Name: _____

Lab 9: Stone Tools & Lithic Analysis

(ANTH B101, Fall 2019)

NOTE: Lithic artifacts, especially obsidian, are very sharp. Please use caution when handling these artifacts, so as not to cut yourselves! Also, if dropped these artifacts will break.

Introduction

In archaeology, the manufacture of tools from stone is referred to as lithic technology. Stone tools are among the oldest surviving artifacts made and used by our hominin ancestors. It is possible that various hominin species were also using other materials (e.g., bone, wood, ivory, etc.) for tool manufacture. However, since stone is durable and often remains preserved over long stretches of time, archaeologists have been able to learn a great deal about early human tool use by the study of lithic assemblages.

The earliest known lithic industry is referred to as Oldowan. Oldowan tools were made and used in parts of Africa between 2.61 and 1.7 million years ago (and earlier stone tools have been found as far back as 3.3 mya). Although seemingly a simple form of technology, the study of Oldowan stone tools is important because it gives anthropologists a window into understanding the roots of cultural behaviors. As stated in your textbook, the small steps towards creating and using stone tools over 2 million years ago "also created a new phenomenon – the archaeological record, the source of the only direct evidence by which researchers can understand the cultural side of our biocultural evolution" (Lewis et al. 2013:225). By studying changes in how early humans were making and using stone tools through time, archaeologists have been able to provide a richer understanding of the evolution of modern *Homo sapiens*.

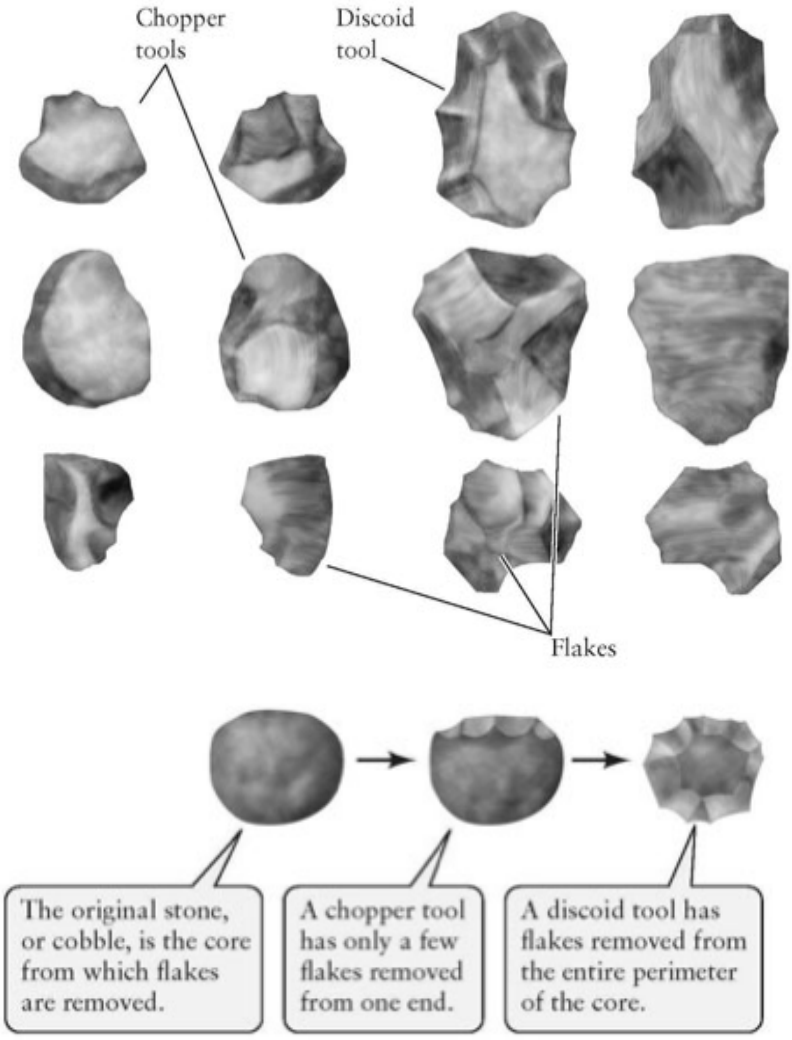
Archaeologists have worked out a general sequence of lithic technological change through time. Following the Oldowan lithic tradition, Acheulean (also spelled Acheulian) stone tools have been found at Lower Paleolithic *Homo erectus* sites. The Acheulean industry is dated from roughly 1.7 to 0.2 million years ago. A later lithic industry common to the Middle Paleolithic period, called Mousterian, is often found in association with Neandertals (and occasionally with early *Homo sapiens* groups). During the Upper Paleolithic period, beginning roughly 40,000-30,000 years ago, modern *H. sapiens* made and utilized a stone toolkit that included a new technological invention: lithic blade tools.

