

ARCHEOLOGY AND THE DOMESTICATION OF ANIMALS IN THE OLD WORLD

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1. INTRODUCTION

OF ALL the transformations through which human society has passed the most fundamental, and the least known, is the "Neolithic Revolution." This event, interpreted economically as the emergence of a food-producing economy based on domestic plants and animals, has provided the basis for all of the cultural elaborations of the past six or seven thousand years. In dealing with the question of the origin of the domestic plants and animals basic to this Revolution, the prehistorian is dependent upon the data provided by various specialists. Thus, in the case of domestic animals, it is necessary to use the morphological and genetic studies of the zoologist, and the chronological and distributional studies of the archeologist. Separately these studies pursue their own particular ends, using different methods and terminology; but in combination they are capable of supplying possible answers and outlining difficulties in terms of more general problems. This paper reviews one such problem: the origin of domestic animals.

The first step in such a review is the definition of the term "domestic." This may be done in two ways. First, a domestic animal may be defined "culturally" as one which breeds in captivity and is of some significant use to a community. Such a definition omits a few animals (like the elephant) which do not breed in captivity but, being applicable in general, will serve our present purpose. Domestication, so defined, would be demonstrated archeologically through the recovery of equipment designed for use with animals, representational art showing the animal in use, and animal bones. The fact that an animal was controlled and utilized, therefore, implies a domestic status.

The "osteological" definition used by the zoologist is stated by Thévenin (1947: 7) as follows:

" . . . un animal domestique serait alors, celui qui, élevé de génération en génération sous la surveillance de l'homme, a évolué de façon à constituer une espèce, ou pour le moins une race, différente de la forme sauvage primitive dont il est issu."

Domestication in these terms is demonstrable by the morphology of the bones themselves. It is important to realize that such osteological domestication necessarily *follows* cultural domestication in time. Unfortunately much discussion has proceeded on the assumption that the points of origin defined by these two definitions ought to be coincident. As a result, in many cases the zoologist, when pressed by the archeologist, has labelled an animal as "probably domestic" not on the evidence of the bones but on the basis of their association with human artifacts. The archeologist has then taken this opinion as osteological evidence of the animal's domestic condition, which is not the case.

That the association of animal bones and human artifacts *per se* is not evidence of domestication in any sense is patently evident from the whole record of Palaeolithic archeology.

In the absence of sufficient artifactual material and when insufficient time has elapsed for osteological change, how is domestication to be demonstrated? The only alternative so far advanced is the use of statistics to show some kind of cultural control over the animal population. An analysis of the fauna of a site over a period of time may indicate at some point a shift from reliance on small or large "wild" game to reliance on "prodomestic" game, by which is meant "potentially domesticable" (i.e., those animals known to be domestic in later periods). Subsequently a second shift, this time in the age at which prodomestic animals are killed, may be indicated. When accompanied by a constant increase of the percentage of the prodomestic group in the total, these two shifts would seem to be reasonably good evidence for inferring cultural control over the animals in question. Since the species and age composition of a given sample is subject to variation due to factors of preservation (accidents, softer immature bones, etc.) and cultural selection resulting from altered eating habits, technology, or hunting territories, this method must be employed with caution. Such objections may be minimized to a large extent by the repetition of the statistical pattern in a number of sites from a wide area, provided the sample in each case is of adequate size.

2. THE NEAR EAST

In view of the fact that the Post-Mesolithic chronology of the Near East is the best known, and that dates for other areas in the Old World are estimated in terms of the Near Eastern sequence, this area will be examined first.¹

