hoyer 1927) and Rzucewo (Niezabitowski 1928). The remains from the first site come from four graves and are associated with Corded Ware pottery. A great variety of bones were found and these have been assigned to both turbary cattle and the local aurochs. The turbary breed was again encountered at Rzucewo as well as remains of an animal which Niezabitowski describes as 'Bos primigenius minutus Matab.'. Nothing is known of the nature of the cattle found in the other three Polish sites, the two in the Baltic States or the three in Germany.

Bones of two cattle were found at Pollik (Amscheler 1949). One was a small adult cow of between 4½ and 5 years, and the other a calf under one year. The horn cores, frontal bones and teeth all indicate the turbary breed, with some resemblances to the modern alpine cattle of the Zillertal, and to the short-horned Pinsgauer cattle.

A statistical analysis has been carried out on the remains from the Swiss sites of Auvernier (Reverdin 1932), Baldegg (Herscheler 1940) and Utoquai (Kuhn 1932), but no uniform picture emerges. They come third in one instance, second in three and first in one (see Figs. 137 - 139, Tables Nos. 99, 197, 198). The greatest quantity of bones was recovered at/
at Baldegg where they are second to ovicaprids. The cattle of Utoquai are known to be basically of turbary stock with a few of the larger breed also present (Herscheler 1940).

The predominance of the turbary breed is also encountered at Amberg and Meyer (Herscheler 1920). A few remains of larger animals were found and cattle are said to be about as common as pigs. The cattle of Luscherz and Vinelz have been compared to the Simmental cattle and so belong in the turbary category (Studer 1883), and two types are recorded at Robenhausen (Rutimeyer 1860) where they are slightly less frequent than pigs.

There are many instances of cattle in a Globular Amphorae context. Between five and seven cattle are represented at Adolfin, with large and medium sized animals present (Bokonyi & Kubaswiecz 1961). At least seven cattle are known from the cemetery of Brzesc Kujawski (Swiezynski 1958; Bokonyi & Kubaswiecz 1961). Here the animals were generally of small size and young. Dwarf animals occur at both of these sites, with the one from Adolfin reaching between 1139 and 1089 mm. in height, and the two from the latter site are between 1165 and 1116 mm. An interesting fact to emerge is that the cattle from Brzesc Kujawski all appear to have had their horn cores deliberately cut off near the base. This fact may account for the absence of horn cores at other sites in Central Europe, if it were practised as part of the ritual burial of these animals.

The other burial to be mentioned by Bokonyi and Kubaswiecz (1961) is that at Zdrojówka. The skeletons of two cows between 2½ and 3½ years old were found in one grave, splinters of bones of at least two cattle were found/
found in a second and at least four animals were found in a third grave and are similar in appearance and age to those from the first. There is no indication of the nature of the cattle from the remaining Polish graves (see Table No. 196).

Cattle occur at ten or eleven German burial mounds, but it is only at Trebus that the breed is known, and is again the turbary breed (Priebe 1938). The other German site to be considered is the megalithic village of Dummersee which fits in best with this section. The original report was unavailable (Reinerth 1939), but cattle are known to have been bred as a result of the work of Luttschwager (1954) and Nobis (1955). The actual numbers of bones identified are of little importance since they represent only a selected portion of the true finds (see Table No. 199).

Cattle were clearly of great ritual importance in both Single Grave and Globular Amphorae burials. It is generally the turbary breed which is present and dwarf animals also occur. The evidence from settlements in Switzerland shows no uniform importance of cattle, although they are often second in importance to either ovicaprids or pigs.

Ovicaprids

Sheep or goats are known from 20 of the 43 sites of the Single Grave Complex and could occur at a further four sites. They are also known at four sites assigned to the Globular Amphorae culture (see Table No. 196).

Ritual burials of sheep and goats are known from Nowy Daromin and Zlota in Poland (Hoyer 1927; Wodzicki 1935; Gimbutas 1956). The bones from/
from the second site include those of a small goat. The goat was again found at Rzucewo (Niezabitowski 1928). Horns of a weak-horned animal were found, which exhibit a slight curvature but no twist; there were no remains of sheep. Bones and teeth of ovicaprids were found at Dobris, where the teeth seem to have formed part of a dress ornamentation (Matthias 1953).

Amongst the burials at Follik were a ewe and lamb and goat and kid (Amscheler 1949). The goat is known to be of the prisca group, from the homonymous twist of the horns, but the breed of sheep is unknown.

The diverse information obtained from the Swiss sites is as follows. At Baldegg sheep and goats are by far the most frequent of the domestic animals (Herscheler 1940; see Fig. 138, Table No. 197), and at Auvernier they are also the most numerous of the three main animals, although equal with pigs on one account (Reverdin 1932; see Fig. 137, Table No. 99). At Utoquai on the other hand they are the least important of the animals and are comparable to the dog in importance (Kuhn 1932; see Fig. 139, Table No. 198). The turbary sheep was the chief breed, but there were also bones which lay within the range of variation of the Copper Sheep, Ovis aries studeri Duerst. Goats appear to have been less common than sheep at all these sites. At Amberg and Meyer, however, goats were more frequent than sheep (Herscheler 1920). The turbary sheep occur again at Vinelz where they outnumber the goats by two to one, and the sheep of Luscherz are described as being small with long legs and two-edged horns which bend slightly outwards (Studer 1883). The Vinelz goats were larger than usual and do not/
not represent the turbary goat common to most Swiss sites. The evidence from Robenhausen shows that ovicaprids are the least important of the main domestic animals (Rutimeyer 1860).

The Copper sheep, Ovis aries studeri Duerst has again been identified at Greng (Studer 1883). Horns were found which were slightly smaller than those of the moufflon, and Studer regards them as domesticated moufflon which therefore illustrate the link between the Mediterranean area and the Swiss Alps. Duerst (1904) also examined these horn cores and came to the conclusion that they represent the same sheep as those from Utoquai, and gave them the name Copper sheep. He held the view that moufflon existed in their wild state at this period in Spain. It should be noted that this sheep also occurs at Bundeø in Denmark, so linking Switzerland with Scandinavia.

The remains from the Swedish Boat Axe graves are all very fragmentary and usually consist of one or two bones which are probably of sheep (Møhl 1962).

Ovicaprids appear to be of less importance in the Globular Amphorae graves than cattle. They are known at Raciborowice (Behrens 1964), Stok (Kowalczyk 1953), Zdrojówka (Behrens 1964) and Strzelce (Bokonyi & Kubaswiecz 1961) but are notably absent from the rich site of Brzesc Kujawski (Swiezynski 1958; Bokonyi & Kubaswiecz 1961).

Sheep and goats were of no great ritual importance in this context. Their importance at settlement sites varies, and turbary and Copper sheep were both being bred.
Pig

Domestic pigs are known from 14 of the 43 Single Grave sites and from nine Globular Amphorae sites. They could be present at a further two sites in each case (see Table No. 196).

In most cases the size or frequency of the pigs is not known. The large variety occurs at Rzucewo (Niezabitowski 1928) and ritual burials of pigs are known from Złota (Gimbutas 1956; Wodzicki 1935). No pigs have been identified at German sites and they are also notably absent from Follik in Austria (Amscheler 1949).

Pigs occur at most of the Swiss sites. The evidence from Auvernier (Reverdin 1932), Baldegg (Herscheler 1940) and Utoquai (Kuhn 1932) shows pigs to be the most important animal in one case, equal first in another, second in another and third in the remaining two instances (see Figs. 137 - 139, Tables Nos. 99, 197, 198). It is only at Utoquai that the type of pig has been identified, and there it was the turbary pig which was being bred. The pigs from Amberg and Meyer all fall within the turbary group (Herscheler 1920) as do those from Luscherz and Vinelz (Studer 1883). At the last two sites a smaller version of the turbary pig is reported, and may be compared with the miniature dogs. At Amberg and Meyer pigs are approximately as numerous as cattle, and at Robenhausen turbary pigs are thought to be slightly more frequent than cattle (Rutimeyer 1860).

