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In This Issue

thereby most of their nutritive value as they could be stored fresh throughout the winter;[114] they produced huge yields per acre;[115] and they doubled the yield of manure.[116] The truly great amount of food which could be grown in the form of roots is illustrated by a premium acreage yield in Pennsylvania of 2065 bushels of mangel wurtzel weighing more than 44 tons.[117] Although a bushel of roots averaged forty-two to forty-five lbs.,[118] individual roots grew as large as fourteen to sixteen lbs. apiece.[119] Young sheep could consume twenty to twenty-three lbs. of turnips daily; older sheep thirty-eight lbs. daily; and oxen forty lbs. per day.[120] It was generally agreed that root crops were not sufficiently nutritious by themselves and required varying proportions of hay and grain supplements.[121] Although Ora Paul of Pomfret lamented that "the cultivation of roots is not practiced so generally as it ought to be throughout our State,"[122] it was nonetheless widespread. Roots could be readily cultivated in most kinds of soil, and even in Addison County where "the soil is generally too stiff to be advantageously cultivated for root crops . . . most farmers have patches of land suitable for raising them in sufficient quantities for their own use."[123] Agricultural journals and farmers' accounts make it clear that root culture had an important function as winter fodder for livestock, a function which demanded proper winter storage facilities.

A broad reading of relevant nineteenth century literature reveals that the word "cellar" was synonymous with "root cellar" and, in its broadest definition, referred to any storage area where vegetables and fruits could be kept fresh through the winter.[124] Examples of nineteenth century references to cellars clearly illustrate the traditional usage of the word:

> Every farm should have the essential appendage of a cellar - dry, ventilated, cool in summer and warm in winter, for the double purpose of a dairy and the storing of roots.[125]
>
> I have a comfortable shelter provided for all my sheep, with a cellar attached to it, for the purpose of storing roots.[126]
>
> In order that the farmer may make the most of his roots, he should have a cellar fixed to receive them in the fall . . . The cellar should be placed as near the yard as practicable with a watering place at hand.[127]

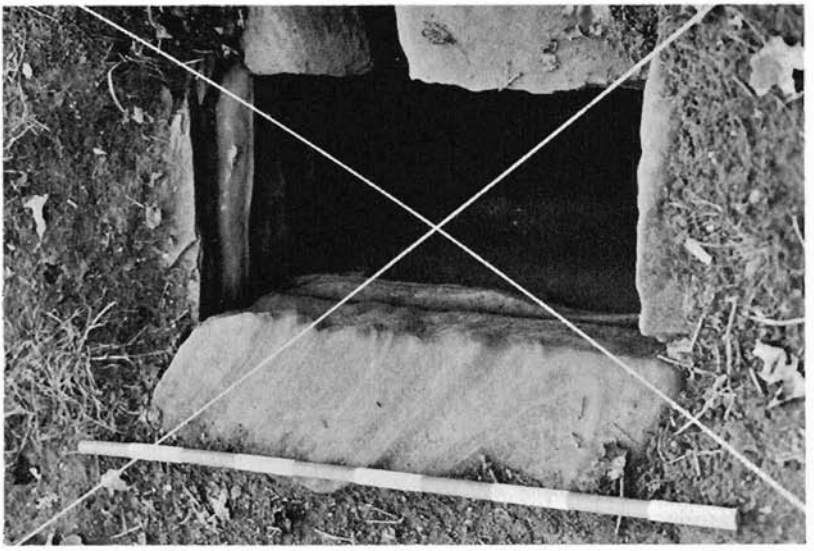
Whatever their final form, and although different crops had different storage needs, storage areas for roots and apples had to meet several basic requirements including proper temperature, moisture and ventilation. Successfully balancing these variables required experience accumulated through trial and error. Temperatures had to be maintained as close to freezing as possible without dropping below 32°F.[128] This condition was partially met by using earth as an insulating and heat storage material either by burying roots in the ground, by constructing cellars below another structure, or by building cellars into available banks or hillsides. J. Lowell of Boston, writing in 1829, noted that "the temperature of the earth a

few feet below the surface in this climate, is generally found to be between 50° and 55°F"[129] in all seasons of the year. Another agriculturist who reported that "sashes with double glass and an intervening thin space of confined air, are nearly equal to stone walls, in shutting out cold," also recommended the protection of "exposed walls with a bank of earth outside."[130] Masonry by itself, according to the accounts, did not provide an adequate insulating material for a cellar and required an earth covering of some kind. Sand, packed around the vegetables or the apples, provided a supplementary insulating material recommended by many, particularly for "those who . . . have cellars which no amount of banking can make proof against the inroads of very severe cold."[131]