It is striking that in each sub-area of this region the earliest stratigraphic levels as a rule contain at least four animals: *Bos* (cattle), *Sus* (pig), *Ovis* (sheep) and/or *Capra* (goat). This association occurs in Egypt in the Fayum (Caton-Thompson 1934: 34), in Iraq at Jarmo (Braidwood 1952: 30), and in Russian Turkestan in Anau I (Pumpelly 1908: 38, 341, 342), in each case accompanied by sickle blades, wheat, and barley (Dyson 1953). The same is probably true at Tell Hassuna (Lloyd and Safar 1945: 284) in northern Iraq although the type of grain is as yet unspecified. In Palestine and Syria, *Bos*, *Sus*, and sickle blades are noted from the Natufian (Garrod and Bate 1937: 152) and Tell Judaidah (Braidwood 1948: 93), while figurines and as yet unidentified animal bones occur in the Neolithic of Jericho (Garstang 1940: 49, 50; Kenyon 1952: 120). Added to these is the presence in Sialk I, Iran (Ghirshman 1938: 146, 197), of *Bos*, *Ovis/Capra*, and sickle blades. This evidence shows an established economy based on grain with the association of these four animals in the middle fifth millennium B.C. The geographical extension of this pattern is seen at later dates in Turkey in material from Troy I (Gejvall 1938, 1939) and the Chalcolithic levels of Alishar Huyuk (Von der Osten 1937: 294), and in India at Harappa (Prashad 1936).

There is, then, an economic grassland complex in the Near East by the middle fifth millennium. But the evidence just mentioned does not indicate that

any of these animals were in fact domesticated. Omitting from consideration the later cultures of Turkey and India, the preliminary report on Hotu Cave, Iran (Coon 1952), and the problematical Natufian, there are two instances in the remaining area of discontinuous pre-Neolithic sequences. In the first instance from Iraq the preliminary faunal statistics from the sites of Palegawra (Mesolithic?), Karim Shahir (Proto-Neolithic?), and Jarmo (Neolithic) indicate a shift in the percentage of *Ovis/Capra* bones from 30% to 50% to 80% in the case of Jarmo (Braidwood 1952: 26, 30, fig. 14), where for the first time a high proportion of immature animals were killed. A second set of statistics is recorded from Belt Cave, Iran (Coon 1951: 43). At this site, above the beginning of the Neolithic (level 10) prodomestic animals number over 50% of the total while nearly 40% of the *Ovis/Capra* are immature; whereas, below level 10 less than 50% of the assemblage is prodomestic, and only about 8% of the *Ovis/Capra* are immature. Comparably high percentages for the killing of immature animals in the European Neolithic are available (Clark 1952: 125) as well as the ratio of wild to domestic animals (*op. cit.*: 49, 50). These cases, considered together, appear to indicate a period in which human control over animal herds is being achieved. The beginning of a dependency upon the four animals discussed is shown by their constant association (to the virtual exclusion of "wild" types—only 5% at Jarmo) with agricultural settlements and by the statistics cited. In most cases, considering the complexity of these basal cultures, one may reasonably infer a domestic status for these animals. However, this inference requires further confirmation.

The identification of animal bones necessarily raises questions of taxonomic procedure (see Simpson 1945; Schenk and McMasters 1948). These are especially difficult in the prehistoric period when detailed zoological taxonomy (based mostly on soft body parts) must be replaced by a more general palaeontological one (based on the skeleton). Moreover, phylogeny is continually being reinterpreted on the basis of new information. As a result the nomenclature, which reflects the phylogenetic interpretation, gradually alters; the consequent necessity of equating terms makes mandatory the inclusion of the describing author's name (e.g., *Bos taurus* Linn.). Many reports by archeologists overlook this fact. Palaeontological species are built up on the basis of skeletal specialization, and phylogenetic interpretations are then based on a comparison of key parts. The absence of these in an assemblage makes sub-generic classification of the remains difficult if not impossible. Even when characteristic parts are found failure to consider the range of individual variation within a group has led to artificial results (Riedel 1951), as in the case of the two species of sheep, the "turbary" and the "copper" which are now known to be female and male of the same breed (Clark 1952: 124).

