

Article Title: Mesolithic adze making & reassessing the past through experimental archaeology

Author(s): Lewis Tingle

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“I found myself under the shade of a great many deciduous trees facing west with the heat of the sun at my back. It was midday during a hot summer drought and while journeying through the area I found that it happened to be a good time to take a break from other more strenuous activities in order to make the adze.”

In the spring of 2024, experimental archaeologist, craftsman, primitive skills and living history interpreter Lewis Tingle walked out of his heritage crafts workshop located in the Peak District, Derbyshire on a journey through local ancient woodlands. An unsupported enterprise with land owners consent to ignite fires and harvest organic materials, Lewis's project was focused around crafting a comprehensive tranchet adze from local materials.

Background

The emergence of the tranchet adze as a composite tool for woodworking is well known and becomes evident during the Mesolithic (for example Themes, 8000BCE Walton-on-the-Naze 4000BCE) They are distinctive for having a tranchet flake removed from across the cutting edge. This flake was removed to make a fresh, razor-sharp edge. As the edge became damaged through use, another flake was removed and a fresh cutting edge could be created.

“Tranchet” comes from the French word Slice, which refers to the last flake removed in the working process. With wooden handles for the axe, preservation only occurs in rare instances such as the Ehenside Tarn axe 1870



FIG1. Tranchet Adze technical drawing - source Cotswold Archaeology



FIG2. Tranchet Adze by Lewis Tingle



1: De barked Elm handle, 2: Danish flint adze head, 3: Oblique hand axe, 4: local chert stone hand saw, 5: Flint saw, 6: Antler pressure flaker, 7: Abrasion stone, 8: Small hammer stone, 9: Pitch stick, 10: Chert scraper, 11: Flint hand axe

which was in fact purposed for a stone axe not an adze despite the key difference between a socketed axe and adze, the interpretation of an adze handle comes from careful observations of Ethnographic Comparisons, (Pacific Northwest Coast carvers) or Rare Organic Preservation(La Draga 2008). Unlike the polished axes of the neolithic era, a tranchet adze does require a binding material for functionality and, while archaeological evidence for binding and glue does not exist this article will include the use of materials which were available at the location where the experiment was carried out. The evolution of prehistoric technology in this case the composite adze is arguably not a static technological period and is instead marked by gradual change in terms of hand-axes becoming more refined through increasingly intensified knapping techniques and the use of soft organic hammers (antler) to remove thin invasive flakes (Beyene, et al., 2013: McNabb and Cole, 2015). The materials involved in this project have climactic significance and point to the granular warming period during the early mesolithic (10,000BCE) in climatic terms relatively recent in the Holocene, pollen evidence points to a climate not dissimilar to what it is today in Scandinavia (Seppä and Birks, 2001).My approach to the experiment is two fold - Trial and error and instinctive intuition which are two aspects of outdoor enterprise that people living in Britain 8000 years ago would have encountered daily.

Archaeologists are commonly left with only the tools with which to construct the behavioural complexity of the past (e.g. Torrence, 1989). An emerging aspect of experimental archaeology is immersion. Immersion becomes an apparent method of observing how people form individual relationships with fauna and flora. Although the results of any experiential archaeology can be criticised it provides us with a cornerstone in understanding about the importance of kinship in a world where the landscape was of the greatest significance.



FIG4. Lewis in prehistoric gear photo by Lewis Tingle

With the above facts in mind, the primary goal of this project was to build a tranchet adze with locally sourced materials and Mesolithic tools and methods at the site in Derbyshire, thus exploring how this could have been achieved there around 8000 years ago.

Introduction

Situated within the limestone hills of what is today the dark peak, 10,000 years ago the valleys and dales form natural highways which were undoubtedly travelled on occasion by Hunter-Gatherer peoples. Within the Peak District there are numerous prehistoric sites located within the Derwent Valley and It is nearby dales of which hundreds of lithic artifacts including arrow heads have been recorded.



