Volvon Bedrock Mortars

Robert Bardell
bbardell@comcast.net

"Common prehistoric resources found in the area are bedrock mortars. Typically, mortars do not represent a unique occurrence and are not considered significant resources due to lack of research potential."

City of Rocklin Draft General Plan - 2005

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Next to fire itself, the mortar-and-pestle was the most important food preparation tool used by California Indians. Indian women pounded nuts like acorns and buckeyes into flour and ground or pounded seeds, roots, berries, and bulbs into useable forms. They tenderized certain animals by pounding them in mortars, and reduced slabs of dried fish into flakes the same way. California Indians typically, though not universally, created their mortars in stone. They made portable mortars in small boulders or slabs. Some of these portable mortars—so-called "flower pot" mortars—featured shaped and adorned exteriors and were intended for show and not for use. Today, most portable mortars reside in museums or private collections. Many are buried, and some are embedded in rock walls or house foundations. For practical purposes, the only stone mortars one encounters in the field are bedrock mortars—mortars created in rock outcrops or in rocks too large for souvenir hunters to carry off. Bedrock mortars are found throughout the state, and one of the largest and most diverse collections lies in the Black Hills of Contra Costa County once home of the Volvon, a Bay Miwok tribe.

Despite the important role played by stone mortars in California Indian life, the mortars themselves have been only lightly studied. Early studies, like Ernest N. Johnson's 1942 report, *Stone Mortars of Contra Costa County, California*, and Richard K. Beardsley's 1947 Ph. D dissertation, published in 1954 as *Temporal and Areal Relationships in Central California Archaeology*,[1] were qualitative in orientation. Johnson and Beardsley proposed mortar typologies largely based on salient shapes, including that of the interior cavity, the opening or "mouth," and the rim. Beardsley explicitly excluded bedrock mortars from his typology. Johnson viewed bedrock mortars as a minor class of stone mortar, having only one general interior cavity shape and no variation in rim type. I do not believe Johnson would have adopted this limited view of bedrock mortar typology had he been exposed to the full range of Volvon bedrock mortars. He would have noted more shapes and features. Johnson may have visited a few Volvon bedrock mortar sites, but we have no way of knowing, since he provided no list of the sites he surveyed. He never referred to the Black Hills and apparently regarded "foothill sites" as subsidiary camps visited annually for specific purposes rather than as year round residential villages.

E. Breck Parkman followed Johnson's qualitative typology in his study of bedrock mortar sites located between San Lorenzo Creek and the old Warm Springs township in Alameda County along the southeastern part of San Francisco Bay.[2] Parkman found two of Johnson's interior cavity shapes—the cone shape and the bowl shape—represented among the mortars in his study.

Most modern bedrock mortar studies reject the qualitative approach to mortar typology. These studies are resolutely quantitative. Their typologies derive from an influential 1985 study of bedrock mortars at Crane Valley,[3] which divided mortars into three classes according to their depth. Depth followed function, according to the Mono informants consulted in the Crane Valley study. The transformation of hulled and peeled acorn nuts to useable flour began in shallow "starter" mortars (less than 2.2" or 5.5 cm deep) and ended in medium depth "finishing" mortars (between 2.2" and 3.75" or 9.5 cm deep). Mortars deeper than finishing mortars enabled the processing of hard seeds. The quantitative approach to mortar typology is highly reductive. All that matters is depth. The shape of a mortar's interior cavity and all of its features are deemed functionally irrelevant. I find this conclusion implausible given the diversity of cavity shapes and features in Volvon bedrock mortars. Although the "small, medium, and large" mortar typology derives some support from functional considerations—acorn does not finish well in deep mortars, for example[4]—it does not license any inference to function from depth alone. Just because a mortar is the right depth to start acorns in does not mean it was used that way. Perhaps

it was used to tenderize ground squirrel meat. And perhaps no self-respecting Indian woman would start acorns in a mortar used to tenderize squirrel if she had the choice. I am not arguing that mortar depth is irrelevant to function, but I contend other factors like shape and volume are relevant too. Parkman seems to agree with this position. He argues that Central California Indian women pounded acorns in relatively shallow bowl-shaped mortars but used a rotary motion to grind hard seeds and some berries in cone-shaped mortars he referred to as "vertical metates."[5] I think Parkman is wrong about the general shape of "acorn" mortars. They are conical—or more generally, parabolic—as we shall see below. To illustrate this point, I offer this 1925 photograph of Mary Pohot finishing acorn under a brush ramada in Tulare County.[6] Note the parabolic tip of her undoubtedly heavy pestle. It will fit snugly into the base of her mortar. The oil stain on her pestle is correlated with the mortar's depth, but is probably not a perfect index of it.

The modern approach to mortar typology also repudiates the once widely held belief that mortars deepened through wear. This older view held that over time mortars deepened as result of pestles striking their bottoms. Thus, shallower mortars suitable for acorn processing gradually deepened until they were no longer suitable for that activity. These deeper mortars were then used to process seeds, roots, and other products until they became too deep for that, at which point they were abandoned. Ethnographic studies cast doubt upon this picture. These studies revealed that the pestle struck acorn meal at the bottom of the mortar, not the bottom of the mortar itself. Stone-on-stone contact was a blunder. Modern theories maintain that mortars were created to specific depths and dimensions and did not change appreciably during their very long life spans. Changes that did occur were far more likely weather-related than caused by incompetent food-processing techniques.

My approach to bedrock mortar typology is primarily qualitative. The qualitative diversity of Volvon mortars is striking. They vary widely in size, shape, and arrangement on their rocks. My aim is to classify and catalogue this diversity. I will also describe specific Volvon milling stations, camps, and villages, in order to convey some flavor of the Volvon homeland. My catalogue of Volvon mortars is not exhaustive. Field research conducted by a dedicated group of amateurs has identified 81 sites and over 2,250 bedrock mortars in a 100 square mile area postulated as Volvon territory.[7] This report covers 41 of these sites and over 2,100 bedrock mortars.[8] My reasons for omitting sites vary: some are now flooded (or soon will be) by the waters of Los Vaqueros Reservoir; some are wholly constituted by mortars that are “suspect” or less than definitive in some way, and some are insufficiently documented. At some sites I evaluate fewer mortars than the aforementioned group has identified. Although some of these mortars are suspect or undocumented, many have simply disappeared. Throughout Volvon territory the earth is constantly on the move, and this movement is abetted by the rototilling of wild boar and the hoof traffic of grazing livestock. As a consequence, mortar rocks get buried and cannot be relocated without effort and excavation. Despite this incompleteness, I believe my sample is large enough to allow for some limited generalizations.[9] I do not turn my back on quantitative approaches completely. I sort mortars by depth, too, and provide some limited statistics on mortar type and frequency of occurrence. Since I did not measure every mortar in my sample, and since I do not provide necessary and sufficient conditions in my mortar classification scheme, I hedge my quantitative claims. The reader will find such hedge words as “about,” “probably,” “likely,” and “nearly” liberally sprinkled throughout this report.

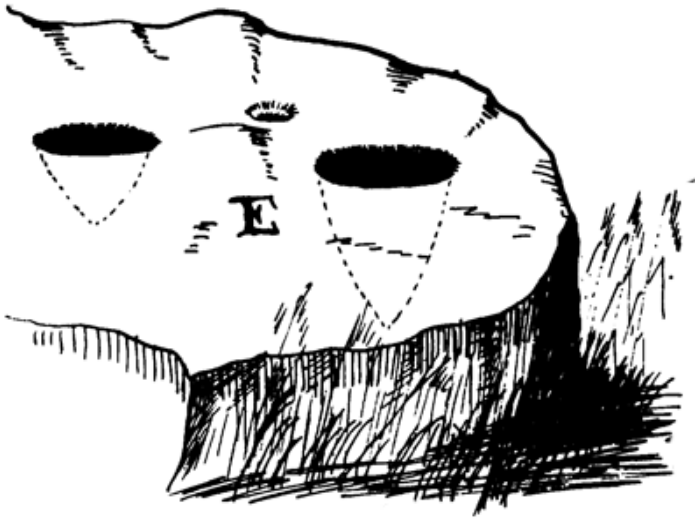
Anatomy of a Simple Mortar

A bedrock mortar is a hole or depression pecked or ground into rock, which in Volvon territory is invariably sandstone. The hole has a bottom and an interior enclosed by its sides. Bedrock mortars are not simply holes (cavities) in rock. They have other features as Johnson noted. The hole has a mouth, which is the area immediately below its lip or rim. Mortar mouths, seen from above, may appear circular or elliptical, and may flare or be surrounded by a narrow “collar”. (A mortar has a “flaring mouth” when the slope of its sides decreases in the mouth area.) The lip or rim is where the mortar hole intersects the surface of its rock. The rim may be flat, rounded, or rise above the surface of the surrounding rock in a “fat lip” configuration. A mortar may be flush with the surface of its rock, recessed in a basin, or connected with another mortar in some way. The interior surface of a mortar may be rough and pitted or smooth. A mortar may have an “Olla” interior where “the inner walls of the cavity flare outward a short distance below the opening, making a cavity of larger diameter at this point than at the rim.”[10]

Although a bedrock mortar is not just a hole in a rock, the shape of that hole is the salient feature for the mortar's classification. My classificatory scheme applies various terms—some derived from everyday kitchen objects—to the shape of mortar holes. (This is why I use "hole" and "cavity" as generic terms rather than "cup" or "bowl," which have more-or-less specific shape denotations.) The drawback of such a scheme is a certain lack of precision in classification. As we shall see, basic mortar shapes have common features and resemble each other to a significant degree. In the classification of individual mortars there will always be calls that could go either way.

Simple Mortar Shapes

Johnson claimed all bedrock mortars he examined in Contra Costa County were "V-shaped" with pointed bottoms. He provided an illustration which I reproduce here.[11]



I prefer to describe these mortars as "conical," even the shallow, narrow-diameter example, which could be called a "cupule" or "anvil." Most Volvon bedrock mortars can be described as conical, but this general term encompasses a variety of shapes. Conical shapes vary according to their depths and the dimensions of their mouths. These two factors determine the slope of a conical mortar's inner surface, which gives the mortar its qualitative style. In the illustration above, the medium sized mortar resembles the fluid-holding part of a cocktail glass, while the large sized mortar looks something like a New Years Eve party hat or a small dunce cap. These are distinct, though obviously related, shapes. Widen the mouth of any conical mortar pictured above while holding its depth constant, and its appearance changes. The slope of the mortar's sides decreases and the cavity becomes more bowl-like, as the image below illustrates. Thought experiments like this convey a sense of the possible variation in conical mortar shapes.

