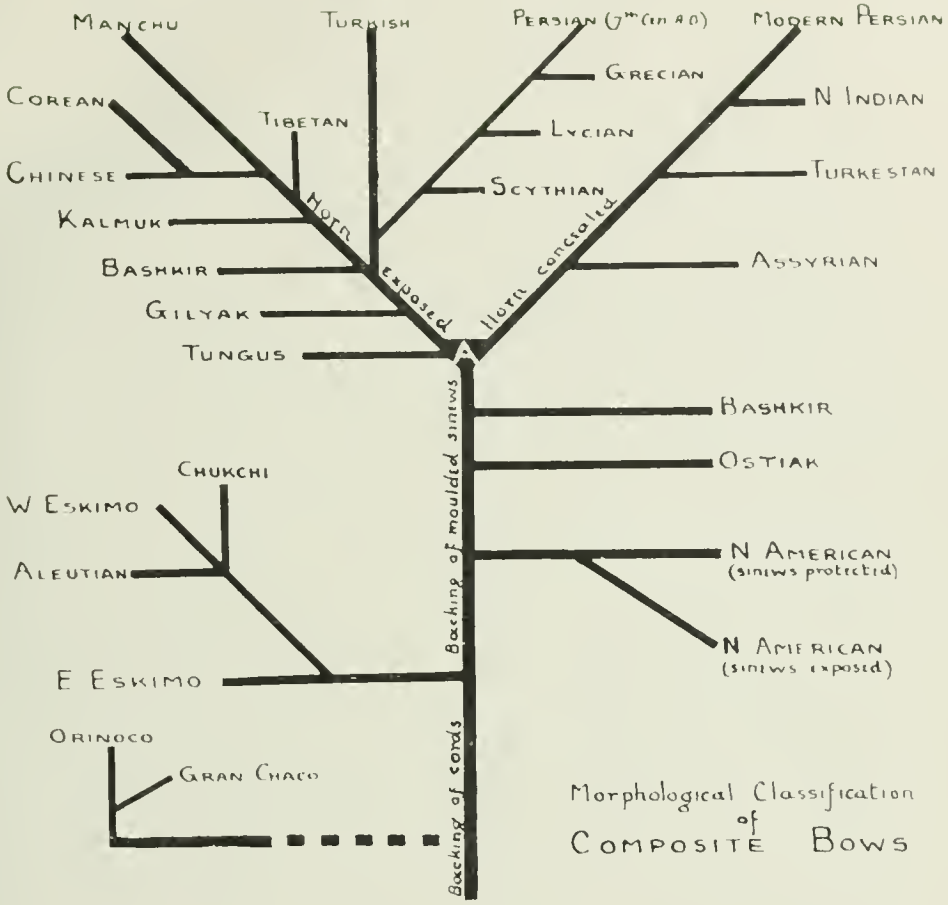


Below A the bows are of wood or horn.
Above A the bows are of wood and horn.

There are two principal references to the Homeric poems with which we are mainly concerned in connection with this study :—

(1) The description of the bow of Pandarus in the fourth book of the *Iliad* (line 105 *et seq.*).

(2) The description of the bow of Odysseus given in the twenty-first book of the *Odyssey*.

According to Homeric tradition, these two bows were derived from different sources ; that of Pandarus (a Lycian of Asia Minor) was apparently made *locally* for Pandarus himself ; the bow of Odysseus (chief of Ithaca) was given to him by Iphitus, son of Eurytus, king of Œchalia, which most authors have located in Thessaly. How Iphitus came by this bow does not transpire. Thus, although the bow of Pandarus was definitely of Western Asiatic origin, the Odyssean bow had been derived from a Greek source, though we have no direct clue as to the country of its *manufacture*.

In spite of the possibly different *provenences* of the two bows which Homer had in mind, it is well to consider both together, since the two descriptions seem to a great extent to supplement one another, and together help to explain the type of bow referred to by the poet.

In endeavouring to arrive at a diagnostic conclusion, we must bear in mind that Homer, in all probability, was not himself addicted to archery, and that his knowledge of the bow was derived from casual and uncritical observation, rather than from any practical experience. He was a ballad-monger, not a soldier ; an artist, not a scientist ; a romanticist rather than a pragmatist. Hence, in describing even familiar objects, accuracy in detail concerned him less than picturesqueness in expression. A master of epic poetry and narrative, wholly satisfying as such, he yet leaves us longing for details which he might have supplied, and we have to struggle to fill the gaps which he leaves in the archæological picture. He often, no doubt, describes what he saw, though with an uncritical eye, and his descriptions have a real value to the archæologist, inasmuch as they afford, at least, suggestive hints of actuality ; and, moreover, their very meagreness, by leaving us unsatisfied, tends to stimulate enquiry on scientific lines.

Of the bow of the Lycian Pandarus, Homer informs us that it was of large size (*μέγα τόξον*) and was made from the horns of a wild goat (*ἰξάλου αἰγὸς ἀγρίου*) which were 16 handbreadths in length (*ἑκκαιδεκάδωρα*) ; that these had been prepared, fitted together, polished and furnished with gilded tips by a skilled artificer (a worker in horn, *κεραοξόος τέκτων*) ; that the bow was kept, when off-duty, in a bow-case (*cf. ἐσύλα τόξον*) ; that the bow-string was made of ox-sinews (*νεῦρα βόεια*). When drawn, the bow assumed an extreme curvature (*κυκλοτερὲς μέγα τόξον ἔτεινεν*).

These are points which are germane to our enquiry into the *structure* of the bow, and I omit reference to other incidental points which have no special bearing upon this problem.

The bow of Odysseus, we are told, was also of large size (*μέγα τόξον*), and was kept in a decorated bow-case (*γωρυτῷ, ὃς οἱ περίκειτο φαεινός*). Again, the only material mentioned in connection with its construction is *horn*. In its unstrung state it was reflexed (*παλίντοιος*), curved or sinuous (*ἀγκύλα* or *καμπύλα*): this is a very important point repeatedly emphasized by Homer. The surface was polished (*εὔξοον*). The bow was exceedingly difficult to string, and part of the test imposed upon her suitors by Penelope was to string the bow as a preliminary to shooting with it. Leiodes failed and so did Eurymachus and others of the younger men, and even the son of the house, Telemachus, did not succeed in stringing this mighty weapon. We may gather that knack, as well as strength, was required for the stringing, since Odysseus strung the bow without effort (*ἄτερ σπουδῆς*), "even as an expert on the phorminx and in minstrelsie easily strains a cord around a new tuning-peg." In order to render the bow more supple and yielding, the suitors warmed it at the fire and anointed it well with fat. That the bow was very liable to injury from damp and other causes, we may infer from the fact that not only was it provided with a protecting bow-case, but Odysseus never took it to sea with him on his expeditions, always leaving it at home.