In this lab, we'll develop a basic understanding of lithic technology and the production of chipped stone tools. We'll also look at examples of some of the earliest forms of stone tools made by our early human ancestors. At Stations 1 through 3, we will look at Oldowan, Acheulean, and Upper Paleolithic stone tools (we will not be looking at the Middle Paleolithic Mousterian industry). At Station 4, we'll get a chance to learn some of the basics of lithic flake analysis. Before beginning, we'll first watch a short video about the production of stone tools (called flint knapping):

http://www.youtube.com/watch?v=SrvPOkMs4U4

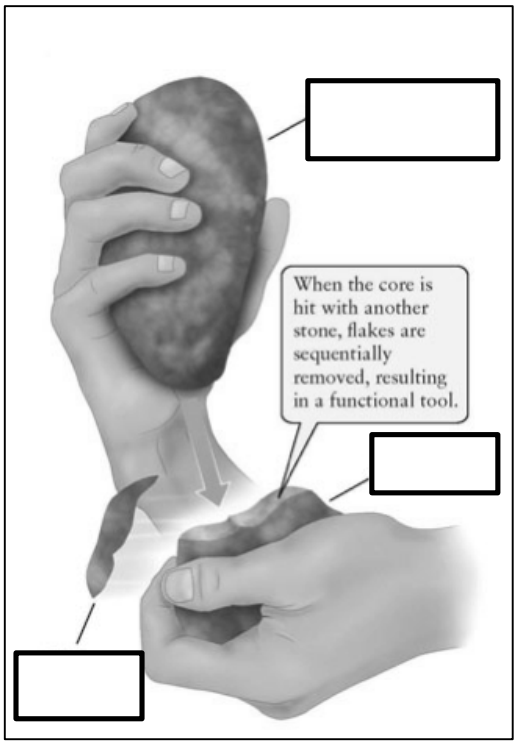
Station 1: Oldowan Technology

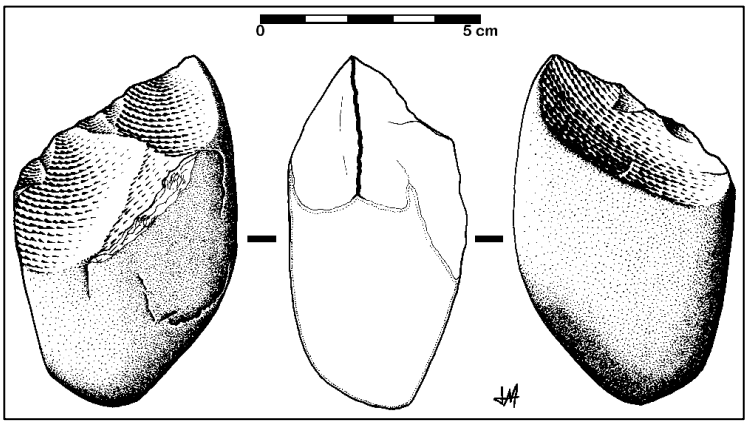
Archaeologists working in East Africa have recovered evidence for the use of stone tools dating back to at least 3.3 mya, and perhaps earlier. The Oldowan lithic industry is known from sites dated between 2.61 and 1.7 million years ago. This period of time marks the beginning of what archaeologists call the Lower Paleolithic Period. Oldowan stone tools were likely manufactured and used by some of the earliest species of the genus *Homo*, for example, *H. habilis*. These early stone tools were simple, consisting of choppers, discoid tools, and flakes (shown here).



Oldowan stone tool technology is considered a pebble-core industry. This is because makers of Oldowan tools utilized small cobbles (or "pebbles") that could be struck with another hard stone (a *hammerstone*) to remove pieces in order to create cutting or chopping edges. The original cobble that was struck is called the *core*; the pieces detached are called *flakes*. The Oldowan industry included hammerstones, sharp flakes for cutting, and choppers used for chopping and cutting. Oldowan is best known for the chopper, which is a hand-held *core tool* (that is, after a few flakes were removed, the altered core is the main implement used).

1. The left image shows an Oldowan tool being made. Fill in the boxes to label the Hammerstone, Cobble, and Flake. On the right is a completed chopper tool; label the chopping edge in each view.