Parabolic Mortars

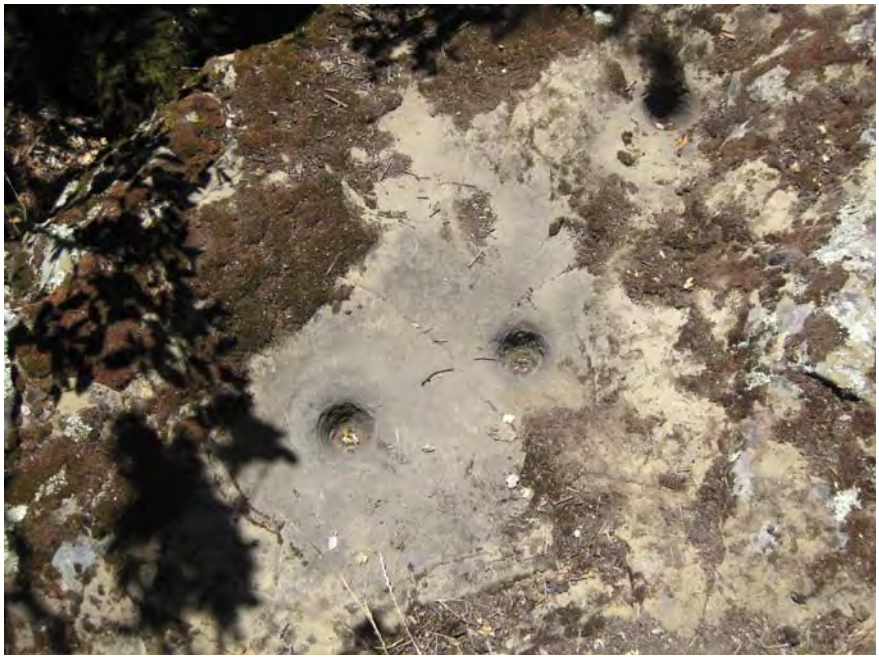
True conical mortars, where flat inner surfaces converge to some actual or imaginary point (the vertex), are rather rare in Volvon territory. Most conical mortars are actually paraboloids.[12] Their inner surfaces curve, especially near the bottom, and converge to a point like Johnson's V-shaped mortars. This sort of parabolic shape is similar to a three-dimensional bivariate normal distribution—the classic bell shape—as these vegetation plugs illustrate.

Nearly 92% of all Volvon mortars belong to the parabolic mortar family. The most common species of this family is the conical mortar. About 70% of all Volvon mortars are qualitatively conical—that is, they appear conical—and 46% of these are less than 4" (10.2 cm) deep. This might seem like a high percentage, but not compared to Brent Leftwich's survey of 2,654 mortars within the Amador Ranger District of El Dorado National Forest.[13] Leftwich found 83% of the mortars in his survey to be less than 3.75" (9.5 cm) deep and 68% to be less than 2.2" (5.5 cm) deep. Although Leftwich treats 98% of his sample as paraboloids for the purpose of calculating volume, only the shallowest of these mortars would look parabolic to a normal observer. Most would appear conical or perhaps bowl-shaped. Still, the typical conical mortar in the Amador Ranger District is considerably shallower than the typical Volvon conical mortar. If more than half of all Volvon conical mortars are deeper than 4", might this indicate that sandstone mortars run deeper, in general, than their granitic Sierran cousins? Perhaps Volvons routinely finished acorn in mortars as deep as six inches. Categorizing all mortars deeper than 4" as "seed" mortars is therefore potentially misleading. For this reason I have augmented Crane Valley's small-medium-large scheme with an "extra large" size. These extra large or "deep" conical mortars are some of the most distinctive in all of Volvon territory. I also note that Leftwich apparently did not encounter any mortars of the type I call "compound" (see below), although he does mention four "collared" mortars.[14] Compound mortars account for over 6.5% of all Volvon mortars.

Conical Mortars

The following four photographs illustrate the size range of Volvon conical mortars. The two shallow mortars pictured below would be called acorn starter mortars by Leftwich and other disciples of the Crane Valley study. It might seem perverse to call mortars like these “conical.” Wouldn’t “small, shallow bowl” or “saucer” be more descriptive? Perhaps it would, but the mortars are clearly parabolic (think of the parabolic dishes for satellite TV and radar), and I am stressing the unity of form among mortars of this class.

The left-hand mortar in the bald patch below is about 4” (10.2 cm) in diameter and 3-1/2” (8.9 cm) deep. The right hand mortar is narrower and slightly shallower. Western Mono informants for the Crane Valley study would use these mortars to produce finished acorn flour.



Although Leftwich and other followers of the Crane Valley study would call these 6” (15.2 cm) deep conical mortars “seed” mortars, we, who know nothing about Volvon food processing techniques, should not jump to conclusions based on mortar depth alone.

This mortar is 8” (20.3 cm) wide and 11” (27.9 cm) deep—a beautiful specimen.

Bullets

Sometimes a conical mortar's sides converge very little from top to bottom, a feature also encountered in paper and Styrofoam cups. Imagine a cone with a five inch diameter mouth that is 100 feet deep. The sides of this cone would converge so slowly that the convergence would be hard to detect with the naked eye. I call mortars where the sides are nearly vertical "bullet-shaped."

Bowl-Shaped Mortars

Parkman says this about the contrast between bowl-shaped and cone-shaped mortars: "Bowl-shaped mortars are rounded and relatively shallow, while cone-shaped mortars are conical with deeper and more pointed bottoms. Bowl-shaped mortars tend to have more irregular and less parabolic walls than do the cone-shaped variety."[15] Parkman was clearly not envisioning the full range of parabolic forms when he wrote that. Any conical mortar significantly wider than it is deep will appear bowl-shaped. This mortar is 6" (15.2 cm) wide and 4" (10.2 cm) deep.

When the dimensions of a parabolic mortar are wide but relatively shallow, it assumes a dish-like form as in this example:

True bowl mortars are all parabolic curvature as the vegetation plug below indicates.

Non-Parabolic Mortars

Bowl-shaped mortars remain within the parabolic family. This is not the case for a small set of Volvon mortars I call “cups,” “pots,” or “pans,” according to their dimensions. All mortars of these types have flat bottoms. They are not V-shaped or parabolic. Cups and pots have vertical sides. Some pans have vertical sides while others have Olla interiors (see below). These types are all rare. Note the vertical sides and flat bottom of this pot.

Cupules

Cupules are small, shallow depressions in bedrock. The archetypal cupule-shape resembles a golf ball cut in half, but cupules may be wider or deeper than this. Cupules and shallow mortars are closely related and in borderline cases are impossible to distinguish. I did not count cupules in this survey. In certain contexts I treat cupule-sized mortars as “anvils” and enumerate them along with the shallow mortars. Cupules were probably not used in food production. Their use may have been symbolic. They may have played a role in fertility ceremonies, initiations, rain-making, or hunting or fishing rituals, just to name a few possibilities. Cupule rocks are found throughout the Diablo Range,[16] yet there is no direct ethnographic information about their function. All we have to go on is conjecture and analogy based on known cupule-rock uses elsewhere.

There are 32 cupules on this rock.

Cupules are associated with deep bullet-shaped mortars at several locations in Volvon territory.

Compound Mortar Shapes

Ernest Johnson labeled one of his four basic mortar types “Y-shaped.” Johnson’s Y-shaped mortar cavity featured a bottom “intentionally sloped to center” with or without a “definite cup in the exact center.”[17] This represented Johnson’s attempt to capture the mortar-within-a-mortar quality of compound mortars. Some compound mortars probably represent adaptive reuses of existing mortars, but the majority of compound mortars seem to have been created that way. I distinguish compound mortars from mortars with flaring mouths (see below). These mortar types are closely related and distinguishing them is often a matter of personal preference.

The most capacious mortar in all Volvon territory is a compound mortar. It could be described as a mortar-within-a-mortar-within-a-mortar. Note the eccentric shape of this specimen and its partially raised rim. It measures 22” (55.9 cm) across its minor axis from rim to rim and 33” (83.8 cm) across its major axis from the raised rim to the end of the flare. It is 19” (48.3 cm) from the top of the raised rim to the bottom the mortar.

Nipples

Compound mortars with a “definite cup in the exact center” come in two types determined by the shape and size of the cup. The first type is the nipple. A nipple’s inner cup is narrow—about the diameter of a Buckeye seed—and shallow. The outer mortar may be narrow too, as this example illustrates.

A nipple’s outer mortar is typically 7” to 8” (18 to 20 cm) in diameter. Nipples are extremely rare in Volvon territory and account for less than 1% of the mortars in this survey. Most have rims higher on one side than the other. Except for two cases they occur alone on relatively flat-topped rocks.

The upper section of this nipple is bowl-like, as the curvature of the plug indicates. The higher side of this nipple's rim is almost vertical.

A number of Volvon bedrock mortars sport small cones in their bottoms, but I have not classified them as nipples because their inner cones are not shaped like the inner cones in archetypal nipple mortars. This broad mouth cone is 6-1/2" (16.5 cm) in diameter and 7" (18 cm) deep. The leaf at the bottom of the mortar rests in a shallow, cupule-like cone.

Funnels

Nipples are kin to funnels. Funnel-shaped mortars are the most common compound mortar type. Over 4.5% of mortars in this survey are funnels. A typical funnel has two parts—an upper section and a lower section, which is typically bullet-shaped, though I sometimes refer to this section as an “inner cone.” The upper section may be conical or bowl-shaped. The upper section of the funnel pictured below is slightly elliptical (about 8-1/2” x 9” or 21.6 to 22.9 cm), and the whole mortar is about 9” deep. The inner cone is 4” (10.16 cm) in diameter and 5-1/2” (14 cm) deep.

Some funnels occur on the sloping sides of rocks so that their rims are higher on one side than another. The inner bullet here is 5” (12.7 cm) in diameter and 6” (15.2 cm) deep.

Mortars appear in natural or manmade basins at several locations in Volvon territory. Sometimes the basins are natural features like the one pictured below. For the purposes of this study, I do not distinguish basins from milling slicks (bedrock metates). The Swiss Army knife spans a shallow mortar.

Basins are often broad and relatively flat. The small cone in this basin is 4” (10.2 cm) in diameter and 2-1/2” (6.4 cm) deep. The basin itself is about 2’ (61 cm) wide.

Sometimes basins are fairly deep.

Several basins in the Volvon Village are tinted blue.

Some basins have unusual shapes that seem, if not completely manmade, to be worked. The bullets in the basin are both about 4-1/2” (11.4 cm) in diameter and 6” (15.2 cm) deep.

There is often no clear demarcation between where a mortar ends and a basin begins. The two mortars in a figure-8 basin on the chair-shaped rock pictured below can be viewed as small mortars in horn-shaped basins or as larger horn- or funnel-shaped mortars in flat, connected basins. I see no principled way of making the distinction.

Mortar Features

Perhaps the most prominent feature of a mortar is its overall size. I hope the examples shown above convey something of the size range of Volvon bedrock mortars.