FIG5. Beginning to peel / de bark elm branch photo by Lewis Tingle

During the period, small communities migrating throughout the area may have relied on hunting mammals such as red deer to supplement their diet before reaching their seasonal destination. These would have been hunted either by trapping or using bows and arrows. Finally, due to a lack of agricultural adoption (Lahtinen and Rowley-Conwy, 2013), they likely relied on trade goods (particularly flint as there is no knappable stone in the region) and hunting more heavily than other contemporary European mesolithic communities.

It is this unromanticised acknowledgement to the context and setting in which prehistoric items are produced that is necessary to fully understand the relationships between ancient people and the native species and stone which are encountered. For everyday use as a pragmatic tool for outdoor living, woodworking and possibly self defence the flint adze can be a simple yet efficient tool when compared to its predecessor in lithic tools. Even socket axes are simpler in design involving just a lithic inserted into a wooden handle. Adzes involved the use of a plant or animal material for binding to attach the lithic to the handle. From the outset, I planned to spend a few days immersed within a quiet woodland with prehistoric items to hand and no modern gadgets save some equipment used to record the experience.



FIG6. Beginning to saw notch to remove platform photo by Lewis Tingle

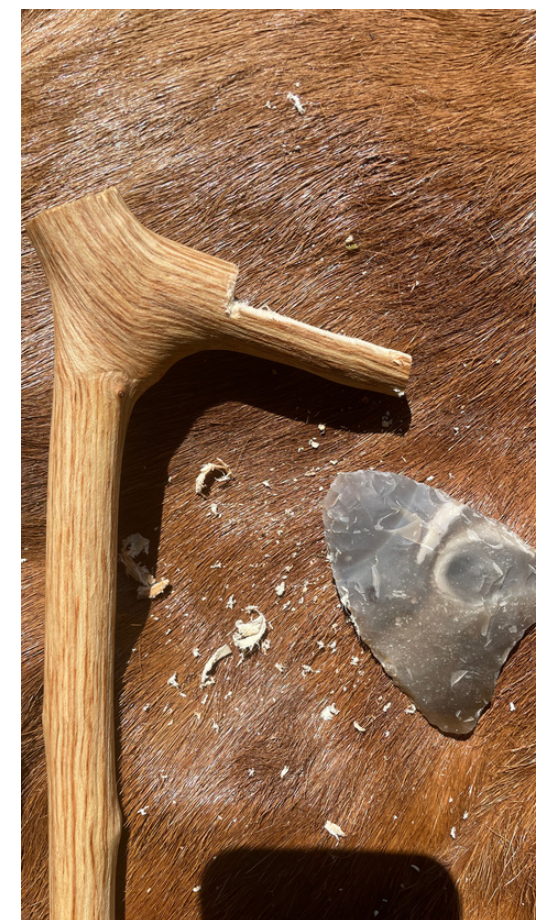


FIG6. Removal of top platform photo by Lewis Tingle

Precedents

Firstly we can address the initial question that could easily be overlooked: Why go to the lengths to produce a tranchet adze and not just use a hand held stone axe? While lithic material is prolific in the area amongst prehistoric sites such as Arbour Low (erbew law), (Harold St George Gray's Excavations 1901–1902). Tranchet axes are absent. The use of microliths and other 'everyday' lithic items are prominent as you might expect and an adze only really comes into effect when the welder and craftsperson has need of it, an example of this may be in the production of a hunting bow or dug out canoe.

At no point were modern tools used in any of the manufacturing steps referenced to in the production of the adze. Wherever possible, the same principles were strictly applied for the procurement of resources as well. With Danish Flint being a key material in the project, the flint stone peice was traded in person from flintknapper Will Lord who collected the peice himself from a beach in Denmark.



