Decoding The Terminology of Chipped Stone Tools

By Gene Gade

Is it chert or chalcedony? Flint or jasper or agate? Mastering the terminology associated with rocks and minerals and their myriad uses is hard (pun intended).

If you are hoping to decipher the Babelesque terminology of any scientific discipline, you'd be advised to brush up on Greek and Latin roots along with a smattering of terms derived from Old English, German, French, Russian, and many other languages. Also, be prepared for differences between "scientific" and common or regional names and even variance among trained professionals.

All over the world, before the advent of metallurgy, humans used stone to make tools such as knives and projectile points. Although many varieties of stone have been used to make tools, most have similar physical and chemical properties.

If making a tool or weapon out of unsmeltered rock, you would want to use stone types that were relatively common and widely distributed. The rock would need to be hard enough not to shatter or crumble when it encountered an animal bone or a plant root. You'd certainly prefer a material that was brittle, that fractured in a predictable pattern, and that formed and held sharp edges.

The stone types most commonly used worldwide for the chipped-stone or "knapping" process are from the very large and diverse quartz family of minerals. Their base chemical compound is silicon dioxide (SiO_2; a.k.a., silica or silicates), and these are among the most common minerals in the earth's crust. The quartz-related silicate minerals are harder than most rocks, about 7 on the Mohs scale where 10 is hardest. Only diamonds and a few minerals like carborundum and topaz are harder. Silicate stones are hard enough to scratch common steel. There are lots of variations on the silicate theme, each with its own name and peculiarities.

The best stones for construction of tools and projectile points have a smooth, glassy texture because they have microscopic crystals or no crystals at all. They also break in smooth, predictable, "conchoidal fractures" (i.e., a smooth, curved shell-like break). Rocks with these properties can be chipped to form very sharp edges. Rocks with large crystals or fractures do not break predictably or form sharp edges and are thus not useful for knapping, no matter what their chemistry.

An example of obsidian showing a conchoidal fracture with a conchoidal mollusk shell and an obsidian projectile point below.

Most stone tools are made from chalcedony. The silica crystals in chalcedony are too small to be seen even with a standard microscope. Chalcedony is usually somewhat translucent (i.e., some light passes through it), has a waxy texture, and is often banded. Chalcedonies are technically sedimentary rocks, because these rocks form by precipitation from mineral-laden solutions. Silica is not as soluble as the calcium carbonate in limestone or the calcium/magnesium sulfate in gypsum, but, in minute amounts, silica does dissolve in water. When silica-laden water seeps into cavities in other rocks or among sedimentary layers, the silica slowly precipitates to form one of the chalcedony types.

The semitranslucent-banded chalcedonies usually form in cavities and can be white, brown, gray, black, or blue. Agates and petrified wood are examples of this type of chalcedony, and these stones were often knapped to make stone implements. Petrified wood is found in many locations near the Black Hills. At least one banded silicified-wood point was found in the Vore Buffalo Jump.

Banded agate (left) and a side-notched projectile point made from the petrified wood that was found at the Vore Site (right).

A major sub-category of chalcedony is called chert. Because of impurities like iron or copper, chert is relatively dull and opaque. It is also slightly coarser and more granular than its translucent cousins. Chert is usually formed as nodules in other sedimentary layers such as limestone. Common examples are flint and jasper. Jasper is generally more colorful than flint; jasper is often red or brown, but may also be yellow, green or blue. True flint is dull gray or black.

Examples of the cherts flint (left) and jasper (right).

One of the most easily recognized stone points found at the Vore Site are made from a beautiful, amber-colored stone commonly called Knife River flint. It comes only from a few known quarries in central North Dakota. Its characteristic color and luster make it unmistakable. Although dark in color, Knife River flint is semi-translucent. Therefore, based on the criteria above, it is a chalcedony, not a flint. All this nomenclature is complicated as different scientists use different terms. For example, a geologist will often call siliceous rocks chalcedony, whereas an anthropologist might refer to these same stones as chert. In any case, Knife River "flint" was another prized and widely traded knapping stone, and tools and projectile points made from this stone are found in the Midwest, Canada, and Southern Plains. Most likely, based on their proximity to the quarries and the point styles, the Knife River specimens found during excavations of the Vore Site were brought by Hidatsa/Crow hunters.

