Flint Tools through the Ages, and the Art of Flintknapping

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1 Flint and Flintknapping

Flint (SiO2 - Silicon Dioxide) is a bio-sedimentary material that was formed in the ocean millions of years ago. It is almost pure silica, containing less than 5% impurity in the form of Calcium Carbonate and other trace elements, such as sodium and potassium which are found in different proportions from different sites, thus allowing analysis to determine the source of flint tools. Its very fine crystalline grain gives flint a glassy character that when struck, fractures conchoidally, which makes it perfect for knapping. Other materials that contain a very high quantity of silica can also be knapped such as obsidian, glass, chert, baked porcelain and even fossilised wood!

Fossil sea urchin sealed within a nodule of Norfolk flint with many of its spine bases still attached. Such preservation is very rare.

Scientists are still not totally sure how it was formed, but we can tell due to the faults in the flint and patterns that appear when flint is broken that the remains of sea creatures play a large role in the formation of flint. It is likely that when an organism dies it sinks to the sea bed and begins to decay. It is at this point the high levels of silicon particles in the sea at that time would have stuck to the decaying remains, eventually sealing it in a cocoon of silicon. This nodule of soft silicon expanded and hardened, eventually forming layers of flint that we see today at the beach in chalk cliffs such as those at Dover. The layers of flint represent what once would have probably been a soft mass of silica, compressed into thinner bands. The concentric layers of chalk and flint are likely to show environmental cycles between shallow lagoons and slightly deeper water that determined formation of chalk or flint.

Puzzling giant flint formations known as Paramoudra and flint circles are found around Europe but especially in Norfolk. They are popular garden features but remain mysteries to geological understanding.

2 People of the Stone Tools

Hominins

The oldest stone tools currently pre-date genus Homo, they were found in Kenya (Lake Turkana) and date to 3.3 million years ago. This discovery pushed back the date for the earliest stone tools by 700,000 years! Meanwhile in Britain, the oldest evidence of hominins and stone tools currently dates to around 850,000 years ago. These come for the eroding cliffs at Happisburgh (Norfolk). This is currently the start of the Lower Palaeolithic (Old Stone Age) in Britain) and lasts until 350,000 years ago. Within the Lower Palaeolithic hominins such as *Homo heidelbergensis* would have moved in and out of Britain in between cold seasons. Their toolkit would have typically included the handaxe which comes in a variety of shapes and sizes. As well as this would have been basic flake-based tools such as scrapers and notches.

A large ovate handaxe such as this require a great deal of skill and experience to make, but not too much time. From scratch this handaxe took only 50 minutes to make. Such tools made ideal butchery implements as shown by experimental archaeology.

These early groups would have scavenged and hunted using basic equipment such as fire hardened spears. Their prey included most large mammals including Woolly Rhinoceros and Giant Elk which would have stayed relatively close to river systems for water. This is why most Lower Palaeolithic sites are found as part of ancient river deposits.

By 350,000 years ago, **Neanderthals** were operating in Britain. They were skilled hunters who used composite technology to give them a better advantage over prey. They were able to bind and glue stone tips to spears using plant fibre or animal skin for cordage and birch bark tar for glue. Neanderthals are well-known for utilizing caves and rock shelters for dwelling spaces. Like their ancestors in the Lower Palaeolithic, they hunted large mammals and butchered them where they fell. Neanderthals used a wider variety of tools including the handaxe towards the end of the Middle Palaeolithic. They are well known for producing implements using a technique called 'Levallois'. This process involves preparing a core and detaching a single flake of a predetermined form. Neanderthals started to disappear around 40,000 years ago and disappeared completely by 30,000 years ago.

They were succeeded by **anatomically modern humans** (us!). However there was a period of several thousand years in which Neanderthals and modern Humans overlapped in time. It is not known if there would have been any kind of interaction between the two but it is considered very likely. With only modern humans (*Homo sapiens)* left, the Middle Palaeolithic ended. The final part of the Old Stone Age was the Upper Palaeolithic, 40,000 – 12,000 years ago. At this time humans would have been highly active and moved between seasonal bases. They would have followed herd animals such as deer, horses, reindeer and bison. This period is most well-known for cave art which not only appeared on cave walls but also as statuettes and stylised hunting equipment. In Britain, there is rock art in the caves of Creswell Crags which is located in a limestone gorge (Notts).