FIG7. Ignighting the fire with two types of tinder fungi; Amodau and King Alfred cake
photo by Lewis Tingle



FIG8. Flint adze knapped to shape and in place on the handle photo by Lewis Tingle

Elm, wych

(*Ulmus glabra*)

The Wych Elm (*Ulmus glabra*) is a native broad leaf tree which became a centre piece in woodlands in the British Isles around 8,000 years ago (10,000 BCE) alongside predominant woodland tree species such as Birch (*Betula pendula*) and sessile Oak (*Quercus petraea*). ("Biological Flora of the British Isles: *Ulmus glabra*" by P. A. Thomas, *Journal of Ecology*, 2018) A new influx of resilient species which would have undoubtedly have had a significant impact on people, places and culture after the Last Glacial Cycle in northern Europe. An interpretation of the ethno-ecological impact of broad leaf species during the mid Mesolithic

can be seen in the Derwent Valley (Valley of Oaks) watershed which stretches 18 miles adjacent to acknowledged paleo sites such as Creswell Crags on the Nottinghamshire, Derbyshire border.

Wych Elm wood is strong and durable with a tight, twisted grain, and is resistant to water. Wych elm is easier to work for carpentry than common elm as it will split. Elm bast (inner bark fibers) is a suitable material for cordage when harvested in early summertime. While archaeological evidence for Elm bast being used during the mesolithic is scarce,

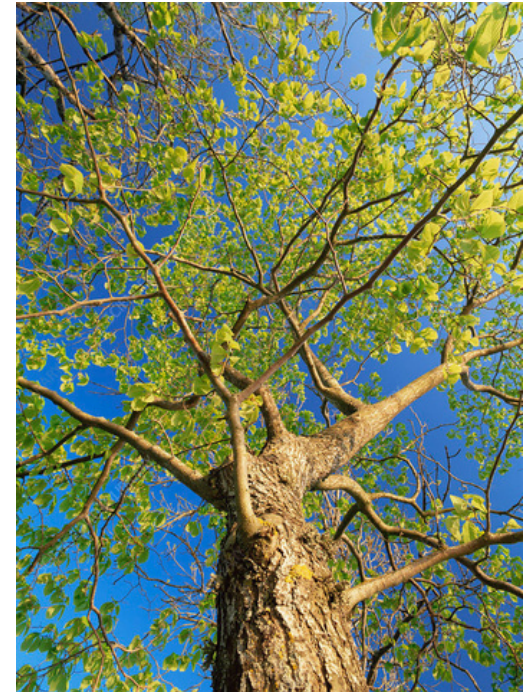


FIG9. Wych Elm Photo by Lewis Tingle



FIG10. Melting pine tar glue in a shell photo by Lewis Tingle

as like many material items of everyday importance we can assume that there are many natural resources that would likely have been utilised. It is through experimental techniques described in this article and a personal appreciation for the complexity of mesolithic culture which is essential to bridge the gap in our overall understanding of the subject in question.

FIG11. Elm bast pre retting phase photo by Lewis Tingle



Methodology

Surveying Raw Materials

Rich soil and dense deciduous woodlands make up a fraction of the wider landscape today, yet at the time of Star Carr the Derwent Valley may well have been an important stop off point for mesolithic hunter-gather people during seasonal migration. The predominantly Oak woodland provided an amenable supply of other species such as birch, Lime and Elm. Due to the open grazing meadows surrounding the area the location is home to a plentiful population of Red Deer, Roe deer, and occasionally mountain hare.

During immersion, I would attempt to construct a composite tranchet adze using a mesolithic tool kit which I was carrying with me. The process involves a series of steps which the maker must account for prior to beginning the process, notably the Elm bast must be fully retted in order for the material to be sufficient for use however as the experience was conducted as part of a A to B journey through the area the full time to ret the Elm bast was shortened in order to complete the process. At no point during the process were modern tools used for the production of the adze, cordage, glue or wooden handle.

