

## LIME KILNS: Evidence of Industry in the Uintah Basin

by Robyn Watkins

Early Utahans utilized the limestone in the surrounding topography to help them build their homes and communities. Evidence of lime kilns and limestone mining has been found on the Ashley National Forest, as well as on BLM land surrounding the Vernal and Roosevelt Areas. Philip F. Notarianni, reporting on mining practices in Central Utah, noted that "this type of mining is somewhat difficult to present in a general narrative fashion because of the amount of 'local' activity that characterized many Utah settlements."<sup>1</sup> Processed limestone could be used for bricks, mortar, paint, and plaster. In other parts of the world, it was also used to top dress their fields, but this process was not necessary for the Uintah basin's soil.

The limestone kilns generally came in two types: dome or shaft.<sup>2</sup> Dome kilns (also referred to as intermittent kilns) were described in 1904 as:

rudely constructed of stone, and were located on the side of a hill, so that the top was easily accessible for charging the kiln with stone and the bottom for supplying fuel and drawing out the lime. In charging, the largest pieces of limestone were first selected and formed into a rough dome-like arch with large open joints springing from the bottom of the kiln to a height of five or six feet. Above this arch the kiln was filled from the top with fragments of limestone, the larger pieces being used in the lower layers, these being topped off with fragments of smaller size. A wood fire was then started under the dome, the heat being raised gradually to the required degree in order to prevent the sudden expansion and consequent rupture of the stones forming the dome. Should this happen, a downfall of the entire overlying mass would take place, putting out the fire and causing the total loss of the contents of the kiln. After a bright heat was once reached throughout the mass of stone, it was maintained for three or four days to the end of the burning. This was indicated by a large shrinkage in volume of the contents of the kiln, the choking up of the spaces between the fragments, and the ease with which an iron rod could be forced down from the top. The fire was then allowed to die out and the lime was gradually removed from the bottom<sup>3</sup>.

The shaft kiln looked something like a chimney where the limestone was put in at the top and fired from below. The continuous process would provide lime at the bottom as limestone was added to the top. This type of kiln has been dated to the 1850s while dome kilns have been dated to the early 1800s<sup>4</sup>.

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<sup>1</sup>Notarianni, Philip F.. Cultural Resources Class I Survey of the Central Utah Area. v5. Utah Mining History Research unit. p14.

<sup>2</sup>Jensen, Albert C.. "Building the Erie Canal." Conservationist. June 96. v50 i6 p8-12.

<sup>3</sup>Eckel, Edwin Clarence. Cements, Limes, and Plasters. 1909 pp99-100

<sup>4</sup>Jensen, Albert C.. "Building the Erie Canal."

Chemically, the process of "liming" in these kilns caused the carbonic acid to be driven off leaving behind the lime and magnesia in its caustic state. After it has been heated, which is noted to occur better in shaft kilns,<sup>5</sup> it is then "slaked." Slaking occurs when the burned lime is removed from the kiln, absorbs moisture, and turns to powder. After this process the lime will no longer absorb water and it can then be made into a paste or mortar. There are three methods to slaking lime:

1. Spontaneous slaking involves piling the lime, covering it with sod, and thereby allowing it to absorb moisture and eventually turn to powder or "fall." This method is primarily for agricultural lime.
2. Slaking by immersion involves dipping the lime briefly into water and leaving it to fall in the air. This method is primarily for engineering use.
3. By pouring water on it and leaving it to fall. This method is for ordinary building processes.<sup>6</sup> As already noted, Utahans limed for building purposes: making bricks, mortar, plaster, and paint. Mortar, plaster, and paint were all easily produced by mixing water in with the slaked lime.

Brickmaking was a longer process as this report from the 1850s explains its technical process, Ground quicklime is thoroughly mixed with clean, sharp sand, and is then subjected to the action of either superheated or high-pressure silica. This process continues for from twenty minutes to ten days, according to the degree of heat employed when the material is molded and compressed by a heavy steam-hammer into blocks of any desired form. . . . Thirty days; exposure of the block, after it is first formed, to the air, produces an induration quite sufficient for all ordinary building purposes. . . . the endurance of this stone when submitted to repeated freezing and thawing is quite remarkable, and experiment proves it to be equal in this respect to granite.<sup>7</sup>

A different report from 1855 takes us through a process more likely used in the Uinta basin, In making, the gravel is laid on a common mortar bed, and the lime, which is slaked and made into a thin putty in a lime-trough, is then run on the gravel and the whole worked up into mortar. The bricks are usually made as large as is convenient for handling and of dimensions to suit the work for which they are intended. The molds are made, several in the same frame, as deep as the thickness of the brick and without any bottom; they are set on smooth ground and filled with mortar. This is worked in a little with the shovel and structure off at the top. In ten or fifteen minutes the mortar will have set, so that the molds can be taken off. The bricks are soon dry enough to handle, when they can be piled up and allowed to dry thoroughly. They are laid in mortar similar to that from which the bricks are made and the outside of the buildings are roughcast with the same.<sup>8</sup>

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<sup>5</sup>pp38-39

<sup>6</sup>p39-41

<sup>7</sup>as qtd in Eckel, Edwin Clarence. Cements, Limes and Plasters. p132.