The proper balance between dryness and moisture was also critical; too much dryness shriveled the produce, and too much moisture invited molds and fungi. Moisture was controlled by proper ventilation which, at the same time, prevented the accumulation of any gases generated as the produce matured. Use of soil floors also prevented excessive drying while at the same time contributing to the need for proper ventilation, usually accomplished by means of one or more ducts or openings leading to the outside air. The vent openings were usually located over the doorway, at the rear top of the cellar or at the bottom of the door and although they varied widely in size, one journal recommended an opening three feet long and one foot deep.[132]

Root storage facilities can be grouped into four basic categories: mounding or pit storage, barn cellars, cellars under houses, and outdoor cellars built into hillsides or artificially embanked. The choice of a particular facility depended on the kind of produce being stored, requirements of access and volume, cultural and architectural traditions and weather factors. Although burying was one of the easiest techniques of storage, it was the least preferred method and recommended primarily if a cellar was unavailable.[133] Pit storage often rendered the produce unavailable in winter when the pits were snow covered and the ground frozen. Farmers generally viewed this kind of storage as a temporary solution: "the advantage of keeping [the roots] in good cellars, over this mode of preserving in heaps, "is the saving of labor."[134]

The root cellar, frequently considered an essential part of the ideal barn, was described by one writer as "the most useful apartment in the whole establishment."[135] The barn cellar had many advantages, foremost among them its proximity to the livestock, although roots for family consumption could be stored there as well. Barn cellars could also be quite large, occupying as much of the barn's lower floor as necessary, and thereby able to store considerable quantities of roots. The barn cellar was virtually always located on the lower floor, below ground level and



Rectangular, neatly constructed vent opening in rear top of Chamber No. 32. (meter rod and triangulation string.)

conveniently placed near to the stables or the sheep or hog pens. In some cases farmers located root cellars underneath the natural or man-made ramp leading to the main barn floor.[136] The size of the barn cellars is rarely mentioned and considerable variation is likely. Two reported cellars were 4.6m (15') by 7m (23') and 2.7m (9') by 5.5m (18'),[137] and one agriculturist recommended that the barn cellar be "capable of containing 2500 bushels of roots" for sheep.[138] Where banked barns were common, particularly in Pennsylvania, farmers sometimes built cellars off the barn wall into the bank,[139] because many banked barn cellars were, in fact, too cold, "the floor above not being sufficient guard from the frost, the upper apartments . . . not being kept warm by artificial heat."[140] Only two sources mention the building material used for the barn cellar: one, a banked cellar off the barn, was arched over with stone and then covered with earth, another lined with brick "edgewise."[141] One wall, or two for a cellar located in a corner location, was bordered by a section of the barn's stone foundation.

Secondary sources, including many poorly researched local histories, frequently imply that the best and most common storage for roots and apples was under the house in the house cellar. House cellars *were* important for storing pickled and canned goods, beverages and other products.

but their use for root and apple storage was not as ubiquitous as commonly believed. Nineteenth century writers were divided on the utilization of the cellar under the house. Those who warned that "the best authorities state that the house cellar is no place for fruit and vegetables" were offset by an equal number who advocated it.[142] Even before the advent of the central furnace, many thought house cellars too warm[143] even when the temperature was regulated by the construction of individual insulated compartments.[144] One technique to ensure proper temperatures involved the construction of the cellar into a bank adjacent to the lower level of the house; the cellar was entered through the house basement.[145] Such a cellar provided a conveniently accessible extension of the basement but was fully insulated with earth on three sides. The potential danger of gases and disease from rotting produce was a major liability of all cellars, but in the house cellar it posed a special threat because of its physical connection with the living quarters.[146] When other cellars were available, the house cellar was either not used for roots and apples, or it was used as an interim form of storage, alleviating the need to make daily trips to the primary cellar.

