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Cover Page Footnote

The author would like to thank the Ontario Heritage Foundation, the Barnum Museum, and the City of Mississauga. In addition, there were many individuals involved during the excavation period at each of these sites. In particular, Mary Catherine Garden and Gary Warrick have contributed to the discussions regarding this paper that began in the early 1990s after the work at Benares.

Burning Down the House: The Archaeological Manifestation of Fire on Historic Domestic Sites

Dena Doroszenko

This paper examines the manifestation of fire as found archaeologically at two historic domestic sites in Ontario. Each site experienced a burning episode of varying significance in the property's history. Soil deposition, debris fields, heat alteration of artifacts, fire intensity, and types of fire debris are discussed.

Cet article examine les manifestations de feu tel que retrouvées archéologiquement sur deux sites historiques de nature domestique en Ontario. Chacune des propriétés de ces sites a connu des incendies d'importance variée pendant son histoire. La déposition des sols, des champs de débris, la transformation par le feu des artefacts, l'intensité du feu et les types de débris associés au feu seront discutés.

Introduction

This article examines two Ontario Heritage Foundation (OHF) farmsteads where fires of varying severity occurred. Established in 1968, the Ontario Heritage Foundation is a leader and recognized expert in heritage conservation. The OHF has a broad mandate to preserve, protect, and promote cultural and natural heritage in Ontario. The OHF owns 135 built and natural heritage properties. In addition, the OHF holds title to 180 easements that protect heritage sites owned by others and manages the provincial plaque program that celebrates important people, places, and events. Furthermore, the OHF conducts community outreach programs such as the Heritage Community Recognition Program that publicly acknowledges the work of heritage volunteers across the province.

There are specific consistencies that reflect fire and clean-up behavior in each OHF case. Physical evidence of fire plays a crucial role at both sites. The oral history connected to each property varies in accuracy, but helps to determine the resulting damage to each home. Of significant interest is the immutable lack of historical documentation about each fire. The lack of documentation is remarkable given the devastation caused by each fire.

The destruction of a building by fire, whether it is constructed of wood, stone, or brick, is often encountered in the archaeological record of historical sites. How a fire burns and the course it takes requires an understanding of the chemical and physical properties involved. Suffice it to say, wood buildings

collapse differently than stone or brick buildings. This is a significant point, for it is not uncommon in the archaeological record to encounter evidence related to the destruction by fire of rural 19th-century wooden buildings.

Encountering fire debris in the archaeological record requires some understanding of the process involved in the creation of this deposit and furthermore, the correct identification of the stratigraphic layers themselves as part of a burn episode. In the following description of two case studies in Ontario, it was recognized early in the excavation of each site that the stratigraphic deposits were in some instances subtle, thin, and not necessarily substantial in appearance whereas in other areas of each site, larger deposits were readily identified. This resulted in careful examination of these deposits and research into what archaeological fire deposits might consist of and how they are created.

The process described by White and Kardulias in their 1985 article has been noted to be present at a number of OHF properties, where following a building demolition, whether due to a fire or age, the archaeological record reflects nothing more than infilling and relandscaping of the area. Generally, the area where the building once stood is abandoned and the owners have little interest in reusing the building's foundations. Economics of the household generally play a factor in the decision to abandon or rebuild on a rural farmstead. This results in patterning that differs

from that described by White and Kardulias (1985) when the context of razing is linked to the event of fire destruction of a home and subsequent rebuilding.

Principles of Fire Behavior

Fire as a cultural artifact has been with humans since the Neolithic Age (Pyne 1997). Societies around the world have used fire to transform their landscapes, often for agricultural use. Humans have struggled to control this natural force and process in the wilderness and the hearth, often unsuccessfully (Hazen 1992).

