10. The Bow

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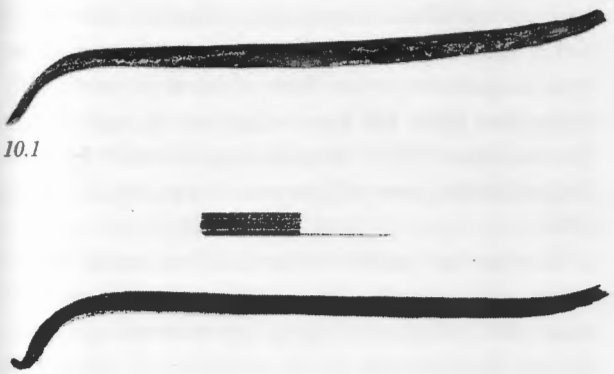
In the excavations carried out in 1993 in Cave 13 in Wadi el-Makkukh near Jericho (Barshad and Shaked, this volume), a burial of a male, wrapped in cloth, was discovered. Several grave goods were found inside and next to the burial bundle; among these were a wooden bow in two parts (Figs. 10.1, 2), and the remains of two arrows (Schick, this volume). A sample of the bow (AA 22234) has been ^{14}C dated to 5120 ± 50 ybp (uncalibrated) (Jull et al., this volume).



10.1

10.2

Figs. 10.1, 2. The two parts of the Warrior's bow.

Description of the Bow

The bow had been broken in antiquity, perhaps ritually 'killed', to ensure its travelling into the afterlife with the warrior. It had been snapped across approximately at its centre (Fig. 10.3). The two pieces could be fitted together perfectly to establish the full length and the recurvature of the centre section (Figs. 10.4, 6). Similar to the other contents of the burial, it had been smeared with red ochre which now colours it.

Measuring along the curvature of the complete bow gave a length of 125.4 cm. Because of some twisting in the limbs, particularly towards Tip A, and the overlapping with rawhide or skin on Tip B, this length is not absolutely precise but gives a fair reflection of the length of the original bow (Fig. 10.5).

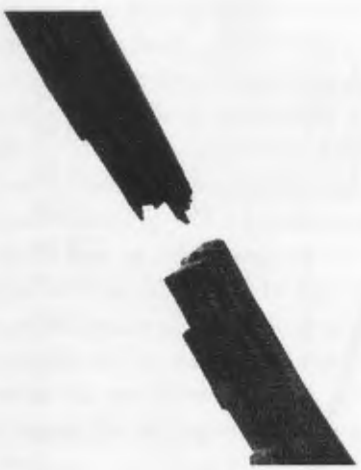
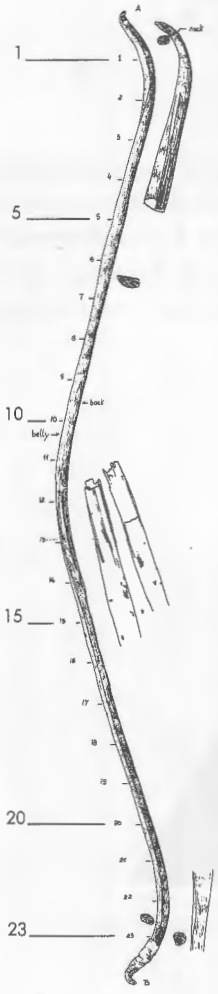


Fig. 10.3. Snapping point at centre of bow.

The handle or place where the archer grasped the bow when shooting, shows no trace of binding or covering as might have been expected. Rather, it is smooth and polished, perhaps from much use (Fig. 10.6). The centre narrows to give a flattened oval section. This narrowing reduces the tendency the bow would otherwise have had of casting the arrow to one side of the intended target. The limbs of the bow broaden out to a shape rounded on the back of the bow but flattened on the belly; the edges are rounded. The limbs of the bow are at their widest approximately midway between the centre and

Fig. 10.4. The two parts of the bow fitted together.