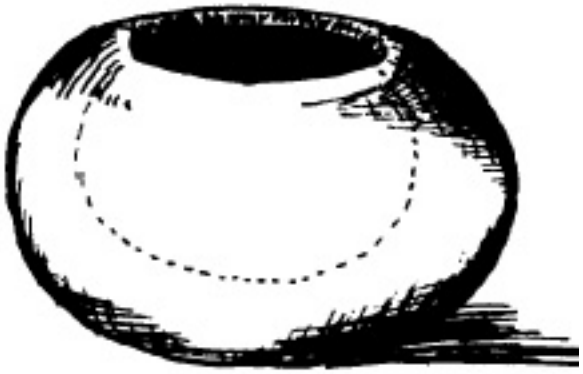
Inner Surfaces

The inner surface of a Volvon mortar may be rough and battered looking. This might be a sign of mortar age. Note the somewhat smoother surface at the bottom of this mortar. This area almost achieves enough definition to be labeled an “inner cone” and may indicate adaptive reuse of an older mortar.

Other mortar interiors are smooth. Surfaces like this are called “polished” by some commentators.[18] I prefer “machined.” Perhaps machined interiors were produced by using pestles in a grinding or twisting motion rather than a pounding one. Over time, imperfections in the machined mortar’s walls would be milled down. On the other hand, the machined interior could have been a feature of the mortar design just like depth, volume, and overall shape.

Olla Interior

One of Johnson's four classes of mortars is the Olla, where "the inner walls of the cavity flare outward a short distance below the opening, making a cavity of larger diameter at this point than at the rim." I reproduce his illustration of a portable Olla mortar here. [19]



I treat Olla as a feature of a mortar's interior. A small number of Volvon mortars exhibit this feature. Most of these mortars are pans with flat bottoms or else compound mortars where the upper section is an Olla pan. The beautiful mortar below, with its combination of curved sides and flat bottom, resembles a frying pan—minus the handle!

Sometimes the Olla feature extends only partway around the mortar, as is the case with this compound mortar. California Indians boiled water by stirring hot rocks in containers. The Olla feature may have facilitated this process. Striations visible on the inner wall of this mortar may have been created by swirling, heated stones.

Mortar Mouths

The shape of a mortar's mouth is a significant feature of the mortar. In his study, Johnson noted two types of mortar mouth shape—the circular and the elliptical. Many mortars that appear circular are actually slightly elliptical. Mortars whose mouths are distinctly elliptical are rare but not uncommon.

The mortars in this example offer a direct comparison of circular and elliptical mouths.

Johnson's mortar mouth shapes are two-dimensional. A third dimension comes into play when the inner walls of a mortar flare outwards in the manner of the bell of a wind instrument like a trumpet or trombone.

There is a family resemblance between mortars with flaring mouths and funnels.

Sometimes the flaring is so narrow it's appropriate to refer to it as a "collar." The three mortars at the left side of this photograph exhibit distinct collar shapes.

Mortar Rims

The intersection of a mortar's interior and the surface of its surrounding rock define the mortar's rim. Mortar rims come in various types and combinations. The interior/surface intersection is abrupt in a mortar with a flat rim, sometimes almost right-angled. Mono informants in the Crane Valley study claimed this sort of rim was associated with seed processing.[20]

If the rim is rounded, the interior/surface intersection is slightly curved as these mortars illustrate.

A lipped or “fat lip” rim rises above the surface of the surrounding rock. This rim type is extremely rare. The upper mortar in this pair also sports a raised rim—a life-preserver form.

A mortar’s rim need not be all one type. The rim of the left hand mortar of the pair below is flat over part of its course and rounded over the rest.

Occasionally a rim opens up on one side, in what I call a “fishtail” or “spillway” pattern.

Sometimes a rim is higher on one side of the mortar than the other. This feature may appear where mortars exploit the contours of relatively flat or gently sloping rock surfaces, but it typically appears where mortars are positioned on the sides of rocks. Nearly all mortars point down—or originally did before their rocks tipped over. By “down” I mean “toward the center of the earth.” The rim of a downward-pointing mortar created on a sloping surface is higher on the “uphill” side than the “downhill.” I call this sort of rim a “hi/lo.” Mortars on the sides of rocks with hi/lo rims are not uncommon. The arrangement would allow the mortar user to straddle the mortar while keeping her feet on the ground.

Volvon Mortar Rocks

Single-Mortar Rocks

Of the 1,052 mortar-bearing rocks or outcrops in this report 665 of them bear but a single mortar. These single-mortar rocks vary in size and shape as do the mortars on them.

Some single-mortar rocks feature capacious mortars on relatively small boulders, like this example. This mortar rock could be moved around by hand, but is hardly portable.

Some single mortar rocks are small and bear small to medium sized mortars. Some rocks in this class have room for just one mortar on their useable surfaces.

Some single mortar rocks feature small cones on broad, slightly concave stretches of rock.

Why do some fairly large rocks hold but one mortar when there is room for more?

Some single mortar rocks look like tables or butcher blocks

.

A significant number of single mortar rocks in Volvon territory feature symmetrical cones about 6” (15.2 cm) in diameter and 6” deep on flat slabs.

The mortars holes of single-mortar rocks may be roughly centered, as in the examples above, or positioned along the edge.

In a few cases, single mortars occur in the flat part of seat-shaped rocks.

Although single-mortar rocks are by far the most common mortar rock encountered in Volvon territory, they do not occur in dense concentrations. The three mortars visible in this photograph exhibit a typical arrangement.

Single-mortar rocks occur in clusters with multiple-mortar rocks, as the three in the foreground here illustrate (one is hidden by grass and duff).

Multiple-Mortar Rocks

Multiple-mortar rocks bear more than one mortar. The most common multiple-mortar rocks in Volvon territory have two mortars—there are 184 of them—and just 42 have more than six.

Single-mortar rocks can be used by only one person performing one task at a given time. This constraint does not preclude using the same mortar in a multi-step mortar-processing task, but doing so might not be efficient. Part of being efficient is not gumming up the works for subsequent steps. For example, if the initial pounding of acorn nut meat in a mortar coats the walls of that mortar with an oily residue that renders it unsuitable for the final reduction of nut meat into flour, the mortar would need to be thoroughly cleaned to advance to next step. This complicates the basic task and is one reason the ideal acorn-processing setup features separate starter and finishing mortars. On many multiple-mortar rocks the mortars are grouped together in a manner that suggests they were used together in a single process. (Suggestion isn't proof, though.)

Paired Mortars

About half of the two-mortar rocks in this survey feature paired or closely paired mortars. Shallow cones and small cones are often closely paired in a way that seems conducive to acorn-processing by a single person.

Sometimes closely paired mortars are actually conjoined.

Paired mortars may be so close that they can be said to share a rim. These two mortars are paired in a 10” (25 cm) spread.

Closely paired mortars may be linked together in small basins. The teardrop basin here is about 9” (23 cm) long and 7” (18 cm) deep from the rock surface to the bottom of the deeper cone.

Pairing is not restricted to the smaller mortars.

Paired mortars are not necessarily of the same type. In this example a fairly wide 5” diameter (12.7 cm) cone or shallow bowl (classification is sometimes a matter of preference) is paired with a 9” (22.9 cm) diameter 8” deep (20.3 cm) funnel within an 18” (45.7 cm) span.

Adjacent Mortars

With some mortars it is better to describe their relation as “adjacent” rather than paired, as these two bullet-shaped mortars with flaring mouths illustrate. Both mortars could be accessed during the course of a single process by performing a rotational “butt-swivel” movement.

Sometimes adjacent mortars seem better suited for simultaneous use by two (or more) women than for use by one woman in a unitary process. The two large flaring cones or funnels on this rock (Take your pick. This is an example of a borderline classification.) adjoin flattened-out areas that seem nicely sculpted for rear ends. The two users would face each other.

Above/Below Relation

Adjacent mortars are sometimes arranged in an above/below relation. About 15% of all two-mortar rocks exhibit this arrangement. Typically, the “above” mortar sits on a relatively flat surface while the “below” mortar inhabits the rock’s sloping side and sports a hi/lo rim.

Closely paired mortars may also be arranged in an above/below relation as these two deep cones illustrate.

The above/below relation is not restricted to two-mortar rocks.

The proximity of mortars on a rock does not prove they were used together in a single process, but even if they were, mere proximity does not prove they were used by just one person in the course of that process. Perhaps two or more women worked together. Still, some mortar arrangements (like conjoined pairs) seem to preclude multiple person use—at least use at the same time! If one woman worked at this group of four shallow and small cones, it's hard to imagine there being room for anyone else.

Here's another example of small, closely packed mortars, this time in a blue-tinted basin. The source of the blue tint is a mystery, but the coloration appears on several mortar rocks featuring basins in the Volvon Village.

Close linear arrangements of mortars would allow easy swiveling or sliding access during a continuous process. The funnel below is separated from the small cone by just 7” (17.8 cm).

The three cones below are grouped in a linear arrangement 18” (46 cm) long. The cones vary in depth from 2-1/2” (6.4 cm) to 5-1/2” (14 cm) and in diameter from 3” (7.6 cm) to 5” (12.7 cm). These mortars were likely devoted to acorn processing. More than one person could use these mortars at the same time, but it would be a cramped operation. The shallowest mortar has the dimensions of a classic “starter” mortar. Perhaps it functioned as a common starter mortar for processing types of acorn with different workability properties such as oiliness. The oilier variety might be easier to manage in the shallower of the two “finishing” mortars. Another possibility is that no self-respecting Volvon woman would use the same mortar to finish both Blue Oak and Live Oak flours. (Note: It is downhill from the boot toe to the mortar nearest the top of the picture, which sits at the base of a slope on the edge of a flatter section of the rock.)

Mortars closely grouped in a triangular arrangement seem ideally suited for a single person using them in a single process.

More widely spaced triangular arrangements do not seem obviously suitable for single person processing, though it is possible to imagine a woman seated in the center of this rock accessing these mortars in turn. The mortars here do not seem ideally arranged for seated multiuser use either. Perhaps a woman used these mortars to process different food stuffs at different times.

These four symmetrical cones (diameter and depth approximately equal) vary in size from 4-1/2” (11.4 cm) to 6” (15.2 cm). Note the flaring or collared mouths, which give these mortars something of the feel of compound mortars. This rock was probably level when it was in use. It has sunk on its side over time. A woman could sit amongst the mortars and access each one in turn by rotating 90°. But did she? Or were these subtly different mortars used in distinct processing tasks?

Deep bullet-shaped mortars are often closely grouped. Small groupings raise the same questions about single or multi-person use. One can imagine several women occupying perches above these mortars. Alternatively, this rock could have been owned by an individual woman who processed different types of hard seeds in each of the bullets.

Larger groupings of bullet-shaped mortars suggest mass production by multiple users. The diameters of most of these mortars range from 6” to 8” (15.2 cm to 20.3 cm). Their depths range from 10” to 16” (25.4 cm to 40.6 cm).

Other close groupings of large mortars suggest substantial production of food that falls below the threshold of mass production. The gigantic flaring mouths on these mortars—measuring from 10” (25.4 cm) to 16” (40.6 cm)—make them look like Victrola horns.