A similar dichotomy of type, due to differences of sex or race, exists in the genus *Bos*. The archtype of +*Bos primigenius* Boj. (Pleistocene and Recent in North Africa, Europe, the Near East, and Central Asia) was described as large in size and long-horned. It is now known that smaller forms also existed in Europe (Reynolds 1939: 28) and North Africa (Romer 1928: 111; 1938: 170, 171, 183). In the Near East bones of both large and small cattle are re-

ported in the Mesolithic of Palestine at Mugharet el Kebarah (Bate 1932: 277), in the Chalcolithic at Megiddo (Loud 1948: 139; Guy and Engburg 1938: 210), and in the Halaf Period at Tell Aswad in Syria (Mallowan 1946: 124). There are also horn cores in some cases but no connection is possible between animal size and horn size. In the latter two instances the large animals have been labelled wild and the small ones "probably domestic" on the grounds that domestic animals should be smaller than wild ones—a thesis which is genetically unsound (Dottrens 1947).

Long-horned cattle descended from +*Bos primigenius* Boj. and its Asiatic relative +*Bos namadicus* Falc. (which is virtually indistinguishable according to some authors) are the most widespread of the earliest domestic cattle, being found from Egypt to the Indus from the Neolithic to modern times. In spite of the association of these cattle with human artifacts, it is still difficult to assert how early in the Neolithic they were unquestionably domesticated.

Humped cattle, *Bos indicus* Linn., are unknown in a wild or fossil state, and are believed to have originated outside of India by Blyth (Marshall 1931: 658) and Friederichs (1933). They have been identified at Harappa (Prashad 1936: 8, 34), Mohenjo-Daro (Marshall 1931: 28, 29, 654; MacKay 1939: 288, 289), and Rana Ghundai I (Piggot 1950: 121). Van Buren (1939: 74-76) states that a humped bull with spreading horns occurs frequently among the Halaf and Ubaid Period figurines and other art representations of southern Iraq. Humped cattle are known in Egypt by the XVIII Dynasty (16th century B.C.) but the time of their introduction is obscure.

Short-horned cattle also present a problem. Duerst (Pumpelly 1908: 364) and Prashad (1936: 8, 32) agree that +*Bos namadicus* Falc. cannot be ancestral because the osteological differences between it and the domestic short-horn are too great. Amschler (Arne 1945: 325-326) identifies a wild short-horn, +*Bos brachyceros arnei* Amsch., from Shah Tepe III D and E in Iran as the progenitor of the domestic type present in the same levels (dating to the end of the fourth millennium). Other short-horns are reported at about the same date at Alishar Huyuk (Von der Osten 1937: 294), and somewhat later at Mohenjo-Daro (Marshall 1931: 28, 29, 654; MacKay 1939: 288, 289) and Harappa (Prashad 1936: 8, 34) where models have been found. Van Buren (1939: 69-74) notes that the "more primitive type had short horns, but there was also a long-horned type at an early date" in Mesopotamia. The attempt to interpret this early material into separate long- and short-horned breeds ought to be made with caution in the light of observations that a herd of Indian cattle often contains animals with horns ranging from long to short and that the concept of a long-horned versus a short-horned species is apt to be spurious except where ample evidence is available or where the animals have been bred selectively for those factors, and in view of the several Pleistocene races of *Bos* known in Europe and North Africa. The general evidence does not commend conclusions except to the effect that large and small, humped and humpless, and long- and short-horned individuals are all known in the Fertile Crescent area during the Neolithic Period.

