ARCHERY EXPLOITS OF THE PHARAOHS

By

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Archery has been an important part of human history and Egypt is no exception. Several stories have been found detailing amazing archery feats of the pharaohs. By testing these stories we can learn more about the status of the pharaoh within Egyptian society as well as how truthful they were when talking about skills that could promote and reinforce their authority. In order to test these stories I have analyzed the archery equipment found within the tomb of Tutankhamun to determine modern day equivalents in order to be able to accurately determine if these stories are true, the result of bragging or a mixture of the two.

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INTRODUCTION

> When he shoots at a copper target, all wood is splintered like a papyrus reed. His Majesty offered an example thereof in the temple of Amun, with a target of hammered copper of three digits in thickness; when he had shot his arrow there, he caused protrusion of three palms behind it (Nederhof 2009).

The above quotation comes from the Armant Stela of Thutmose III and is one example of several texts in which the Pharaoh boasts of his military prowess. However, how much of these stories are to be believed as recounting actual events and facts? Through the use of experimental archaeology, this study will examine and test these stories to determine if such boasts were physically possible given the technology available at the time of Egypt's New Kingdom.

Archery technology has existed for thousands of years and not only has it been a part of our day to day life in the past it has also been part of a number of stories and legends throughout history; Robin Hood is one very good example of archery playing a key role in a legend that has lasted through the centuries. Ancient Egyptians used archery in their day to day lives and just like today many liked to brag about what they could do. Naturally, if someone were to walk up to you and say that they shot the tab off of a soda can that was one hundred yards away, without the can moving, you would be incredibly skeptical. A number of stories have been found where pharaohs are stating amazing feats that they have done with a bow and arrow and just like today they beg the questions did this really happen? Was this really possible? Some of these stories could have been true. However, it may also be that the majority of these stories were simply the pharaohs bragging about their skills. The only way to know for sure is to test these stories.

The best way to test these stories would be to make an exact replica of the bows that were used and recreate the stories, testing to see if what the pharaohs said was possible or not. However, there has been enough analysis conducted on ancient bows to be able to use modern day equivalents of the ancient bows in order to test these stories and still obtain accurate results. By using a modern day equivalent we can easily change the velocity at which the arrows are fired and will therefore be able to see if the stories were extremely far-fetched or if with just the right circumstances and conditions it would be plausible for that story to have actually happened. In testing these stories I hope to give a glimpse into the ancient Egyptian society through the eyes of the pharaohs to better understand the pharaoh's role in society as well as how the upper and lower class citizens would have seen the pharaoh. Were these stories a way to create and reaffirm the pharaoh's power and situation in society while having never actually happened? Or were the pharaohs incredibly skilled archers capable of amazing feats? Or is reality a mix of the two?

BACKGROUND

Actual examples of ancient Egyptian bows and arrows have been recovered from many different sites, but perhaps the most famous and well preserved were recovered from the eighteenth dynasty tomb of Tutankhamun (Brewer and Teeter 2007). Two types of bows were found within the tomb first is referred to as a self-bow which is a standard wooden bow that has a single curve to it which becomes even more accentuated when the bow is drawn. The second is referred to as a composite bow which has a double curved shaped and is also made from wood (McLeod 1982). One of the composite bows found was identified by Dr. Laurence Chalk, Imperial forestry institute, oxford, around the time of discovery as ash and Carter himself identified the covering

of several of the bows as being birch and a few others as being “cherry-like” though this has never been confirmed by expert botanical analysis (McLeod 1970). The bowstrings of these bows were made of one of two materials either gut or linen (McLeod 1982). According to the description that McLeod gives of the bows and their strings I have concluded that the self-bow would be very similar to an English long bow and the composite bow would be fairly similar to a modern recurve bow in terms of structure and how it would have been strung. Modern day recurve bows have a string that is attached to the limbs by an eyelet type knot on both ends of the string that fit into the notches of the limbs (Figure 1).