Like Neanderthals before, anatomically modern humans used caves for shelter; it was only at the end of the Upper Palaeolithic in Britain that people started to use free standing shelters. Even then, caves were still used. Groups would have had a wide area they covered seasonally to collect resources and avoid the cold during the winter. From Wales, the 'Red Lady of Paviland' is actually the burial of a young man from the earlier part of the Upper Palaeolithic; he was buried with ivory ornamentation and covered in red ochre. Red ochre is a natural iron pigment used to paint the frescos at Lascaux and many other cave art sites.

These spear points require several stages of careful flaking to thin them down enough to be used for spears. They are especially well known in France and Spain where they were produced during the Solutrean, unfortunately this culture has not yet been found in Britain.

Mesolithic

The Upper Palaeolithic ended with the retreat of the last glacial maximum around 2,000 years ago, it was followed by the Mesolithic or Middle Stone Age, which continued until around 8000 years ago. People still lived nomadically but returned to seasonal camps between the summer and winter. Generally summer camps were inland so hunters could track large mammals while winter camps were near the sea for the food security the sea offered. Dwellings are thought to

be tent-like structures made of wood in tepee or bender shelter arrangements, then covered in animal skins and/or bark panels. These light shelters were quick to erect and light to transport making them ideal for seasonal movement. In Mesolithic Britain, people focussed their hunting on deer as there were large numbers at this time. Britain was also attached to the mainland via a land mass known as “Doggerland”. Britain was connected to the continent several times during prehistory which allowed new groups access and cut off others when the connection was drowned by the sea. The Mesolithic was the last time Britain would be connected to the continent.

The Star Carr headdresses are certainly one of the great mysteries from British prehistory. There have been a number of theories as to the exact purpose of these unusual objects.

The bow and arrow appeared during the Mesolithic although no actual bows or arrows (except the arrowheads) have been found in Britain. Full sets of bows and arrows have been found in waterlogged conditions in Denmark dating to the Mesolithic. Laminar blade technology was a process used in the Upper Palaeolithic to produce many long blades by single strikes from one core. This was continued into the Mesolithic although flintknappers generally fully exhausted the cores before discarding them. Some of the blades produced were retouched into tiny microliths which could be set into arrow shafts or harpoons for fishing. The first type of tree felling axe was also produced, known as the “tranchet” axe. This was a simple, flaked axe with a flake removed from the blade which made it very sharp, although slightly fragile. These were almost certainly used in the acquisition of timber and for land clearance to aid hunting. Over 100 were found at Broom Hill (Hants), which are suspected to be part of large scale woodworking or land management. Star Carr, in the Vale of Pickering (Yorks), is probably Britain’s most well-known sites. Here, archaeologists found a wooden platform and evidence of domestic activity. The most intriguing finds were over 20 sets of red deer antler frontlets. They all had two holes drilled into the skull caps, it has been assumed for many decades that these are headdresses for ritual or hunting disguise.

Neolithic

The Mesolithic was followed by the Neolithic or New Stone Age around 7000 years ago. It was in this period that pottery, agriculture, polished tools and monument-building appeared. The overlap period in between saw a gentle transition from semi-sedentary hunter- gatherer groups or more static settlements. Within the Neolithic material culture, there is clear evidence of craft specialisation not seen consistently before. The stone tools in the Neolithic became specialised although there were a number of tools that continued from earlier periods such as scrapers and piercers. Stylised arrowheads in the Neolithic started with the leaf arrowhead, then chisel, oblique and finally barbed and tanged into the early Bronze Age. Polished stone axes were also a major part of Neolithic community, both as a functional tool and also as an important social marker. It was thought for many years that good quality stone (especially flint) was traded. However there is no evidence of actual economy based around flint apart from the finished tools and flint mines such as Grimes Graves (Norfolk). A more likely theory is that groups travelled to rough out nodules at a source then travelled back with their half-finished flint blocks. This is supported by environmental data from raw material source sites that show extraction was sporadic and irregular, not a constant industry.