Closely grouped mortars are sometimes connected in a way that makes it seems as if they were involved in some common process.

Just what those processes might be remains a mystery.

Multi-Purpose Rocks

Multi-mortar rocks might be multi-purpose rather than multi-user.

The adjacent mortars with substantial flaring mouths on this rock were probably involved in the production of large quantities of some foodstuff, likely acorn flour, yet their range of depths and variety of shapes are consistent with this being a multi-purpose “kitchen rock” designed to process different foodstuffs. Note: Sheep penned up at this site damaged the surface of this rock with their cloven hooves. The scratches did not result from over-zealous daylighting of the mortars.

Mortar rocks may have been owned by women or families.[21] The diversity of mortar shapes and sizes on this beautiful table rock as well as the close packing of the mortars themselves suggest this was an individual woman's kitchen rock. Of course, individual ownership would not rule out help in food production at this rock from a daughter or a friend.

The six conical mortars on this probable kitchen rock vary in depth and diameter. They seem to be arranged in two sub-patterns—one linear and one triangular. This apparent arrangement may be meaningless functionally. The two smaller mortars in the linear string look like classic acorn starting and finishing mortars. Note their rounded rims. The deepest mortar on the rock might not be functionally connected to these mortars, even though it is right next door to them. There is so much we just don't know. The three triangularly arranged mortars are packed closely enough that a woman could use them all, without moving around, in the course of a single process. But did she?

The organization of mortars on a rock into identifiable sub-groupings does not automatically categorize the rock as either multi-purpose or multi-user. There are six identifiable sub-groups of adjacent or closely grouped mortars on this rock. These groupings could represent separate workstations for processing distinct foodstuffs used by an individual woman over the course of a season or a year. They could also represent separate workstations for several individuals working concurrently.

Close grouping and mortar type differences do not prove that a rock was a multi-purpose rock. We know something about how the California Indians processed acorns into useable flour, but we know next to nothing about how they processed hard seeds and other vegetable crops. The bullet-shaped mortars here are 10-1/2" (26.7 cm) and 5-1/2" (14 cm) deep respectively—too deep for acorn processing according to the "modern" theory of mortar function. Were the shallow mortar and the funnel used in acorn processing with the funnel mortar playing the functional role of a basket hopper mortar, known to be closely associated with the production of acorn flour?[22] Or were all four mortars involved in processing some seed or root?

Multiple User Rocks

Food production—especially of acorn flour, which involved a particularly complex process[23]—was often a social activity for California Indian women and was sometimes centered on a single rock.

Wide spacing of mortars on a multi-mortar rock is consistent with the rock's being either multi-purpose or multi-user.

The seven conical mortars on this rock vary somewhat according to depth and seem to be arranged in sub-groupings. This is consistent with the rock being multi-purpose or multi-user.

Wide spacing of similar mortars might be the mark of a multi-user rock. Four women could comfortably occupy this rock.

Large rocks with many widely-spaced similar mortars seem likely to have been multi-user rocks. The ten cones on this rock range from about 3” (7.6 cm) to 6” (15.2 cm) deep with 4” (10.2 cm) to 5” (12.7 cm) diameters. The shapes and dimensions of these mortars suggest they were used in acorn processing.

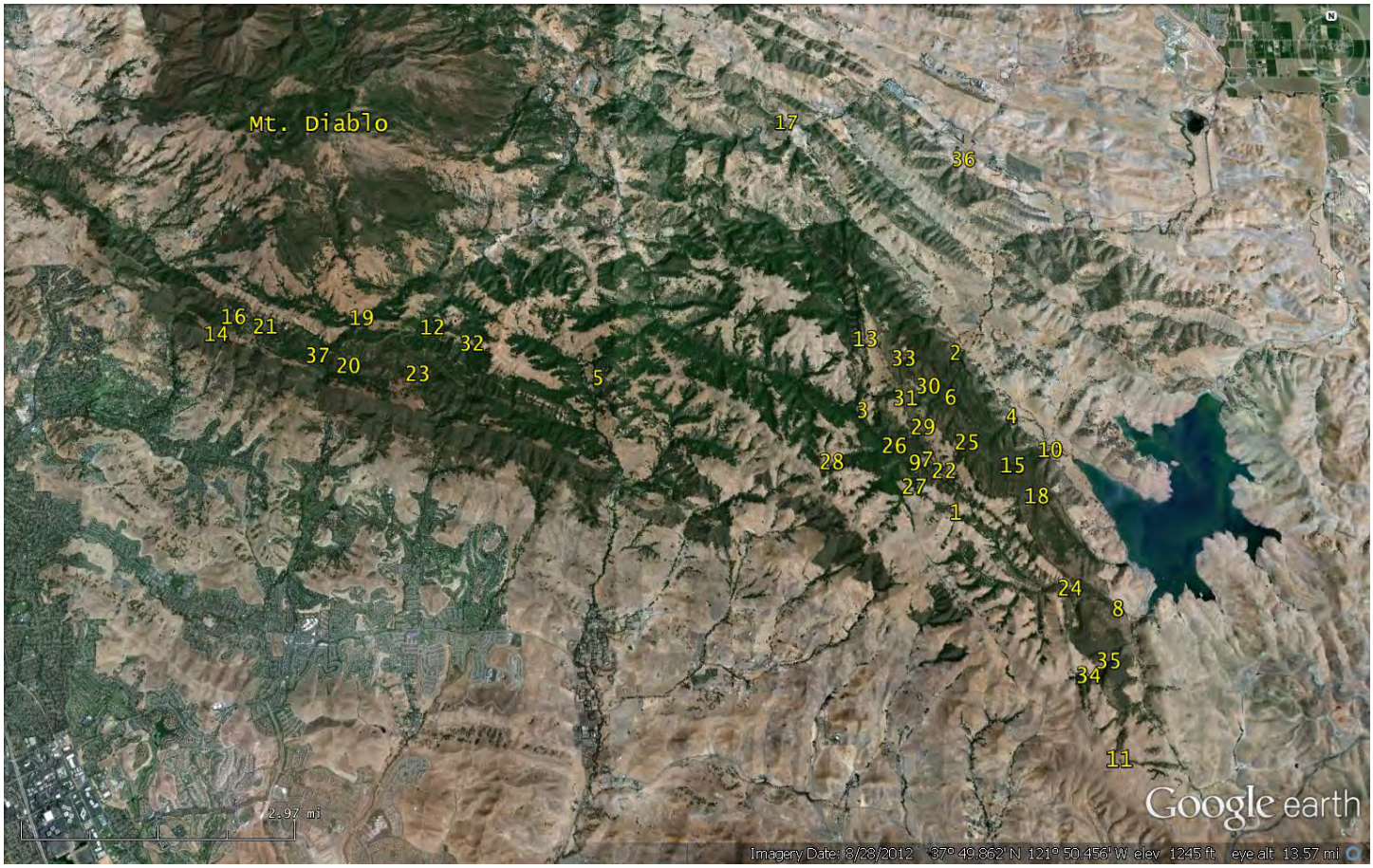
Some high-count mortar rocks just have the feel of multi-user milling stations. This is a totally subjective reaction, but not necessarily an invalid one. There are 16 nicely spaced mortars and sub-groups on this rock. Not all are visible. The depths and dimensions of most of these mortars suggest they were used for acorn processing.

There are 25 mortars on this rock, none deeper than 6” (15.2 cm). It is almost inconceivable that this was a single-user, multi-purpose rock.

Detail of the previous rock, which shows 16 (and part of a 17th) of the 25 mortars on this rock. Note the close pairing of mortars and the positioning and number of shallow cones.

The Sites

Here is a map, courtesy of Google Earth, of the sites in this report. A key follows. E. Breck Parkman defines four types of bedrock mortar site (family, extended family, clan, and village), which reflects characteristics of his study area. For Parkman, a village is a site with 20 or more bedrock mortars.[24] This definition is not appropriate for Volvon territory, where bedrock mortar sites are generally far larger than those encountered by Parkman. I will restrict the term "village" to the larger sites examined in this report, and to sites that exhibit a diversity of mortars that suggests occupation during different seasons of foodstuff availability.



Key: 1 Volvon Village; 2 Round Valley; 3 Lower Volvon Village; 4 Pond Village; 5 Riggs Canyon Amphitheater; 6 Bob's Mortar; 7 Lion's Mane; 8 Mallory Shelf; 9 Fallen Oak; 10 Log Cabin; 11 Nothing There; 12 Jan Enderle; 13 Stone Corral; 14 Live Oak; 15 Canyon Milling; 16 Trail Through Time; 17 Marsh Creek; 18 Fig Pig Gulch Meadow; 19 Curry Creek Milling Station; 20 Knobcone Trail; 21 Below Rock City; 22 Blue Oak Trail; 23 Below Cave Point; 24 Mallory Creek; 25 Pond Village Creek; 26 Molluck/Coyote; 27 Coyote Trail; 28 Highland Ridge Pond; 29 Hummingbird; 30 Manzanita Trail; 31 Slick Ridge; 32 SW Windy Point; 33 Whelk Pond; 34 Mid Silva Creek; 35 Silva Creek; 36 Off Marsh Creek; 37 Devil's Slide

Volvon Village

This village is home to over 700 bedrock mortars, numerous house pits, and several open areas that could have accommodated dance houses or other large structures. It was undoubtedly the capital of the Volvon tribe. The village extends over a narrow band of land in the Black Hills between Morgan Territory and Highland Ridges. From its northwestern end at a saddle separating the Marsh Creek and Mallory Creek drainages, it runs downhill for half a mile along the north bank of Mallory Creek. The average elevation of the village is 1950 feet (594m). "Volvon" translates as "natural springs,"[25] and the village's location near the sources of Marsh and Mallory Creeks (the latter is the principal tributary of Kellogg Creek) shows it to have been aptly named. The headwaters of a number of other important Contra Costa County creeks also rise in Volvon Territory.

Like modern cities, Volvon Village is an agglomeration of neighborhoods. Some commentators might treat these neighborhoods as separate sites, but this would ignore an important holism that characterizes the village. The widest separation between groups of mortar rocks in the village is 250 feet (77m). The proximity of potential sub-sites to the core and each other creates an overall unity. Because of the size and stature of Volvon Village, I provide here a brief photographic tour of its principal neighborhoods.

A small but surprisingly diverse collection of mortars and basins cluster around the base of a small knob at the northwestern end of the village. The road cutting in front of this group of mortars and basins is the Volvon Trail in Morgan Territory Regional Preserve.

This next photograph looks out from atop an area I call the “Mound,” which is home to another diverse group of mortars. Beyond the mortars in the foreground lies a small group of mortars I call the “Ring.” Beyond this group and across the Volvon Trail is the small knob pictured above.

This view shows the Ring and the Mound just beyond it.

An ancient trail links the Ring and the Mound to a small group of mortars on the top and east side of this little hillock.

About 12% of the mortar rocks (45 rocks) and less than 10% of the mortars (68 mortars) in the Volvon Village occur in the areas pictured above.