The use of hillsides for the construction of the cellar was the fourth and highly recommended method for storing roots and apples as well as cider.[147] "The leading features of a good root cellar are: cheapness, nearness to the place where the roots are consumed, dryness, ventilation, and above all, it should be frostproof. If a hillside is handy it can aid much in securing all of these important points."[148] Because soil both insulates and stores heat, the temperature several feet below ground level remains fairly constant throughout the year.[149] Consequently, when hillsides were not available, a cellar was insulated by deeply mounding the inner structure over with earth in simulation of a natural hillside.[150]

Farmers used hillside cellars from the earliest settlement period. Log cabins, frequently built without foundations or basement,[151] necessitated the use of outside storage facilities. In his useful *History of Pomfret* Henry Vail noted that "so long as log cabins were the only houses, apples and potatoes were stored in an outdoor cellar," which he described as "a sort of artificial cave dug into a bank, walled up and covered with logs, buried deep under loam. The entrance was protected by a door and by bundles of straw."[152] In addition to the association of the hillside cellar with the foundationless log cabins, Amos Eaton of South Royalton described the outdoor cellar as a supplementary form of storage for the expanding farmstead. "The early houses," according to Eaton, "were small with cellars under only part of the house . . . Cellars built later were larger, reaching under about one half of the house . . . As the farmer's flock of sheep increased in size this small cellar was too small to hold the

necessary turnips for fodder for the sheep, and the family's supply of vegetables, pork barrels and cider barrels. As a result, the outdoor cellar developed."[153]

Many nineteenth century husbandry journals recommended the use of "cellars" rather than pit storage or barn cellars. Because each of these storage types was usually mentioned to the exclusion of the others in the discussion of food storage for livestock, references to "cellars" probably referred to the outdoor, hillside type, apparently sufficiently familiar not to require further elaboration. In his major work on Pennsylvania farms of the eighteenth and nineteenth century, Amos Long devoted considerable discussion to the hillside or "cave" cellar:

> When there were large quantities of vegetables and fruits to be stored for late winter use or for marketing purposes, a permanent cellar, constructed with stone, and built into a nearby hillside served best. The ventilated room, excavated from a bank or hillside was walled in on all sides and top with stone or brick to a depth which kept it completely below the ground surface. The roof was covered over, when necessary, so there were several feet of earth for insulation and to provide the conditions necessary for maintaining a reasonably cool temperature as desired. The area over the cave was sodded to prevent erosion during heavy rains. One or more ventilation ducts or openings to provide fresh air, exclude stale air and excess moisture were located usually over the rear top surface of the cellar . . . Steps, laid with stone in a cellar-way which varied from two to four feet wide, were built to enter the vault. Over the cellar-way large flat stones were laid which were likewise covered over with ground and sod . . . The entrances varied from a vertical to a nearly horizontal door which measures upwards to six feet in length, often less. Some of the interior walls had protruding stones to support shelves, usually of wood or slabs of stone, on which vegetables and earthen containers with their contents were placed. In some cave cellars the side walls were corbelled inward near the top to support the roof. The roof then was constructed with large slabs of limestone; or large flat stones were laid over the wall on each side. The stones projected far enough over the cellar wall to support other large slabs of stone which formed the center portion of the roof . . . Most of the cellars contained only an earthen floor and the entrance was in the open . . . The square or rectangular room varied from nine [2.74m] to twelve [3.66m] feet wide and from twelve [3.66m] to eighteen [5.49m] feet long. Some were larger, many were smaller.[154]

Two other descriptions of outdoor cellars, the first written in 1782 and the second in 1920, provide interesting detail and are striking for their similarity despite a difference of 140 years:

> We have another convenience to preserve our roots and vegetables in the winter, which we commonly call a Dutch cellar. It is built at the foot of a rising ground which is dug through, about eighteen [5.49] feet long and six [1.83m] feet high. It is walled up about seven [2.13m] feet from the ground; then strongly roofed and covered with sods. The door always

> faces the south. There it never freezes, being under the ground. In these places we keep our apples, our turnips, our pumpkins, cabbages, and potatoes. The cellars which are under the houses are appropriated for cider, milk, and butter, meat and various necessaries.