Equally obscure is the origin of the domestic pig. The only statistics are from Iraq where the preliminary field count indicated 1% of the bones at Karim Shahr and 10% at Jarmo (Braidwood 1952: 26, 30) were pig, and from Anau where pig was nearly absent in Period I, but made up 12% and 15% of the bones from Periods II and III. The Mesopotamian data are of interest in the light of Hilzheimer's (1941) conclusion that sheep and swine were the two most important Sumerian animals. Interesting also is the large quantity of pig bones at Merimde (Mond 1937: 258) and Ma'adi (Menghin 1932: 52) in Lower Egypt in the Predynastic period in contrast to their rarity in later times when they were considered unclean. Pigs were still in use during Dynasty III and IV, probably in association with the god Set, and their subsequent disuse possibly may be associated with the ascendancy of the god Horus over Set (Paton 1925: 17, 29). Since the nearby marshland of the Delta would have been an ideal habitat, it is impossible to claim a domestic status for these pigs. All of the early Near Eastern pigs are classed as *Sus scrofa* Linn., with the exception of the fragments from Sialk II (Ghirshman 1938: 198) which could be either *scrofa* or *cristatus* in that location. The nomenclature of pigs is very confused due to the difficulty in differentiating the north Eurasian *Sus scrofa* Linn., the Indian type commonly identified as *Sus cristatus* Wagn., and various other types in Southeast Asia which are sometimes grouped as *Sus vittatus* Mull. & Schleg. The relationship between the three is unclear; some authors (Kloss 1931) make *cristatus* a subspecies of *scrofa*; others (Chasen 1940) group it with *vittatus* or make it a race of the latter. This question may well eventually be settled by seriological studies (Sasaki and Moribe 1930). Pig bones at Mohenjo-Daro (Marshall 1931: 669) are reported as numerous, while those at Harappa are identified as *Sus cristatus domesticus* Pras. (Prashad 1936: 9, 54) apparently largely by virtue of their association with cultural remains.

In the case of the sheep the problem is even more complex. All domestic sheep originally were designated *Ovis aries* Linn. on the premise that they had a single common origin. This theory is no longer held and, therefore, the term has no phylogenetic significance. The earliest widely bred sheep in the Near East appears to be a primitive hairy type found in Mesopotamia and Egypt (Hilzheimer 1936: 195; Mond 1937: 256). The art of the late fourth millennium (Jemdet Nasr Period) in southern Iraq reveals both woolly and fat-tailed sheep—the former reaching Egypt during the New Kingdom and the latter important in negro Africa. Wild sheep may be divided into two sectors (Carruthers 1949: 42, 43): the Argaliformes east of the Oxus River (*Ovis nivicola* Esch., northeastern Siberia; *O. ammon* Linn., Central Asia), and the Moufloniformes west (*O. vignei* Blyth, Oxus River to eastern Iran; *O. gmelini* Blyth, western Iran; *O. ophion* Blyth, Turkey and Cyprus; *O. musimon* Pallas, Corsica and Sardinia). It should be noted that the above classification by Harper (for a summary of this and others see Carruthers 1949, Appendix) divides the older *O. orientalis* Lyd. into *O. ophion* Blyth and *O. gmelini* Blyth. In identifying the Anau sheep, Duerst (Pumpelly 1908: 374) pointed to the presence of intermediate forms linking the turbary sheep, *O. aries palustris* Rutim., with the osteologically wild *O. vignei* Blyth of Period Ia. On this basis he assumed the

derivation of the former from the latter. Pilgrim (1947) on the other hand expresses the opinion that the turbarly sheep was probably descended from *O. orientalis* Lyd., but also remarks that there is reason to believe that some of the prehistoric sheep of Turkestan may have originated from *O. vignei* Blyth. Nasonov (1923: 186) suggested that *O. ammon* Linn. is the ancestor of the turbarly sheep. The thesis that *O. vignei* Blyth is the ancestor of the domestic sheep in eastern Iran and northwestern India is supported by its presence at the sites of Harappa (Prashad 1936: 9, 46) and Rana Ghundai I (Piggot 1950: 121), Shah Tepe III D and E (Arne 1945: 325), Sialk I (Ghirshman 1938: 146), and Anau I (where *O. vignei* Blyth comprises 22% of the bones in Period I, and *O. a. palustris* Rutim. 25% of II; Pumpelly 1908: 341-342). If *O. a. palustris* Rutim. is the domesticated *O. vignei* Blyth, the Harappan identification as *O. vignei domesticus* Pras. is open to question. Pilgrim (1947: 283) also states that some foreign breeds have been derived from *Ovis ammon*. Linn. Nevertheless, the earliest domestic sheep appear to be Near Eastern.