A small seasonal creek separates the group of mortars on and around the hillock shown above from an area of Volvon Village I call the “Knoll.” The top of the Knoll is clear and flat. This area may have been home to the village dance house. The Knoll holds 14% of the mortar rocks (53 rocks) and 13% of the mortars (95 mortars) in Volvon Village.

The views from the top of the Knoll are extensive. The dark hill in the distance is Brushy Peak, home of the Ssaoam, an Ohlone tribe. The main trading ground serving Bay Area and Central Valley tribes was located on the northeast side of Brushy Peak.

The two and one-half acre area comprising the Knoll and central core of Volvon Village holds 72% of the mortars in the entire village (and two thirds of the mortar rocks). The Knoll and core both appear in this photograph. They are separated by a dirt road. An impoundment dam created the pond sometime in the historic era, although a smaller pond may have occupied the same general area in Volvon time.

A striking feature of the core is its layout. Note the three lines of mortar rocks between the pond and the fence that cuts across them. This one and one-half acre terrace is home to 52% of the mortar rocks (194 rocks) and 58% of the bedrock mortars (414 mortars) in Volvon Village. Although some of these rocks are natural outcrops, many appear to have been moved into place. Beyond the farthest line of rocks the terrace drops off precipitously toward Mallory Creek. Volvon homes and granaries may have occupied the rock-free areas between the rock lines.

The following six ground-level views convey something of the look-and-feel of the core of Volvon Village. I call this enclosed area above the impoundment dam “Camp Benney.” Rocks stacked across the southeast end of this enclosure were likely placed there during historic times. The soil in many of the open areas in Camp Benney is dark in color and slightly greasy in texture—characteristics of midden soil. Many of the rocks visible in this photograph hold bedrock mortars.

Outside of Camp Benney, mortar rocks line both sides of a large open area. It is easy to imagine structures of various kinds occupying this space.

Mortar rock density increases from east to west across the terrace. Rocks occasionally roll down from the cliffs above.

Several important mortar rocks lie in the mass of rocks at the center of this photograph, which is part of the middle line of mortar rocks in the core of Volvon Village.

This view looks southeast from the middle line of mortar rocks. Open areas adjacent to this line of rocks would have afforded numerous building sites for the type of moderately large conical structure likely to have been a Volvon home.

The westernmost line of rocks boasts the highest concentration of bedrock mortars in the core of Volvon Village.

The mortars thin out in the southeastern end of the village, which ends at a knob I call the "Watchtower," depicted here at the left center of the photograph below. "Thin out" is, of course, a relative term, since there are 140 mortars in this area, including a nice grouping in Mallory Creek below the Watchtower.

The full panoply of mortar types and features finds expression in the Volvon Village. Many of the most striking mortar rocks in Volvon territory are also found here and have appeared in the analytical section of this report. Details of mortar type and number may be found in Appendix A.

Round Valley

Round Valley village sits at the foot of the eastern slope of the Black Hills alongside Round Valley Creek. Part of the village strings out along an unnamed tributary of this creek. Where the two creeks merge, the village begins. The heart of the village spreads over the top and sides of a small hill. The village ends where the hill butts up against the steep escarpment of the Black Hills. Round Valley was the Volvon's "second city"—home to 317 bedrock mortars on 173 mortar rocks. Round Valley village is also home to a distinctive *tsektsel* or prayer seat.[26] If you visit this site, please respect this archaeological treasure.

This view looks toward the village. Most of the mortar rocks at Round Valley are on top of the small hill that rises in this center of this photograph.

Although there are mortars on the banks of Round Valley Creek, which is just out of sight beyond the left hand margin of the previous photograph, and mortars on the slope of the hill, the heart of the village lies where the hill flattens out at its top. The ten-mortar rock in the center of this photograph marks the beginning of this area.

Round Valley village is perhaps the least photogenic of the bedrock mortar sites in this study. The layout of mortar rocks is nearly impossible to discern among the trees, fallen wood, high grass and poison oak. Access to parts of this village is effectively blocked to all but the most determined (and poison oak resistant) visitor. The rocks in the center of the village near the *tsektsel* are arranged in rough bands separated by open aisles. Unfortunately, there is no vantage point from which this arrangement is clearly visible.

Looking out over the *tsektsel*.

A small terrace.

A string of rocks with bedrock mortars on them.

About half of all mortars at Round Valley are conical mortars less than 4” (10.2 cm) deep. At Volvon Village the corresponding figure is 27%. There are no distinctive basins at Round Valley, no nipples, few bowls, and just a handful of mortars that are even funnel-like. These could be better described as conical mortars with flaring mouths, as this example illustrates.

Lower Volvon Village

Lower Volvon Village spreads out over a gently sloping terrace not far from Marsh Creek about 1.25 miles (2 km) from the northwestern end of Volvon Village. Two small ephemeral creeks (more like drains from nearby hills) cut through the site. The elevation at the village is about 1450 feet (442 meters). The village is home to 200 bedrock mortars that exhibit nearly the same diversity as the mortars at Volvon Village.

Looking down at Lower Volvon Village from the hills above. Most of the mortars at this site flank the barely visible drainage at the left center of this photograph.

There are 51 mortars and 21 mortar rocks scattered along this tiny creek. Two nipple mortars and an egg-shaped cupule rock may be found here.

Many of the mortar rocks in this section of Lower Volvon Village are arranged in aisles and terraces. There are 50 mortar rocks and 71 mortars on this low mound.

The concentration of mortars is lower in this part of the village, which may have been a residential area.

Single mortar rocks account for 72% of all mortar rocks at Lower Volvon Village. The comparable percentage at Volvon Village is 60% and at Round Valley 64%. Single and two-mortar rocks account for 88% of the mortar rocks here, a figure higher than, but more in line with, the percentage at Volvon Village (80%) and Round Valley (82%). Many Lower Volvon Village mortars have battered interiors, though a significant number of these feature smooth parabolic surfaces at their bottoms. Perhaps this indicates adaptive reuse of older mortars.

Pond Village

Pond Village sits at the base of the eastern slope of the Black Hills about one mile (1.5 km) southeast of Round Valley Village. The village is named for an impoundment pond on an unnamed tributary of Adobe Creek. The village spreads out in a V-shaped plan over both banks of this tributary creek. The vertex of the "V" lies near where this creek debouches from the steep escarpment of the Black Hills. This beautiful eight-mortar rock (and its single-mortar companion) sits near that vertex.

The north bank of what I will call Pond Village Creek is on slightly higher ground than the south bank.

This trio of flaring cones may be found next to the bread loaf-shaped rock at the left center of the previous photograph.

The south side of Pond Village Creek is a narrow, relatively level terrace.

As is the case at Round Valley, there are no true funnels or nipples at Pond Village. There are, however, several nice examples of mortars in basins.

Riggs Canyon Amphitheater

The Amphitheater off Old Finley Road above Riggs Canyon is an intriguing geological formation. It boasts amazing acoustics, and its rock face presents designs and images to those with active imaginations. A large rock near the mouth of the Amphitheater holds more bedrock mortars than any other in Volvon territory. This view looks out from the top of the Amphitheater. Mission Peak and Mt. Allison are visible through the haze at the top left corner.

A close-up of the main rock at this site. It is home to 41 bedrock mortars, some of which are visible in this photograph. Dark holes at the top of the rock are basins with mortars in their bottoms.

Adjacent to the big rock (actually an extension of it) is a slab with 23 bedrock mortars, 20 of them deep bullets. In all, there are 64 deep bullets at this site, several of them a foot (30.5 cm) or more deep. Most of these deep bullets have elliptical mouths and slightly battered interiors. Not all of the mortars on this slab are visible in this photograph.

A second slab, probably continuous with the first but separated from it by a patch of soil, holds 20 deep bullets. The close packing of deep bullets at this site suggests mass production of some non-acorn foodstuff.

A close-up of some of the deep bullets here. Note the battered interiors and the flat rims.

Bob’s Mortar

Bob’s Mortar straddles a small seasonal creek on the eastern slope of the Black Hills. The namesake mortar at this site is a compound mortar that sits directly above a seep spring, which dribbles water throughout the year. Nearly every mortar at this site is less than 6” (15.2 cm) deep and conical in form. This suggests that acorn processing was the dominant (if not sole) food-processing activity here. Bob’s Mortar is dominated by a beautiful 25 mortar rock pictured on pages 49 and 50 in the section on multiple user rocks. The site is wooded and shady today. It may not have been this way in Volvon times.

A small cluster of mortar rocks lies a short distance away from the rest. The five cones in this shallow basin range in depth from 3” (7.6 cm) to 4-1/2” (11.4 cm).

Lion’s Mane

The Lion’s Mane site is dominated by a beautiful twelve-mortar rock. The mortars on this rock generally sport battered interiors and have smooth surfaces, if any, only near their bottoms. Could this pattern reflect an adaptive reuse of older, possibly abandoned, mortars?[27] Most of the mortars on this rock straddle the line between having a collar or a flaring mouth and being a compound mortar.

A close-up view of some of some of the mortars. Note their compound nature. Three of them could be called “nipples.” The bottom one looks like half an avocado with the pit removed.

These four mortars seem connected.

Another view of the rock that better depicts the work surfaces.

A minor seasonal creek flows past Lion's Mane. This illustrative four-mortar rock sits not far from the channel. Three of these four deep bullets have hi/lo rims. Note the above/below relation of the upper two.

The curvature of this mortar's bottom makes it a bowl and not a pan. A high percentage of the mortars at this site (19%) are bowls.

Mallory Shelf

The Mallory Shelf site occupies a small terrace or shelf above Mallory Creek not far from its confluence with Kellogg Creek. The view below looks out at the site over an eight-mortar rock.

Detail of the above rock. There is a nice variety of cones here with machined interiors and mostly rounded (or a combination of rounded and flat) rims.

Raisins sit at the bottoms of 18 cupules/anvils on this four-mortar rock. (One shallow mortar is virtually invisible.)

This slab outcrop in Mallory Creek below the shelf is home to seven conical mortars.

Fallen Oak

The Fallen Oak site is 800 feet (244 m) northwest of Lion's Mane. The main cluster of mortar rocks appears in this view, as well as the fallen oak tree that gives this site its name.

A number of compound mortars exist at this site. Some probably represent reuse of older mortars.

There are nipples and funnels here too, as well mortars that seem to straddle the divide between those two classes.

Log Cabin

Log Cabin is the smallest of three sites strung out along the eastern foot of the Black Hills. Just two Log Cabin mortars could be described as bullet-shaped. The rest are all conical. There are a few examples of mortars in basins here, but no compound mortars. Log Cabin has an unusually high percentage of paired or closely grouped mortars. This specimen sports a conjoined pair—note how the shared rim dips—and a tightly packed triplet. (A bay leaf partially obscures the tiny, leftmost mortar in the triplet.) Note the stark color contrast between the interiors of the mortars and the rock's surface.