2. Examine the three Oldowan hand choppers at this station. Have flakes been removed from this tool? How can you tell? How would early humans have held and used these tools?

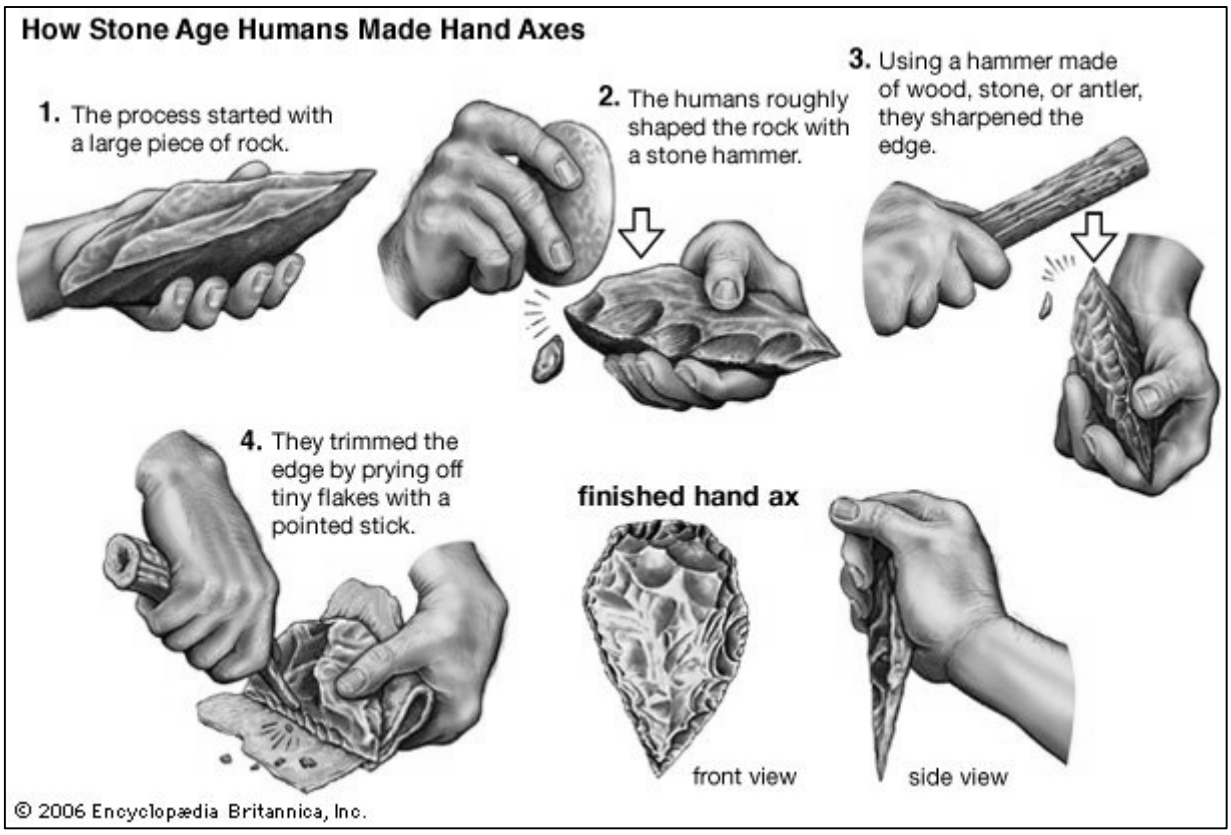
3. Use the calipers to measure the length of the cutting edge on Specimen #29: _____ mm.

4. Not counting the flakes removed from Oldowan choppers, how many individual tools were made from each pebble-core?

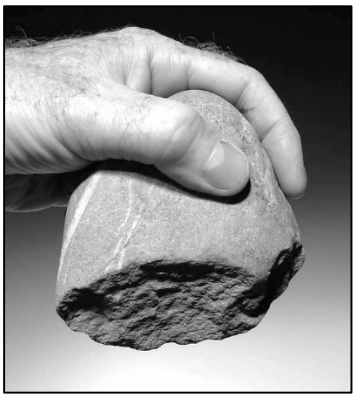
Station 2: Acheulean Technology

From roughly 1.75 to 0.2 million years ago during the Lower Paleolithic Period, *H. erectus/ergaster* developed a new way of making and using stone tools which we call the Acheulean tool industry. It is seen as a marker of evolving cultural behavior as our human ancestors were becoming more reliant on the use of stone tools and likely other forms of material culture. Making an Acheulean stone tool requires greater capacity for forethought than making Oldowan tools. Acheulean tool makers had to carefully choose a core and then plan out multiple steps of flake removal in advance with an end-goal in mind: an Acheulean hand axe. Hand axes are larger tools that are symmetrical in shape and have long sharp edges. These tools first appeared in Africa, but have also been found in the Middle East, the Indian subcontinent, and East Asia reflecting the migration of *H. erectus* out of Africa.