The goat, difficult to distinguish skeletally from the sheep, is known to be present in many early levels but is poorly reported, and is often included in the sheep references as an alternate identification for some of the material. The early Mamber goat is possibly present at Tell Mefesh (Mallowan 1946: 128) in the Halaf Period, and is thought to have originated in Syria. It is also reported from the Egyptian Predynastic at Toukh (Guy 1938: 211). Pilgrim (1947: 286) suggests that the Persian wild goat, *Capra aegagrus* Linn., the Central Asiatic goat, *Capra falconeri* Wagn., and the Pleistocene goat, +*C. prisca* Adam. and Niez. (but cf. Schwarz 1935 on the dating of this goat), are all ancestral to the domestic goat, *Capra hircus* Linn. Acceptance of the monospecific origin of the goat from *C. aegagrus* Linn. resulted in the classification of the latter as a subspecies of *hircus*; thus, *C. hircus aegagrus* Linn. When this designation is used the term *C. hircus* is not by itself definitive, since the subspecies may be either the wild or the domestic form.

The four animals discussed above are often accompanied by an equid of the onager group. During the Palaeolithic and Mesolithic of Palestine at least one large onager (+*Equus* cf. *hemionus* Pallus), and possibly others, is present at Shukbah Cave (Bate 1928: 20), Wadi Dhobai (Bate 1938: 293, 294), Oumm-Qatafa (Neuville 1931: 256), and Mugharet el Kebarah (Bate 1932: 277, 278). The Recent equids in this area (Harper 1945) have included the African ass, *Equus asinus* Linn., the Syrian onager, +*Equus hemionus hemippus* Geoffroy, and the larger true onager of Iran and further east, *E. h. hemionus* Pallas. Equids have been identified from Harappa (Prashad 1936: 8, 28), Mohenjo-Daro (Marshall 1931: 654, 666), Rana Ghundai I (Piggot 1950: 121), Anau I (Pumpelly 1908: 38, 42, 341, 342), Shah Tepe III (Arne 1945: 325), Sialk II (Ghirshman 1938: 195), Belt Cave level 9 (Coon 1951: 44), Jarmo (Braidwood 1952: fig. 14), Tell Mefesh (Mallowan 1946: 128) in the Ubaid Period, Megiddo (Guy and Engburg 1938: 210) in the Chalcolithic, and at Ma'adi (Mond 1937: 255) and Badari (Brunton 1928: 38) in the Predynastic. Most of these equids are identified as asses or onagers, the taxonomy used being inconsistent. Lundholm (1949), reviewing those remains identified

as true horse, *Equus caballus* Linn., at Anau, Sialk, and Shah Tepe, shows conclusively that they belong to the onager group and not to the true horse. Lundholm, Hilzheimer (1935), Van Buren (1939), Friederichs (1933), and Slawkowsky (1940) all agree that there is no evidence for the true horse in the Near East before 2000 B.C. Consequently, it must be concluded that it was the onager that pulled the wheeled vehicles of the late Uruk and Jemdet Nasr Periods (Falkenstein 1936: 56; Frankfort 1939: 22; Speiser 1935: 73, 74) in Mesopotamia, using, as Van Buren points out, a system of harness without a bit, designed originally for oxen. The true bit is unknown until the Kassite Period in the second millennium. In the Aegean area the ass appears in Troy IV and the true horse not until Troy VI (Gejvall, 1938, 1939). In Egypt the true horse is not found until the 15th century B.C. (Chard 1937: 317), although war chariots are known between 1580 and 1557 (Clark 1941: 57), one or two generations after the Hyksos invasion. The first hieroglyphic sign for "horse" also occurs about this time (Paton 1925: 1).