Neolithic arrowheads with the earliest (left), the leaf arrowhead. The latest, the barbed and tanged arrowhead (middle). Finally the chisel arrowhead (right), from the middle Neolithic.

Bronze Age

Burial practice suggests society was becoming less egalitarian towards the end of the Neolithic. Individuals are placed within their tombs with grave goods that often included stone tools such as axes or dagger blades. This continued into the Bronze Age, with arrowheads in particular being placed in male graves with other archery equipment. In terms of flintwork in the Bronze Age, arrowheads and some daggers blades known as 'beaker daggers' generally hold the limelight for discussion. However there is also a strong appearance of basic core and flake assemblages with many flake-based tools. Flint is certainly used as the primary material for cutting tools in the early Bronze Age, while metal remains a high status material. It is only in the later Bronze Age that flintwork starts to really die out. At this time the quality of flaking is very poor and consists of only very crude removals from cores.

Post-Medieval

After a few thousand years of only being used for masonry, the use of flint changed with the invention of the firearm. 'Flintlock' is a general term for any hand-held firearm based on the flintlock mechanism. Introduced in the early 17th century, the flintlock rapidly replaced earlier firearm-ignition systems, such as the 'Matchlock' and 'Wheellock'. It continued to be in common use for over two centuries, replaced by percussion cap and later, cartridge-based systems in the early-to-mid 19th century.

The 'Snaphaunce' or 'Snaplock' was the early form of a flintlock, first used in southern Germany around 1570s. Flint is attached to a spring-loaded arm, and when the trigger is pulled, a cover slides off the flash pan allowing the arm to snap forward, striking the flint against a metal plate over the flash pan. Hopefully enough hot sparks are created to ignite the powder. This mechanism was much simpler and less expensive than the Wheellock.

In 1608, Marin le Bourgeoys (ca. 1550–1634) from Lisieux in Normandy was appointed to the Louvre gun shops in France. By combining improvements in prior firearm mechanisms, he created the first flintlock for King Louis XIII shortly after his accession to the throne in 1610. He replaced the separate steel and manually operated pan cover with a spring-loaded frizzen and also introduced an intermediate position between the released and full cock positions (known as the half-cock position). So the flint was held away from the frizzen, but the trigger could not release the cock, preventing it from firing and making it much safer. Marin le Bourgeoys' design was very popular and was used in various forms throughout Europe by 1630 and was the

standard in firearm use until the 1840's, when it was finally replaced by percussion lock systems.

The flint scrapes off particles of iron as it contacts the striking surface and the friction rapidly ignites the iron to form Magnetite (Fe3O4) sparks, which lights the gunpowder, firing the ball from the barrel. Each flint would produce enough sparks for up to 50 shots.

Northern Arabs acquired the Snaphaunce and Flintlock technology in the late 1600's and often redesigned their long guns with a sharply curving butt, so that they could be easily tucked under an arm for single-handed firing from the back of a moving camel or horse. Swedish inventor Sven Åderman is credited with creating a rapid firing musket that was first used in the Great Northern Wars of King Charles (Karl) XII of Sweden. For his efforts, Åderman was given the hunting estate of Halltorps by King Frederick I of Sweden in 1723.

In 1790 Philip Hayward received a musket flint army order for "100,000 flints of the best sort" and so was born the Brandon Gunflint Company. At the time of the Napoleonic Wars (around 1804) nine Brandon gunflint makers were commissioned by the Board of Ordnance to supply 360,000 flints a month to the gunsmiths working in the Gun Quarter area of Birmingham. These were for the famous Baker Rifle; a muzzle-loading flintlock, that has the distinction of being the longest service rifle in the British Army.

Brandon flintknappers prospered until just before the Battle of Waterloo (1815) when all the gunflints for the British Army were ordered from Brandon. In 1813, fourteen Brandon Flint Masters were supplying more than 1 million flints a month and employing around 160 knappers and diggers. In 1816 however, the order was nil, which lead to the unemployment of many knappers.