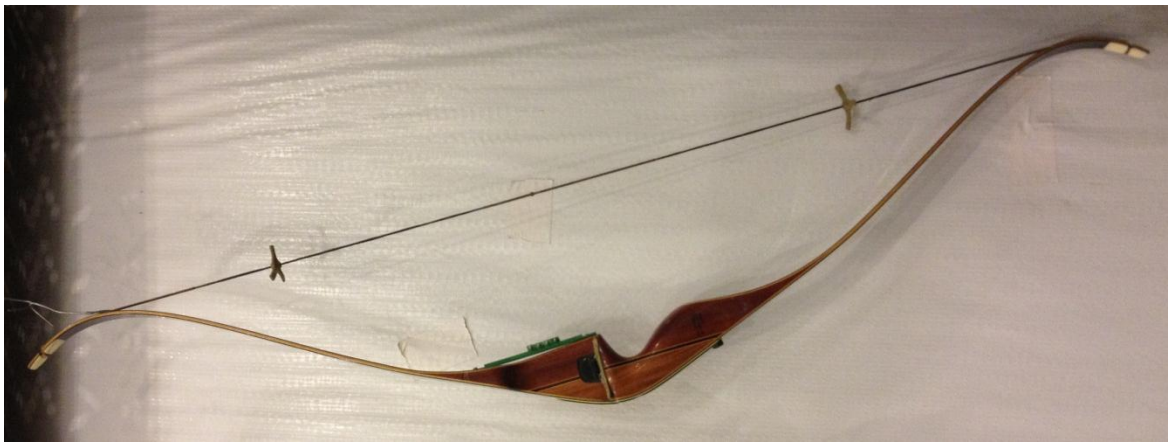

Figure 1. Modern recurve bow.

Two types of arrow shafts were also found within the tomb of Tutankhamun, made of either wood or reed with the majority being made of reed. Arrowheads were found from two different types of materials with five different shapes. The first material, bronze, was found in two different shapes, a leaf shape (Figure 2) that would serve like a modern day broad head and a bullet shape. The second material, wood, was found in three different shapes, a flared shape that would serve well as a stunning arrow, a bullet shape and a blunt shape (Figure 3) (McLeod 1970).

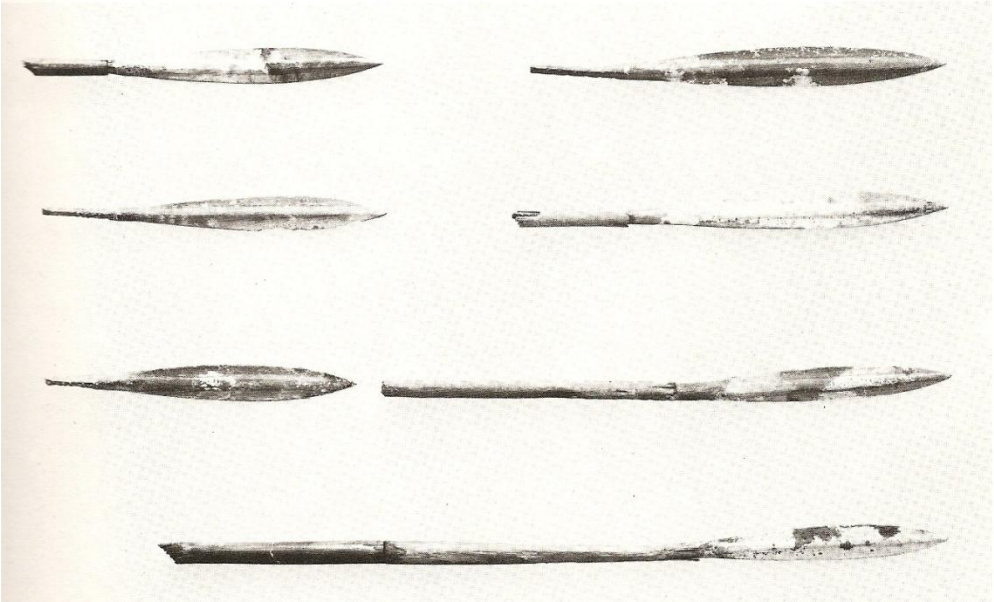

Figure 2. Bronze leaf shaped arrow heads from the tomb of Tutankhamun. (Adapted from McLeod 1982:Plate V)