These are the chief points in the Homeric rendering to which I wish to call special attention.

Shooting-bows, in general, may be classified into four principal groups:—

(1) The plain or "self" bow, consisting of a single stave, usually of wood.

(2) Compound bows, built up by uniting two or more staves of similar materials.

(3) Composite bows, in which the bow is formed by the union of staves of different materials.

(4) Sinew-backed bows (a variety of the composite bow), in which increased strength and resiliency are given by the addition of a layer of longitudinally-disposed sinews. This elastic reinforcement is applied to the *back* of the bow, *i.e.* the surface which, in shooting, is furthest from the archer.

It is with the last two groups that I am especially concerned, since, as I pointed out in 1889, such evidence as we have clearly indicates that the Homeric bows were of composite structure reinforced with a sinew-backing.

Let us consider first the material of which the bows both of Pandarus and Odysseus are said to have been constructed. In both cases *horn* is the only material mentioned. In the description of the bow of Pandarus it is specified that the horns used in its construction were those of a wild mountain goat, killed by Pandarus himself, and therefore, presumably, *locally*. The local species of wild goat in Western Asia Minor is the Persian Wild Goat, or Pasang (*Capra hircus aegagrus*), which is and was abundant in the Taurus Mountains, at no great distance from the Lycian home of Pandarus, and is commonly believed to be the parent stock from which the domesticated goats are descended.

If we examine the horns of this wild goat, we readily observe two facts. Firstly, we cannot fail to note that if the natural horns, after being cut off the skull, were merely set base to base and united by means of a centre-piece or "grip" (πῆχυς), as seems to be suggested by several writers upon the subject,[1] the resultant bow, while it might possess artistic qualities and gratify poetic aspirations, would be *entirely useless* for purposes of archery. The horns would be practically unbendable, and would virtually have no resiliency at all, since, as in all the cavicorn ruminants, the

FIG. 1.—HORN OF THE PERSIAN WILD GOAT AND DISSECTION SHOWING THE BONY CORE WHICH SUPPORTS THE HORN SHEATH. *a–b* AND *c–d*, TRANSVERSE SECTIONS THROUGH THE HORN AND THE CORE.

horns of the goat grow upon a central rigid core of bone (Fig. 1). Were they flexible, they would be of little practical use to the goat!

Moreover, if the sheathings of true horn were drawn off their bony cores, the result would hardly be more effective, since, owing to their shape and structure, they would still remain practically inflexible.

Hence we may, I think, confidently rule out the suggestion that the *entire* horns could have been so used, whether with or without their skeletal supports of bone.

[1] *Cf.* T. D. Seymour, *Life in the Homeric Age*, 1907, p. 668.

Indeed, some more elaborate process of manufacture than that of merely joining together the pair of natural horns is indicated by the statement that a specialist (*κεραοξόος τέκτων*) was called in to make the bow.

Secondly, we may notice that if, as was suggested by Colonel Lane Fox in 1877,[1] strips or staves were cut from the horns to make the bow, the resultant weapon would be so weak and flexible that a small child could easily string and draw the bow, which would still be ineffective as a serious weapon. Staves of sufficient thickness and width to serve the purpose *unaided* could not be cut from the horns of a single animal. Only the front and hind narrow marginal ridges would furnish material of any degree of thickness, and even these would be far too thin and narrow (see Fig. 1, transverse sections, *a-b*, *c-d*). That the horns must have been cut down, in *length* at any rate, may reasonably be inferred from Homer's statement as to their length —16 handbreadths each (*ἑκκαιδεκάδωρα*), equivalent to about 48 to 50 inches, an unusual though by no means unrecorded size for this species of goat. If these, or staves cut from them, in their full length were united together end to end, the bow would have measured 96 to 100 inches in length (8 feet to 8 feet 4 inches). If it was Homer's intention to convey this impression, we must, I fear, conclude that, in describing the *μέγα τόξον*, or "long-bow," of Pandarus, the poet was also, metaphorically, "drawing it."

It has been suggested to me more than once that the fact of Odysseus remaining *seated* while he discharged his "test" arrow (*ἐκ δίφροιο καθήμενος*, *Odyssey*, xxi, 420) proves that the bow cannot have been of great length. But this is not really the case. If an archer were seated upon a bench of the ordinary height, the bow-hand, and therefore the centre of the bow, would, in shooting, be raised about 3 feet 3 inches to 3 feet 9 inches from the ground if the arrow were drawn to the eye; and this would admit of the use of a bow of a length up to nearly 6 feet 6 inches to 7 feet 6 inches, although it is highly improbable that the Odyssean bow attained such dimensions. If the arrow were drawn to the breast, in the manner adopted by Pandarus (*μαζῷ πέλασεν*), the maximum length of the bow would have to be reduced by about 12 inches.

For reasons which I have given, it is impossible to believe that the bow of Pandarus was made of *horn alone*, if it was constructed from the horns of a single wild goat, as stated.

It is true that bows do exist which are made entirely of horn, as, for instance, in India and Java (Fig. 2), but these are made from the huge horns of the Indian Buffalo (*Bos bubalis*), from which staves of far greater stoutness and width may be cut than can possibly be obtained from the horns of any member of the goat family. But even such horn-bows as these are by no means very powerful, and would not test the strength and skill of practised archers. It does not seem possible that a bow possessing the enormous power attributed to that of Odysseus could have been

[1] *Catalogue of the Anthropological Collection*, 1877, p. 47.

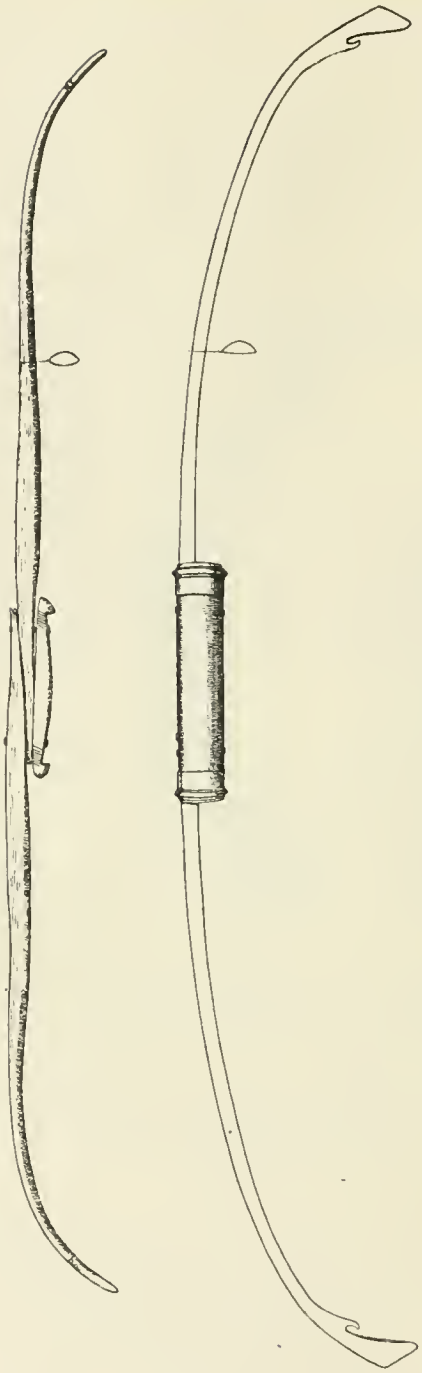


FIG. 2.