In summary the evidence to date indicates the domestication within the Near East of some of the four basic Neolithic animals as early as the middle fifth millennium B.C. All four of these and the onager/ass were in use by the late fourth millennium, while the true horse was introduced only in the early second millennium.

The camel, *Camelus dromedarius* Linn., may also have been domesticated in this area, possibly quite early for packing, though not ridden probably before the late second millennium (Free 1944: 191). This animal, formerly reported only at Harappa (Prashad 1936: 9, 58), is now reported from Palestine in the Pleistocene (Yeivin 1952: 141; Neuville 1951: 214) and in the Neolithic at Sha'ar ha-Golan (Stekelis 1951: 5, 17), and at Warka in southern Iraq where Hilzheimer identifies it among figurines of the Ubaid Period (Van Buren 1939: 36).

In addition to these animals, the elephant, *Elephas indicus* Linn., water buffalo, *Bubalus bubalis* Linn., and a chicken, *Gallus* sp., have been reported at Harappa (Prashad 1936). The latter is identified elsewhere only at Mohenjodaro (Marshall 1931: 662) where the identification is questioned, and at Belt Cave where one spur from the Neolithic is said to be *Gallus* (Coon 1951: 90). The etymology of the Akkadian word for this bird indicates that it was known in Mesopotamia before the second millennium (Carter 1923: 2, 3).

The recently excavated Neolithic levels in India, exclusive of the Northwest, have still to be correlated chronologically with other Near Eastern areas. The preliminary reports do not discuss the animal bones in detail, though the report of fossilized bones of cattle, sheep/goat, buffalo, and horse associated with microliths in Gujerat is interesting (Sankalia and Karve 1949: 28). If the earlier cultures of India follow the pattern of the later ones, however, it will not be surprising to find that they also are later than similar developments in the Near East proper.

3. OTHER AREAS

Turning now to North Africa, the following are reported (Romer 1928,

1938) from Palaeolithic sites: +*Bos primigenius* Boj. (including a smaller type referred to as *Bos ibericus* Pomel, or +*Bos curvidens* Pomel, the validity of which as a separate species Romer [1938: 170, 171] strongly questions), *Sus scrofa* Linn., *Equus asinus* Linn., and *Camelus dromedarius* Linn. While both *Ovis* and *Capra* have been reported in earlier reports, on the basis of more material Romer concludes that the remains of pre-Neolithic animals are more likely to be assigned to *Ammotragus* the present wild "sheep" of the area, or to other small antelopes. This interpretation would indicate the introduction of these two Neolithic animals from outside the area. There is no *a priori* reason to eliminate North Africa as a possible origin area for domestic cattle and pigs, perhaps even the ass and camel (although the latter seems to have almost died out by the Roman Period). Nevertheless, the importation of two of the economically important animals combined with the uncertain dating of the beginning of the Neolithic in this area does not provide a very substantial argument in its favor. Radio-carbon dates place the Upper Capsian sometime between 6848 and 4848 B.C., and the "Neolithic of Capsian tradition" in Tunisia to sometime between 3198 and 2898 B.C. (Kulp *et al.*, 1952), considerably later than comparable Near Eastern material.

Africa south of the Sahara probably received its domestic cattle, sheep, and goats from the Nile Valley or Arabia as no wild or fossil relatives of these animals have been found in the area with the exception of *Capra nubiana* Cuv. and *C. walie* Ruppell, two wild goats from East Africa, believed to be unrelated to domestic types. An historical reconstruction of the introduction of cattle to southern Africa based upon the distribution and relationship of types has been published by Bisschop (1936). This reconstruction reflects the sequence Gaillard (1934) outlines for Egypt (i.e. long-horns, pre-3000 B.C.; short-horns ca. 2000; humped zebu ca. 1000; and a second type of zebu directly from India to East Africa, A.D. 500), which is probably too late in terms of dates in view of the presence at Kom Ombo (Gaillard 1934: 114) in the pre-Neolithic deposits of both long- and short-horned cattle (+*Bos primigenius* Boj. and +*Bos brachyceros* Rutim.). This evidence indicates a much earlier date for the short-horned type in Egypt, and the figure of a humped bull on the Temple of Ramses II at Abydos (MacKay 1939: 287) shows the presence of that animal as early as the 16th century B.C. Another complicating factor is the discovery at Shaheinab in the Sudan (Bate 1950) of a dwarf sheep and small goat dated by radio-carbon to about 3500 B.C. Such evidence suggests earlier movements to the south than previously considered but does not alter the conclusion that domestic animals (of the types considered) did not originate there.