The mortar rocks at Log Cabin are sprinkled in and around a small tributary of Adobe Creek. This view shows a cluster of four mortar rocks that includes a conjoined pair (just beyond the far end of the fallen limb in the foreground) and a pair of mortars in a narrow basin (to the left and slightly behind the single-mortar table rock butting up against a tree.)

Nothing There

Nothing There is the southernmost site in Volvon territory. It clings to the spine of a small knob at the southern end of the Black Hills near the source of an unnamed tributary of Kellogg Creek. Several mortar rocks appear in this view, but you'll have to take my word for it.

Many of the mortar rocks here are cracked or broken. The interiors of many mortars are battered. Are these signs of age or of abuse by weather and livestock? Is the composition of the rock itself to blame?

Over half of the mortars at this site are bullet-shaped. Less than a quarter of the mortars here are cones shallow enough for traditional acorn processing. The four deep mortars shown in this view are different enough that each could have been dedicated to the processing of a particular foodstuff.

Detail of the left hand rock. The deep bullet on the left is nearly enclosed by a wide, flaring rim that makes the mortar seem recessed in the rock. Note that the rim of the funnel on the right is mostly rounded.

Jan Enderle

Jan Enderle is a peaceful site situated along a quiet tributary of Curry Creek. This view looks toward the creek.

Nearly all the mortars at Jan Enderle are conical and of a depth appropriate to acorn processing. One rock adjacent to the creek holds the only bullet-shaped mortars in the village.

Stone Corral

Stone Corral features an unusually high percentage of cones with broad mouths. All mortar rocks at this site are single-mortar rocks—except for one. That exceptional rock has ten mortars.

Detail of two deep cones with funnel-like features on the ten-mortar rock. Each of these mortars has a small inner cone in its bottom, covered by water in this photograph.

Live Oak

The Live Oak site is dominated by two high-count mortar rocks. One rock is home to a group of cones and deep cones with rounded or flat, mostly hi/lo rims. The elevation difference between the sides of a hi/lo rim can be slight, as it is for each of the four mortars running in a line down the spine of this rock, or steep, as it is for two mortars on the side. The spacing of these mortars and the relative uniformity of mortar type suggest this was a multiuser rock.

The other high-count Live Oak mortar rock is notable for its compound mortars. There are true funnels as well as mortars in pans and bowl-shaped basins. The upper sections of these mortars are often partial Ollas and are quite capacious.

Rims of the compound mortars here often flare out on one side.

Canyon Milling

Canyon Milling sits about halfway up the eastern slope of the Black Hills alongside the same tributary creek that runs past Log Cabin. The mortars here are all cone-shaped. There are no bullets or compounds. There are no deep mortars. Volvon women likely processed acorns here. This four-mortar rock looks like it was set up for three users.

Note the machined interiors and rounded rims on these mortars.

The dark circles on the bare patches of rock below are shallow mortars and cupule/anvils.

A closer look.

Trail Through Time

Trail Through Time is part of a cluster of sites in the Live Oak/Rock City area in Mt. Diablo State Park. Nearly 40% of the mortars here are deep bullets.

The Trail Through Time goes right over this beautiful nine-mortar rock.

Marsh Creek mortars are primarily deep bullets. Note the vegetation plugs.

Note how this deep bullet is recessed into a seat-like ledge.

Fig Pig Gulch Meadow

Fig Pig mortar rocks are scattered over a fairly wide area, but most are near this short, spring fed creek.

Fig Pig mortars are all conical. Two have large flaring mouths that give them qualities of funnel-shaped mortars, if not outright membership in that class.

The nearly complete wide flaring mouth on this specimen could promote it to the “partial funnel” class. The missing mouth section does not seem to have simply broken off. Instead, the mortar appears to have been created with a “fishtail” opening of a type encountered elsewhere in Volvon territory. Note the parabolic vegetation plug.

Curry Creek Milling Station

Curry Creek Milling Station is home to some unusually capacious mortars. I discussed one of them—the most capacious in all of Volvon territory—in the section on compound mortar shapes. This view looks over the big compound mortar toward a notable ten-mortar rock on the hillside below.

The largest of the elliptical funnels here measures 15” (38 cm) x 13” (33 cm) x 13” (33 cm) deep to the bottom of the inner cone. Most rims are a mixture of flat and rounded features. Interiors are generally machined. The cones with flaring mouths take on funnel-like features.

Knobcone Trail

The principal mortar rock at the Knobcone Trail milling station—with sixteen nicely spaced out mortars—appeared above in the section on multiple user rocks. The second rock at this site features two compound mortars. The upper section of the larger one is an Olla pan with a wide, flat, slightly raised rim.

Detail showing the inner cones.

Below Rock City

Both mortar rocks at the Below Rock City site feature compound mortars. This funnel and partial funnel make a beautiful pair. Note the companion shallow mortar.

Behind this capacious compound mortar is a basin or slick with two shallow cones in it.

Blue Oak Trail

Blue Oak Trail is a pleasant camp site on a knob not far from Lion's Mane. It is home to some fine examples of compound mortars. The setting here seems to imbue this nipple mortar with extra significance.

This elliptical funnel measures 10” (25.4 cm) x 8” (20.3 cm) x 9-1/2” (24.4 cm) deep to the high point of the rim.

Below Cave Point

The Below Cave Point site consists of a single eleven-mortar rock. Four large compound mortars whose upper sections are Olla pans dominate the rock. Note the wide, flat rims that edge these mortars. They seem to provide standing places.

Mallory Creek

Mallory Creek not a single site but a group of three sites. The notable mortar rock here features an *in situ* pestle. The ovoid pestle is 6” (15.2 cm) long and snugly fits into a 5” (12.7 cm) diameter cone that is 4-1/2” (11.4 cm) deep. If you visit this site please do not remove the pestle.

Since the fit between mortar and pestle is so tight, is it possible the pestle was used with a twisting rather than a pounding motion?

Pond Village Creek

Pond Village Creek is a small camp that sits on the upper reaches of the creek that drains down to Pond Village. The mortar rocks here mostly hold bowl mortars. An exception is this rock with two closely-paired pot-shaped mortars. Several cupules/anvils also adorn the surface of this rock.

Molluck/Coyote

The mortar rocks at Molluck/Coyote string out along an intermittent creek near its confluence with Marsh Creek. The camp takes its name from two trails in Morgan Territory Regional Preserve that intersect nearby. This six-mortar is a fine example of a kitchen rock. Although the mortars are basically conical (there is just one funnel), they vary enough in features and arrangement to suggest each was a utensil with a distinct use. The gash-like hole is a shallow basin with a conjoined pair of cones in its bottom.

A nice, closely-grouped trio of cones adorns this table rock.

A single-mortar rock with an *in situ* pestle exists at this site. If you visit, please do not remove the pestle.

Coyote Trail

Coyote Trail is a group of three small sites near the headwaters of a tributary to Marsh Creek. The largest locus of mortar rocks includes this fine example of a deep, eccentric cone-shaped mortar.

Highland Ridge Pond

There is just one mortar rock at Highland Ridge Pond, which sits a little below the spine of Highland Ridge near the headwaters of a tributary of Marsh Creek.

Hummingbird

At Hummingbird a few mortar rocks are scattered beside the drainage of a seasonally wet meadow.

Manzanita Trail

“Where’s the water?” This question will likely arise in the mind of a visitor to this improbably located camp. Despite its unpromising aspect, Manzanita Trail is home to eight mortar rocks. The two mortars on this rock sit in the bottom of a natural depression that I hesitate to call a “basin.”

Slick Ridge

A high concentration of flat rocks bearing shallow, slick-like depressions gives Slick Ridge its name. Slick Ridge is also home to a number of beautiful Olla pans.

SW Windy Point

SW Windy Point is a small camp on a hill slope near a tributary of Curry Creek. Several deep mortars may be found here.

These mortars are perhaps better described as “compounds” than as “funnels,” but it’s a close call. Note the grouping of these mortars and their hi/lo rims.

Whelk Pond

The mortars at Whelk Pond lie in and along the upper reaches of Round Valley Creek.

Mid Silva Creek

Silva Creek provides a bucolic setting for this camp.

Silva Creek

A single, lonely mortar rock down in the bed of Silva Creek makes up the whole inventory of this site.

Off Marsh Creek

A large bedrock outcrop holds the handful of conical mortars at this site.

Devil’s Slide

This solitary conical mortar sits at the intersection of Devil’s Slide Trail and the Trail Through Time in Mt. Diablo State Park. The gentle sloping surface makes a comfortable seat.

Concluding Remarks

In this report I have tried to describe the variety of Volvon bedrock mortar types and their associated features. Since there is no Volvon ethnography, I have, for the most part, avoided drawing definitive conclusions about the use or function of Volvon bedrock mortars. However, I believe limited conclusions or hypotheses about mortar use consistent with published ethnographic studies are uncontroversial. For example, I think it is clear that deeper mortars, especially those with steeply sloping sides, which I call "bullet-shaped," were used to process hard seeds.[28] I believe relatively shallow conical mortars were used to produce acorn flour. Their gently sloping sides might have functioned like inclined planes. A woman withdrawing pounded acorn from a mortar by hand or with a soaproot brush could let heavier chunks needing further pounding roll back into the bottom of the mortar. I think it likely that the upper sections of some compound mortars functioned to contain material being pounded or ground in the mortar's inner cone or bullet, but I hesitate to make this claim for all members of the class. Likewise, I hesitate to claim any functional significance for mortar features even when they have natural interpretations. A "fishtail" or "spillway" rim looks like it would be useful for transporting material out of a mortar, but was it used this way? Who knows?

An inadequate functional account of Volvon bedrock mortar types and features encourages a sense of wonder—just what were Volvon women processing in those mortars and how did they do it? The simple picture of women pounding acorn or grinding (pounding?) seed does not tell the whole story of Volvon mortar use. It abstracts from all detail. Bedrock mortars are treated as mere holes in rock. I hope my report puts some detail back into focus, but the larger questions about the functional significance of these details remain unanswered. Perhaps some future study will address these questions and deliver a plausible functional account of Volvon bedrock mortar use.

In this report I have also tried to describe certain arrangements of Volvon bedrock mortars on the rocks that bear them. Although mere proximity furnishes an insufficient basis for secure conclusions absent any Volvon ethnography, I believe closely grouped mortars were likely used in unitary processes. For example, closely paired shallow and small conical mortars were likely used for starting and finishing acorn flour.[29] Bedrock mortars on some multi-mortar rocks exhibit such a diversity of depth, type, and feature that the rocks seem likely to have hosted distinct food processing tasks. I have called this type of rock a "kitchen rock." Bedrock mortars on other multi-mortar rocks exhibit such a uniformity of size, type, and feature that it seems appropriate to view these rocks as multi-user rocks, provided there are enough mortars on the rock and they are spaced in a way that would allow multiple users to work concurrently. Yet most Volvon mortar rocks are ***not*** multi-mortar rocks. Nearly two-thirds of the rocks evaluated in this report bear but a single mortar. What is the explanation? To be sure, some rocks could not accommodate two or more mortars on their useable working surfaces, but these constitute a small minority of single-mortar rocks.