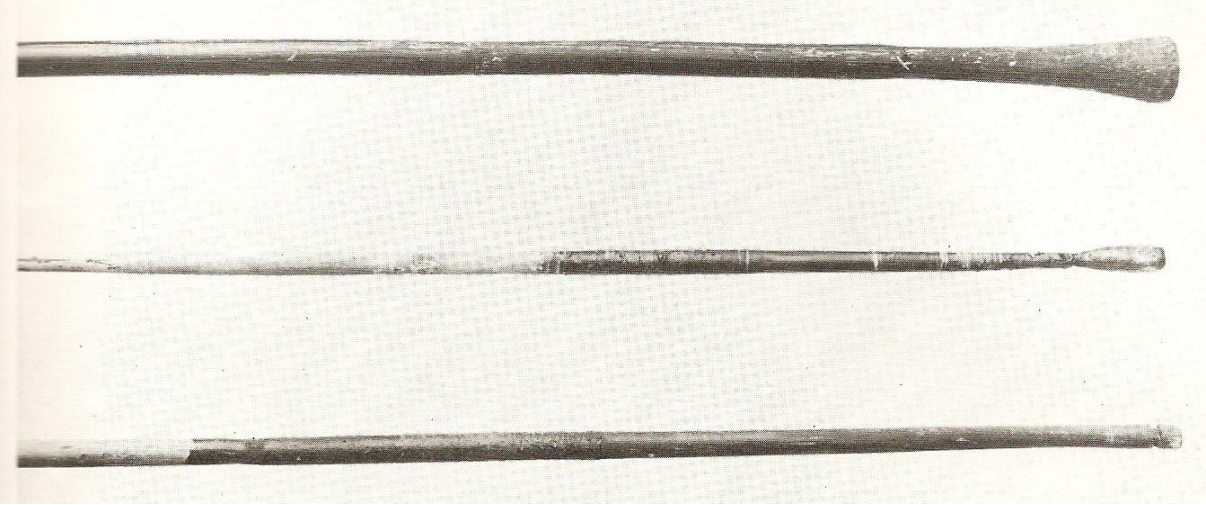

Figure 3. Wooden arrow heads from the tomb of Tutankhamun. (Adapted from McLeod 1982:Plate V)

Stories

This study focuses on stories in which the pharaoh boasts of shooting through a piece of copper. The Armant Stela outlines one story of the pharaoh Thutmose III; it says that he shot through a piece of hammered copper three finger widths thick as demonstrated in this passage from the stela.

> When he shoots at a copper target, all wood is splintered like a papyrus reed. His Majesty offered an example thereof in the temple of Amun, with a target of hammered copper of three digits in thickness; when he had shot his arrow there, he caused protrusion of three palms behind it, so as to cause the followers to pray for the proficiency of his arms in valour and strength. I am telling you what he did, without deception and without lie, in front of his entire army, and there is no word of exaggeration therein (Nederhof 2009).

This is one example of a story that could have been true but could also be an exaggeration to reinforce Thutmose's power and his leadership position to the armies under his command. Thutmose III came to power during the eighteenth dynasty of the new kingdom after ruling as a co-regent with his father's wife Hatshepsut. He spent most of his reign campaigning in Syria as well as sending expeditions to Nubia (British Museum). Due to the militaristic style of his reign this story could be an example of him reinforcing his position as military leader.

This story also describes many of the details needed in order to recreate the situation and test whether or not the story is true. It says that he shot at hammered copper telling us that it was not just a solid block of copper fresh from the ground. It also says that "all wood is splintered like a papyrus reed" (Nederhof 2009). Telling us that he used a wooden arrow as opposed to a reed arrow. Also it says that the target was three digits in thickness telling us that it would be roughly 7.62 centimeters in thickness, when using my own fingers or digits as the scale. Another story that exemplifies a pharaoh's military prowess is from the Great Sphinx Stela of Amenhotep II at Giza as demonstrated by the following quote

> Entering his northern garden, he found erected for him four targets of Asiatic copper, of one palm in thickness, with a distance of twenty cubits between one post and the next. Then his majesty appeared on the chariot like Mont in his might. He drew his bow while holding four arrows together in his fist. Thus he rode northward shooting at them, like Mont in his panoply, each arrow coming out at the back of its target while he attacked the next post. It was a deed never yet done, never yet heard reported: shooting an arrow at a target of copper, so that it came out of it and dropped to the ground (Lichtheim 1976).

Amenhotep II was also an eighteenth dynasty ruling in the New Kingdom and ruled after Thutmose III (Brewer and Teeter 2007).