Left.—BOW MADE BY RIVETING TOGETHER TWO STAVES OF BUFFALO-HORN: INDIA. LENOTH 38 INCHES. PITT RIVERS MUSEUM.

Right.—BOW MADE BY UNITING TWO STAVES OF BUFFALO-HORN WITH A CENTRAL WOODEN GRIP: JAVA. LENGTH 42 INCHES. PITT RIVERS MUSEUM.

FIG. 3.

SINEW-BACKED BOW MADE FROM THE HORNS OF THE ROCKY MOUNTAIN SHEEP: OSSAGE TRIBE, MISSOURI, U.S.A. LENGTH $38\frac{1}{2}$ INCHES. PITT RIVERS MUSEUM.

made solely of horn, even though buffalo-horn were available, which, though possible, as I shall later suggest, is by no means certain.

Thus, we are driven to conclude that both the bows referred to, while admittedly made *with* horn, must have been reinforced with some other material or materials.

The use of horns and antlers of various kinds in bow-making is very widespread, particularly in the Asiatic region and among the Eskimo and North American Indians. Owing to the dearth of wood suitable for bow-making, the Eastern and Central Eskimo of the arctic New World frequently make their bows from flat laths cut from the antlers of the cariboo (or New World reindeer). These are united together at the centre, usually with rivets. As such bows would be far too weak for effective use, they are invariably reinforced along the back with a continuous lacing of plaited or twisted sinew cord, forming a "backing" of several strands extending from end to end, and braced to the bow at intervals with transverse sinew lashings. When the bow is strung, and still more when it is drawn, the greater part of the strain is taken by the sinew-backing, whose elasticity gives a strong rebound. A fairly useful bow, possessing strength and resiliency, is thus arrived at by the reinforcement of a material (antler[1]) which, if used alone, would be ineffective. This form of Eskimo bow is a simple and, as I believe, a primitive type of the sinew-backed composite-bow.

Among the North American Indians (*e.g.* the Sioux, Ossage, Shoshone, Utah and Oregon tribes, etc.) bows made of horn occur frequently, but in this region the true horn of cavicorn animals is usually employed. Many examples of bows made from the horns of the Rocky Mountain sheep (*Ovis canadensis*) have been collected, while, more rarely, specimens made from cow-horn, bison-horn, or wapiti-antler have been noted. These bows are usually, if not invariably, backed with sinews, but they differ from the antler-bows of the Eskimo, inasmuch as the sinews form a layer closely moulded and glued to the back of the bow, of which they form an integral part (Fig. 3). In some of these North American bows the sinew-backing is concealed from view by a protecting covering of snake-skin or other material, so that only the horn is visible externally, and, *at first sight, horn might appear to be the only material used in their structure.*

Improvements upon these rudimentary types of sinew-backed bows are prevalent throughout a vast area of Asia, extending from Siberia through Mongolia, Tartary, Tibet, Corea, Manchuria and China, into India, Persia and Turkey. Throughout this extensive region one nearly always finds that, where horn and sinews are used together in bow-construction, there is also introduced a third material, wood.

[1] Deer antlers, though very commonly designated "horns," are not true horns. Anatomically, they are in reality solid osseous structures deposited from a vascular layer lying immediately *underneath* the skin. They are the analogues (possibly the homologues) of the bony cores of cavicorn ruminants (oxen, sheep, goats and antelopes), and differ materially from the true horns of the latter, which are hollow structures of keratin, deposited as epidermal growths *outside* the vascular layer (or *corium*). Deer antlers also differ from the horns and osseous horn-cores of cavicorn animals in being deciduous, *i.e.* annually shed and annually rebuilt.

Wherever this triple association of materials occurs, the wood is used to form the central core, or skeletal support, of the bow. The horn layer is glued along the "belly"[1] of the bow, and the moulded layer of sinews supplies the "backing" (Fig. 4). This is an admirable association of materials. The wooden staves afford central support together with some resiliency; the horn, being a compressible substance, gives resistingly to the crushing strain imposed upon the "belly," which becomes strongly concave when the bow is drawn; while the elasticity of the sinews effectively takes the tensile strain thrown upon the "back," which becomes markedly

FIG. 4.—TRANSVERSE SECTION THROUGH THE LIMB OF A MANCHU BOW.
a = CORE OF BAMBOO; *bb* = LAYERS OF MOULDED SINEWS; *c* = BUFFALO-HORN; *dd* = THIN STRIPS OF HORN PROTECTING THE MARGINS. ACTUAL SIZE.

convex. For, when a bow is drawn, the "belly" or "ventral" surface suffers compression and the "back" is stretched, to an extent varying with the degree of curvature imposed upon the bow by the action of drawing the bow-string in shooting. Hence, these three materials, so disposed, work ideally together, and a bow of almost any degree of power can be constructed in this way.

The best Asiatic and Turkish bows are built up on these lines (Fig. 4), though many of them, especially in India and Persia (Fig. 5), were *completely* enveloped in thin bark, or other similar protective material, lacquered over, and they do not exhibit externally any trace of their elaborate composite construction, which is

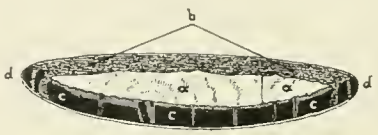


FIG. 5.—TRANSVERSE SECTION THROUGH THE LIMB OF A PERSIAN BOW.
aa = CORE OF WOOD; *b* = MOULDED SINEWS; *cc* = STRIPS OR RODS OF BUFFALO-HORN; *dd* = LATERAL STRIPS OF HORN. ACTUAL SIZE.

only revealed by dissection. The Manchu (Fig. 4), Chinese, Corean, Central Asiatic and Turkish bows, however, are not so completely encased; for, while the sinew-backing and joints are invariably protected with a sheathing layer (usually of bark or leather), *the horn remains exposed* and can clearly be seen. This point has a bearing upon our diagnosis of the Homeric bows, since in these, too, the only *visible* part of the structure was horn.