Volvon bedrock mortar sites cluster in two distinct areas within the overall territory. The area I call "West Volvon," which includes Riggs Amphitheater and all the bedrock mortar sites west of it, holds 22% of the sites evaluated in this report but just 11.5% of the mortars. Nonetheless, West Volvon mortars are quite distinctive and beg for special consideration. For example, why are so many extraordinarily capacious mortars concentrated at the Curry Creek milling station? Were the big compound mortars with Olla pans in their upper sections at Knobcone Trail and Below Cave Point really used as cooking utensils? Certain mortar types are over-represented in

West Volvon. More than half of all deep bullets in Volvon territory occur there, thanks to the predominance of this mortar type at Riggs Amphitheater. West Volvon is home to nearly 40% of all compound mortars in Volvon territory as well as 18% of the funnels. What's the explanation, and why, for example, are funnel-shaped mortars virtually absent from lower elevation sites like Round Valley, Pond Village, and Log Cabin? This asymmetric distribution of bedrock mortar types among the various Volvon sites should be a topic for future research.

The major villages in Volvon territory are so close together it's unlikely that a significant part of the Volvon population migrated from one village to another in a "seasonal round." None of the four largest Volvon villages lies more than 2 miles (3.22 km) from any of the others. This is an hour's walk, at best. Since an hour's walk each way would not deter a fit California Indian from making the commute, it seems likely that each one of these villages had a permanent population. I don't mean to suggest that whole families might not go and stay with cousins to participate in an intensive, several-days-long harvest of some foodstuff, but they had no compelling reason to pull up stakes and relocate to another village. The villages were just too close together to make this a reasonable project. The Volvon food-gathering situation was not like that of the Sierra Miwok or the Tuibin tribe of Parkman's study area. The Sierra Miwok could not exploit food resources above the snowline until late spring or early summer, and the Tuibin's focus on an estuarine environment meant their main villages were located near the bay shoreline, a significant distance away from large scale sources of vegetable and terrestrial animal foodstuffs. By contrast, the main Volvon villages were surrounded by the Volvon "foodshed."

The sheer number of bedrock mortars in Volvon territory seems hard to reconcile with accepted estimates of Volvon population. Randall Milliken is the unquestioned authority on contact period Bay Area Indian demographics. He estimates the pre-contact Volvon population at no more than 200.[30] If a family comprised five or six individuals, then there were just 35 to 40 families occupying all of Volvon territory. If we divide these families among the four largest villages (and assume that none of the other sites or site complexes had a permanent population), we'll find that each family is associated with over 30 bedrock mortars. Does this make sense?

I think not. It is unlikely that only the four largest villages had permanent or semi-permanent populations. Thus the mortars per family ratio probably exceeded 40 to 1. The Volvons were a sophisticated bedrock mortar-using tribe, but that sophisticated? Several of the sites covered in this report contain a large number of mortars with battered interiors. Perhaps these sites or the battered mortars in them were abandoned at the time of European contact. Yet many of these battered mortars sport smooth, polished bottoms—a probable indicator of relatively recent use. Absent any reliable method for dating bedrock mortars, I think it is wise to refrain from speculating about mortar or site abandonment. I will also refrain from speculating about a "missing" segment of the Volvon population—one that avoided missionization by fleeing the tribal homeland. The apparent mismatch between Milliken's population estimates and my count of Volvon bedrock mortars will have to remain unresolved.

Milliken believes the Volvons may have been a less sedentary people than many of their neighbors since they lived in "a dry land watered only by intermittent creeks and small springs," where "village populations in these summer-drought lands may have broken up and reconverged at various camps throughout the year."[31] This view, I believe, is seriously mistaken. The principal creeks in Volvon territory are perennial. Their flow rates drop in summer and fall, but they do not dry up completely. Some camps undoubtedly were seasonally abandoned, but the

four largest villages and many other sites enjoy year round water flows. I imagine Milliken has not spent enough time in Volvon territory to appreciate the ecological situation there.

One virtue of the "reconvergence" theory lies in its potential for explaining the size of Volvon Village and the number of bedrock mortars there. Perhaps a better explanation is that Volvon Village functioned as a ceremonial site in addition to its role as a permanent settlement. The population of the village would swell at certain times. Perhaps members of neighboring tribes attended "Big Time" celebrations there. Round Valley may also have been the site of celebrations and trade festivals. Unfortunately, the lack of ethnographic information for the Volvons makes all of this the rankest kind of speculation.

A Note on Pestles

In my many visits to Volvon bedrock mortar sites I have encountered few pestles. I have seen a number of rocks or cobbles that could have been used as pestles, and maybe were, but very few definitive examples. No doubt there are many pestles lying just below ground level, but these are inaccessible. I wish the situation were different and that I had access to a sample of Volvon pestles large enough to propose some sort of provisional typology. I have encountered far more pestles at sites on and around Walpert Ridge (above Hayward) and in the Mission Peak vicinity than in Volvon territory, even though the Walpert Ridge and Mission Peak sites all together contain just one tenth of the number of bedrock mortars present in Volvon territory.[32] I cannot remedy this pestle deficit, but I will close this report with an image of a distinctive Volvon pestle from Volvon Village.

Footnotes

1. Ernest N. Johnson, *Stone Mortars of Contra Costa County*, *California*, American Antiquity, Vol. 7, No. 3 (Jan., 1942), pp. 322-326; Richard K. Beardsley, *Temporal and Areal Relationships in Central California Archaeology* (in two parts), Reports of the University of California Archaeological Survey, Nos. 24 & 25, (Nov. 1954).
2. E. Breck Parkman, The Bedrock Milling Station, in *The Ohlone Past and Present: Native Americans of the San Francisco Bay Region*, ed. Lowell John Bean, pp. 41-63, Ballena Press, Menlo Park, 1994.
3. McCarthy, H., C. Blount and R. Hicks. Appendix F: A Functional Analysis of Bedrock Mortars: Western Mono Food Processing in the Southern Sierra Nevada. In *Cultural Resources of the Crane Valley Hydroelectric Project Area,* edited by Inc. Infotec Research and Inc. Theodoratus Cultural Research, pp. 303-356, vol. 1. Prepared for Pacific Gas and Electric Co., Sonora and Fair Oaks, California.
4. At least one commentator disputes this claim. Alice B. Francisco in *The Distribution and Function of Bedrock Mortars in California*, Contributions of the University of California Archaeological Research Facility, Vol. 33, pp. 57-75, 1976, contends that "an arbitrary level of depth is unlikely to affect the tendency of acorn meal to pack into a solid mass…the depth of mortar holes may have been determined by nothing more than habit and custom." p. 61
5. Parkman, The Bedrock Milling Station, pp. 46-7.
6. Mary Pohot working at bedrock mortars, near Ward Ranch, Woodlake, Tulare County, April 1925, Anna H. Gayton photographer. UC Berkeley, Phoebe A. Hearst Museum of Anthropology, California Ethnographic Field Photographs, South Central California Yokuts, identifier 15-7875.
7. The geographical location of Volvon territory derives from Randall Milliken, *Ethnogeography of the Los Vaqueros Region*, in Native American History Studies for the Los Vaqueros Project: A Synthesis, Fredrickson, Stewart, and Ziesing eds., 1997, pp. 8-31. My view is that Kellogg Creek was the boundary between the Volvon and Ssaoam tribes.
8. In the site description section of this report and in the tables of Appendix A I list 37 sites. Two of these "sites" are really complexes. For each one I combine site information from three distinct sub-sites. For a complete inventory of known Volvon bedrock mortar sites download the Google Earth compatible overlay available at eastbayhillpeople.com. Both the overlay and Google Earth are free.
9. By comparison, Parkman in The Bedrock Milling Station covers 18 sites and 126 mortars. This mortar count includes 5 cupules Parkman categorizes as possible "incipient" mortars. My bedrock mortar sample compares favorably with the one compiled by Brent Michael Leftwich in *Set in Stone: Bedrock Mortars and Behavior in the North-Central Sierra Nevada*, Ph. D. dissertation, University of California Santa Barbara, December 2010, p. 155. (See page 5 below.) Leftwich's sample derives from 296 bedrock mortar sites. About half of these sites (146) contain five or fewer bedrock mortars. Just 25% of the sites in my sample are that small, but this percentage would have risen to Leftwich's level had my sample included all the bedrock mortar sites identified in Volvon territory. Leftwich's sample contains 20 sites with 25 or more bedrock mortars. Mine contains 13. (See Appendix A.)
10. Johnson, *Stone Mortars of Contra Costa County*, *California*, p. 325.
11. Johnson, *Stone Mortars of Contra Costa County*, *California*, p. 333.

12. Leftwich, *Set in Stone: Bedrock Mortars and Behavior in the North-Central Sierra Nevada*, p. 143. (Leftwich misspells the term, unfortunately.).
13. *Ibid.,* pp. 147-8.
14. *Ibid.*, p. 322 and p. 323.
15. Parkman, The Bedrock Milling Station, p. 46.
16. E. Breck Parkman, *Cupule Petroglyphs in the Diablo Range, California*, Journal of California and Great Basin Anthropology, Vol. 9, No. 2 (1986), pp. 246-259 and E. Breck Parkman, *Further Notes on Cupule Petroglyphs in the Diablo Range, California*, Journal of California and Great Basin Anthropology, Vol. 10, No. 1 (1988), pp. 114-117.
17. Johnson, *Stone Mortars of Contra Costa County*, *California*, p. 325.
18. Leftwich, *Set in Stone: Bedrock Mortars and Behavior in the North-Central Sierra Nevada*, p. 122, for example.
19. Johnson, *Stone Mortars of Contra Costa County*, *California*, p. 325 for the description, p. 333 for the image.
20. McCarthy et al 1985, p. 317, as cited by Susan M. Hector, Daniel G. Foster, Linda C. Pollack, and Gerrit L. Fenenga in *An Overview of Cuyamaca Oval Bedrock Basin Metates*, Proceedings of the Society for California Archaeology, Vol. 21, pp. 161-168, 2009.
21. Leftwich, *Set in Stone: Bedrock Mortars and Behavior in the North-Central Sierra Nevada*, p. 60 citing T. L. Jackson, Pounding Acorn: Women's Production as Social and Economic Focus, in *Engendering Archaeology: Women and Prehistory*, ed. J. M. Gero and M. W. Conkey, pp. 301-325, Basil Blackwell Publishing, Oxford, 1991.
22. Michael A. Glassow, *The Significance to California Prehistory of the Earliest Mortars and Pestles*, Pacific Coast Archaeological Society Quarterly, Vol. 32., No. 4, Fall 1996, p.19
23. See for example Beverly Ortiz, *It Will Live Forever*, Heyday Books, Berkeley, 1991.
24. Parkman, The Bedrock Milling Station, p. 46. His correlation of "social units" and bedrock mortar counts deserves further study. Leftwich, *Set in Stone: Bedrock Mortars and Behavior in the North-Central Sierra Nevada*, pp. 151-55, defines stations, temporary camps, subsidiary camps, and principal camps in a manner analogous to, but a little wider than, Parkman's definitions. Leftwich's principal camps, for example, have 25 or more bedrock mortars.
25. Catherine A. Callaghan, *Los Vaqueros Linguistic Area*, in David A. Fredrickson, Suzanne B. Stewart, and Grace H. Ziesing, *Native American History Studies for the Los Vaqueros Project: A Synthesis*, Anthropological Studies Center, Sonoma State University Academic Foundation, Inc., 1997, p. 48. Callaghan's definition of 'Volvon': "Probably from Bay Miwok wolwol 'pond, natural springs.' Note Northern Sierra Miwok wolse- 'to come up (water), as in an artesian well,' and Northern Sierra Miwok wooles-ə- 'artificial pond'; also Lake Miwok pólpol 'pond, lake'."
26. Joseph L. Chartkoff, *A Rock Feature Complex from Northwestern California*, American Antiquity, Vol. 48, No. 4 (Oct., 1983), pp. 745-760. The reference to the Round Valley *tsektsel* is on page 757.
27. Hector et al, *An Overview of Cuyamaca Oval Bedrock Basin Metates*, p. 165, speculate that some of the Cuyamaca Ovals at CA-SDI-852 (the Two Pines site) may be of "great antiquity." "At this site, only the polished bottoms of the ovals are preserved, and the rock itself is highly weathered and exfoliated." This is a pretty fair description of the mortars on the twelve-mortar rock at Lion's Mane.