This story tells us less details about the type of copper and type of arrows used however, it does tell us that the copper target was thicker and that the arrow not only penetrated the entire target but went all the through the target to land on the ground on the other side of the target.

METHODOLOGY

In order to tests these myths I have determined modern day equivalent bows based on the analysis of the bows found in Tutankhamun's tomb. Based on the lengths of the bows, focusing mainly on the composite bows, found in the tomb and comparing them to a modern day recurve of similar length and curvature I have determined that the weight of the bows at full draw could not have been more than forty-five to fifty pounds without snapping the limbs of the bow (Figure 4).

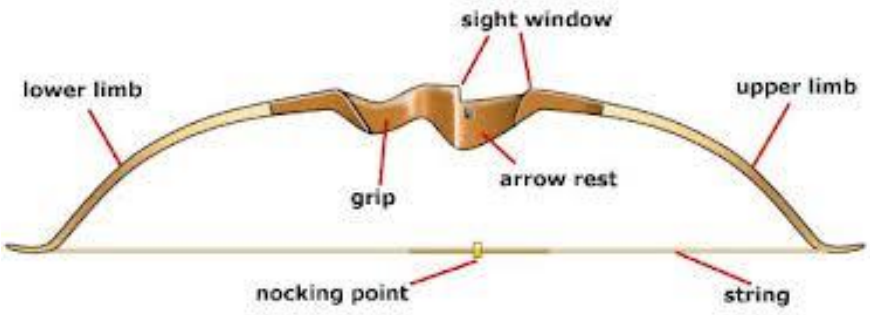

Figure 4. Bow Morphology and Terminology. (Hunter Education 2002)

Based on this conclusion I then took a modern day recurve that had a weight of forty-five pounds at full draw and shot it through a chronograph, a machine that works similar to a speed gun, to determine the feet per second the arrow would travel when fired. With a wooden arrow made of ash at 699 grains shot through the modern day recurve bow the arrow would travel on average 120 feet per second. I then took a compound bow, a Hoyt Avenger, with a weight of forty-five pounds and shot it through the chronograph as well. The same wooden arrow shot through the compound bow would travel on average 184 feet per second and an aluminum arrow at 460 grains shot through the compound bow averaged the same. Based on the difference in velocity

between the two different types of bows I decided to conduct my experiment with both bows to see how much of a difference the change in velocity would make when penetrating the copper target.

The arrows and arrowheads in Tutankhamun's tomb were also analyzed. To the inexperienced archer arrows seem to be a fairly inconsequential detail however they are very important; if the shaft of the arrow and the arrowhead are softer than the material that is shot at they could shatter on impact and not pierce the object. Based my analysis of the arrows both wooden and aluminum arrows were used. The reed arrows found in the tomb were hollow and because of this would have been more likely to shatter on impact and less likely to carry the amount of force needed to pierce the copper unless they have an insert to make them stronger however; no insert was mentioned in the descriptions by McLeod (1970, 1982). The wooden arrows used in the experiment were made of ash and had a steel broadhead attached to them. The steel broadhead (Figure 5) is a good match in terms of strength for the bronze arrowheads found within Tutankhamun's tomb. The aluminum arrows having stronger shafts and stainless steel Muzzy broadheads attached to them (Figure 6) were used to determine if the stronger materials used today with today's bow technology would make a difference in penetrating the copper target.

In order to create the copper targets I obtained twenty-four gauge copper plating and cut it into six inch by six inch squares. I then drilled a hole in opposite corners of the copper in order to be able to attach it to a target. Then I hammered the copper giving it ripples like the hammered copper mentioned in the stories would have had. I did this because the ripples in the copper could affect how the arrow hit the target and could potentially cause the arrow to ricochet off of the

target leaving little or no penetration. In order to achieve the proper thickness I then strung together twelve of the copper plates to make it roughly three finger widths thick (Figure 7).

Figure 5. Steel broadheads.

Figure 6. Stainless steel Muzzy broadheads.