[1] *i.e.* the surface which is turned towards the archer in shooting.

It seems to be more than probable that the poet, uninitiated into the mysteries of practical bow-construction, assumed, from the examples which he had noticed, that the bows were made solely of that material which alone could be seen; and, *ex pedes Herculem*, from a "few feet" of visible horn he conceived, in the Odyssean bow, a weapon of "Herculean" strength, being unaware that horn was insufficient unless reinforced.

From the analogy offered by other bows of considerable power in the construction of which horn is used, we *must*, I think, conclude that an elastic "backing" of sinews was a *sine qua non*, and that this important structural element is not referred to simply because it was invisible, being overlaid with a protective sheathing, after the fashion universally prevalent throughout Asia in recent times. Without this powerful "backing" the bow of Odysseus would have been a relatively feeble weapon, and Penelope's test of her suitors' prowess would have sunk to the level of a very "soft option."

Even if we accept this seemingly inevitable conclusion, a constructional difficulty still remains and invites suggestion. The bow of Pandarus is, as I have mentioned, described as having been made from the horns of a *single* wild goat. Now, from each horn of the pair only two very narrow staves possessing reasonable thickness could be cut, one from the front and one from the hind margin (Fig. 1, sections *a–b*, *c–d*). The lateral portions of the horn are too thin to prove serviceable. Two of the strips *at least* would be required to equip the "belly" of each limb of the bow, and it is very doubtful if these would suffice. But, assuming, for the sake of argument, that two pairs of strips, sufficiently stout and wide to be useful for the purpose, *could* be furnished by a single pair of goat's horns, and that the "belly" of the bow was formed of a pair of horn strips to each limb, after the fashion adopted in making recent Persian bows (Fig. 5) (in which several narrow horn strips are united together to form the "belly"); then, judging again by analogy, it is practically certain that, in addition to being glued to the central wooden core and to each other, the strips would also be braced to the bow with a transverse seizing of sinews; which (like the sinew-*backing*) would have to be protected from damp by a layer of bark or leather.

But, in this event, *the horn would be no more visible than would the sinew-backing*, and the poet would have had nothing tangible to describe, and must have been dependent upon hearsay for his belief that even horn played a part in the structure.

If, as I think we may fairly assume, the horn layer was exposed to view, I feel compelled to suggest that, possibly, the horn used was not derived from the wild goat at all, but from some other cavicorn ruminant whose horns could furnish staves of the requisite width and stoutness to supply a *single* stave for each limb of the bow.

Two animals seem to offer possible alternatives :—

(1) The Armenian Wild Sheep, or Asiatic Mouflon (*Ovis orientalis typica*),[1] which, like the Pasang, occurs in the Taurus Mountains, and whose horns are of relatively massive build—long, broad and fairly thick. Horns of 40 inches in length are recorded for this species. I fancy that *fairly* serviceable staves could be cut from the horns of this animal, capable of furnishing each limb of the bow with a *single* horn stave ; witness the use made of the horns of the allied Rocky Mountain Sheep in North American bow-making. I suggest that, possibly, a lack of zoological knowledge may have led Homer to confuse the wild sheep with the wild goat, a by no means unnatural error. The story of the killing of the animal by Pandarus himself in the neighbourhood of his Lycian home might still hold good.

(2) The buffalo suggests itself as another plausible alternative. Nearly all recent Asiatic composite bows are " bellied " with staves cut from the horns of the buffalo (the Indian Buffalo, or Arni, *Bos bubalis*). These horns are often of enormous length, up to 6 feet and more, and are capable of furnishing very broad and stout staves. Is it possible that the very powerful bows referred to by Homer were made with the horns of *this* animal ? I am aware that this species is very generally believed to have been confined to India until a relatively recent date, when it spread westward into Asia Minor and elsewhere as a domesticated beast.

At the same time, as has been pointed out by Dürst, Ward and others, one cannot ignore the ample evidence which points to the water-buffalo having been well known in Mesopotamia at a very early date. A. H. Layard[2] discovered a Babylonian seal of green jasper upon which is engraved the figure of a bovine animal which can be no other than the water-buffalo (either the Arni, *Bos bubalis*, or its prototype *Bubalus antiquus*, or *B. palaeindicus*). W. H. Ward, in his valuable works on Oriental seal-cylinders, gives illustrations of many similar cylinders,[3] on which, it is averred, the legendary hero Gilgamesh is represented overcoming, or in one case giving water to, a buffalo (Figs. 6 and 7). The earliest cylinder-seals usually depict the Bison (*B. bonasus*) of the hill-forests ; but on the somewhat later, though still early, examples, from the time of Sargon I (*c.* 2870 B.C., according to Professor Langdon) onwards, the water-buffalo of the swamps of Southern Babylonia is usually represented, and is distinctly differentiated from the bison. On

[1] *Ovis musimon orientalis*, Brandt ; *Ovis gmelini*, Blyth.

[2] *Discoveries in the Ruins of Nineveh and Babylon*, 1853, p. 605.

[3] *The Seal-cylinders of Western Asia*, 1910, figs. 26, 27, 135*b*, 156, 161, 163, 167, 172, 176, 180, 183 and 203 ; *Cylinders and other ancient Oriental Seals in the Library of J. P. Morgan*, 1919, pl. vii, fig. 41.

the still later seals the Aurochs (*Bos primigenius*) takes the place of the buffalo. The long, rugose horns of the latter beast, characteristically turned backward over the shoulders, are unmistakably indicated on the seals of Sargon I and his successors.

Dr. J. U. Dürst[1] even mentions a seal of the "Kings of Sirgulla,"[2] which has been referred to 5000 B.C., upon which an undoubted buffalo is engraved. This

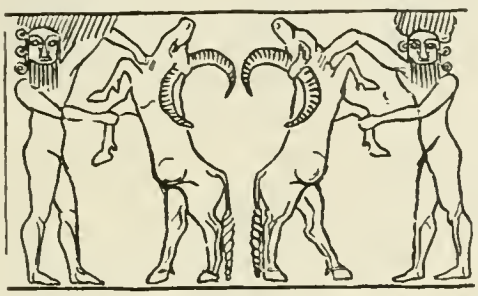


FIG. 6.—FIGURES OF THE WATER-BUFFALO ENGRAVED ON AN EARLY BABYLONIAN SEAL-CYLINDER OF JASPER. (FROM W. H. WARD, *Seal Cylinders of W. Asia*, 1910, fig. 167.)

author is of opinion that the water-buffalo was indigenous in Babylonia as a wild species from the earliest times and that it probably survived until the Assyrian era.