The large domestic pig is associated with Globular Amphorae ware in the graves at Erzesc Kujawski (Swiezynski 1956; Bokonyi & Kubaswicz 1961). It is not known whether large or small pigs are present at the other sites in/
in this context. Luttschwager (1954) was unable to identify pigs amongst the bones he examined from the megalithic village of Dummersee, but Nobis (1955), on the other hand, was able to find a single bone of pig (see Table No. 199).

Pigs occur at several burial mounds and also at settlement sites of the Single Grave culture. In some cases they are the most important animal and in others are the least important. Both turbary and sorofa types of domestic pigs occur. They are also known in graves of a Globular Amphorae context.

Dog

Remains of dogs have been found at 27 possibly 30 sites of the Single Grave Complex. This makes them the most frequently occurring animal at these sites, which is striking since dogs usually occur at fewer sites than the other domestic animals owing to their small numbers. They are also known at five Globular Amphorae sites (see Table No. 196).

Several remains were found at the Polish site of Rmucowo and they all have been attributed to Canis f. matris optimae Jeitt. (Niezabitowski 1928). The most detailed description of remains from this culture comes from Złota. Wodzicki (1935) reports dogs from the 1926-27 excavations found in two pits. In one were remains of a small to medium sized animal, with a skull of basal length 145 mm., and between one and two years in age. In the second pit were two skulls of animals of a similar age and size. Wodzicki made various calculations and diagrams of comparison of these Corded Ware remains/
remains with those of the later periods at this site, and he came to the conclusion that all three animals belong to the Canis f. palustris ladogensis breed. The dog from Rinnekalns is attributed to this same breed (Gandert 1930).

Perforated teeth of dogs have been identified at two Czechoslovakian sites. About 150 teeth were found at Lovosič lying around the waist of a skeleton (Fleiner & Moucha 1958). At Marefy as many as 421 dogs' teeth were found and there were a further 56 bone imitations of dogs' teeth, all ornamenting the dress of an old woman (Neustupny 1961). It would have taken a minimum of 22 dogs to provide this trimming. Bored teeth also occur at most of the German sites mentioned (see Table No. 196). At Braunsdorf a dog's skeleton was found in conjunction with a human burial and a horse skeleton but Behrens (1962) thinks this is probably of the first millennium A.D. rather than of the Single Grave Complex.

Dogs form a small proportion of the remains at the Swiss sites of Auvernier (Reverdin 1932), Baldegg (Herscheler 1940) and Utoquai (Kuhn 1932). The majority of the bones from Baldegg can be attributed to the turbary dog. Remains of a larger dog or wolf were found in 1939, and closer examination showed that they represented Canis f. matris optima Jeitt. At Utoquai a large form of the turbary dog is thought to be present. Further Swiss sites with evidence for the breeding of the turbary dog are Amberg and Meyer (Herscheler 1920), Greng, Luscherz and Vinelz (Studer 1883). The dog is also present at Robenhausen (Rutimeyer 1860).

A complete dog's skeleton was found at the Swedish site of Bergsvägen (Möhl/
(Möhl 1962). It is said to represent a small spitz-like animal, and so again indicates the occurrence of a turbary animal. This is the only complete skeleton of an animal amongst the Swedish sites which have been considered.

Dogs are known in a Globular Amphorae context at Brzesc Kujawski but the breed could not be determined (Swieszynski 1958; Bokonyi & Kubaswiecz 1961). The same applies to the four German sites, where the remains consist mostly of perforated teeth. A few bones of a dog were also found in the Megalithic village of Dummersee but again the species is unknown (Nobis 1955).

Dogs occur at sites of the Single Grave Complex more often than any other domestic animal. There are two basic types present, Canis f. matris optimae Jeitt., and Canis f. palustris, with the larger version of the last species Canis familiaris palustris ladogensis also represented. The breeds present in conjunction with Globular Amphorae are not known.

**Horse**

There are four possible instances of domestic horses in a Single Grave context, and three in a Globular Amphorae context (see Table No. 169).

There is a claim for domestication at Żłota. Behrens (1962) discusses the remains identified by Zurowski, but could not accept their association with Corded Ware since there were no associated finds. The horse bones reported by Wodzicki (1935) do not have their status specified and so must be assumed to be of wild animals.

Two/
Two well preserved horses and the skull of a third were found at Follik. There was a foal with a 3 - 4 year old mare and the skull of an animal between 18 and 20 years of age. Amscheler (1949) came to the conclusion that these horses belonged to the representative of the Arabian horse *Equus Caballus L. orientalis*. This horse was of medium size and lies within the range of modern Arabian horses. Bokonyi (1954) has suggested that these bones in fact represent the donkey, *Equus Asinus cfr. hydruntinus Reg*, that was thought to be extinct at the time Amscheler was working. However, no comparative measurements have been carried out, so the original diagnosis must still be accepted.

The domesticity of the horses at Baldegg has been established by comparison with remains of Helveto-Gallic horses (Herscheler & Reuger 1940). No claim is made for the domestication of the horse remains found at Amberg and Meyer (Rutimeyer 1860; 1861; Herscheler 1920). Herscheler was able to identify two different types of horses amongst the osteological remains which he calls *Equus caballus nehring Duerst* and *Equus caballus robustus Nehring*, the former being the smaller of the two. He assumes that both are wild in origin. If, however, the difference between the sizes is greater than the variation indicated by Lundholm (see below), it seems probable that one of these animals must have been brought there by man and so be at least semi-domesticated.

A skeleton of a horse was found at the Swedish site of Hvellinge (Behrens 1962; Lundholm 1949). It was discovered during the excavations of 1860, and the excavator and all subsequent authorities have been unable to decide whether or not it was contemporary with the grave.

There/
There is a strong possibility of horse domestication at the Megalithic village of Dummersee (Lundholm 1949; Luttschwager 1954; Nobis 1955). Reinerth originally reported them to be definitely of domestic status, and if this is true Lundholm says these are the earliest known domesticated horses. According to Lundholm the basis of the argument rests on the size variation that was apparent amongst the remains. However, he has shown that there was a variation in size amongst the wild post-glacial horses, so that this factor alone is no proof of domestication. Some of the remains are attributed to wild animals by both Nobis (1955) and Vogel (1933), but both are of the opinion that there are some bones of domesticated animals (see Table No. 199).

Another claim for domestication was made at Weick-Luisenthal. The discovery is mentioned by Kilian (1955) and Gimbutas (1956), but the original report by Ehrlich was unavailable. The nature of this evidence and reason for domesticity is therefore not known. The skeleton of either a horse or a cow was present at Langendorf (Behrens 1964).

From the above evidence it seems most probable that the horse was making an appearance as a domestic animal at a few isolated sites. It was, however, far from becoming a frequent occurrence at sites.

Cultivated Plants

Wheat

Wheat has been identified at 9 of the 22 sites considered (see Table No. 200). There is a single instance of einkorn, five or six cases of emmer/
emmer and four of bread or club wheat. The remainder of identifications are of unspecified wheat.

Einkorn occurs only at Meyer in Switzerland, where its proportion is known to be small (Neuweiler 1924).