As the experiment was conducted as part of a larger immersion experience, I utilised my knowledge of the local area to forage wild edibles to supplement my calorie intake. Wild foods which were seasonally available to forage along with mesolithic accurate foods such as venison pemmican and Hawthorn fruit leather.

Materials and Tools

For the adze handle / shaft, Wych Elm ((*Ulmus glabra*) was chosen and the binding material was of the Elm branch bark or bast. The glue was made from a four part ununified combination which was gradually heated, then mixed in a oyster shell as it was exposed to heat from an open fire. The mixture contained charred wood from a previous fire, pure pine resin, dry punk wood powder and locally sourced commercial beeswax. Interestingly, there are two totally wild beehives inside two separate Oak trees located nearby where the experiment was carried out. Danish flint was used for the tranchet adze head which was worked to a rough shape with 95% of the cortex removed prior to the experiment beginning. Fine sand and leather was used to sand the wooden shaft during the experiment.

A replica mesolithic tool kit consisted of five linear blades from a blade core, and a hand axe.



FIG12. Adze head temporarily glued in place photo by Lewis Tingle

All materials used during the process were sourced within walking distance of the river Derwent. The materials involved entirely dictated the outcome of the project and it is reasonable to suggest that if there were people traveling through the area during the Mesolithic, one might expect that the very same spot may have been used as a temporary camp over 8000 years ago.

Making the Adze

I lay out a collection of simple stone tools (five linear blades), a large flake which I would use to knap into the tranchet adze and a flint knappers kit, consisting of a piece of buckskin for a protective garment, two antler pressure flakers of different sizes, a hammer stone, an abrasion stone and a few pieces of fresh Yarrow (*Achillea millefolium*) in case of any cuts during the knapping process. I set about preparing a fire as further down the line the use of hot embers would become an essential tool for heating pine pitch. The tools I started the experiment with were a small collection of items that I would consider everyday use for a Hunter-Gatherer in the mesolithic, along with a small clay pinch pot containing 50 grams of pine pitch, an unequal mixture of pine resin, fine ground charcoal, powdered punk wood and a 2 grams of beeswax.



FIG13. Composite Tranchet Adze with Elm bast binding photo by Lewis Tingle

I laid out the collection of lithic tools in front of me and observed the core stone. The outer cortex had been previously removed from the piece of Danish flint. It is likely that any flint artifacts which found their way to the north of Britain had been worked at their source or possibly even traded for material value. The core stone's dorsal end provided a good platform to begin the knapping process for which the first hammer stroke fell onto the flint. The pleasant smell of woodsmoke provided an aroma of security. I spotted a mature Elm tree about 10m away from me.

An adze has a specific elbow shape as seen in the FIG 13. a 90 degree angle on the blade haft makes for an excellent axe handle and yet for an adze, an angle obtuse to 90 degrees is preferable and it may be noted that on this occasion the small branch was cut using a hand axe before being stripped of its bark which was immediately taken to a nearby stream, coiled and left under a stone to begin the retting process.

With the Elm bark suitable for cordage which I could finish producing later, I turned my attention to carving the Elm handle and socket for a flint tip. Using a selection of flint and local chert stone tools, notably a simple hand saw and ovate blade. As I had already some practice with the tools, I found no cause to re-fake any of the tools during the carving process but did find that continuous



FIG14. Piece of sandstone used for smoothing handle
photo by Lewis Tingle

carving was better done with a leather pad between the hand and the cutting tool. After sawing a 90 degree notch I used a flint blade and a wooden mallet to split the green wood down to the notch, with minimal need to tidy up the platform where the flint blade would sit.

In an everyday flint knappers tool kit, it is logical to assume that whenever possible an individual might carry a few ideal flakes to purposes such as this. In this instance, I had a previously worked flake which I used an antler tip and a small hammer stone to knock into shape. This By facial (flaked on two sides) adze tip is made from a noticeably darker Danish beech flintstone which, on closer inspection had few inclusions and on this occasion I left a very small chunk of cortex on what would become the underside of the piece for the simple reason of functionality over artistic elegance. As an experienced knapper, the decision to leave a piece of cortex was because of the risk of unwanted fracture of the item.