Fire is commonly defined as the rapid oxidation of a substance (Carroll 1979: 65). Discussion of how a fire burns and the course it takes is limited to fires in which wood is the chief combustible agent. Construction materials play a vital role in how a fire burns. Fire breaks down wood from a solid substance composed of lignin and cellulose to its elemental components. Flame fires pyrolyze (i.e., burn) wood into volatile flammable gases. It is these gases that burn, not the wood. Pyrolysis is defined as the destruction of wood through the application of heat in the presence or absence of oxygen. If no oxygen is present, charcoal is formed; with oxygen present, pyrophoric carbon is formed. Pyrophoric carbon is formed by the application of a low heat source to a combustible material. This degradation of wood changes the structure of wood thereby lowering the ignition temperature required to sustain combustion. This often signals the rate of burning (Carroll 1979: 66–67). As a fire destroys the wood from the outside inward, the structural strength of the wood section is decreased until finally the structure collapses (Carroll 1979: 54).

Wood buildings often experience wall and floor collapse simultaneously. As a result, the length of time for collapse can be estimated: wood-frame buildings generally collapse after 1 hour of intense burning because of rapid fire spread (Dunn 1988: 198). Three contributing causes of building collapse are fire destruction of bearing walls, the mortise and tenon joints of a braced frame building, and overloading of exterior wooden walls (Dunn 1988: 202). High temperatures generated by a fire accumulate

toward the roof and expose the trusses of a building to higher temperatures than any portion of the building. Roof collapses often signal the structural failure of the building (Carroll 1979). Experimental burnings of wood houses also indicate that they burn quickly and with intense heat (Bankoff and Winter 1979).

As a result, wood buildings collapse in three ways (FIG. 1): 90° angle collapses; lean-over collapses; and collapse in an inward/outward configuration (Dunn 1988). While it may not be possible to determine if a wood building has collapsed and in which direction, because of the level of clean-up activities after a fire, the fire debris field may indicate direction. For example, if there is a heavier debris field to the front of a building, then one may hypothesize the possibility of a 90° collapse of the front of the building. As shown in Figure 1, a 90° angle collapse generally involves one wall falling straight outward. This collapse is often due to the corners of the building splitting apart from the remaining walls. Lean-over collapses involve the entire building starting to tilt or lean to one side. Subsequently, the density of fire debris would be found on one side of the building versus the others. The inward/outward collapse of a building is the most dangerous while a fire is underway for its collapse happens when several walls within the building collapse simultaneously (Dunn 1988: 193–194).

Other indications of the intensity of a fire include changes to other materials found in the area of a fire. Substances of particular interest are glass artifacts and metals (e.g., iron). Glass will soften at approximately 1000° F and flow at 1300° F. Wrought iron has a melting point set at 2750° F (Carroll 1979: 52). Evidence of melted iron artifacts, however, is rare. More often, they appear fire hardened and reddened. These melting points are useful for determining the temperatures reached during a fire.

The Role of Fire During The Nineteenth Century

Fire was a constant and central concern for most people during the 19th century because of its use as energy to cook food, heat homes,

and provide light. While fire could be started easily, particularly after the invention of friction matches in 1827, the danger was everywhere (Hazen and Hazen 1992). Diaries and other published materials from the 1800s note the perpetual smell of burning (Hazen and Hazen 1992: 8), and the need to be vigilant against accidental fires within the home (Beecher and Stowe 1869).

As early as 1830, urban areas such as New York had three to four outbreaks of fire per day. From 1800-1858 Americans lost an estimated \$255 million worth of property to fire (Hazen and Hazen 1992: 72). Fire disasters of epic proportions happened time after time in urban areas leading to staggering losses of buildings and property. Rural areas were at risk of wildland/prairie fires that endangered homesteads.

It was also not uncommon for farmers in various parts of eastern North America to use fire as an aid to agriculture. The reason for agriculture's reliance on fire lies in basic fire ecology. Fire purges and promotes, and this creative destructiveness sends nutrients through the soil. Either the farm moves through the landscape (classic slash and burn agriculture) or the landscape, in effect, cycles through the farm (rotating fields). Clearing land by burning was not a choice undertaken by every farmer, however.