Aristotle (*Hist. Animalium*, ii, 4) alludes to wild bovines in Arachosia (Afghanistan), differing completely from the domesticated type; being black and of

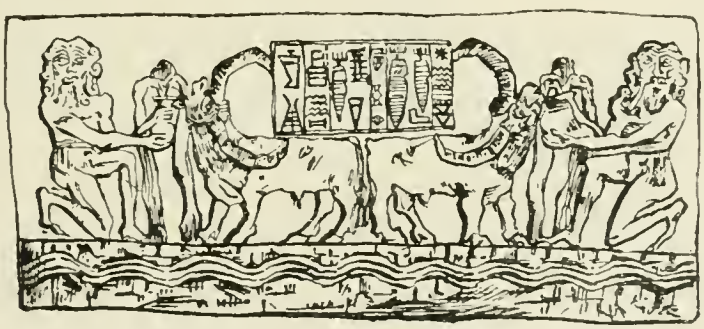


FIG. 7.—FIGURES OF THE WATER-BUFFALO ENGRAVED ON AN EARLY BABYLONIAN SEAL-CYLINDER OF THE TIME OF SARGON I. (FROM W. H. WARD, *ibid.*, fig. 26.)

powerful build, and whose horns were characterized by a marked backward sweep (*τὰ δὲ κέρατα ἐξυπτιάζοντα ἔχουσι μάλλον*). This description suggests the water-buffalo rather than any other wild bovine, and there can be little doubt that this is the animal that was referred to by Aristotle in the fourth century B.C.

[1] *Die Rinder*, and also his article on "Prehistoric Bovidae" in *l'Anthropologie*, xi, 1900, pp. 129–158. See also R. Lydekker, *The Ox and its Kindred*, p. 180.

[2] *i.e.* Sirpulla or Sirburla (= Lagash), one of the oldest Sumerian cities. The earliest *identified* King of Lagash is Ur-Nina, who is dated 3000 B.C. by Professor Langdon. The seal referred to by Dürst may, presumably, be referred to the oldest Sumerian culture.

The Sassanide hunting scene, represented in Fig. 15, proves that the water-buffalo still existed in a wild state in Persia during the early part of the seventh century A.D. Among the victims of Khosrau II are two unmistakable buffaloes, one of which has already been wounded by the royal archer.

The ancient figures of the now extinct buffalo (*Bubalus antiquus*) engraved upon rock-surfaces in Western and Southern Algeria,[1] and believed to date back to late Quaternary times, point to a still wider extra-Indian dispersal of a bubaline animal closely akin to the Indian Arni, which appears to have spread into North Africa at an early date.

Dürst[2] mentions that fossil buffaloes, nearly allied to *B. palaeindicus*, have been found in Italy and other parts of Europe, as far north as Dantzig.

Hence, it is evident that water-buffaloes in a wild state were widely dispersed in early times outside the confines of India, and the possibility of the horns of this

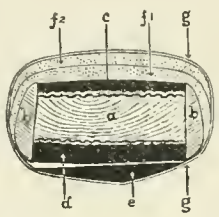


FIG. 8.—TRANSVERSE SECTION THROUGH AN ASSYRIAN BOW FOUND IN AN EGYPTIAN TOMB OF THE XXVITH DYNASTY.

a AND *b* = WOOD ; *c*, *d* AND *e* = HORN ; f^1 AND f^2 = LAYERS OF MOULDED SINEWS ; *g* = OUTER SHEATHING OF BARK. ACTUAL SIZE. PITT RIVERS MUSEUM.

animal having been used in bow-making in Western Asia, and, perhaps, also in Eastern Europe, seems far from remote.

Moreover, a bow of elaborately composite structure, probably of Assyrian origin, was discovered in Egypt in a tomb of the XXVIth dynasty. This bow I partially dissected to ascertain its structural details, and it proved not only to be backed with layers of sinews, but also to be fitted along the " ventral " surface with broad staves of black horn which I believe to be buffalo-horn.[3] A transverse section of this bow is shown in Fig. 8.

At least, we may admit the *possibility* of *buffalo*-horn having been employed in the construction of such bows as that associated with Odysseus, the enormous strength of which would be rendered more credible by this supposition (assuming, of course, that there was also a powerful backing of sinews). I know of Manchu bows, com-

[1] A. Pomel, *Carte Géologique de l'Algérie*, 1893 ; *Monographies de Paléontologie*, 1893. G. B. M. Flamand, *l'Anthropologie*, iii, 1892, p. 145, and xiii, 1902, p. 510. Gautier, *ib.*, xv, 1904, p. 495. L. Péringuey, *Trans. S. African Philosophical Soc.*, xvi, 1906, pp. 404, 405.

[2] Quoting Von Baer, 1823, F. Romer, 1875, and Rutimeyer, 1875.

[3] This bow I obtained from Professor Petrie and gave to the Pitt Rivers Museum. I described it fully in the *Journ. Anthrop. Soc.*, xxvi, 1897, pp. 210–220.

posed of buffalo-horn, wood and sinews, which would probably have defied the strength and skill even of Odysseus himself, or of Teucer, the Salaminian, or the Trojan Philoctetes!

To be sure, the acceptance of the suggestion that it may have been the horns of the buffalo and not of the goat which furnished an important element in the structure of these Homeric bows, involves the repudiation of Homer's picturesque tale of the hunting of the wild mountain goat by Pandarus and the use made by the latter of his trophy. But I have already pointed out the practical difficulties

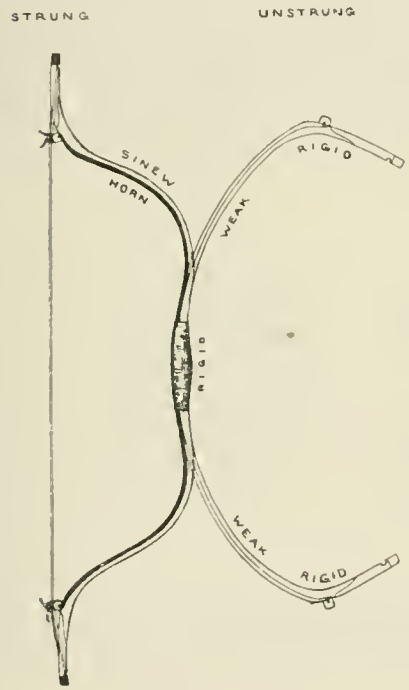


FIG. 9.—TATAR COMPOSITE BOW, SHOWING THE SHAPE ASSUMED IN THE UNSTRUNG AND IN THE STRUNG STATE. *c.* $\frac{1}{20}$. LENGTH (STRUNG) 65 INCHES. PITT RIVERS MUSEUM.