The only wheat to be identified in Poland and the Baltic States is emmer. It occurs at Zlota (Burchardówna 1952) and again at Lindenberg (Kilian 1955). An impression of the same wheat is thought to be present on a pot from a grave at Schafstadt in Germany (Matthias 1956). Emmer is also known from the Swiss sites of Meyer and Utoquai (Neuweiler 1924; 1930). At the first site emmer was the second most frequent grain to be encountered whereas at Utoquai it was the most frequent species. The grain from the two sites compare well in size and many carbonised clumps of this wheat were found. The final instance of emmer to be considered comes from Hornslev in Denmark (Brønsted 1957, p.393). Only a single impression was found at this site.

Club wheat has been found at the Swiss sites of Meyer and Utoquai (Neuweiler 1924; 1930). At Meyer it is the most common of the three species of wheat to be identified, and in all some 3 - 4 litres of this cereal were recovered. The seeds vary a lot in size, some being almost spherical; the smallest ones found belong to the antiquorum sub-species that is described by Heer (1865). This small version of club wheat is also present at Robenhausen together with the larger type of club wheat. Here it is again the most frequent of the cereals encountered (Heer 1865; Neuweiler 1905). Both types occur at Utoquai, but club wheat is not as frequent/
frequent as emmer (Neuweiler 1930). The only other instance of bread or club wheat in this context comes from the Danish site of Kettrup where a single impression was found in a pot (Brønsted 1957, p.393).

Einkorn, emmer, club wheat and possibly bread wheat were known during this period. Club wheat and emmer were probably the most common types.

Barley

This cereal has been identified at 13 of the 22 sites mentioned (see Table No. 200). In many cases the exact species involved is not known.

Heer (1865) identified the six-rowed barley at Robenhausen where it was much less common than wheat, and the same species occurs at Meyer (Neuweiler 1924). Only one ear could be assigned to this variety, the rest being indeterminate and accounting for only a small percentage of the crop.

Naked barley is known at the Danish sites of Hammer, Gaarslev, Klelund and Tyregodlund and glumed barley is also known from the last site (Brønsted 1957, p.392 - 393). There are a further two impressions of naked barley on pottery from unknown sites.

There are three instances of naked barley in Sweden. These occur at Hyltarp, Maglø and Sannehed (Hjelmqvist 1962), and there is a possible occurrence of glumed barley at Rotved (Hjelmqvist 1962). The impression of barley identified at Svedala is more rounded than is usual and has not been assigned to either group (Hjelmqvist 1955). Barley is the only cereal that has been identified in Sweden at this stage, despite a thorough investigation by Hjelmqvist.
Barley was of major importance in Sweden, but does not seem to have had much value in other areas. The six-rowed variety is known from Switzerland, and both naked and glumed barley are known in Scandinavia.

**Millet**

Millet is only known in Switzerland (see Table No. 200).

Both *Panicum miliaceum* and *Seteria italic*a were identified at Auvernier (Neuweiler 1905) and Robenhausen (Neuweiler 1905; Heer 1865), but only the former variety occurs at Sutz (Neuweiler 1905). This species is also known from Meyer where a small quantity was recovered (Neuweiler 1924).

In all cases millet is known in small quantities only and was of no great consequence to the economy.

**Flax**

Flax only occurs at four sites in Switzerland. Many carbonised seeds are reported from Amberg, Meyer (Neuweiler 1924), Robenhausen (Heer 1865; Neuweiler 1905), and Utoquai (Neuweiler 1930). Neuweiler has identified these remains as belonging to *Linum cf. austriacum*, but it is more probable that they are in fact *Linum usitatissimum* (Helbaek 1959a).

**Legumes**

Peas are recorded at the Swiss sites of Luscherz (Neuweiler 1905), Robenhausen (Heer 1865; Neuweiler 1905) and Utoquai (Neuweiler 1930). Their absence/
absence at Meyer is striking since many plant remains were recovered (Neuweiler 1924).

**Poppy**

The poppy is recorded at most of the Swiss sites mentioned (see Table No. 200). No definite evidence for cultivation is given, although this is possible since the seeds often occur in large quantities.

**Acorns**

It is interesting to note that whilst no cereal remains were discovered at Succase, Ehrlich (1934) reports a large quantity of carbonised acorns. These could have been ground into flour for human consumption, or alternatively used as fodder for pigs.

**Plough Marks**

Kjaerum (1954) reported a series of criss-cross plough furrows under a Single Grave tumulus at Aldrupgaard in Jutland. The network of markings were found under the whole of the excavated area and are orientated east-west and north-north-east - south-south-west. The furrows vary in width between 3 and 10 cm., and are on average 30 cm. apart. A rectangular framing of stones and a plank coffin surround the body, and the grave goods include a thick-butted axe of Single Grave type and a fragment of a flint blade. This is the only occurrence of plough furrows known to be of this period, and so are the earliest known instances in Europe.

**Summary/**
Summary

Cattle appear to be of great ritual value in both the Single Grave and Globular Amphorae contexts. This is particularly true of the last culture and it may be compared with the Baden culture in this respect. No consistent picture emerges of the economy of settlement sites. The ovicaprid-breeding communities may be again linked with the Baden culture, and pigs with the Horgen culture. Both emmer and club wheat were of importance in central Europe, whereas barley was the basic crop in Scandinavia.
CONCLUSIONS

The origins of agriculture took place in the Near East within the area of distribution of wild sheep and goats and the wild prototypes of einkorn, emmer and barley. There are two possible regions in which this could have taken place. The first is in the foothills of Iraqi-Kurdistan and is referred to as the Fertile Crescent, and the second is in Palestine. More sites are known from the former area, and it is in this district that the earliest evidence for probable sheep domestication has been found, namely at the site of Zawi Chemi Shanidar, dated to around 9000 B.C. This is the earliest evidence for domestication in the Near East, since the claims for the domestication of the dog and other animals during the Natufian period cannot be substantiated. Both goats and dogs were domesticated during the Aceramic period at Jericho in Palestine, and there is evidence for animal domestication and plant cultivation at this stage from Anatolia and the Fertile Crescent. Neither cattle nor pigs were domesticated until considerably later. Cattle are known from the late neolithic in Anatolia and Turkestan, but they do not occur in Mesopotamia, as far as is known, until the Chalcolithic period when they are known to be present in a Halafian context. This period is probably earlier than the late neolithic in Anatolia and Turkestan, and may be placed at around 5000 B.C. The pig was acquired as a domestic animal at a slightly later stage, and it is known from the late neolithic in Anatolia and from Jarmo. There is, however, no evidence for its domestication during the Hassuna, Halaf or 'Ubaid periods in Mesopotamia or Iran, but this may be due to the fact/
fact that most osteological remains from early excavations were discarded.

Einkorn, emmer and two rowed barley are all present in the early cereal fields, and they are known from the Aceramic, Neolithic and Chalcolithic periods. Legumes also occur at these three stages, but there is no evidence of their cultivation until the neolithic period. During the Halaf culture of the Chalcolithic, flax was added to this list of cultivated plants. This occurred in the Kurdish foothills around 5000 B.C.

Donkeys and probably half-asses were domesticated during the later Chalcolithic period, and the Bactrian camel is known to be present at the end of this period.

Cattle were domesticated from *Bos primigenius* or *Bos namadicus* according to the position of the sites, and sheep from *Ovis orientalis* and *Ovis vignei*. At Anau in Turkestan it has been shown that a sheep very similar to, if not identical with the turbary sheep of central Europe evolved from the mountain sheep or urial *Ovis vignei*. The goats all emerged from *Capra aegagrus* and include both large and turbary-sized animals. Hornless sheep are also known from the Chalcolithic. Both large and turbary-sized pigs appear during the late neolithic or Chalcolithic, and also originate from one wild species, namely *Sus scrofa ferus*.