A sample of Knife River "flint" (left) and a projectile point found at the Vore Site made from this type of chalcedony (right), which is not a true flint.

Quartzite is a metamorphic rock that forms when sandstone is subjected to high temperatures and pressures. This occurs when the sandstone is sandwiched between molten magma and layers of overlying sediment. If the heat and pressure are great enough, the sand grains begin to melt and fuse together. The crystals in quartzites are not as smooth or small as those in chalcedonies, but quartzite is hard and can form fairly sharp edges when knapped.

Orthoquartzite is a tool-making stone with major significance to the Vore Buffalo Jump. Orthoquartzite is a sort of hybrid between chalcedony and metamorphic quartzite. It is sedimentary, but it results when silica-laden water fuses the grains in fine-grained sandstone. Some folks just call it quartzite. Orthoquartzite nodules are found in the famous Spanish Diggings quarries in east-central Wyoming. Charles Reher, who supervised most of the excavation at the Vore Site and who was responsible for most of the technical writing about the site, believed much of the stone used for the projectile points found at the Vore Site were made from Spanish Diggings quartzite. He hypothesized that the ancestors of modern tribes like the Cheyenne/Arapaho or Plains Apache/Kiowa groups brought the stone from the Spanish Diggings quarries. There are, however, quarries of similar stone in the Bear Lodge and Inyan Kara Mountains and Black Hills proper that are much closer to the Vore Site than the Spanish Diggings quarries. Researchers at Chadron State and the University of Wyoming Archaeological Repository are analyzing samples of stone from the Spanish Diggings and from these local quarries and from the Vore Site sinkhole as this is written. Perhaps we will definitively know the origin of some of the Vore Site projectile points within the year.

A biface tool (left) fashioned from Spanish Diggings orthoquartzite and a knife found at the Vore Site made of a light purple orthoquartzite (right). The knife may have been made from Spanish Diggins quartzite or from stone quarried locally.

Finally, there are points and tools found in the Vore Site made from stone called porcellanite. Porcellanite is a silica-based sedimentary rock that is often mistaken for chert. However, it is created by a different process. Porcellanite is formed when clay is exposed to heat to such a degree that the tiny particles are fused into a fine-grained, usually light-colored rock. It was named because it resembles unglazed porcelain. Porcellanite has the desired tool-stone properties of hardness and conchoidal fracturing. It is slightly less hard than chert and is probably better used for tools such as scrapers than for projectile points. The porcellanite found at the Vore Site was probably formed when abundant, exposed coal seams in the Powder River Basin in northeastern Wyoming and southeastern Montana caught fire and baked an adjoining layer of clay until it fused. These fires burn hot and may smolder for decades.

A porcellanite projectile point found at the Vore Site.

Obsidian is another silica rock, but it is igneous, not sedimentary, in origin. It is formed from lava that cools so rapidly that crystals do not form and is essentially a volcanic glass. When knapped, obsidian forms extremely sharp edges, sharper than honed steel knives or surgical scalpels. There are a number of sources of obsidian in the volcanic areas of northwest Wyoming and Idaho. This stone was quarried by the Shoshonean people of that area and was a highly valued trade commodity. Obsidian from Obsidian Cliff in Yellowstone National Park has been found as far east as the Hopewell Mound sites in Ohio. Charles Reher found obsidian points in his excavations near Pine Bluffs in southeast Wyoming, but, to date, no obsidian has been found in the Vore Site.

Making tools from stone is an ancient process. Crude stone tools dated to over 3 million years ago have been found in Kenya and Ethiopia. The stone items from the Vore Site are only a blink of an eye back on that time scale. In fact, the Vore Site artifacts are important precisely because they are so recent, probably bridging the momentous transition from stone to metal tools among the Northen Plains tribes. That story must wait, but I hope this piece helps clarify and not confuse the understanding of common knapping stones.