The twentieth century version describes "the only satisfactory" isolated root cellar as one "found by going into the side of a bank and constructing a chamber whose top as well as sides are completely covered by the earth . . . The ground above the top should be at least three feet deep; the entrance - the one side exposed to the air - had best face south, though its exposure may incline to the east or west but never to the north. Ventilation must be provided, which can be arranged by an inlet in the door and a flue carried up above the ground at the back . . . A concrete roof is the best. In fact such a structure is practically indestructible and should serve its purpose as long as it is put to use."[155]

Although the hillside cellar, by virtue of its earth insulation, maintained sufficiently cool temperatures throughout the summer to prevent spoilage of various foodstuffs, the consistent recommendation that they face south suggests a primary function of winter storage. The southern exposure would ensure the greatest amount of winter sunlight, lower snow piles, faster melting in the spring, and radiant heat on sunny (and often coldest) days of winter.

Stone offered the best insulating qualities and the greatest degree of permanency, but proper building stone was not always available, and farmers often used wood in lining the cellars. If Amos Long, a few years ago, bemoaned the difficulty of locating intact stone root cellars,[156] the difficulty in finding intact wooden cellars is even greater. In constant contact with their soil covering, wooden cellars rapidly decay. For example, the wood linings of a pair of root cellars built in 1914 in Winhall, Vermont to service several lumber camps exhibit total decay. The only visible remains are two large horse-shoe shaped excavations in the side of a bank.[157] The remains of three wooden root cellars, including both the hillside and artificially embanked types, have been found in northern Maine on the St. John River at the site of the abandoned mid-nineteenth century community of Seven Islands.[158] Evidence of these structures will not last another fifty years. Based on documentary evidence, many hundreds, if not thousands, of wood lined hillside cellars dotted the countryside of the northeast. The low frequency of the stone chamber type of cellar found in Vermont and elsewhere relates to the fact most of the hillside cellars were of wood and are long gone. The obliteration of the vast majority of wooden cellars of the nineteenth century hampers a comprehensive distributional study of the outdoor cellars.

Chamber No. 29. Hillside chamber (Type B), Windsor County. Entryway, which had at one time been filled in, has been recently excavated.

While a systematic distribution study of the outdoor cellar was not undertaken, research indicates the widespread construction of the hillside or banked cellar form throughout New England and Pennsylvania, and it is also documented from Iceland to Michigan and as far south as Kentucky. The distribution of outdoor cellars indicates that this construction type was not limited to the harshest climes, but farmers utilized it in more temperate areas, the basic requirement being the occurrence of freezing temperatures.

Local topography and architectural traditions also influenced its distribution.[159]

A review of the literature indicates that root cellars of various kinds continued to be constructed into the twentieth century. The gradual shift away from cellar storage started by the last quarter of the nineteenth century with the increasing usage of new techniques. Ensilage and the advent of the silo thus promoted an increased cultivation of corn, grasses and other crops for winter feed for livestock, while family food storage needs were eased by the icebox and pressure canning techniques. Some farms and rural homes undoubtedly utilized the cellars for storage long past the time they became obsolete elsewhere and others were put to different uses from their original intended function. Of all of the root cellars, the stone ones had the longest life simply because of their robust construction, which invited adaptive usage.

Analysis and Discussion

Based on oral evidence, a number of the stone chambers in Vermont were built to serve as root cellars, and several functioned in that capacity until recently. In contradiction to arguments that history contains "no record of any construction of this kind" and that "the existence of these structures in colonial New England is totally without explanation or rationale," the historic record, oral and written, abundantly documents a tradition of the construction of hillside root cellars. The record also demonstrates the widespread and persistent employment of this construction technique from its use in temporary dwellings in the period of first settlement to the later banked barns. The stone chambers in Vermont exhibit the same sort of variability apparent in documented forms of root cellars: situated under barns or other outbuildings, under houses, in hillsides, or freestanding and embanked with earth. Further, earth mounding apparently served the purpose of temperature regulation. Of the fourteen chambers located within or attached to another structure or foundation hole, only those chambers or portions of chambers exposed to freezing temperatures have earth mounding. In the entire sample, with one exception (the hideout built by Oliver Plaisted), the only chambers which have no earth covering whatsoever are those located entirely within the lower floors of other structures or situated within abandoned house foundation holes. These uncovered chambers either served functions which did not require temperature regulation or they were situated so that extreme temperatures did not effect them. Oral tradition points directly to this interpretation. Reported by local informants as chimney supports, the five chambers located within abandoned foundation holes are identical to the hollow chimney supports described in the literature. Mounding chimney supports with earth was clearly illogical in terms of their location and unnecessary in terms of their function.