<sup>8</sup>as qtd in Eckel, Edwin Clarence. Cements, Limes and Plasters. pp130-131.

Brig Swain from Vernal described a similar process. He and his brother Karl worked with their father and brothers who owned the "Swain and Sons Brick Company." They made the brick or "burnt" it as they call it, for several of the buildings in Vernal. Nick and Abner Swain (Brig's father and uncle) learned their trade from Charles Bunker when he burnt brick for the local LDS tabernacle at the turn of the century. The Swain brothers burnt the bricks for Maeser school, the old Naples school, Ashley Ward school, the Congregational church, and many others. The process to make these bricks sounds very familiar. Brig describes a process where "clay," probably slaked limestone mixed with water, was put in a large mixing pit some sixteen feet in diameter. Then it was put in a "pug mill" that was described by Karl Swain as five feet high and four feet in diameter. A pole with a paddle was inside this mill and turned by horse power. Then, Brig Swain tell us that "they would open the gate and it would come out of a square hole in the bottom." They would then put it in brick molds and allow to dry, just as the report from 1855 describes. But the Swains from Vernal went further then that, they proceeded to pile up the sun-dried bricks into what Brig called "kilns." He described them as "half as big as this house square. . . . just as a high as a kite."<sup>9</sup> He described them as piled facing somehow that the heat could rise up and "cure" them, hence the term "burnt brick."<sup>10</sup>

Due to the evidence from local and historical descriptions of liming, slaking, and brickmaking, it does not seem unlikely that there is evidence of lime kilns near spots on the Ashley such as Lime Kiln springs (AS-353) and Dodds Hollow (AS-271). In fact, liming and slaking and burning of bricks seem a much more likely process than the gold mining that some think occurred at these sites. Other sites exist closer to town, some on BLM land, that point to the likliehood that these structures were for liming and not for teasure troving. On December 3, 1996 Byron Loosle and I visited four of these sites and they varied from elaborate structures with artifacts in close proximity to deceiving piles of rubble.

The first kiln (see map A) was the most elaborate complete with a rubbish pile, coal remains, and a makeshift road that led straight up to it. The kiln itself was missing part of its wall but its diameter of 11'5" was still measurable. On either side of the kiln there were, what I would assume to be, retaining walls-one measuring 13' and the other 9'7". The large coal stain beside the kiln was assumedly to feed the fire inside the kiln. The large rubbish heap directly in front of the kiln could either have been just that, a rubbish heap, or possibly an area where the lime was left to be slaked. In addition to the structures, there was aqua-colored and clear -colored glass that Byron felt was from around 1913 due to the fact that it didn't look like it was machine manufactured. We also found pieces of metal, tin cans, and a metal bucket.

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<sup>9</sup>Interview with Brig Swain. p3. Vernal Library folder #1858.

<sup>10</sup>"Foundation for Community." The Vernal Express. January 22, 1992 and Interview with Brig Swain. p3. Vernal Library folder #1858.

The second kiln (see map B) was much closer to the local living area of Maeser. The two kilns were about thirty-four meters from a road that quickly junctions with 500N, the main road into Maeser. These two kilns were also built into the side of a hill, one with a diameter of 8' and the other with a diameter of 7'. The only artifacts surrounding these two was some aqua-colored glass. These kilns were further from any limestone quarry but closer to town and the remaining rock walls were more black than any of the others we saw.

The third kiln (see map C) was so close to the road its debris was falling into the road. This one had been dug out so we were able to get a height of 9'8" and a diameter of 7'7". At the bottom of the kiln, there was evidence of an opening similar to the one Karl Swain described. The fourth kiln's diameter was eleven feet. All of these differ from the descriptions by Karl and Brig Swain in that there was no way that horses would have been able to be attached to a "pug mill" that would turn the lime. These kilns were all built into the side of hills as the first quote describes and the lime must have been mixed by hand. The Swains, however, made their living by this process whereas these small kilns were probably for much smaller, personal uses. Due to the size and the inaccessibility of the kilns for horses, I would argue that these were mostly used for mortar and paint rather than large efforts to make bricks.