By now, the small fire had burned down to embers, such was my need for the purpose of melting a 50 g shell container of pre-mixed pine resin.(Aveling, E. M. & Heron, C. 1998. Identification of birch bark tar at the Mesolithic site of Star Carr), tar was applied the with a piece of wood chipping which proved an efficient method of applying the resin as to avoid wasting any of the material as it was transferred to the adze. First I dipped the bottom of the flint into the mixture

Then with a delicate hand, the pitch could be applied onto the shaft before heating the two pieces over the embers for a final adjustment.

Beyond the Adze

As an acknowledged thermo plastic, the pine pitch mixture sets hard when cool and although the consistency of the material will affect the time taken to fully set, It is best to heat the items again once the items have had glue applied before pressing the two pieces together with considerable force for as long as it takes for the resin to harden. Notably, as the two pieces stuck the crafter can pitch the glue to cover the sides of the flint in place. This leaves the unique and individual maker's mark in the form of a finger or thumb print on the glue. Something which has never been accredited to in the archaeological record due to lack of preservation and yet for the craftsman, such a feature on any object can be observed as a thing of abstract beauty, unchanged in its original appearance. While archaeological records provides adequate data to assist research in the field, small details such as the 'makers mark' left by the maker's imprint on the pine (or birch) tar, are a clue to the cultural significance of the items as more than practical objects.

Elm for binding

After a short break to rest and cook a Reedmace root over the last embers, the Elm bast was recovered from within the stream. In some instances the outer layer of bark may be left on the material however for its functionality, the outer bark had been peeled by hand before being submerged in the water. This action of submerging the item into a water source no less a stream which I felt a personal connection to after traveling up and down its banks over the last few years had a profound impact on my experience. The act of submerging an item into water is clearly a cultural ritual of significance. During the Mesolithic, water culture practice refers to the deep reliance of Middle Stone Age hunter-gatherer societies (c. 12,000–6,000 BCE) in wetland environments. Because of post-glacial sea-level rises and peat preservation, unique underwater and waterlogged sites provide rare, perishable artifacts that shed light on these ancient maritime and riverine communities (Conneller, C. J. 2005. Moving beyond sites.)

Once removed from the water after the partially retted Elm bast was wrapped at the top of the adze, with downwards tension applied to the cordage as it was laid over the lithic material to secure the piece in a fixed state. Once fully wrapped with sufficient pressure around both the flint and the handle a further 50 g of pure pine sap resin was applied with a small shaving of wood in a thin layer over the elm bast which would later prove an effective way to ensure that the piece reframed from damage and was an effective measure in water resistance as like raw hide the elm bast has a tendency to rot and stretch once re wetted.

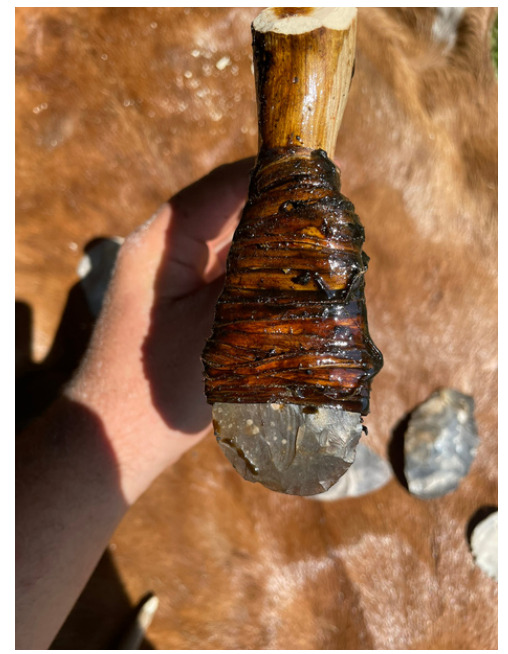


FIG15. A thin layer of pure pine resin is heated before applied to the elm bast binding photo by Lewis Tingle