The Vermont stone chambers also exhibit other patterns or distinctive attributes which conform to documented information on root cellars. Regardless of the location of the chamber, with two exceptions the entryways are oriented towards southerly or easterly exposures; one chamber faces west and another north. Arguments using the systematic orientation of the entryways with respect "to the ancient rites of the Celtic solar year" as evidence of prehistoric construction to the exclusion of later construction ignore the fact that the late eighteenth and nineteenth century farmers were also intimately concerned with the proper orientation of their structures. The historic documentation emphasizes that root cellars and various other outbuildings should be oriented to the south or east.[160]

Only a few Vermont chambers differ in size from between 3-5m (9'-16') in length, 1.5-2m (5'-6¼') in height, and 1.5-3m (5'-9') in width

and readily compare with documented hillside cellars in Pennsylvania which average between 3.7-5m (12'-18') in length and 2.7-3.7m (9'-12') in width. As expected, since the hollow storage areas were incidental to their primary function, the chimney supports tend to be smaller than the overall average dimensions, and the two smallest chambers in the sample [Nos. 8 and 18] were built, according to oral evidence, as a hiding place from marauding Indians and as a grave. Historic descriptions of root cellars indicate that cellar sizes varied widely depending upon the storage needs of the homestead, the number of livestock, and whether or not storage for the two units was kept separate or combined. Unfortunately, a dearth of quantified data on the food storage requirements of a typical nineteenth century farm family and on the storage capacity of documented root cellars hampers comparison between the potential storage capacity of the chambers and actual requirements of the farmstead. Research suggests that the largest chambers had the storage potential sufficient for a moderately sized livestock herd and much larger than the average household needed to store the family's share of the produce.[161]

Ten chambers, all built into hillsides, exhibit vent holes comparable to those described in documented root cellars. Cited by Byron Dix as an example of the "Megalithic Yard,"[162] a unit of measurement used by ancient peoples of Europe, the vent in one chamber [No. 32], an opening 0.82m (32") long and 0.37m (14¼") wide located at the rear top of the structure, also corresponds in size to the 3' (0.90m) by 1' (0.30m) dimensions recommended for a root cellar vent by a mid-nineteenth century periodical.[163] Documented cellar vents were usually placed over the doorway, at the bottom of the doorway, or at the rear top of the cellar. The current absence of vents in many of the chambers thus suggests that they may have been incorporated into the wooden doorways, long since decayed or removed, which are documented to once have existed on many of the chambers. From the few chambers which still exhibit doors or door frames it is apparent that the builders rarely used hardware to attach the wood to the masonry. Instead they wedged the framing into the stone entryway and mounted the door onto the framing. Consequently the masonry around the entryway shows no evidence of hardware holes, or other, doorway apparatus.

Several stone chambers exhibit traits which distinguish them from the rest of the structures. The lone subterranean chamber [No. 3], fully mounded with earth, has a unique entryway construction on top of the mound. Formed by overlapping roof stones, the entry is a small triangular opening barely large enough for a large man to squeeze through. Seemingly inconvenient for root storage, this kind of entryway ensured the

greatest insulation for the roots. In describing various options for root cellar doorways, one nineteenth century periodical reported that "a door should be provided upon the exposed side or end. This door may be large enough to enter without stooping. *Or it may be simply a 'man hole,' which is better than a regular door, so far as protection from frost is concerned, but not so convenient for putting in and taking out roots.*" (Italics added.)[164]

Another chamber [No. 50] has a unique arched roof of mortared random rubble construction. Local tradition ascribes it to an early nineteenth century munitions magazine associated with Commodore Macdonough's operations on the Otter Creek during the War of 1812. Its masonry detailing closely resembles several other structures erected by Macdonough's men in Vergennes. On the other hand, its hillside construction and arched roof are identical to many Pennsylvania root cellars described and photographed by Amos Long, and its location immediately behind a late eighteenth century brick house suggests a closer association with the farm complex than with military operations almost a mile away.