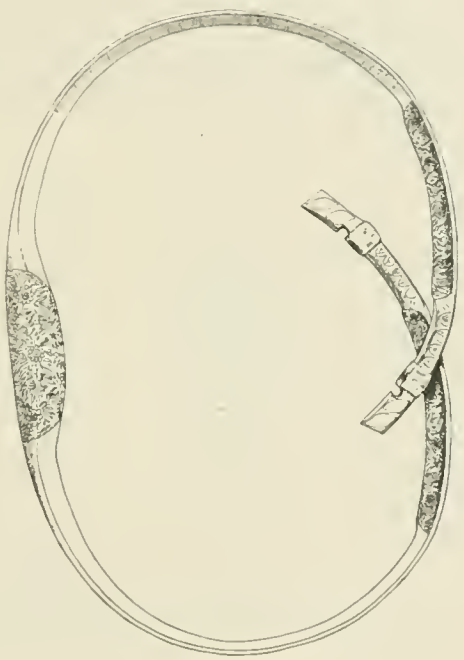


FIG. 10.—PERSIAN COMPOSITE BOW, EXHIBITING EXTREME REFLEX CURVATURE IN THE UNSTRUNG STATE. *c.* $\frac{1}{5}$. PITT RIVERS MUSEUM.

which militate against acceptance of this poetical embellishment and call for an alternative rendering.

Whatever the particular kind of horn employed may have been, I think that there can be little doubt that the bows of the Homeric sagas were *composite, sinew-backed* bows of the Asiatic type. Apart from the reasons which I have already given, there are others which lead one unmistakably to the same conclusion.

The frequent repetition of the expressions *τόξον παλίντονον*, *ἀγκύλα τόξα* and *καμπύλα τόξα*, as applied to the bow in its *unstrung* state, shows that the

bow of Odysseus, at any rate, was *reflexed* when in a position of rest; and the emphasis laid upon this characteristic suggests that this reflexed curve of the unstrung bow was a very marked feature.[1]

Æschylus (525–456 B.C.) mentions the Σκυθικά βέλη παλίντονα in his *Choephori*, 160, *i.e.* the "reflexed Scythian bows," βέλη being a periphrasis for τόξα, the bow being identified with its missiles. Scythian archers (τόξοται) appear to have been employed as police at Athens from 480 B.C.[2] Sophocles (495–406 B.C.) also refers to παλίντονα τόξα (Tr. 511). The terms ἀγκύλα and καμπύλα are also applied to bows which were strung and ready for use, so that these adjectives may refer to bows whose outlines were sinuous both in the unstrung and in the strung state.

Now, this backward curving of the bow in the unstrung state is a feature peculiarly associated with bows of *composite* construction, and is rarely seen, and usually only slightly marked, in single-stave and compound bows. Nearly all the Asiatic

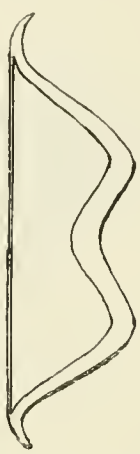


FIG. 11.—BOW EXHIBITING THE "CUPID'S BOW" FORM.
ON A COIN OF PHILETAERUS OF PERGAMUS.

composite, sinew-backed bows are reflexed (παλίντονα), some of them to a very remarkable extent, which would not be possible in bows of simple structure (Figs. 9 and 10). Usually, when *strung*, these bows assume the well-known "Cupid's bow" curvature (Fig. 9), a shape frequently represented in ancient Greek art; this fact indicates a familiarity with bows of composite structure (Fig. 11).

Another point to be noted is the statement κυκλοτερὲς μέγα τόξον ἔτεινεν, in the description of the drawing of his bow by Pandarus (*Iliad*, iv, 124). The term κυκλοτερὲς suggests that the bow, when fully drawn, was strained almost into circular form; a poetic exaggeration, no doubt, but evidently intended to convey the idea of a very high degree of curvature, such as well-made *composite* bows can

[1] *Cf. Iliad*, viii, 266; x, 459; xv, 443; *Herodotus*, vii, 69.
[2] *Cf.* T. G. Tucker, *The Choephori of Æschylus*, 1901, p. 46.

well sustain, while bows of simple structure would break under the strain involved in such extreme bending. We may compare Virgil's account of the shooting of Arruns by Diana's "valkyrie," Opis (*Æneid*, xi, 859–861):—

> "*Cornuque infensa tetendit et duxit longe, donec curvata coirent inter se capita. . . .*"

Here we note the same exaggerated bending of the bow "till the ends met," which is comparable to the κυκλοτερὲς of Homer. It is noteworthy that in this passage (as also in *Æneid*, xi, 773, "*spicula torquebat Lycio Gortynia cornu*") the word *cornu* is used for bow, instead of *arcum*, suggesting that the bows in question were made of, or, more probably *with*, horn. Compare Ovid (*Met.* iv. 303) '*flectentem cornua.*" In like manner, Anacreon (Ode III) uses κέρας as equivalent to τόξον—κέρας ἀβλαβὲς μὲν ἡμῖν, σὺ δὲ καρδίην πονήσεις. So, too, Homer (*Iliad*, xi, 385) κέρα ἀγλαὲ, and Theocritus (25, 206).

a b.

FIG. 12.

a—BOW IN BOW-CASE. ON A SILVER COIN OF ERYTHRAE. *c.* FOURTH CENTURY B.C.
b—BOW IN BOW-CASE. ON A SCYTHIAN VASE FROM CHERTOMLYK, S. RUSSIA.

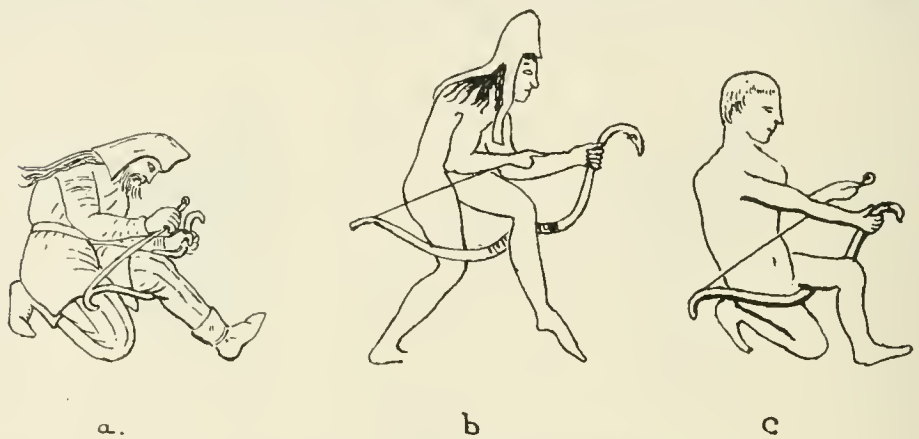
Again, as I have already quoted, the bows both of Pandarus and Odysseus were kept, when "off-duty," in special bow-cases. This also suggests very strongly that these bows were of composite construction, since the use of a protecting bow-case prevails wherever composite bows are employed (among the Eskimo, American-Indian and Asiatic peoples), while a bow-case is but rarely associated with a single-stave bow. Among Asiatic archers the bow-case is frequently beautifully decorated (*cf.* γωρυτὸς φαεινός of the *Odyssey*). The bow-case, which sometimes held the arrows as well, is referred to by various Greek and Latin authors under the names γωρυτός, τοξοθήκη, *corytus*, and where it is represented in painting or sculpture, the bow contained in it is clearly a *composite* bow, as judged by its shape (Fig. 12).