The Acheulean lithic industry is more complex and diverse than the Oldowan toolkit. For example, Acheulean toolmakers invented a new kind of stone tool: the biface. Bifaces are stone tools that have had many flakes removed from two opposite sides of a core; flake removal continues around the entire core to create a cutting edge circumscribing the entire "bifacial core." Thus, to make a biface, humans systematically removed flakes in a way to make a tool with *two* faces or sides. Removing small flakes in such a delicate and planned manner would often have required use of a soft-hammer percussion method, employing striking tools made of bone, hard wood, antler, or ivory. The process of making an Acheulean hand axe yields numerous small and sharp flakes that could be used for more precision cutting; the hand axe itself represents a tool with a longer cutting edge per core relative to Oldowan choppers.



1. Below are three types of stone tools. Label them using these terms: Oldowan, Acheulean, Upper Paleolithic. Using the information provided on this guide, what time period is each tool type from?



Tool Type: _____ Tool Type: _____ Tool Type: _____

Age: Age: _____ Age: _____

2. Examine the bifaces. Describe the evidence that flakes have been removed from this core. Where does this evidence occur (one or both sides of the axe)? How could early humans have used bifaces? Why is it important that this tool had a distinct, pre-fabricated form?

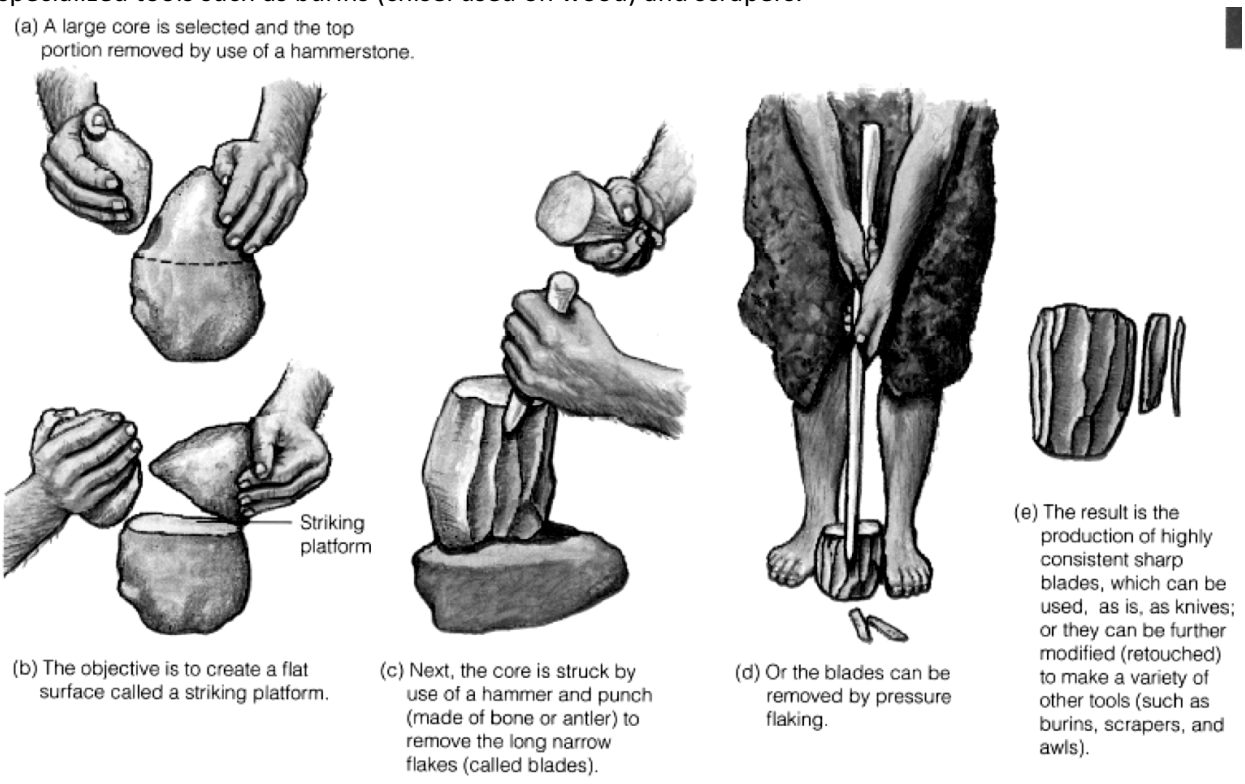
3. Use the calipers to measure the length of the cutting edge on Specimen #71-8-14: _____ mm