Ceilings of stone slab construction, frequently cited as a highly significant and distinctive trait of the chambers, mark virtually all the chambers regardless of whether or not they are attached to or located within other structures, built into hillsides, or artificially embanked. The slab ceiling construction thus demonstrates a strong architectural continuity among the chambers based in Vermont upon a building tradition primarily associated with distributions of the thinly laminated and easily split rock types of the Waits River and Gile Mountain Formations. This construction form was employed on diverse building types including chimney supports, burial vaults, and barn and hillside cellars. The widespread distribution of the slab roofed stone chambers from Maine to Kentucky in regions with readily available suitable metamorphic rock types demonstrates the practicality of this architectural tradition.

Of all possible construction materials, the literature recommended that where stone "exists in abundance, where the cost of quarrying is little or nothing, and that of moving and cutting it is slight, stone may be advantageously employed on buildings of moderate cost."[165] Use of stone construction instead of brick presented a choice, which included availability and relative cost benefits. Wood was frequently the most economical material for many kinds of structures, such as dwellings and barns. Good quality field or quarry stone was not always available, and even if available, local architectural traditions and the needs and whims of individual farmers often precluded its use. When stone was available, the labor involved in procuring it, especially if undertaken personally, was abundantly compensated by the cheapness of the material.

Chamber No. 27. Close-up of entryway. Note split and dressed stone work and details of doorway.

The technologies of stone hauling, cutting and building were common knowledge in the early settlement period and throughout the nineteenth century. Field stone and quarries were the main sources. The quarries were not usually huge cuts, but simply bedrock exposures or outcroppings which necessitated splitting and other "quarrying" techniques before the stone could be utilized. Particular varieties of stone would readily split into useable pieces with straight edges and smooth faces. "In many quarries stones are often taken out ten or twenty feet in length, and from six to ten or twelves inches in thickness, and sometimes from one foot to three feet in width, with straight edges and true and smooth sides." The nineteenth century guide recommended that, "to break them in pieces of a desirable size, let little fires be made of with hard, dry wood, across the stone where it is desirable to break it, and in a few minutes a seam will be formed so that a crowbar will easily separate them. We have often broken large flat stone, very true and straight, with fire."[166]

The stone was also split by wedges driven into the seams or holes drilled into the stone. Once split, many kinds of stone required little or no trimming to produce a smooth face ready for laying.[167] Very large stones of suitable thickness which required little preparation were especially valuable for foundations, sills, lintels, hearths, and doorstones: "if you can

find huge, flat stones of one or two yards area, and six to twelve inches thick, you will feel especially fortunate."[168]

Large field stones could be broken by fire or moved intact. Builders often hauled large stones in winter when sleds could transport heavy loads for long distances. "For the big ones they would have to use the oxen and a stoneboat. They would dig around them and then flip a chain over the stone with what they called a rolling hitch . . . With a proper rolling hitch the oxen could pull the stone right out of the ground and on to the stoneboat."[169] Stoneboats, or runnerless sleds, were essential hauling devices and when drawn by oxen they could transport extremely heavy loads. A combination of tools and methods were used to move heavy stone. With proper tools "it is but the work of a few moments to tumble a large stone six or eight feet."[170] Canthooks, for example, enabled a man to roll a six or eight hundred pound boulder with ease. Grapple hooks, used singly or together, windlasses, crowbars, sheers and tackles, and planks, rollers, ropes, and chains were all standard farm equipment for moving stone.[171] The custom of communal and "change" work expedited both the hauling of stones and subsequent construction work and permitted pooling resources such as oxen,[172] which performed many tasks including the common practice during the nineteenth century of moving entire dwellings and other structures.[173] In Plainfield, Vermont, for example, forty team of oxen moved one large barn.[174] Arguments against the historic construction of the stone chambers which focus upon the supposedly illogical and inconvenient use of great stone slabs and "the enormity of the task of emplacing stone roof slabs and the seemingly insuperable difficulty of sliding such stones onto unmortared stone walls" have not taken account of early construction practices common in Vermont.