In Europe the abundant Neolithic remains show in their lack of transitional forms and in the associated faunal statistics (Clark 1952: 49, 50, 118) the rapid introduction of an already established new way of life to that continent. The influence of the new environment in gradually changing the economic pattern from an emphasis on swine and cattle to one on sheep-goat has been admirably traced by Clark (1952: 48-51, 108-128). The Neolithic faunal assemblage included *Sus scrofa palustris* Rutim., *Ovis aries palustris* Rutim. (including the

male, incorrectly classified as *O. a. studeri* Duerst. *Ovis* is unknown in a wild state in Europe today, and is uncertain in the Pleistocene (Reynolds 1939: 56; Amschler 1949: 42, 64); blood tests show that Polish sheep are related to *O. musimon* but that English sheep are not; Kaczkowski 1928), *Capra hircus* Linn. (the occurrence of which in the Pleistocene of Europe is questioned; Reynolds 1939: 56; Mayet 1923: 65. Ibex types, *C. ibex* Linn. and *C. pyrenaica* Schinz, are, however, known from the Alps and Spain), and *Bos taurus* Linn. including three long-horned races: *B. t. primigenius* Boj., *B. t. trochoceros* H. von Meyer, and *B. t. frontosus* Nilsson; and a short-horned race, *B. t. longifrons* Owen (= *B. brachyceros* Rutim.). This classification of races is based upon the present-day assumption that domestic cattle, *Bos taurus* Linn., are all descended from one species of wild Pleistocene cattle, + *Bos primigenius* Boj., which should, therefore, correctly be called *B. taurus primigenius* Boj. since there is no specific difference between the two. The other races have formerly been given specific rank (as *Bos longifrons* Owen, etc.) but are now believed to be more properly races of *Bos taurus* (Reynolds 1939: 5; cf. Kolesnik 1936: 413).

Clark (1952: 121) refers to the addition of a small slender breed of domestic horse to the British fauna at the end of the Neolithic (middle second millennium) which is about the same time that domestic horses appear at Troy VI and elsewhere in the Near East, though the animal does not become abundant in Europe before the Late Bronze Age (middle first millennium). The domestic horse would seem to have originated further east; although, as in the case of other animals, the local European varieties undoubtedly contributed to the later multiplicity of domestic breeds. The other earliest domestic European animals, however, date at least a millennium if not longer after the earliest ones known in the Near East. Europe, therefore, cannot be regarded as the region in which domestication first began.

Elsewhere the adoption of a Neolithic economy can be shown in Siberia in the Afanasiev Culture (Kiselev 1951: 45-48); in Kansu (Bylin-althin 1946: 457, 458); in north China at Yangshaotsun (Anderson 1923: 32); and in Shang Dynasty sites near Anyang (Lin 1938: 27) where cattle, pig, sheep/goat, horse, water buffalo, and elephant are reported. Cattle, pig, sheep, and horse bones have been found at Ch'eng-Tzu-Yai (Li 1934: 11) in Shantung province; while cattle and horses are known in the Final Jomon of Japan (Groot 1951: 69). Stratified remains are insufficient in number to permit any sound interpretation of the Neolithic prehistory of Southeast Asia (Worman 1949; Beyer 1952). The pattern of later history in this region, as in the case of southern India, suggests the relatively late adoption of a food-producing economy based on animals and grain (Vlekke 1943). In any case, all of the foregoing material is dated later than 2500 B.C., which makes it much younger than the Near Eastern data.