Although there are no known instances of mesolithic dogs in the Near East, they occur at several sites in Europe. They are found most frequently at Maglemose settlements in northern Europe, but are also known in an Azilian and Tardencisian context in Russia, and a Tardencisian and Asturian context in France and Spain respectively. In the last two instances they may/
may occur with other domestic animals. Two breeds of dogs have been distinguished, the larger probably *Canis familiaris inostranzewi* and the smaller *Canis familiaris palustris*. The evidence indicates that the former originated from the indigenous wild wolf *Canis lupus* and it is probable that the smaller turbary breed evolved from the larger dog. There is no evidence to indicate to what extent, if indeed any, the small Arabian wolf played in the evolution of the turbary dog.

Apart from these instances of dogs at mesolithic sites in Europe, there are a few cases of sheep, small cattle and small pigs. Of these it is the presence of sheep that arouses the greatest interest and speculation. Sheep have been identified at sites of the Tardenoisian and Azilian cultures in France, at an Asturian and Tardenoisian/Sauveterrian site in Spain, at a Tardenoisian site in Russia and at a Sauveterrian site in England. The majority of instances are concentrated in France.

There are three possible explanations for their presence. These sheep are either wild animals which survived from the Final Pleistocene (late palaeolithic) until well into Post Glacial (late mesolithic) times, or they are animals which have been domesticated by the local mesolithic populations, or finally they could represent contact with external neolithic communities. As far as the last possibility is concerned, it can be seen from Fig. 140 that many of the sites involved lie outside the area occupied by the Initial Colonisation neolithic cultures. This implies that the people occupying such sites in France, for instance, could either have obtained their sheep by distant trade with the coastal Impressed Ware communities/
communities or else with the Chassey culture. The earliest date for the Impressed Ware in France is around 4200 and that for Chassey is around 3400, thus implying that both the Tardenoisian and Azilian cultures must have survived until at least 4000, and probably for another 600 years in certain regions. There are unfortunately no carbon 14 dates for the Azilian culture, although in some cases it can be shown to be contemporay with the Tardenoisian culture. Most of the evidence favours a date of between 6000 and 4000 for the Tardenoisian culture, but at one site in Germany a date of as late as 3300 has been obtained (Birsmatton). From this evidence it is seen that contact between the mesolithic and neolithic cultures would be just possible.

As far as domestication by the local mesolithic communities is concerned this necessarily implies the presence of wild sheep in the vicinity. It is generally thought that sheep became extinct on the European mainland at the end of the Palaeolithic. They did, however, manage to survive on certain Mediterranean islands such as Corsica and Sardinia (Zeuner 1964). The northern tip of Corsica lies on the same degree of latitude as does the southern-most point of France, where sheep have been identified during the Tardenoisian period. This southern region of France is noted for its Mediterranean climate of hot dry summers and mild winters, which do not differ notably from those found in Corsica. Since the environmental conditions are similar in the two areas, it is most probable that if sheep did in fact manage to survive in one region, they did so in the other also. It is accepted that wild sheep were present in Corsica and/
and Sardinia after the Palaeolithic. It is therefore proposed here that they could equally well have survived in southern France. If the climatic conditions are suitable for sheep in a certain area, Reed also thinks that there can be no positive reason for assuming that they did not continue to live and breed in that neighbourhood (Personal communication).

Nearly all the sheep of the palaeolithic in Europe were large in size and similar to the European and Asiatic moufflon. There are, however, at least one or two instances of a small wild sheep during the palaeolithic in Europe. These occur in the Mousterian levels of Pech de l'Aze (Bouchud 1955) and at the Grotte de l'Observatoire in Monaco. Both of these animals are of very small size. Bouchud compared the remains from Pech de l'Aze with other sheep and found a close agreement between it and small modern sheep found in Spain. In some cases no indication of the size of the sheep found in the mesolithic cultures under consideration is given, but the majority of them appear to be small in size. In one instance they are said to be very similar to the turbary sheep of the later neolithic in Europe (Châteauneuf-Les-Martigues). In other cases they are said to be either small or very small. From this it may be assumed that several of the mesolithic sheep were a good deal smaller than the European moufflon. Lundholm (1949) has pointed out that the actual mechanics for a small species emerging out of a large one are the same for both wild and domestic animals. He applies this to horses, but it is equally applicable to sheep. This happens to isolated communities of animals, such as on islands, and in this case the southern part of France could equally well be considered as/
as isolated. Wild dwarf horses are well known on islands, such as the Shetland horse, the Osel horse, Faroe horse, and in several Mediterranean islands such as the Veglia horse, and this is also known to happen outside Europe (Lundholm 1949; Ch. IX). Lundholm reckons that dwarfs in wild communities can occur fairly rapidly, perhaps in as little as a hundred years. Sewall Wright (1931) investigated the changes in sizes of wild animals on a purely mathematical basis (Lundholm 1949). He shows that in small isolated groups there is a greater probability of reduction in size than there is of an increase in size or the size remaining the same. The mathematical proof of this is given in Lundholm (1949), 218–219.

It is clear that wild sheep were not common during the post-palaeolithic period in Europe, and so for the present purpose the limited areas in which sheep have been detected may be regarded as isolated communities. Hence it is probable that small turbary-like sheep evolved out of the larger European moufflon in certain areas of southern France during the mesolithic period. There is no valid reason to assume in this case that because the sheep are mostly small, they were domesticated. They could equally well have been wild. In some botanical cases, dwarf plant forms can survive in extreme conditions when the original species appears to die out, as for instance the dwarf polyploid juniper of the Himalayas. A small version of this plant is also found in mountainous regions of Britain. This is by no means an unusual botanical phenomenon, and one of the best examples of this dwarfing in unfavourable conditions is scurvy grass (Cochlearia officinalis L.). There are in all four forms, of which the smallest/
smallest is that found in mountains where the environment is less favourable. These were until recently classed as four different species as the variation in size was so great, and it was Linné who demonstrated that they were in fact all members of the same species that were affected by differing environments.

The Mousterian instance of small wild sheep occurs associated with a cold, though not glacial, fauna, which implies that with certain modifications sheep could survive in a colder climate than would occur in their natural habitat. If this is possible during the Mousterian, there is no reason why it should not be possible during the late palaeolithic and mesolithic. Bouchud (1955) also reports that small sheep were identified by Duerst in a palaeolithic context in central Europe, and compare well in size with the neolithic turbar sheep.

The exact status of these mesolithic sheep in France cannot be decided with confidence on the evidence available. It is conceivably possible that they arise from contact with either the Impressed Ware or Chassey cultures of the neolithic. However, from the above evidence the author thinks that it is more probable that they are native to southern France, and represent a diminutive form of the wild sheep of the later Palaeolithic, which survived the climatic changes from the Palaeolithic to the late Mesolithic. There is again insufficient evidence to say, if the above suggestion should prove correct, whether these animals were hunted or bred. It is very difficult to imagine communities of the Tardencisian and Azilian cultures breeding sheep, but it is conceivable that they could have/
have performed a primitive form of selective herding, which left without external influence, could have resulted in a situation similar to that encountered at Zawi Chemi Shanidar.

As to the other instances of mesolithic sheep, small cattle and pigs, those in an Asturian context can be placed well into the neolithic period and almost certainly arise as a result of contact with the neolithic animal breeders, and very little is known of the Sauveterrian site in Devon at which sheep have been found. The small cattle and pigs are probably small forms of the wild aurochs and pigs, but since virtually no work has been done on these finds nothing further can be concluded. It must be remembered that 'small cattle' were reported from Star Carr in Yorkshire, and upon a thorough examination Jewell found that they were in fact aurochs and there was no question of their domestication.