Although there were certain conventional masonry techniques and styles, stone work was as diverse as the men who executed it, the stone they used, and the dictates of local tradition. For example, in western Windsor County, a "very interesting method of stone-laying" resulted "from deposits of stone that splits naturally into thin sheets. These are broken into handy sizes and set on edge in the wall instead of flatways (the usual way). These edge-set pieces are bonded by smaller stones set flat."[175] This construction technique exactly describes the masonry in one chamber [No. 14] which some proponents of the ancient theory single out on the basis of its "unique" masonry detail.

While most farmers had basic masonry skills and did much of their own work, there was also some specialization of labor. Itinerant "jobbers" frequently built stone walls.[176] Although some particularly distinctive masonry can be readily attributed to individual masons, most masonry styles were sufficiently uniform to obscure identification of the builder.

Chamber No. 11. Chamber built off barn foundation, shares a common (left) wall with barn (Type A), Windsor County.

Examination of Vermont's historic sites survey inventory reveals clear trends relating to the tradition of stone construction. The state survey (roughly two-thirds complete),[177] consisting of a town by town inventory of the entire state suggests that Addison and Windsor Counties have the highest proportion of stone buildings, the vast majority of which were built between 1790 and 1850. Houses constitute the predominant stone structure still standing, followed by public buildings and structures such as schoolhouses, churches and bridges and commercial structures, such as mills, foundries, kilns, and iron furnaces. While the geographic distribution and architectural traditions of most of these stone structures are functions of the availability of good building stone, the use of stone in the construction of iron furnaces was a ubiquitous practice. The stone work represented in these furnaces provides additional evidence of the sophistication and skill of Vermont masons between the 1790's and 1830's. For example, the Forestdale Iron Furnace, built in Brandon in 1810, has a stone stack sixty feet high and thirty-two feet square consisting of

random coursed, random sized stone slabs.[178] The twelve furnaces documented in the Vermont state survey, built between 1791 and 1837, are of dry masonry construction with walls six to eight feet thick.[179] In comparison to these great stone furnaces, the slab roofed chambers required considerably less technical building skill.

The most common use of stone, however, was in the building of hundreds of miles of stone walls. Besides being repositories for millions of stones removed from the field, stone walls, some as wide as eight feet, delineated property and field boundaries and roadways and served to keep livestock out of one field and inside another. While the longevity of most stone houses and churches was assured by their continued use through time, stone walls met the fate of most facilities whose utility had come and gone. In the twentieth century and earlier stones were removed wholesale from stone walls, pounds (square enclosures with high stone walls used to pen livestock),[180] furnaces, abandoned foundations, drains, mining facilities, and other structures and were put to new uses. The rock crusher converted many into gravel, new foundations were built from the stones of old ones; and the larger stones were appropriated for doorsteps, sills, walkways and patios. Occurrences such as these undoubtedly took their toll of many stone chambers.

Conclusion

Oral evidence identifies seven slab-roofed stone chambers constructed expressly as root cellars, including two [Nos. 14 and 36] specifically cited by Professor Fell as "Celtic temples."[181] While only one builder, Mr. Arunah Woodward, has been identified by name, the other unnamed builders were local residents at least one of whom participated in the construction of five neighboring chambers. This group of structures conclusively demonstrates that banked architecture incorporating large ceiling slabs was a popular building tradition in particular Vermont communities which was readily undertaken with available local technologies. The popularity of this slab roof building form is further confirmed by its use in the construction of functionally different chambers built as chimney supports, burial vaults, and barn cellars.

The interpretation of those chambers for which there is no direct conclusive evidence must rest on the examination of their relationship to cultural traditions. The written record clearly shows that banked architecture, so common in the construction of cellars, was a widespread and persistent American tradition. The record also documents that hillside cellars structurally identical to the bank form of chamber were a preferred form of storage facility for roots in an era of pervasive root cultivation.

The written record and field observations demonstrate a strong nineteenth century concern with proper solar orientation of the hillside cellars and other structures. The evidence confirms the availability of appropriate stone working technologies. The historic record, thus, conclusively refutes many of the arguments presented by the ancient theory proponents that the chambers could not derive from the historic period. The historic record also corroborates the oral tradition. The careful examination of each chamber further demonstrates that their structural attributes are consistent with their documented counterparts. Three lines of evidence — historic documentation, oral tradition, and primary data — all converge on the same interpretation. Based on the evidence, it is proper to conclude that most of Vermont's stone chambers were built as root cellars in the nineteenth century with some possibly as early as the late eighteenth century. The evidence also confirms that not all the chambers were root cellars; some were built for other purposes such as chimney supports.