Measuring Point	*Width*	*Thickness*
1	13.73	11.37
2	17.41	13.50
3	20.64	12.15
4	25.17	11.20
5	28.00	11.93
6	28.34	12.65
7	29.45	12.47
8	23.76	12.41
9	28.35	12.12
10	25.80	14.04
11	23.66	14.45
12	23.04	13.32
13	23.86	14.46
14	26.20	12.50
15	28.64	13.40
16	28.49	13.27
17	27.92	12.87
18	28.67	12.10
19	27.58	10.87
20	27.58	11.33
21	24.61	12.71
22	21.22	14.26
23	16.74	13.86

Fig. 10.5. Width/Thickness measurements of the bow (in mm).

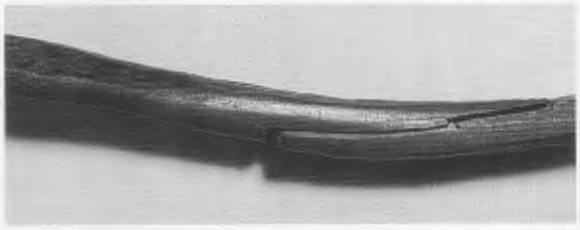


Fig. 10.6. Smooth and lustrous area at centre of bow.

the curved tips: Limb A – W 29.49, Th 12.47 mm; Limb B – W 28.49, Th 13.27 mm (see Fig. 10.5 for a list of measurements taken at 5 cm intervals along the entire length of the bow). This cross section is different from the norm accepted by modern archers who would, following medieval European practice, expect the back to be flat with the belly rounded. However, the cross section given to the limbs by the Wadi el-Makkukh bowyer conforms precisely to the practice of Neolithic bowyers in Europe. It must be added that the double curvature of the el-Makkukh bow is in contrast to the Neolithic European bows, which generally have simple curvatures. This cross section is probably the result of the methods and tools used and a desire to limit the labour involved, rather than a conscious attempt to design an efficient bow. Nonetheless, a bow limb which is proportionally wider than thick, has been recognized by engineers to be more efficient than one with a round section, particularly with short bows (Hickman, Nagler, and Klopsteg 1947).

The bow is a selfbow, that is, it was made from a single piece of wood. The wood was identified as being olive (*olea europaea*) (Werker, this volume), an identification corroborated by T. Lawrence of the Jodrell Laboratory, Royal Botanic Gardens, Kew. Olive wood is a rare material for bow making although not totally unknown (Paterson 1990:35).[1] It is likely that wild olive was used rather than a cultivated variety, since the pruning required for the intensive production of olives renders the wood unsuitable due to the proliferation of knots and the short, twisted limbs it produces. It was most probably made from a branch or sapling rather than from the trunk of a mature tree. Werker (this volume) reasonably suggests that long and resilient shoots growing from the roots of the tree were here used. The reasons for such a choice of wood are twofold. Firstly, the stone or possibly copper tools in use at the time of manufacture, although capable of

Fig. 10.7. Marks of knife-scraping on belly side of bow.

Fig. 10.9. Tip of bow showing remains of skin cover.

Fig. 10.8. Tip of bow with nock.

surprisingly accurate work, were laborious and the cutting of large pieces of wood could not have been a simple undertaking. (Fig. 10.7 shows marks of an implement used to scrape the wood.) Secondly, young green wood is more readily shaped into the permanent curves of this type of bow.

The bow is doubly curved with the centre section curving towards the archer, and the limbs projecting away from him. Approximately twelve centimetres of each end of the bow curve sharply towards the archer. The last two centimetres of each tip then curve in a reverse direction. This final curve is in the nature of a small hook cut out of the wood rather than the result of having been bent into shape with the aid of heat and moisture.

It should be noted that there are no fully formed nocks on the bow, but there is a shallow groove cut into one tip (Fig. 10.8), which may have served as a nock. The other tip is covered with skin which may conceal another nock (Fig. 10.9). If the groove is a nock it would confirm the direction in which the bow was bent in use.