That Odysseus *did not care to take his bow to sea* with him on his travels (*Odyssey*, xxi, 39) may, perhaps, have been due less to his sentimental desire to preserve it as a memento of his dead friend Iphitus (as stated by Homer), than to the practical

necessity of protecting this delicate weapon from deterioration by damp atmosphere, by which composite bows are specially liable to be affected.

Further, the bow of Odysseus was, at the suggestion of Antinous, subjected to special treatment—warming and greasing—in order to render it more supple and amenable (*τόξον . . . θάλπων ἔνθα καὶ ἔνθα σέλαι πυρός*). This also is reminiscent of the careful preparation undergone by Asiatic composite bows, whereby the horn was softened and suppled by heat and the sinews were rendered fully elastic.

Odysseus himself examined the bow very carefully, testing it to see if perchance boring grubs had eaten into the horn (*πειρώμενος ἔνθα καὶ ἔνθα, Μὴ κέρα ἶπες ἔδοιεν*, line 394). If one may judge from the remains of ancient composite bows found in Egypt, the horny portions of their structure were specially liable to insect attacks. In some instances the horn has been entirely eaten away. The sinews



a. b c

FIG. 13.—METHOD OF STRINGING ANCIENT COMPOSITE BOWS.

a—FROM A SCYTHIAN ELECTRUM VASE FROM KUL OBA, NEAR KERTCH.
b—FROM A GREEK PAINTED VASE IN THE LOUVRE. *c*—FROM A THEBAN COIN.

also, though to a lesser extent, were attractive to insects, the wood alone seeming to have resisted their attentions.[1]

The fact that considerable knack, as well as strength, was required in *stringing* the bow of Odysseus, is another point in favour of composite construction, as it is certain that greater skill and dexterity are called for in stringing the strongly reflexed Asiatic bows, than are needed for any bow of simple or "single-stave" type. I can speak from experience and know how difficult and risky it is.

If we compare, as Anuchin[2] has done, the prevailing method adopted by Oriental archers in stringing bows of composite build with some of the Ancient Greek renderings of the process as applied to bows of *similar shape*, we see at once that the action was similar. The figure on the famous Kul Oba vase of a Scythian archer stringing

[1] See my paper in the *Journ. Anthrop. Inst.*, xxvi, plate ix; also Von Luschan's *Ueber den Antiken Bogen*, 1898, p. 193.

[2] *Luk i Strely*, Moscow, 1887, p. 23.

his bow, shows the bow crooked between the legs, the upper end being forcibly drawn back to meet the loop at the end of the bow-string (Fig. 13, *a*). Compare with this the figure taken from a painted Greek vase in the Louvre (Fig. 13, *b*), and with that on an Ancient Theban coin (Fig. 13, *c*), and it will be noted that the method is the same in all three cases. This is not the process usually applied to bows of simple construction, but it has prevailed among the Eastern users of the *composite* bow,

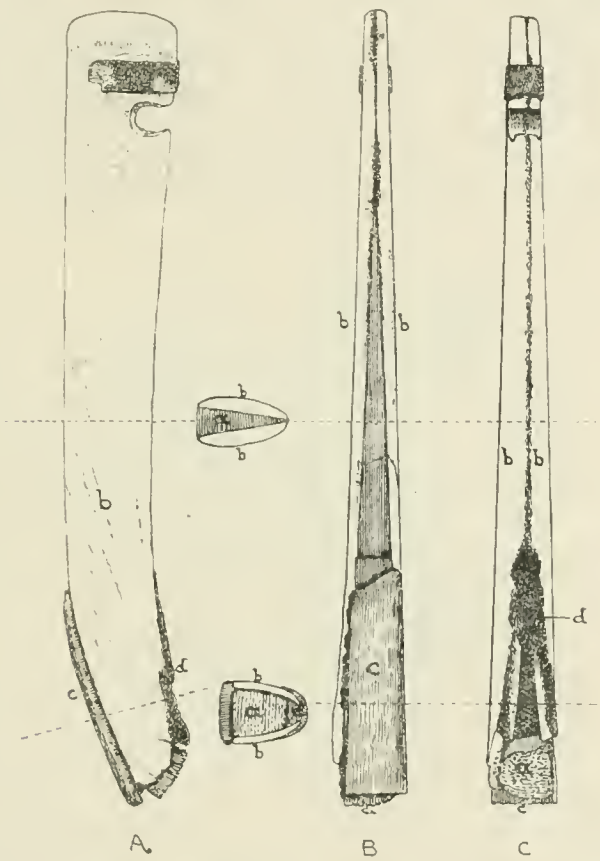


FIG. 14.—ONE END OF A BROKEN BOW, PERHAPS OF PERSIAN ORIGIN, FOUND AT BELMESA, EGYPT. (ROMAN PERIOD.)

A, LATERAL VIEW; B, VENTRAL VIEW; C, DORSAL VIEW.

a = WOODEN CORE; *bb* = PLATES OF BONE ENCASING THE CORE AND BEARING THE NOCK; *c* = STAVE OF HORN COVERING THE VENTRAL SURFACE; *d* = REMAINS OF SINEW-BACKING.

who were able to string very powerful bows in this manner, though considerable dexterity was required.

These are the principal reasons which lead me to urge that the two bows specially referred to by Homer were *not constructed of horn alone*, the only material mentioned, but were of composite build, in which horn, wood and sinews were combined as essential component elements. This diagnosis is the result of a comparative and

anatomical study of ancient and modern bows, and on archæological, ethnological and zoological grounds this conclusion seems to me to be inevitable.

That the Greeks, and, for that matter, the Etruscans and the Romans, were familiar with exotic types of the composite bow, is evidenced by their having frequently depicted bow-forms, which can only have been practical if a sinew-backing were employed as reinforcement. Presumably, these composite types were derived from the Asiatic region—from Asia Minor, Mesopotamia, Persia or Scythia. The latter region appears likely to have been an early distributing centre for the composite bow, southward and westward, since the Scythians were particularly famous as archers and undoubtedly used this type of bow. Cyaxares (634–594 B.C.), King of Media, is said by Herodotus (i, 73) to have retained at his court certain Scythians in order that they might give instruction in the use of the bow.[1]

FIG. 15.—KOSRAU II (CHOSROËS), KING OF PERSIA, HUNTING BUFFALOES, ETC. FROM A SASSANIDE DISH IN THE CABINET DES MÉDAILLES, PARIS. (*Revue Archéologique*, XL, 1902.)