28. Jefferson W. Haney, *Acorn Exploitation in the Eastern Sierra Nevada*, Journal of California and Great Basin Anthropology, Vol. 14 No. 1 (1992), pp. 94-109. Haney makes a number of interesting observations on bedrock mortar use.
29. Thomas L. Jackson, in *Pounding Acorn: Women's Production as Social and Economic Focus*, in *Engendering Archaeology: Women and Prehistory*, Joan M. Gero and Margaret Conkey eds., pp. 301-325, Blackwell, Oxford UK and Cambridge USA, 1991, notes that the ideal distance between starter and finishing mortars was 20 cm—about 8 inches.
30. Randall Milliken, *Contact Period Lifeways* in Fredrickson et al, p. 37.
31. *Ibid.*, p. 37.
32. I refer the interested reader to the Google Earth compatible overlay mentioned in footnote 8. Many of the pestles on and around Walpert Ridge and in the Mission Peak vicinity are pictured in that overlay.

Appendix A

Bedrock Mortar Counts by Site and Type

Notes: “Deep” is generally 7” (17.8 cm) or greater, although there is variability to this appellation as there is for all categories based on depth. Broad mouth cones have diameters or major axes wider than 6” (15.2 cm) and depths that are shallower than their mouths are wide. The category of “funnels” includes funnels, partial funnels, and horn-shaped mortars. Compounds are multi-part mortars that do not easily fit into either the “funnel” or “nipple” category. Basins are counted separately. Mortars within them are enumerated in their proper categories.

Site Name	Shallow Cones	Small Cones	Cones	Deep Cones	Broad Mouth Cones	Bullets	Deep Bullets	Funnels	Nipples	Bowls	Compounds	Pots, Pans, Cups	Total	Basins
Volvon Village	81	120	247	30	39	82	16	50	3	38	5	5	716	49
Round Valley	31	124	83	18	22	16	13	3		5			315	2
Lower Volvon Village	26	34	46	11	17	12	9	14	6	21	2	3	200	3
Pond Village	28	27	40	14	11	9	2			3			134	5
Riggs Amphitheater	2	6	13	1	1	9	64	6				1	103	10
Bob’s Mortar	20	25	24	1		6		1			1		78	2
Lion’s Mane	4	7	12		2	5	4		5	11	3	4	57	
Mallory Shelf	10	3	19	4	2	2	2	1		1			44	1
Fallen Oak		3	9	1		5		2	3	11	4	2	40	1
Log Cabin	10	19	11	1	2	1	1						45	4
Nothing There	3	2	2	2		9	7	3		3	1		32	
Jan Enderle	7	7	10	1		1	2			1			29	1
Stone Corral	1	5	3	1	10	4		2				1	27	
Live Oak	2	3	10	3				4				1	23	5
Canyon Milling	7	9	7		1								24	
Trail Through Time			12	1		1	9						23	
Marsh Creek		1	2		1		19						23	
Fig Pig Gulch Meadow	5	2	5		4			2					18	

Site Name	Shallow Cones	Small Cones	Cones	Deep Cones	Broad Mouth Cones	Bullets	Deep Bullets	Funnels	Nipples	Bowls	Compounds	Pots, Pans, Cups	Total	Basins
Curry Creek	1	4		3	2		1	3			3		17	
Knobcone Trail		5	3			7	1				2		18	
Below Rock City	6		1					2			2		11	2
Blue Oak Trail	3		1	2	2			1	1	5	1	1	17	
Below Cave Point	2	4	1								4		11	
Mallory Creek	1	1	5					2					9	
Pond Village Creek			2							3		2	7	
Molluck/Coyote	2	2	5					1					10	
Coyote Trail	2	1	5	1									9	2
Highland Ridge Pond			2	1									3	
Hummingbird	1	2	1				1			1			6	
Manzanita Trail	3	4	2	1				1					11	
Slick Ridge			3							6	2	8	19	3
SW Windy Point							1	3			1		5	
Whelk Pond	1		2										3	
Mid Silva Creek	2	2	7							1			12	
Silva Creek		2											2	
Off Marsh Creek			5										5	
Devil’s Slide				1									1	
Totals	261	424	599	98	116	169	152	101	18	110	31	28	2107	88

Mortar Rock Counts by Site and Mortars per Rock

This table shows the number of mortar rocks evaluated at each site as well as the number of single- and multi-mortar rocks.

Site Name	Rocks	1s	2s	3s	4s	5s	6s	7s	8s	9s	10s	11s	12+ show number
Volvon Village	374	221	77	33	15	11	7	2	2	2	1		13, 14
Round Valley	173	111	30	16	6	2	2	3	1		1	1	
Lower Volvon Village	125	88	22	6	4	1	1	2		1			
Pond Village	67	41	12	6	3		1	1	1	2			
Riggs Amphitheater	7	2					1					1	20, 23, 41
Bob’s Mortar	24	13	1	6		1		1	1				25
Lion’s Mane	34	25	6		2								12
Mallory Shelf	17	8	2	2	3		1		1				
Fallen Oak	23	18	1	2	1						1		
Log Cabin	26	16	6	2	1			1					
Nothing There	21	13	6	1	1								
Jan Enderle	13	5	4	2	1		1						
Stone Corral	18	17									1		
Live Oak	4	2									1	1	
Canyon Milling	14	10	1	1	1	1							
Trail Through Time	6	2	1			2				1			
Marsh Creek	3	1					1						16
Fig Pig Gulch Meadow	14	12		2									
Curry Creek	4	2				1					1		
Knobcone Trail	2		1										16
Below Rock City	2				1			1					
Blue Oak Trail	13	11	1		1								
Below Cave Point	1											1	
Mallory Creek	7	5	2										

Site Name	Rocks	1s	2s	3s	4s	5s	6s	7s	8s	9s	10s	11s	12+ show number
Pond Village Creek	5	3	2										
Molluck/Coyote	3	1		1			1						
Coyote Trail	7	6		1									
Highland Ridge Pond	1			1									
Hummingbird	5	4	1										
Manzanita Trail	8	5	3										
Slick Ridge	14	11	1	2									
SW Windy Point	3	2		1									
Whelk Pond	3	3											
Mid Silva Creek	9	6	3										
Silva Creek	1		1										
Off Marsh Creek	1					1							
Devil’s Slide	1	1											
Totals	1052	665	184	85	40	20	16	11	6	6	6	4	9

Appendix B

This appendix provides the site locations of mortars and mortar rocks depicted in photographs in the analytical section of this report. All photographs in this report are by Bob Bardell or James Benney except where noted.

Page 5, Lower Volvon Village
Page 6 upper, Volvon Village; lower, Volvon Village
Page 7 upper, Volvon Village; lower, Volvon Village
Page 8 upper, Volvon Village; lower, Pond Village
Page 9 upper, Lion's Mane; lower, Volvon Village
Page 10 Fallen Oak
Page 11 upper, Lower Volvon Village; lower, Round Valley
Page 12 Curry Creek Milling Station
Page 13 upper, Fallen Oak; lower, Lower Volvon Village
Page 14 upper, Lion's Mane; lower, Volvon Village
Page 15 upper, Volvon Village; lower, Lower Volvon Village
Page 16 upper, Volvon Village; lower, Volvon Village
Page 17 upper, Volvon Village; lower, Volvon Village
Page 18 upper, Volvon Village; lower, Volvon Village
Page 19 upper, Lower Volvon Village; lower, Round Valley
Page 20 Volvon Village
Page 21 upper, Below Cave Point; lower, Curry Creek Milling Station
Page 22 upper, Bob's Mortar; lower, Volvon Village
Page 23 upper, Round Valley; lower, Volvon Village
Page 24 upper, Lower Volvon Village; lower, Round Valley
Page 25 upper, Volvon Village; lower, Pond Village
Page 26 upper, Volvon Village; lower, Riggs Canyon Amphitheater
Page 27 upper, Round Valley; lower, Volvon Village
Page 28 upper, Volvon Village; lower, Volvon Village
Page 29 upper, Lower Volvon Village; lower, Pond Village
Page 30 upper, Volvon Village; lower, Mallory Shelf
Page 31 upper, Volvon Village; lower, Volvon Village
Page 32 Lion's Mane
Page 33 upper, Volvon Village; lower, Log Cabin
Page 34 upper, Volvon Village; lower, Volvon Village
Page 35 upper, Volvon Village; lower, Volvon Village
Page 36 upper, Volvon Village; lower, Lower Volvon Village
Page 37 upper, Round Valley; lower, Volvon Village
Page 38 upper, Pond Village; lower, Volvon Village
Page 39 upper, Volvon Village; lower, Volvon Village
Page 40 upper, Bob's Mortar; lower, Round Valley
Page 41 upper, Volvon Village; lower, Volvon Village
Page 42 upper, Riggs Canyon Amphitheater; lower, Volvon Village
Page 43 upper, Volvon Village; lower, Volvon Village
Page 44 upper, Volvon Village; lower, Volvon Village
Page 45 upper, Volvon Village; lower, Volvon Village
Page 46 upper, Volvon Village; lower, Volvon Village
Page 47 upper, Round Valley; lower, Round Valley

Page 48 upper, Volvon Village; lower, Round Valley
Page 49 upper, Knobcone Trail; lower, Bob’s Mortar
Page 50 Bob’s Mortar