The other apparently mesolithic culture to be considered is that of Ertebølle-Ellerbek. Domestic cattle, ovicaprids and pigs as well as dogs have been found in the context of this culture, together with instances of cultivated plants. There is, however, ample evidence for contact between this culture and that of TRB, and it is proved earlier in this thesis that most of the domestic animals are those of the TRB people. It has also been shown that the claim for cultivated plants in this context is false. All impressions of wheat or barley occur on sherds of TRB pottery and not Ertebølle pottery. The Ertebølle communities did, however, possess the domestic dog, and it is possible that they also domesticated cattle and pig but this was purely as a result of their contact with the TRB culture.

There/
There are one or two sites in south-east Europe which may safely be described as 'Aceramic neolithic', but they differ from the comparable sites in the Near East since they also possessed domestic cattle and pigs in addition to ovicaprids and dogs. The size of the sheep in Greece vary, and it is probable that the turbary sheep is in the process of evolution under the conditions of domestication.

The three cultures of the Initial Colonisation possess a different economy from one another. The Starčevo-Korós and allied cultures concentrated upon ovicaprid breeding. Both large and small sheep were present, and hornless sheep appear for the first time at this stage. There is a record of a large 'moufflon-like' animal from Hungary. Goats also show considerable variation in size, as do pigs. The cattle, however, were still fairly large and clearly related to the aurochs. Very little evidence is available for the Impressed Ware culture, but the indications are that in this case also ovicaprids were more important economically than cattle and pigs. One of the richest cultures in evidence for animal domestication is the Linear Pottery culture.

In this context the emphasis had switched from ovicaprids to cattle, which were clearly the most important animal to be bred. They were usually of medium-size, but both large and small animals also occur. One of the most striking facts to emerge after a careful examination of the cattle remains by Müller (1964) was the high proportion of castrated cattle. They account for approximately half of the male stock. The presence of oxen in such large numbers is of great significance, as they were/
were therefore available not only to draw plough and so facilitate the planting of larger cereal fields, but also could be employed as draught power for any wheeled vehicles. No such vehicles survive, but since they would be made of wood, they could only do so in exceptional circumstances, and such circumstances have not been encountered at Linear Pottery sites. The possibility that the use of the wheel, or perhaps just a simple thick log, had been realised at this stage, does nonetheless remain. There is ample evidence for local domestication of both aurochs and pigs, although the majority of pigs are of a relatively small size. The ovicaprids show a considerable size range, with several turbary-like animals, and also a few resembling the wild animals from which they were domesticated.

The evidence indicates that ovicaprids fell in importance from second position during the early and mid phases of the Linear Pottery culture to third position during the late phase. Both pigs and cattle became more important during this final phase.

The subsequent neolithic and copper age cultures may be divided into three groups, namely those which had their subsistence-economics based upon cattle breeding, those which were based upon pig breeding and those which bred more sheep and goats.

The majority of the cattle-breeding cultures of this later neolithic period may be derived archaeologically from the Linear Pottery culture, and their animal-breeding habits confirm this derivation. The cultures which may be placed in this category include those of Vinča, Butmir, Bukk, Szilmeg, Tisza, Herpály and Lengyel, which developed in central Europe.

One/
One Michelsberg site in Switzerland had its economy centred upon cattle breeding, but at another site in Germany pigs were of greater importance.

Hunting was still of much importance at the Cortaillod sites in Switzerland, but otherwise its animal breeding habits were virtually identical to those of the late Linear Pottery culture. Some indirect connections with the Linear Pottery culture are apparent in the pottery, since some late Cortaillod pots resemble those of the Rossen culture which evolved out of the late Linear Pottery. Otherwise there is no apparent link between the two cultures.

The Chassey-Chalain and Windmill Hill cultures of France and England also have their subsistence-economics based upon cattle breeding, with the exception of the sites in southern France which are on the peripheral area of the Chassey culture. It is probable that there was a long tradition of sheep breeding in this area, and so that when a new style of pottery was introduced, it did not affect the method of farming. These Western Neolithic cultures show close agreement in their economy, and this economy appears to be derived in some way from that of the Linear Pottery culture. Further agreement between the Chassey and Windmill Hill cultures lies in the pottery, which is usually round-based, simple and only occasionally bears some form of incised decoration. Although vase supports are known from France they do not occur in England, and lugs perforated horizontally and vertically do occur in both cultures. Hunting appears to have been relatively unimportant in both instances.

Yet a further basically cattle-breeding culture is that of T.R.B., whose/
whose economy resembles the late stages of the Linear Pottery culture remarkably closely. Cattle, ovicaprids and pigs occur in approximately the same percentages in both cultures. The origin of the T.R.B. culture is under dispute, although it is generally felt that it must have arisen by some means or other from the Linear Pottery culture. The evidence from the animal breeding techniques of both cultures indicates that there is a strong link between the two. Another common factor between these two cultures is the fact that both castrated a proportion of their bulls, a fact which has not been established for many other neolithic cultures. Hunting did not play an important role in the economy of the TRB culture.

The pottery of the Scandinavian Middle Neolithic is derived from that of the T.R.B. culture, and so is its agriculture. Cattle are again the dominant animal, followed by pigs and ovicaprids. There is, however, a difference in the size of the cattle, with those of the T.R.B. culture considerably large than those of the Scandinavian Middle Neolithic. This could easily be brought about by more primitive farming techniques and less nourishment. In connection with the Scandinavian Middle Neolithic it should be mentioned that a large sheep, known as the Copper Sheep and originally found in Switzerland by Duerst, was found at the site of Bundspø.

Other communities who had their economy centred upon cattle breeding are those of Boian, Hamangia and Tripolye B and Ci, which occur to the south and east of the distribution of the Linear Pottery culture.

The cultures which had their economy based upon pig-breeding are composed/
composed of the Sesklo, Salcuța I-IIb, Tripolye A, Horgen and Pitted Ware cultures. In order to see if there is any link between these communities other than their economy, it is necessary to compare their pottery and any other archaeological characteristics.

Sesklo pottery is usually fine red burnished ware which occasionally bears rectilinear patterns in black or white. The flame design also occurs. In the Salcuța culture on the other hand very little painted decoration occurs, and the clay often bears rustication or fine wave impressions. Plain graphite painting is also found. The pottery of the Tripolye culture is very sophisticated. Complicated geometric designs are painted in red, black or white or outlined with channelled grooves on either a red or white background. It is extremely well made. The pottery of the Horgen culture represents a complete contrast; it is both coarse and badly baked. Some of the vases may have splayed bases, others rounded bases. The Pitted Ware culture, as its name suggests, is characterised by pots with pit-comb impressions, which are usually arranged in horizontal rows. These vessels are bag-shaped, with rounded bases. As far as pottery is concerned it is clear that these five cultures have nothing in common, some have fine painted ware, and others rough primitive-looking pots.

The stone industry of the Sesklo culture is basically a macrolithic blade industry, but vases do occur. Many long blades are found at sites of the Salcuța, whose stone implements are otherwise derived from the earlier Boian culture. The stone from which most of the Tripolye tools and weapons are made is generally local in origin. Adzes, axes and arrowheads are common. The implements of the Horgen culture are made out of/
of local flint rather than imported material and axes and unbored celts occur. Adzes, chisels, celts, maceheads, slate knives and darts all occur at sites of the Baltic Pitted Ware culture. As far as the relative importance of hunting in these five cultures is concerned, it is of little importance to the economy of the Sesklo and Salcuţa cultures, but usually formed half or more of the osteological remains at sites of the Tripolye A, Horgen and Pitted Ware cultures.

From this evidence it can be concluded that the five cultures under consideration have no archaeological factors in common other than their concentration on pig breeding. In the case of the pig-breeding communities the archaeological criterion cuts across the evidence obtained for agriculture. Wild and domestic pigs could thrive anywhere in Europe, their natural habitat are forests, and they can only be bred successfully by non-nomadic communities. On this basis the evidence may suggest that the Sesklo, Salcuţa I-IIb, Tripolye A, Horgen and Pitted Ware cultures were more settled than other neolithic communities, but the archaeological evidence gives no reason to suppose this, so it cannot be accepted as an explanation for their animal-breeding economy.