A fragment of a composite bow, dating to the Roman period, found at Belmesa in Egypt, was given to me by Professor Flinders Petrie in 1897 for the Pitt Rivers Museum. This fragment testifies to the influence of the northern type of bow upon that of the Persians. It consists (Fig. 14) of the nock-bearing end of a bow, built up with horn, wood and sinews, overlaid with plates of bone, and differs markedly from the developed Persian bows of later times, but corresponds closely with a representation[2] of a bow in the hands of King Chosroës II (Khosrau II), who

[1] At a date later than the Homeric sagas, in 512 B.C., Darius, the Persian King, invaded Greece from Persia, and reached the lower Danube during his so-called "Scythian" invasion. Later on, Megabazus, one of his generals, conquered the Thracian sea-board, and Macedonia came under the Persian rule.

[2] On a Sassanide dish in the Cabinet des Médailles, Paris; *Revue Archéologique*, XL, 1902, p. 242.

conquered Egypt early in the seventh century A.D. (Fig. 15). This type of bow shows affinity with bow-forms which are characteristic of N.E. and Central Asia, particularly with Chinese and Manchu examples. Those vaguely defined and imperfectly identified people, the "Scythians," if not themselves of Mongolian origin, at least appear to have had contact with the Mongolians of Central Asia, and we may reasonably assume that their type of bow was influenced by that of peoples living further to the East and North. The wide overrunning of the Asiatic regions by the Scythian raiders probably was a material factor in spreading both their fame as archers and their characteristic type of bow.

The peculiarly *unequal curves* of the two limbs of the Scythian bows were noted by the Pontine geographer Strabo[1] (about the beginning of our era), who compared their outline, when strung, to that of the Black Sea: the two large unsymmetrical

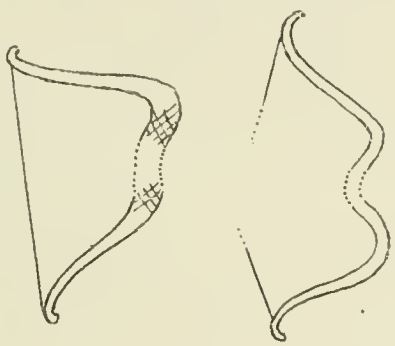


FIG. 16.—BOWS WITH UNSYMMETRICAL CURVES.

a—FROM A REPRESENTATION OF AN AMAZON ON A GRECIAN VASE FROM CANINO. BRITISH MUSEUM. (*Archaeologia*, XXIX, p. 139.)

b—FROM A FIGURE OF HERCULES PAINTED ON A GRECIAN *crater*. (REICHEL, "HOMERISCHE WAPPEN," 1901, p. 54.)

northern bays of which resembled the curves of the bow, while the relatively straight southern coast suggested the bow-string. Others[2] have likened the Scythian bow to a very early form of the Greek *sigma*, in which the curves were unsymmetrical. This asymmetry is indicated in many of the ancient Greek pictorial renderings of the bow, in which the two limbs of the bow are represented as having unequal curvature, one limb being more strongly flexed than the other (Fig. 16, *a* and *b*). Figures of Hercules occur on Theban and other coins showing a bow of this asymmetrical composite form, and it has been suggested by Rich that this may be the bow received by Hercules from the Scythian shepherd Teutarus (Fig. 16, *b*). Theocritus (*Idyll.* xiii)

[1] II. v, 22. *Cf.* Ammianus Marcellinus, *Rerum Gestarum*, xxii, ch. 8.

[2] *Cf.* Rich, *Dict. of Roman and Greek Antiquities*, 1873. Athenæus, quoting Agathon, compares it with the Greek Σ, but the particular form of this letter is not stated.

suggests that this was so. This asymmetrical curvature, which is very commonly noticeable in the Asiatic composite bows of recent times, was, I believe, not intentional, but due to the difficulty of building up the two limbs of a bow of composite structure so as to give them *exactly* equal strength and flexibility.

It is significant that the most renowned archers among the Greeks had their homes near the sea-coasts, and were, therefore, specially accessible to foreign influence. Odysseus inhabited Ithaca, Philoctetes, Mount Hermaeus and Lemnos, Teucer Salamis, Meriones Crete.

To sum up briefly: from the evidence which I have given, and which could easily be elaborated further, I think that we must assume that the Homeric bows specially referred to were of the Asiatic type, having a central supporting core of wood, a stout layer of horn glued along the "ventral" surface, and a powerful "backing" of longitudinally disposed sinews. That only the horn should have been visible externally is perfectly in keeping with the practice of the bow-makers of Central and Northern Asia, and also of Turkey, who leave the horn exposed, while covering and concealing the more delicate sinew backing and the lateral margins of the bow with a protecting sheathing of bark or leather. If Homer only refers to that material which could be *seen*, and was unaware of the other essential structural details, we can hardly blame him—a poet among a people whose practice of archery was relatively limited—since in far more recent times a similar omission to refer to the sinew-backing may frequently be noted in descriptions of Turkish and Persian bows,[1] in which allusion is made to the horn but no reference is made to the sinew reinforcement, although the latter was certainly an essential feature in the structure of *these* bows. The poet's lack of detailed knowledge of bow-construction is paralleled by a similar ignorance exhibited by artists in all ages, whose toxographic errors form in themselves a curious and interesting subject for study.

Finally, the probability of the reflexed "horn" bows referred to by Homer having had an Oriental parentage, seems, as some have suggested, to be reflected in the legendary origin assigned by the Greeks to the bow and arrows. According to Pliny (*Hist. Nat.* vii, cap. 57), the Greeks attributed the invention of these weapons alternatively to *Scythes*, son of Jupiter, and to *Perses*, son of Perseus ("*Arcum et sagittam Scythen Jovis filium, alii sagittas Persen Persei filium invenisse dicunt*"). The names of these legendary inventors have a familiar ring in connection with ancient archery, and suggest very strongly that the origin of the myth may be sought in the actual derivation of the Greek composite bow from the Scythians or the Persians, two peoples who were especially renowned in antiquity for their skill in archery.

[1] *e.g.* Barbosa (1514) describes a "Turkish" bow seen at Ormuz, Persian Gulf, as "made of buffalo's horn and stiff wood, painted and gilded." Similar incomplete descriptions could be quoted from much later writers.

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