4. Not counting the flakes removed from Acheulean hand-axes, how many individual tools were made from each core?

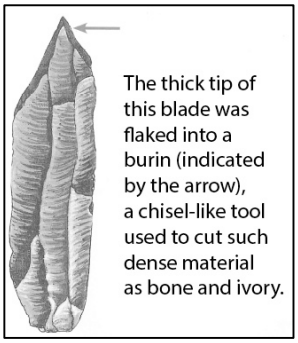
5. How do Acheulean hand axes differ from Oldowan choppers? What may we infer from any differences in terms of human evolution?

Station 3: Upper Paleolithic Blade Core Technology

The Upper Paleolithic Period in Europe and the Middle East dates from roughly 40,000 to 10,000 years ago. This time period represents the wide-spread appearance of *Homo sapien*s in this part of the world. Upper Paleolithic stone tool industries are distinct from earlier Paleolithic industries like Oldowan, Acheulean, and Mousterian. Upper Paleolithic technologies (and the concurrent Late Stone Age industries in Africa) represent the continued evolutionary trend towards greater human cognitive abilities and cultural-symbolic thought. By this time, fully-modern *H. sapiens* populations were creating a diversity of finely crafted and specialized stone tools. The Upper Paleolithic industries also continued the long-term trend towards greater economizing of high-quality stone resources (i.e., from just one core, multiple tools and a diversity of tool types could be created). A common feature of Upper Paleolithic stone tool industries is the use of blade technology (and blades have been made since the end of the Upper Paleolithic). It was possible to remove numerous parallel-sided blades from a single core using a punch and hammerstone (kind of like using a chisel and mallet). The blades could be retouched to form specialized tools such as burins (chisel used on wood) and scrapers.



Blade technology is a "chipped stone toolmaking approach in which blades struck from prepared cores are the main raw material from which tools are made. A blade is a chipped stone flake that is at least twice as long as it is wide" (Lewis et al. 2013:299). Blade-making industries begin with selecting and preparing cores so that numerous, individual ribbon-like flakes/blades can be systematically removed. Blade removal takes special care, and often is done using an indirect percussion removal method (e.g., punch technique). Archaeologists have found that the toolmakers would often keep (or "curate") a blade core for long periods of time, and remove individual blades only as needed. Each blade could then be more finely worked to create a diversity of specialized tool implements for different tasks. For example, individual blades were used to create knives, scrapers, dart points, burins (see image right), and other tools.



1. Look at the various blades at this station. How would you describe these blades? How many cutting edges does each blade have, and how would you describe it/them? What is the benefit of making tools like these (instead of an Acheulean hand axe or an Oldowan chopper)?

2. Look at the obsidian blade core, and think about how blades were removed from this core. How can you tell where individual blades were removed? Which end of the core do you think was struck to remove these blades?

3. About how many individual blades can you count were removed from this obsidian core (circle one)?

   1-5 blades 8-15 blades 30-40 blades

4. Measure the length of the core to estimate the average length of each removed blade. About how long was each individual blade (circle one)?

   about 20 mm about 100 mm about 300 mm

5. Now, multiply that number by 2 to estimate the amount of cutting edge per blade, and circle the correct estimate below.