Finishing the Adze

A scattering of organic debris lay around the temporary camp, debitage from the flint knapping process had been collected into a small pouch for conservation purposes as the site was part of ancient woodland although not SSSI. (site of special scientific interest) The fire was extinguished with water from the nearby stream, a few damp charred organic pisces were scattered and the pit was re laid with foliage in order to leave minimal impact on the site. The first attempt to use the adze came later that day when the adze was put to use against a hazel branch which would be intended for a bow stave. The Hazel branch measured 18cm in diameter and took over forty strikes at its base before it was susceptible to breaking through a pushing motion.



FIG16. Finished Adze measuring a length of 31cm photo by Lewis Tingle



One cm wide and no more than one cm deep, which could easily be polished out with a sand stone.

The pine resin which had been applied to the exterior of the Elm bast binding showed a little sign of crumbling in some places due to its brittle consistency however such a readily available resource could easily be re applied. Overall the adze worked remarkably well as a complete piece, with all parts of the making process relatively straight forward.



Conclusion

Irrefutably, a functional Tranchet adze could be produced and put to use with the occasional need to repair aspects of the item as and when wear from use becomes necessary. From within the Derwent watershed the adze can be manufactured providing that the crafts person has previously acquired through trade or personal retention a suitable stone although a lesser desirable river stone can be used in place of high quality flint. This is possible to do using only mesolithic tools and techniques; While this experiment was exclusively from the following locally sourced materials: an elm branch, elm bast cordage, and pine tar adhesive.

A reasonably experienced crafts person with adequate experience with prehistoric techniques could produce a functional comprehensive tranchet adze along with the fundamental tools needed, under these conditions in around four hours (See Table 1). A mesolithic Hunter-Gatherer could have doubtlessly produced a higher quality, possibly decorative working tool faster.

Task	Hours	
Tool Production	Total:	6h
Liniar Flint Blades - knapping	1h	
Pine Tar Adhesive - finding materials, grinding, melting	3h	
Antler Tip for Pressure Flaking - Sawing & sanding	2h	
Tranchet Adze (blade)	Total:	2h
Finding stone	n/a	
Working stone into rough shape from core stone	1h	
Knapping into final tranchet shape	1h	
Handle Production	Total:	12.5h
Harvesting suitable branch - Navigation in woodland, harvest & movement	3h	
Initial Processing – debarking, debranching & knot shaving	1h	
Elm bast production - ret fibers	4h	
Roughing out shape and hew elbow branch – rough tapering using linear blades and hand axe	1h	
Shape handle for use - scraping and sanding with flint blades and sandstone	1h	
Pine pitch glue application - Heating pre produced mixture and application to handle and adze head	15 min	
Secure adze head onto handle - Binding with partially retted elm bast	15min	
Apply pure resin finish - Source pine resin, heat and Allow to dry and fibers tighten	2h	

Estimated Production time: 22h

A simple yet pragmatic tool for mesolithic life; while the importance of prehistoric working tools can be dwarfed in their presence in prehistory by the megaliths and henges that appear in the neolithic or by the natural phenomena which draw attention to climate change and contemporary issues of today. The manufacture of a tranchet adze in the Derbyshire (Derwent Valley) woodlands provides the maker / interpreter with a unique experience through immersion of ethno-ecological relationships which, however biased we can further claim to appreciate prehistoric crafts, seasonal rhythms which human beings can be physically as well as mindfully associated with.

Despite modern processing methods, the maker found that lithic tools, textiles and general gear were all together transferable and not to much surprise, the experience evoked a sense of place for the maker as his movements during the making process felt intentional, with a clear vision uninterrupted by modern distractions.

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