The documented conclusion that some of the Vermont stone chambers were demonstrably built as root cellars and other purposes and that all the chambers in the sample fit comfortably into the historic milieu in which they are found places the association of purported Celtic inscriptions, phallus stones, and animal figures in obvious conflict. This conflict is best illustrated by the fact that two chambers *known* to have been constructed in the nineteenth century as root cellars [Nos. 14 and 36] allegedly exhibit evidence of Celtic inscriptions and markings. On the basis of present evidence, the "inscriptions" and other "Celtic evidence" associated with the chambers are not what they are purported to be. Again, several lines of evidence converge. Professor Anne Ross, a foremost authority on the Celts and on Ogam script, made a field inspection of a number of the stone chambers and associated markings. She concluded that she could not "with any honesty, say that at the moment . . . the scoriations on the stones . . . , either in reality or on numerous slides and photographs [are] . . . any form of script at all." She concluded emphatically that she "certainly cannot accept them as Ogams."[182]

If the grooved markings examined by Professor Ross are not an ancient Ogam script, what are they? Based on documented stone wôrking practices of the nineteenth century, the many grooved markings found on the large lintel and ceiling stones of the chambers in particular appear to have resulted from chains and other tools used in the process of hauling and emplacing these large stones. Identical linear and parallel grooves are also evident on many other large rocks found elsewhere, usually at the edge of a field or adjacent to or incorporated into a stone wall.[183] Many of these rocks are crystalline limestones from the Waits River and Gile Mountain Formations which have a particularly soft rind and are easily

scored. Many of the chambers exhibit initials, dates, and graffiti, some of nineteenth century derivation, others demonstrably more recent. The metamorphic rocks of the Waits River and Gile Mountain Formations, especially the limestones, are easily weathered, and any scratches or markings rapidly lose their clarity and sharp edges. According to Dr. Charles Ratté. Vermont State Geologist, who visited chamber No. 14, constructed in the nineteenth century as a root cellar, "the representation of Tanith, the Mother Goddess" was carved by someone, but within the past twenty or thirty years.[184] Other marked or grooved stones which have been cited as evidence of ancient settlement are similarly equivocal. According to informants, many are harrow or drag marks: the initial impact would leave a deep gouge; the machinery would then kick into the air leaving a shallower tail at the end of the groove.[185] A few are glacial scars. Even the nineteenth century farmers were impressed by the scoriations left by the glaciers, called by one man "the original Vermont plow." "Dig away the soil that covers a rock," he instructed, "and the surface of this rock will almost surely be found channeled and smoothed like a stone roadway. The lines drawn over the surface of the rocks are from the faintest of fine marks to channels a foot or more in breadth and depth."[186]

In the western part of Vermont in the Champlain Lowlands region, the dolomitic rocks are particularly susceptible to weathering. One "inscription" (which received attention in the Vermont news media) was the "Salisbury Stone," found in 1977 and originally labelled the first discovery of pre-Columbian European inscriptions in the Champlain Valley. Professor Fell translated the inscription to read "dedicated Temple Bel,"[187] but geological assessments have since verified that the Salisbury "inscription" is an example of "beeswax-weathering," a ubiquitous phenomenon in the dolomite beds of the Champlain Valley. The grooves or indentations characteristic of this kind of weathering "occur because the dolomite developed abundant tight cracks when the strata were warped and folded, and calcite later filled these cracks as a paper-thin vein. The calcite dissolves more rapidly than the dolomite, so that on weathering the calcite is etched, and this faint groove holds more water than the adjacent stone, causing the groove to enlarge."[188]

One of the most noticeable characteristics of the Waits River and Gile Mountain limestones is their susceptability to weathering into soft, rounded, amorphous shapes. Eastern Vermont is riddled with large boulders or outcroppings which exhibit this characteristic weathering phenomenon. The many alleged phallus stones and animal figures are naturally weathered limestone and not, as Professor Warren Cook has suggested, rocks "originally shaped by nature and later modified by a culture that regarded unusual rocks as sacred."[189] Many of these large stones exhibit the typical grooves