It has been proved that pigs became of greater importance during the later stages of the Linear Pottery culture than they were at the beginning of it. It is probable that this increase in pig breeding was a natural adaptation to the local surroundings. This change in the economy of the Linear Pottery culture may have led to the emergence of certain basically pig-breeding communities in specific areas of Europe. A map of the distribution/
distribution of these cultures which had a preference for the pig is shown in Fig. 141. It is seen that they lie on the peripheral area of the Linear Pottery culture and not within the area of its greatest influence. Within this area the subsequent cultures remained basically cattle breeding. Amongst the material collected there were also some cultures which bred more sheep or goat than they did cattle or pigs. These are the early neolithic cultures of Starčevo-"Kóros and Proto-Sesklo in Greece and Impressed Ware in southern France, and the late neolithic cultures of Dimini, Salcuta IIic, Tripolye Cii, Cernavoda, Baden, Swiss Corded Ware and French Copper Age sites.

The earliest neolithic communities of the Near East concentrated upon the breeding of sheep and goats, so that it is not surprising to find the same situation in the early neolithic of Europe. Evidence available from the Starčevo-"Kóros culture, and the allied Greek sites indicates that they followed the pattern of early agriculture in the Near East. The Greek sites which are included in this cultural group also bear some similarity to sites of the Impressed Ware culture. This resemblance lies in the pottery. There are three classes of pottery in the Starčevo-"Kóros culture. The first is rough, the second a plain burnished ware and the third is a hard fine painted pottery. It is this first rough pottery, which is decorated with rustications, finger-tip impressions which bears similarity to some Impressed Ware pottery. Fingertip impressions occur in both cultures. The pottery is not as well made as the finer ones of the Starčevo-"Kóros culture, and it resembles the category of rougher vessels. There is also a possibility that sheep breeding was practised in southern France before the/
the arrival of the Impressed Ware colonists. The fact that the
agriculture of the Proto-Sesklo phase differs from that of the Sesklo
phase is striking. The economy of the Proto-Sesklo culture followed that
of the preceding culture, which was allied to that of Starčevo-Koros and
monochrome pots occur in both contexts.

The pottery of the late Neolithic ovicaprid-breeding communities is
now compared and contrasted. Dimini vessels are painted with spiral and
meander patterns which may be tri-coloured, and may be white, black or
incised. The background is usually buff, brown or red. It is inferior
in quality to that of the preceding Sesklo culture, and the pottery, stone
work and agriculture all indicate a clear break with the former tradition.
The pottery of the Salcuţa culture is described above. It may be linked
indirectly with that of the Dimini culture, since the pottery of the
Dimini culture bears some similarity to that of the Gumelnita culture.
However, although the Salcuţa culture is a regional version of the
Gumelnita culture, one of the main differences between the two lies in the
pottery. For this reason no satisfactory relationship can be established
between the Dimini and Salcuţa pottery styles.

The characteristics of the Tripolye culture have also been described
earlier. Also present in the late Cil site were plain cord-ornamented
pots as well as the painted and grooved varieties which were more common.
The Baden culture is best known for its channelled or grooved decorated
pottery. The vessels are usually self-coloured, fairly dark, and many
pots have distinctive ribbon handles rising above the level of the rim.
The Swiss Corded Ware vessels are again different. The main form is a long-necked beaker or amphora which is richly ornamented with cord impressions over the upper portion of the vessel. Both plain and decorated pots have been found at the French Copper Age sites considered by Josien (1957). The decoration may take the form of grooved channels, diamond-shaped reliefs or incised chevrons.

It is clear that there is no overall similarity between the pottery styles of the Dimini, Salouța IIa, Tripolye Cii, Cernavoda, Baden, Swiss Corded Ware or French Copper Age cultures. Certain of these cultures may be linked by their methods of ornamenting the pottery, but this is the only similarity to emerge. Channelled decoration, or grooved ware has been recorded at sites of the Baden culture and the French Copper Age, and it is used to outline some of the decorations of pots of the Tripolye culture. Cord impressions are characteristic of the Swiss pottery, and they also occur on a few pots of the Tripolye Cii phase. Since both channelled decoration and cord impressions occur in several other cultural contexts at this time, it cannot be regarded as a significant link between these cultures.

The stone industry of these cultures does not differ notably from those of the preceding neolithic cultures. Perforated axes occur for the first time in Greece in a Dimini context, and battle axes are known from Swiss Corded Ware sites and possibly from Tripolye Cii sites.

One feature in common to all these cultures is the occurrence of copper. Both copper and gold have been found in small quantities at Dimini settlements, and small copper axes and gold ring pendants have been discovered/
discovered. Copper occurs more frequently in both the Salcuța and Cernavoda cultures. The copper axes of the Dimini culture occur together with copper adzes, and double spiral pins similar to Anatolian models. Although a few copper beads, axes and adzes occur during Tripolye A and B, they are relatively rare, and it is not until the Cii phase that they occur in substantial quantities. At this stage, in addition to the earlier forms, daggers with a midrib on one face only and small rings and spirals in copper, gold or silver all occur.

The greatest amount of copper occurs in the Baden culture. Large copper axe/adzes had evolved and the axes and battle axes of earlier cultures are also represented. For the first time copper neck rings occur in Hungary and Austria; torques from graves can be matched by examples from Chalcolithic graves in Anatolia (Childe 1957, p.126). Axes, rhomboid and triangular daggers are all found at Swiss Corded Ware sites, and daggers and occasional gold objects are found in southern France.

From this it appears that the Dimini, Salcuța IIc, Cernavoda, Tripolye Cii, Baden, Swiss Corded Ware and French Copper Age sites have certain elements in common. There is no substantial similarity in their pottery, although cord impressions and channelled decoration do appear in two or three of these cultures. Certain cultures have painted ware and others only have plain pottery. The most obvious link between these cultures, apart from their subsistence-economics, lies in the presence of copper at the majority of sites.

It must, however, be emphasised that the presence of copper in these cultures/
cultures does not imply that the implements and trinkets were made by the people of the cultures themselves. With the probable exception of the Baden culture it is much more probable that these objects were the result of trade with long established metal-producing societies. These societies are to be found in the Near East. Links between this area and central Europe are also apparent by some strong similarities in the form of these copper objects, and also by various details in the pottery. The flanged handles found in the Baden culture are encountered in the Chalcolithic at Mersin, as well as at Troy. The clay model of a cart, the first model of a wheeled vehicle in Europe, found in the Baden culture can link this area with Mesopotamia where the wheel was probably first invented.

The isotopic dating of these cultures has an interesting result. The Dimini culture may be placed between 4200 - 3600, Salcuţa II c to between 3500 and 3300, Cernavoda to 3200 - 3000, Tripolye Cii to 3100 - 2900, the Baden culture to 3200 - 2900. The approximate dates of the Swiss Corded Ware sites are thought to be between 2800 and 2200 and those of the French Copper Age may be placed at 2600 to 2100. When the time-span of these cultures is mapped over their known areas of distribution, it is seen that there is a continuous spread of these ovicaprid-breeding and copper-trading societies from Greece through eastern and central Europe to western Europe (see Fig. 142). Their origin must be placed somewhere in the Near East. As yet there is insufficient evidence to locate the exact areas or centres, but they must have evolved by the fifth millennium, and been both breeding and domesticating sheep, and producing vast/
vast quantities of copper objects. The regions in the Near East in which copper ore is found are the highland zones of Iran and Anatolia, and so it is probable that the impetus behind these European cultures is to be found somewhere within these two neighbourhoods. On purely theoretical grounds this places their origin either in the mid and late Chalcolithic of the hilly region of Iran or the early and mid Chalcolithic of Anatolia. It is, of course, possible that the people who mined the copper did not in fact produce the copper objects but traded the ore to other Chalcolithic communities who were the actual manufacturers.