   about 40 mm about 200 mm about 600 mm

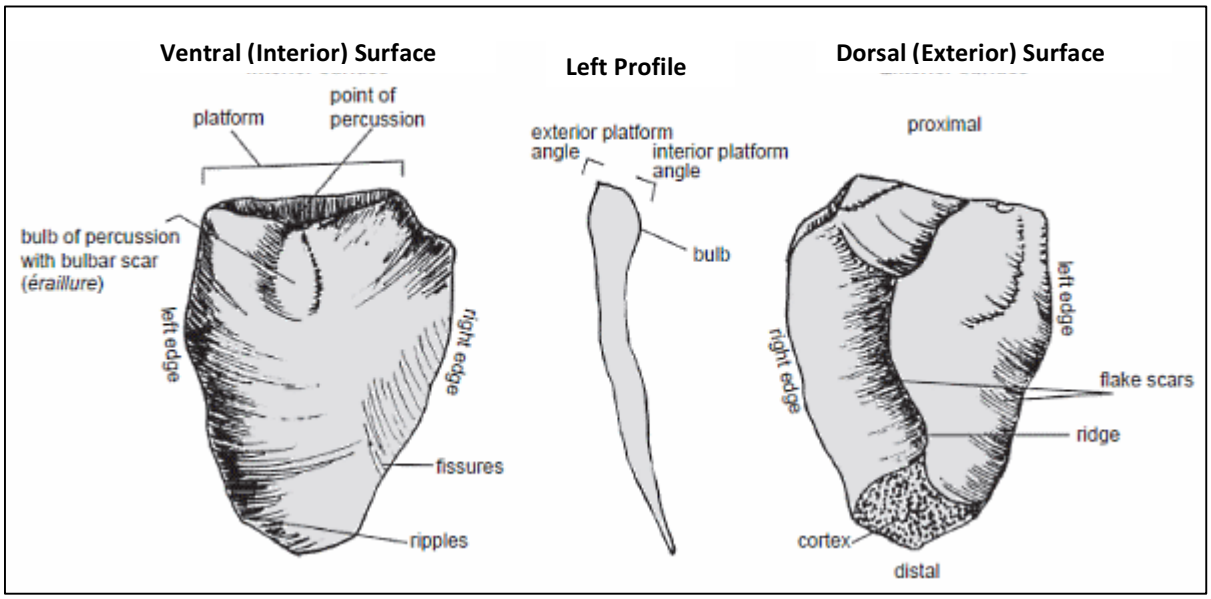
6. Assuming 10 blades were removed from this core, what amount of cutting edge did this one core produce (circle one)? (Keep in mind that additional blades could have been removed from this core.)

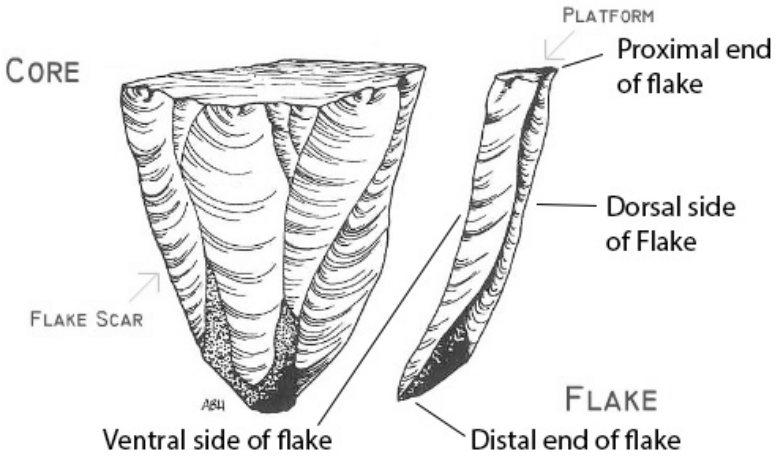
   about 400 mm about 2000 mm about 6000 mm

7. How does the Upper Paleolithic blade core technology differ from Oldowan and Acheulean technologies? What may we infer from any differences in terms of human evolution?

Station 4: Lithic Flake Analysis

When archaeologists excavate sites, they often recover many more flakes than formal tools like cores or blades. This is because flakes are usually produced as a bi-product of core reduction and tool manufacture. Sometimes individual flakes are used as tools themselves because flakes are sharp and can be used for cutting. Oftentimes, however, many flakes are never re-used. This does not mean that flakes cannot tell us about past human cultural behaviors. In fact, understanding the process of flake removal through detailed study of all recovered flakes can tell us a lot about how toolmakers were using cores and making specialized tools, even if we don't recover the cores or tools themselves! For this reason, we'll consider the basics of starting an analysis of flake artifacts.





1. Look at the core and its one associated flake. Piece the flake and core back together. Determine where the core was struck to remove the flake. On the flake, point out the striking platform, the bulb of percussion, the ventral and dorsal sides, and the proximal and distal ends and any remaining cortex (cortex is the rough outer "rind" on the core).

2. Now, select one of the other flakes and draw both the ventral and dorsal sides. LABEL the following features on your sketch:
    a. striking platform,
    b. bulb of percussion,
    c. any noticeable ripples,
    d. any remaining cortex (outer surface of stone before any flake removed), and
    e. the proximal and distal ends (on both illustrations).

Ventral Side

Dorsal Side