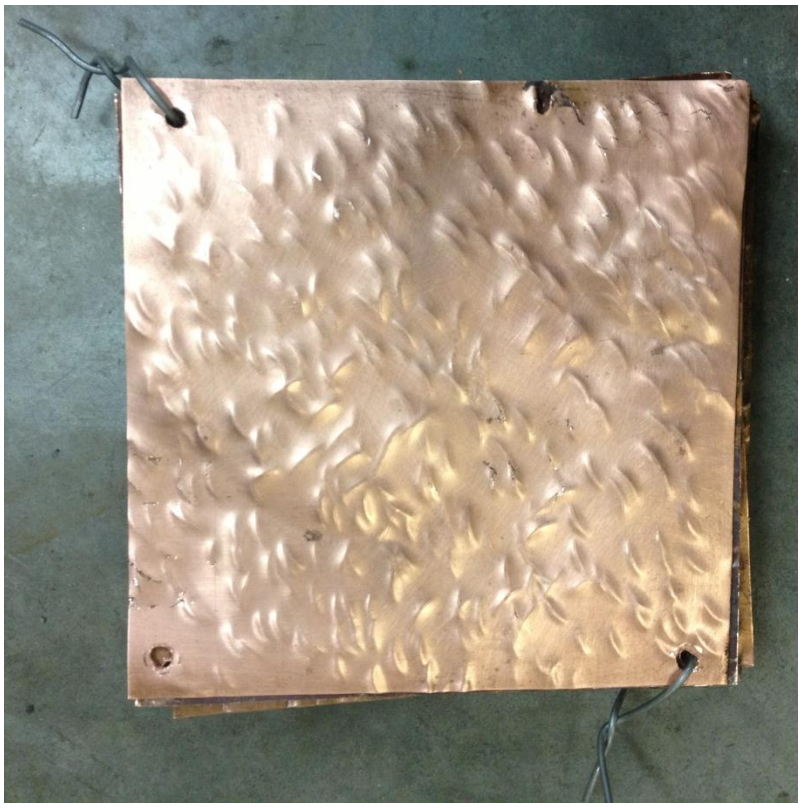

Figure 7. Finished copper target.

I chose to use the lesser thickness mentioned in the first story above because I was skeptical of the arrow penetrating the target. However, I did make additional copper plates to add to the target if the arrow did penetrate the entire target. By having plates strung together I was able to more accurately measure how far the arrow penetrated the copper target. I then attached the copper target to an archery block target (Figure 8) and shot the target at a distance of 3.8 meters with both the wooden arrows through the recurve bow as well as the aluminum arrows through the compound. Having over seventeen years of experience with archery all of the tests were performed by myself with the assistance of Randy Loew who has over forty years of experience with archery himself.

Figure 8. Target.

RESULTS OF THE EXPERIMENTS

The results of the 12 trials are presented in Table 1. The first three attempts at penetrating the copper target were done with arrows made of ash with steel broadheads shot through the modern day recurve bow. The first attempt with Arrow 1 that weighed 637 grains penetrated seven of the twelve copper plates denting the eighth plate but not going through the eighth plate. The second attempt with Arrow 2 weighing 699 grains hit on the bottom edge of the target and as a result only penetrated two of the copper plates while denting but not going through the third plate. The third attempt also done with Arrow 2 hit with better position on the target and penetrated six of the twelve plates while denting but not going through the seventh plate.

The next two attempts were done using aluminum arrows with stainless steel Muzzy broadheads shot through a modern compound bow. The fourth attempt using Arrow 3 weighing 460 grains penetrated ten of the copper plates while denting but not going through the eleventh plate. The fifth attempt using Arrow 4 also weighing 460 grains hit in the center of the target and at first seemed like it would have better penetration than the fourth attempt however, it only penetrated nine plates while denting but not going through the tenth plate (Figure 9).

I was then curious to see if shooting a wooden arrow through the modern compound would achieve different penetration than the aluminum arrow and for the sixth attempt I shot Arrow 2 through the compound penetrating nine of the copper plates while denting but not going through the tenth plate, achieving the same results as the aluminum arrow through the compound bow (Figure 10).