One of the chief problems that would arise for the ovicaprid-breeders in Europe would be the problem of obtaining new stock. It would be impossible to domesticate the animals themselves as the cattle and pig breeders could do, so that either the stock would have to be maintained without external means, or otherwise new stock would have to be obtained by trade from the Near East. If the latter solution was the one employed, it is probable that some of the animals at these sites should be close to the wild sheep and goat of the Near East. A few such animals have been identified. Boessneck (1962) reports an exceptionally large sheep from Otzaki in a Dimini context, and others occur in the Corded Ware sites of Switzerland. A sheep, described by Duerst as being close to the moufflon, was identified at Utoquai and another was found at Greng. Duerst has called this sheep the Copper Sheep, or Ovis aries studeri. There has been no detailed analysis of the sheep remains from either the Cernavoda or Salcuţa cultures. The majority of sheep of the Tripolye Cii sites are known/
known to be of the turbary variety but it is not known whether there was any indication of a larger breed.

There is further indirect evidence for the presence of large sheep amongst the stock of the Single Grave peoples. At the Scandinavian Middle Neolithic site of Bundsgårdsbro, a large sheep which compares well with that of Duerst's in Switzerland was found. It is at this time that the Single Grave Complex first appears in Denmark, and trade between the two different cultural groups can be established in many instances. No settlements of the Single Grave period are yet known from Scandinavia, but if one were found and the osteological remains examined, it is highly probable that there would be a few bones of very large sheep, similar to the moufflon, and that it was this kind of sheep that was traded to the Middle Neolithic settlements, and was found at Bundsgårdsbro. There is also a possibility of similar sheep being present on the Swedish island of Stora Karlsö. They occur in a Pitted Ware context, and it is again at this time that the Single Grave folk appeared in Sweden.

From the above evidence it is therefore concluded that the ovicaprid breeding cultures spread over Europe between 4200 and 2100 and that they were identical to the chief copper-trading cultures of this period.

Some striking disagreements in the economy of certain cultures are apparent, when they are thought to be closely related archaeologically. The agriculture of the Cucuteni and Tripolye cultures are not identical, despite the fact that the Cucuteni culture is the Rumanian version of the Tripolye culture. Cattle were the basis of the Cucuteni economy, but pigs, cattle/
cattle and ovicaprids are dominant in the A, B and Ci, and Cii phases of the last culture respectively. The economy of the Gumelnița and Salcăța cultures also differs, although it should be remembered that the evidence from the Salcăța culture comes from a single site excavated by Berciu and no statistics have yet been provided from this site. The sequence of dominant domestic animals in the latter culture is the same as that found during the neolithic in Greece. Both the Salcăța I-IIb and Sesklo economics are based upon pig breeding, those of Salcăța IIIc and Dimini on ovicaprids, and Salcăța IV and the Larissa–Butres culture breed more cattle than any other animals. Millet is also known from the Greek neolithic and Salcăța cultures, but not from the Gumelnița culture. The relationship between the Salcăța culture and those of Greece has been considered earlier, and there is no evidence of any other archaeological similarity. Another surprising fact is that the Proto–Sesklo and Sesklo cultures have entirely different economies, the former being based upon ovicaprid breeding and the later upon pig breeding.

The Altheim culture of southern Germany is generally regarded as an eastern extension of the Horgen culture of Switzerland and south-west Germany (Childe 1957, p. 296). However, when the subsistence-economics of these two groups are compared a discrepancy is at once visible. The Horgen culture favoured pigs whereas the Altheim culture reared more cattle. It is clear from this that there are many instances in which archaeologically similar cultures do not have the same form of agriculture, in other words the cultural criterion does not agree with the archaeological evidence for agriculture.

The/
The last animal to have been domesticated in the period under consideration in this dissertation was the horse. Since much of the evidence for the evolution of the domestic horse rests upon osteological finds from Bronze Age rather than Neolithic or Copper Age sites, the question of horse domestication cannot be fully investigated in this present thesis. There is no evidence for the domestication of the true horse from the Chalcolithic period in the Near East, although there are two probable instances of half-asses and one of a donkey, all at late Chalcolithic sites.

The earliest European culture in which the question of horse domestication arises is the Tripolye culture. Horses are present at all stages of the culture, but in most cases their status is either not stated or not known. It is, however, clear that the horse was an important domestic animal by period Cii, when it occurs in large proportions, and there is one report of a domestic horse in stage A at Luka Vrublevetskaia. This decision was reached after a careful examination by two Russian experts. Therefore it would appear that the horse was probably bred or at least herded sporadically during the early stages of the Tripolye culture, but that by the final stage it had become an important domestic animal. There is no indication that this was a gradual process, indeed it appears to have been a rapid change which coincided with the increase in sheep farming and also in copper trade during the Cii stage. The other east European claim for a domestic horse comes from the Cernavoda culture, and rests upon a report of some bones, including a hoof, found at the type-site/
site. At this stage sheep were again the dominant animal and made a
sudden appearance at this stage as did the domestic horse. Copper is
also present. On the basis of tooth diagrams it appears that the tarpan
was the progenitor of the east European domestic horse (Lundholm 1949).
Bokonyi reports the find of a single horse bone from a grave of the Copper
Age in Hungary (Deszk B), but it is not stated to which of the three
Copper Age cultures this belongs. It is thought to originate from a
domestic animal. Another claim for domestication, this time definitely
in a Baden context comes from Ossarn in Austria, where ovicaprids were the
dominant feature in the economy.

There has been much speculation as to the status of the horse during
the Single Grave culture. There has been a claim for domestication at
Zlota which has been discounted by Behrens (1962, 1964), but domestic
horses were definitely present at Baldegg in Switzerland. At this Corded
Ware site, ovicaprids were the dominant feature in the economy so that the
spread of the domestic horse can again be linked with ovicaprids and copper.
Two different sizes of horse were found at Amberg and Meyer by Rutimeyer,
but both are attributed to wild animals. There is a further possibility
of horse domestication at Pollik in Austria. Amscheler attributed the
remains of the two individuals to representatives of the Arabian horse,
which if this is correct, must have come from the Near East and so were
domesticated. There is also a strong possibility of domestication at
Dummersee in Germany, which is probably contemporary with the early Single
Grave Complex, and another claim is made for the equoid remains from Weick-
Luisenthal/
Luisenthal. However, since this report was unavailable the basis and validity of the claim cannot be established.

Boessneck thinks it highly probable that the horses he found at sites of the Altheim culture were domesticated. These horses were definitely of the eastern and not the western group, and he thought that they were probably Przewalski horses. They also agree well with the measurements given by Amscheler for the horses found at the Single Grave site of Föllik. Since the Altheim horses are not of the western group they must have been brought to that area of southern Germany by some external community, and this community must have obtained their domesticated or semi-domesticated horses from the east. The only known archaeological culture which was contemporary with the Altheim culture, had a wide distribution from Switzerland to eastern Europe, and also probably possessed domestic horses is the Single Grave Complex. For this reason it appears that the Single Grave folk brought domestic horses with them to central Europe, and that they had obtained these animals in the eastern area of their distribution. This fact strengthens the claim that this complex of cultures had an eastern origin rather than a western one.