Discussion and Correlation

Following Rausing's classification, this type of bow may be termed 'doubly convex'. However, his description says that 'it forms two curves joined by a pronounced straight line ...', omitting any mention of the 'setback' in the handle or centre of the bow, an important feature of the el-Makkukh bow (Rausing 1967:20, Figs. 5b, 36, 37). In further references to the type (e.g., Figs. 36 and 37), his examples clearly have a curved centre section. The extreme curvature in the centre of the el-Makkukh bow supports the belief that the bow is of the type depicted on the Predynastic 'Hunters' Palette' (p. 69) from Egypt (Fig. 10.10; Yadin 1963:119). If the brace-height of the bow (the distance between the centre of the bow and the bowstring) is kept low it certainly does resemble this type of bow. However, if the brace-height is increased, the bow more closely resembles the bow type depicted on the Assyrian relief from Nineveh at the British Museum; it is in the hands of Arabs mounted on dromedaries, pursued by Assyrians carrying composite bows (Fig. 10.11; Barnett (n.d.) 109–112). We regard the bow as being generally of the Hunter's Palette type, with the bows held by the Arabs being a variation or subspecies of the same type. The el-Makkukh bow is the earliest actual specimen known to the present writer. Its special cross section, with a rounded back and almost flat belly, may well be unique for this form of bow.

Fig. 10.10. A bowman carrying a bow and three arrows. Drawing after Hunters' Palette.

Fig. 10.11. Arabs pursued by Assyrian soldiers. Drawing after Ashurbanipal relief, Palace of Nineveh.

It has been noted that permanently curving the tips of the bow towards the archer is far from efficient (Longman and Walrond 1894:31 and Illus. on p. 69). Nonetheless, the type continued in use throughout the history of Ancient Egypt, even into comparatively recent times, in parts of Africa such as Somalia (Grayson 1961). There seems little doubt, therefore, that it could at least hold its own against more sophisticated designs. Many examples of this type, but of later date, have been found in Egyptian tombs, a notable case being the tomb of Tutankhamun, where some fourteen Hunter's Palette type bows of varying sizes were discovered along with twenty-nine angular composite bows (McLeod 1982). It is noteworthy that there are some differences in design between the el-Makkukh bow and the ancient Egyptian specimens. The section of the Egyptian bow is more or less rounded along its entire length and tapers from its centre towards both tips; the el-Makkukh bow has a rounded centre and limbs which flatten and widen out and then taper again in width into narrow rounded tips. The surviving Egyptian bows vary considerably in length – from 67 to 198 cm (McLeod 1982:51). We have no means of knowing if the el-Makkukh bow is typical of its period and area; it may well be that longer and heavier draw-weight bows were also made.

Reconstruction of the Bow
(Fig. 10.12)

Initially there had been some doubts regarding the identification of the wood used to make the bow. Two obvious possibilities were sidder (*Ziziphus* sp.) and acacia (*Acacia* sp.), both of which grow today in Israel. Although the wood had not been conclusively identified, almost all of the bows recovered in Egyptian excavations had been made of one or the other of these woods (Western and McLeod 1995). A decision was therefore made to proceed with the reconstruction using one or both of these woods. Four branches of sidder which seemed suitable were brought to England. However, when the bark was removed it could be seen that they were less than perfect for the task because of a large number of awkwardly-placed knots.

Reconstruction of the bow using the sidder branches was already in progress when the wood was positively identified as olive. A reproduction in olive wood is therefore planned for the future once suitable wood can be obtained but it was decided to continue with the construction of the sidder wood bow and to conduct some tests of its performance.

Though unable to inspect the bow at first hand in Jerusalem, I have been able to rely on 1:1 drawings and detailed photographs by A. Weinstein of Tel Aviv. Subsequent communication with Mr Weinstein has been