4. CONCLUSIONS

The discussion of the origin of domestic animals is handicapped by fragmentary material and inadequate reporting by both archeologists and zoolo-

gists. Older identifications are badly in need of review by zoologists using current concepts and taxonomy. In recent reports these problems have been receiving increasing attention to the benefit of both fields of study.

In the light of the current evidence, a Neolithic economy based in part on four domestic animals (cattle, sheep/goat, and pig) was first developed in the Near East by the fifth millennium B.C. From this area the practice of domestication spread through the Old World in two ways: (1) as an idea which was applied either (a) to the wild relatives of already domesticated animals (e.g. the European pig; Clark 1952: 123), or (b) to entirely new species (e.g. reindeer; Jettmar 1952); and (2) as a movement of the animals themselves (a) into areas formerly unoccupied by them (e.g. southern Africa), or (b) into areas inhabited by their wild relatives (e.g. Europe). In the latter case accidental and intentional hybridization (Clark 1952: 123; Carruthers 1949: 50) occurred with the local wild population, with a consequent increase in the variability of the stock and the origin of new local breeds. Different combinations of animals resulting from the operation of these factors, combined with local cultural patterns and various physical environments, produced regional specializations in the economic pattern. Thus there was an initial emphasis on swine and cattle in Europe replaced by one on sheep; pigs, abundant in Predynastic Egypt, almost disappear in later times; pigs are abundant at Yangshaotsun; sheep and pigs are important in Iraq and Iran; cattle in later Egypt and negro Africa, and so on.

It would be unrealistic to infer that *all* domestic animals in the Old World had to be derived from the Near East either directly or indirectly. It is clear that the true horse was probably domesticated first in Central Asia or Eastern Europe. Species found only in the tropics are known to have been domesticated, but there is no sound archeological evidence concerning this problem in these areas. And one must recognize that until the Neolithic of North Africa has been more adequately dated that area cannot be rejected as another, possibly equally early, center of domestication.

Nevertheless, in view of the knowledge at hand and the cultural and chronological relationships of the Near East with the rest of the temperate and grassland areas of the Old World (so far as they are known), one can only conclude at present that the four animals of most basic importance to the development of culture in the Prehistoric Period of the Old World were domesticated first, sometime during or prior to the fifth millennium, in the Near East.

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CAMBRIDGE, MASSACHUSETTS

NOTE

¹ Carbon-14 analysis dates the habitation of sites to sometime within the following time ranges: Sudan, Shaheinab: 3914-2658 B.C.; Egypt, Fayum A: 4395-3895 B.C.; Iraq, Jarmo: 5078-4314 B.C.; Iran, Belt Cave Neolithic: 7635-4635 B.C. Estimated dates for Mesopotamia are as follows: Hassuna Phase ca. 4400 B.C.; Halaf Phase ca. 4100 B.C.; Ubaid Phase ca. 3900 B.C.; Early Uruk (= Warka) Phase ca. 3600 B.C.; Late Uruk and Jemdet Nasr (= Proto-literate) Phase ca. 3400 B.C. Other estimated dates: the fifth millennium: Sialk I, Tell Judaidah (Amouq A Phase), Jericho (Neolithic); fourth millennium: Anau I, Shah Tepe III D and E, Megiddo (Chalcolithic),

Merimde, and Ma'adi (Egyptian Predynastic); third millennium: Early: Troy I, Alishar Huyuk (Chalcolithic), Rana Ghundai I, the Archaic and Old Kingdom in Egypt; Late: Harappa and Mohenjo-Daro. (Carbon-14 dates: Kulp *et al.* 1952, Braidwood 1952, Coon 1951. Estimated dates: Braidwood 1952, and unpublished notes of Lauriston Ward.)

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