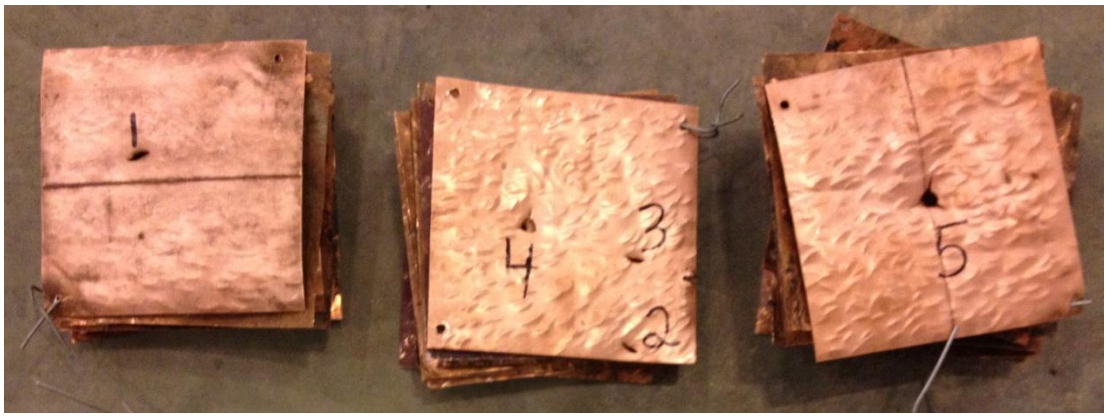

Figure 9. First five attempts.

Figure 10. Attempt number six.

For the next six attempts I used both wooden and aluminum arrows that had bullet shaped tips to them to see if I could achieve better penetration (Figures 11 and 12). Arrow 5 was made of cedar and weighed 490 grains and arrows six and seven were aluminum and weighed 460 grains.

For attempts seven and eight I used Arrow 5 and shot it through the modern day recurve. Attempt number seven penetrated five of the copper plates while denting but not going through the sixth plate. Attempt number eight achieved the same results. For Attempts nine and ten Arrow 5 was also used but shot through the compound bow. Attempt nine penetrated six of the

copper plates while denting but not going through the seventh plate and Attempt ten penetrated seven plates while denting but not going through the eighth plate.

For Attempt eleven the aluminum Arrow 6 was used and shot through the compound bow penetrating seven plates while denting but not going through the eighth plate. Attempt twelve with aluminum Arrow 7 shot through the compound bow achieved the same results as attempt number eleven (Figure 13).

Figure 11. Tip of wooden arrow.

Figure 12. Tips of aluminum arrows.

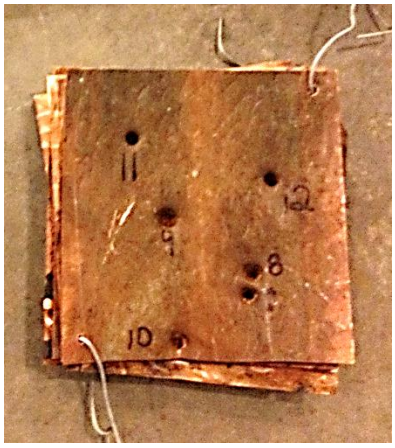

Figure 13. Shots seven through twelve.

When shooting both the wooden arrows with broadheads and the wooden arrow with the bullet shaped tip through the compound bow there was no difference in penetration between the wooden and aluminum arrows. However, there was greater penetration with the broadheads with both the recurve bow and the compound bow compared to the penetration with the bullet shaped tips (Table 1). Based on the difference in penetration between the two types of arrowheads I suggest that the pharaoh would have been using broadheads when shooting at his copper targets even though it is not specified in either myth.

Table 1. Results of attempts to penetrate the target.

Shot Number	Arrow Number	Shaft Type	Type ofArrowhead	Type of Bow	Number of Copper Plates Penetrated
1	Arrow 1	Ash	Steel Broadhead	Recurve	7
2	Arrow 2	Ash	Steel Broadhead	Recurve	2
3	Arrow 2	Ash	Steel Broadhead	Recurve	6
4	Arrow 3	Aluminum	Stainless Steel Muzzy Broadhead	Compound	10
5	Arrow 4	Aluminum	Stainless Steel Muzzy Broadhead	Compound	9
6	Arrow 2	Ash	Steel Broadhead	Compound	9
7	Arrow 5	Cedar	Steel Bullet-shaped Arrowhead	Recurve	5
8	Arrow 5	Cedar	Steel Bullet-shaped Arrowhead	Recurve	5
9	Arrow 5	Cedar	Steel Bullet-shaped Arrowhead	Compound	6
10	Arrow 5	Cedar	Steel Bullet-shaped Arrowhead	Compound	7
11	Arrow 6	Aluminum	Stainless Steel Bullet-shaped Arrowhead	Compound	7
12	Arrow 7	Aluminum	Stainless Steel Bullet-shaped Arrowhead	Compound	7