The skeleton of a horse was discovered at the Swedish Single Grave site of Hvellinge but the excavator and all subsequent authorities have been unable to decide whether the skeleton is contemporary with the grave or not. There have also been various suggestions that the horse was present, as a rare domestic animal during the late Passage Grave period in Denmark, just after the arrival of the Single Grave immigrants. The frequency/
frequency of horse bones increases greatly at this point and this animal is thought to have been domesticated at Lindø and Lindeskov. There is also a possibility that the horse skull with a late neolithic dagger in its forehead found in Ulltorpsbach in Sweden was in the initial stages of domestication.

From the above evidence it seems highly probable that the horse was present as a domestic animal in Scandinavia during the late Middle Neolithic and Late Neolithic periods, and that the Single Grave people were the impetus behind this. However, these horses, if they were domesticated, were obtained from the indigenous wild horses rather than brought with the immigrants (Lundholm 1949). Since no Single Grave settlements have yet been found in Denmark, it cannot be directly established that they did breed horses in this area, although from the evidence in other regions of Europe this assumption seems reasonable. It is equally possible that they did bring a certain quantity of their own domestic horses with them and that the neolithic communities of Scandinavia proceeded to domesticate the indigenous horses, after realising the value of possessing such an animal.

From the above information it appears that the horse was domesticated during the late neolithic and copper age in eastern and central Europe and that it was transmitted to north-western Europe by means of the Single Grave Complex. In both eastern and central Europe this innovation can be associated with the ovicaprid-breeding cultures and with the trade in copper. It is therefore proposed that the domestic horse was present in the Tripolye Cii culture, the Cernavoda, Baden and Swiss Corded Ware cultures, and that the evidence from the latter culture, which is a member of/
of the Single Grave Complex, strengthens the claim for domestic horses during the period of the Single Graves in both Germany and Scandinavia.

There is, unfortunately, very little that can be concluded from the remains of cultivated plants in Neolithic Europe. There is much less evidence for plant cultivation than there is for animal domestication, and in the majority of cases no statistical work on the relative importance of the different cereals has been done. When this has been done the results do not always show agreement within the same cultural context. The best example of this situation occurs in the Rossen culture, where Hopf identified 50,000 cereal grains at Wahlitz, and Schiemann identified several thousand at Ur-Fulerum. However, the cereal dominant at the first site was club wheat, whereas at the second it was four-rowed barley. Another discrepancy arises in Switzerland. The cereal remains, both carbonised and impressions indicate that wheat was more important than barley, but when Troels-Smith investigated the pollen diagrams near Thayngen-Weiher, he found that the pollen of barley was much more common than that of wheat.

However, the following tentative conclusions are put forward. Einkorn and emmer were the main cereals of the Initial Colonisation cultures. These two wheats together with four-rowed barley were cultivated during the Aceramic Neolithic and lentils and millet were also present but whether or not they were cultivated cannot be established. The same situation is encountered in the Starčevo-Koros culture, but no evidence for cultivation in an Impressed Ware context has been found. Einkorn and emmer were again/
again the main constituents in the cereal fields of the Linear Pottery colonists, but at this point bread wheat, club wheat and hard wheat had all emerged for the first time. They are, however, present in only very small quantities and are known from only a single site in each case. The evidence indicates that emmer was probably of greater economic value than einkorn. Barley is only present at a few sites and so was presumably much less important. Millet has also been identified, as has wild oats and rye. Peas were probably cultivated, as was flax. This last plant is, however, only known in a single instance, but it must be remembered that the earliest evidence of its cultivation in the Near East occurs at around 5000 B.C.

The evidence from sites of the Cortaillod culture indicates that club wheat was the basic crop. Emmer was also present, but both einkorn and the other naked wheat, bread wheat, occur only rarely. Barley and millet (broomcorn) were both of little importance, but flax played an important role in the economy. The presence of a naked-wheat cultivating society at this stage is of much interest. The origin of the naked wheats is attributed to chromosome aberration of emmer. This implies the dominance of emmer and allied wheats in the crops of the Cortaillod people, which connects them with the Linear Pottery people. Their animal-breeding methods were also of the same basic type. Since this Alpine zone of Europe is the first area in which it can be established that a prehistoric community based its cereal crop on the cultivation of naked wheats, club wheat in this instance, it is suggested here that the chromosome aberration of/
of emmer took place in this alpine region as a result of the change in environment. It is possible that this took place in the highest pasture zones which would be exposed to more ultra-violet and cosmic radiation, and when the advantages of glumeless wheat was realised, the grain was generally traded for sowing in lower altitudes. All these cereals were present in the later neolithic periods of Switzerland.

The Chassey-Chalain culture of France cultivated more emmer and bread wheat than they did einkorn, spelt or six-rowed barley. Flax was also present in small quantities. The cultivation of this culture can therefore be linked both with that of the Cortaillod culture in Switzerland, and with the Linear Pottery culture. The pottery of the Cortaillod and Chassey cultures has much in common, both have rounded bases, are usually plain with occasional incised decoration, which provides another link between the two cultures.

Einkorn, emmer, club and bread wheat, spelt, four and six-rowed barley and flax were all cultivated at various sites of the TRB culture. Of these, it is einkorn that is the most frequent component at a German site, followed by emmer, and barley is much more common than wheat in Sweden. This last fact is probably due to climatic conditions, which would favour barley in Scandinavia as it is a more hardy plant.

On the other hand emmer was the main crop of the Windmill Hill culture. Naked wheats were rare, as was einkorn, barley and flax. The dominance of emmer links this culture with the Chassey-Chalain culture rather than with the TRB culture. This fact agrees with the results of the/
the pottery comparisons and other archaeological considerations (Piggott 1955).

The economy of the Danish Middle Neolithic was, however, different. The basic crop appears to have been einkorn, followed by emmer and club wheat. Barley was also present at a few sites. This resembles the cereal fields of the T.R.B. culture very strongly, and indeed the pottery is derived from the basic funnel-beaker of the T.R.B. culture. This emphasis on einkorn does not however apply to Sweden, where barley was the chief crop as it had been during the TRB culture there, and as it continued to be during the Pitted Ware culture.

Very little can be said about the evidence for early cereal cultivation in eastern Europe. Einkorn and emmer are present in most contexts, and wheat is thought to be more important than barley at one site in the Hamangia culture. The Central European Neolithic cultures seem to have maintained the Linear Pottery tradition on the whole, as they did in animal breeding. Wheat was of greater importance than barley in the Copper Age cultures of Salcuța and Gumelnita. Einkorn, emmer and bread wheat were all present, and millet is only known from the Salcuța culture. Bread wheat and club wheat are the only cereals known in a Cucuteni context. These two wheats together with emmer and hard wheat occur at sites of the Tripolye culture. Of these, it is bread wheat that is by far the most important variety. There are also a few instances of barley, and it is the six-rowed variety that has been identified. Millet, however, appears to be of much more importance than barley, and this is the first neolithic culture/
culture in which the cultivation of millet can be established to be of importance. It is not stated in the various reports to which of the two varieties this millet belongs. Flax appears to be unknown in this context.

Evidence from the Baden culture in Austria (Ossarn) indicates that einkorn was the basic cereal crop, with emmer also known, and both emmer and club wheat were found at sites of the Mondsee-Altheim culture, as well as barley, millet and flax.

Wheat, barley and flax were all cultivated during the Copper Age period in Iberia, and of these wheat was the main crop. Club wheat was the most common variety, and bread wheat and emmer were also present.

The Single Grave Complex did not change the agricultural activities of the communities in central or northern Europe. Club wheat and emmer remain the dominant species in Switzerland, as barley does in Sweden. Einkorn, possibly bread wheat, broomcorn and Italian millet, and flax have all been identified. In connection with the Swiss sites of both this period and the earlier neolithic it is interesting to note that poppy seeds occur in profusion. Their use can only be speculated upon. The narcotic properties of the seeds are well known today, and it is not unreasonable to suppose that they were realised four or five thousand years ago.