A beautiful engraving (A.J. Forrest 'Masters of Flint') of a Brandon Flint shop in 1876, shows the flint master at work with his apprentice. The apprenticeship lasted for seven years, but boys leaving schools generally looked for other jobs to avoid the killer dust.

Around 1868, the gunflint industry engaged around 36 men, but employed 10 fewer in 1878. Between 1880-1885 over twenty million gunflints were shipped from Brandon to Zanzibar (Africa), packed in old flour barrels (29,000 per barrel). At the end of the 19th century, Brandon was supplying about 4 million gunflints a year to Africa, China, Java, Sumatra, Malay and Latin America.

In central France, the towns of Meusnes, Noyers and Couffy also had thriving gun-flint industries, with 800 workers employed to make thirty million gunflints in 1794. French flints are easily distinguished by their honey- yellow or blonde colour.

The flint mechanism was eventually replaced with the invention of the percussion cap and the later breech- loading cartridge. At the end of World War II there were around five knappers left at Brandon, however South Africa's withdrawal from the Commonwealth in 1961 led to the imposition of a voluntary United Nations arms embargo in 1963 - this ended the flintknappers trade to Africa.

3 The Art of Flintknapping

The word "knapping" derives from the Germanic word "knop" which meant to strike or shape. 'Flintknapping' is generally recognised as the complete term in the UK, as flint was the most commonly used material for knapping. It is easiest to break the process down in a set of generalised stages although these are not the rule and differ with technique and material.

Below are the stages of knapped used to make a Neolithic style axe head using Suffolk flint. I used a selection of hammer stones, an abrader and an antler hammer.

Here is the nodule of flint in its raw, untouched state. You can see some of the flint under the quarry dust and cortex. The cortex is the chalky skin that covers the flint, it protects it from frost damage to some extent but is generally removed during knapping. My first flake will usually be where this is an angled edge where flint is visible such as at the top of the nodule.

The first few largest flakes are created with the largest hard hammer. Most of these will remove any visible surface problems, such as flat edges or ridges. Much of the cortex is removed at this stage. As with all the flakes detached, the blows must be at the edge of the flint. The edge itself must also be under a 90˚ angle otherwise the flint will not flake. The area struck to remove a flake is called the **platform**.

I will use the hammer stone to start shaping the flint to the rough shape desired. So long as there are no natural flaws or cracks, I should not have a problem. When striking the platform I generally make my blows no deeper than 1-2cm from the edge. I work all the way around the nodule removing flakes from both sides to start to create a lens profile. This will help me refine the axehead later.

As you can see I generally try to face the area I want to strike towards my hammer stone. This makes the movement of flaking easier and improves accuracy. I also tilt the flint slightly downwards, this encourages successful flaking. It is important to check each freshly flaked area of the flint before continuing in case there are any new issues I need to address or correct.

I continue to flake around the axehead, refining the shape. I can use the ridges or flake scars as energy highways to direct my flakes. The energy I put into the flint with each strike travels at the surface, any ridges or high points will focus travelling energy. Notice that I have reduced my hammer stone size, since the areas I am aiming for are smaller so I want to ensure I hit the right spot.

Before moving on to the antler hammer and final refinement; I need to abrade the edges. This removes the razor sharp, thin edge that would shatter if I struck it. But by pushing the edge back to a thicker area it is strong enough to take the blow of a soft hammer. This results in a clean flake with no crushing. I will abrade an edge again with each antler hammer removal.

A strike with an antler or soft hammer clips the edge of the flint rather than makes a blow on top of the edge (as with the hard hammers). Antler works well because it is softer than the flint; this means that when connection is made the flint bites into the antler. With the downward force of the antler; the flint is forced to flake off at a thin and lateral plain. This type of flaking means I can remove much thickness but only need to sacrifice a little surface area.

Here is the finished axe head, it only took around 20 minutes to flake, but this is not the longest part of making a Neolithic axehead. It is at this point I would take the axehead to a large abrasive stone in the landscape and grind it against it. This starts to work off the ridges and surface and leaves a smooth, polished finish. An axehead like this would require over 50 hours work. The polishing process certainly improves the longevity of the axehead.

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