There was also greater penetration with the compound bow than there was with the recurve bow. This suggests that the difference in velocity made a difference in penetration although not an incredibly huge difference because the compound bow penetrated only two to three more copper plates than the recurve bow. Because none of the arrows penetrated all the way through the target it was not necessary to increase the thickness in the target in order to satisfy the second story with the greater thickness of copper. Also because none of the arrows penetrated all the way through the target it is highly unlikely that the arrow would have passed completely through the target of copper dropping out the other side. None of the wooden arrows used in the experimentation shattered on impact or showed any sign of damage from hitting the copper target making it unlikely that their arrow would have shattered unless it hit the target at a precarious angle making the possibility of penetration even less likely.

CONCLUSION

For the recreation of these stories where the pharaoh states that he shot through targets of copper three finger widths think or greater I used modern day equivalents of the technology that they would have had during the eighteenth dynasty of the New Kingdom in Egypt based on the bows that were found within the tomb of Tutankhamun. The arrows that I used were a mix of ash, cedar, and aluminum and the bows that were used were a modern day recurve and a Hoyt Avenger compound bow. The recurve bow was used due to its similarity to the composite bow within Tutankhamun's tomb. For this experiment the self-bows within the tomb were not fully analyzed due to the lack of availability of a modern day equivalent. Both broadheads and bullet shaped arrowheads were used in order to gain a better understanding of which arrowheads the pharaoh would have been using when shooting the copper, which was not specified within the stories themselves.

Multiple copper targets were made by hammering and stringing together six by six inch plates of twenty-four gauge copper. These targets were then shot using a combination of the wooden arrows, aluminum arrows, broadheads, bullet shaped arrowheads, the recurve bow, and the compound bow.

The broadheads achieved greater penetration than the bullet shaped arrowheads making it more likely that the pharaoh would have been using broadheads when shooting at the copper target. Also the compound bow achieved greater penetration than the recurve bow showing that the difference in velocity made a difference in the force and penetration of the arrow.

None of the arrows penetrated all twelve of the copper plates leading me to conclude that even if the poundage of the pharaoh's bow was slightly greater than the forty-five to fifty pounds

due to the decrease in the velocity between the recurve bow and the compound bow it would be unlikely that he would have penetrated the entire copper target with the arrow protruding or going completely through it. However, it could be possible that the pharaoh could have penetrated the entire target barely making a hole in the back of the target. If this is the case it could be that the pharaoh did actually shoot through the copper targets; however, the amount of protrusion of the arrow would have been exaggerated making him seem stronger and more skilled than he was.

It is also possible that the bows analyzed in Tutankhamun's tomb are not entirely representative of the bows that were used. Tutankhamun was a boy king and it is possible that the bows used in these stories were longer than what was analyzed giving them more poundage and velocity, increasing the likelihood that they could have penetrated the target.

Neither story specified if the pharaoh was using a composite bow or a self-bow and without testing a modern day equivalent of a self-bow or a replica of a self-bow we cannot know if there would be a difference in weight and therefore penetration between the bows. Because of this and the penetration achieved with the recurve bow as well as the compound bow I am hesitant to say that the stories are completely false. It is more likely that the pharaoh actually did shoot the copper targets and the penetration of the arrow was exaggerated in order to make the pharaoh appear stronger and more skilled to reaffirm his position as leader and stop people from questioning his authority.

Another unknown in these stories is whether or not the copper targets were solid blocks of copper or if they were copper plates that were put together to achieve the appropriate thickness. This could cause a difference in the distribution of force when the arrow hits the target leading to a difference in penetration and possibly making the details of protrusion within the

stories more likely to have happened. Also due to the impurities in the copper it is possible that the copper used was softer than what was used in my experiments increasing the possibility of being able to shoot through the entire copper target with greater protrusion.

In order to better understand these stories as well as the skills and mentality of the pharaoh it will be beneficial to continue this experiment testing the unknowns in order to glean more accurate and conclusive data.

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