Determining whether fire evidence at a historic site is the result of the house burning down or field clearance by fire is not difficult to discern. The major evidentiary factor is the presence of multiple lenses of debris and artifacts altered by heat exposure. Several approaches that can be used to identify and discriminate between archaeological evidence of fire resulting from natural processes, such as on a landscape, and archaeological evidence of fire resulting from human activities (e.g., a fire damaged or destroyed structure), include: macroscopic examinations of fire feature surfaces and profiles; analyses of magnetometer data, magnetic susceptibility studies; analyses of alternating field demagnetization characteristics; studies of isothermal remanent magnetization (IRM) acquisition; analyses of coercivity of remanence characteristics; and palaeointensity studies (Bellomo 1993). The usefulness of these methods remains to be seen as practical on a site-by-site basis. While the use of magnetometer data may have applicability in the

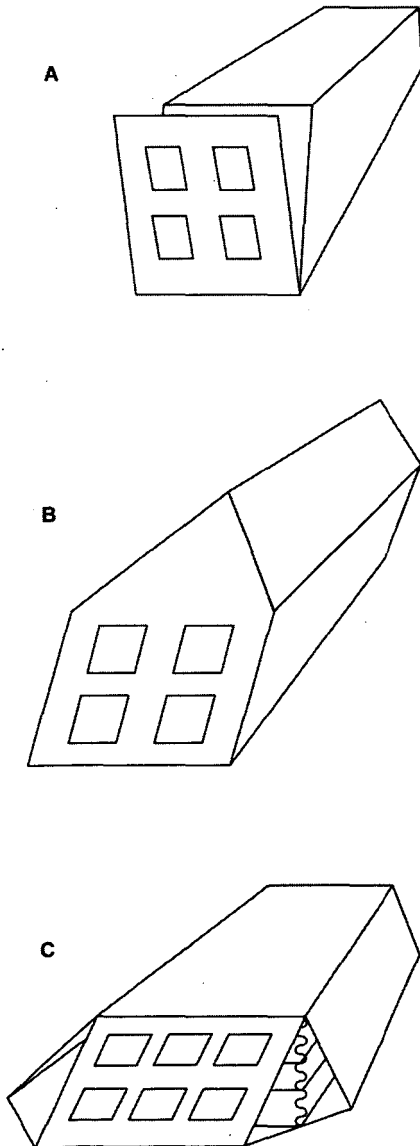


Figure 1. Three Types of Wood Frame Building Collapse. (Based on Dunn 1988: 193-194). A) The wall of a wood frame building collapsing at a 90o angle. B) Wood frame building falling in a lean-over collapse. C) Wood frame building collapsing in an inward/outward configuration. Drawing by Manuel Oliviera (OHF).



Figure 2. Barnum House in Grafton, Ontario.

field to locate hearth features on prehistoric sites, its usefulness on historic sites appears nonexistent for this purpose. The other techniques noted require specialized analyses and may not necessarily produce what is not already historically known or available in terms of evidence of a fire on a historic site.

Case Study: Barnum House, Grafton, Ontario

Barnum House is without doubt one of the finest houses to survive from the early years of settlement in Ontario (FIG. 2). The property is located in the southwest corner of the south half of Lot 26, Concession One, of Haldimand Township along Highway Two, which served as the principal land route from Toronto to Kingston and Montreal in the 19th century.

James Norris first acquired the property in 1811. Norris was already quite prosperous and almost immediately built a large and certainly expensive two-story frame house recorded for

tax purposes as having as many as seven fireplaces (Unterman 1983).

Building the house, however, may have contributed to Norris' financial ruin. In 1812, perhaps to meet outstanding bills for the construction of the house, he agreed to sell the southern half of Lot 26 to Eliakim Barnum, a Vermont native who immigrated to Upper Canada and prospered through investments in milling and distilling, as well as property development. Norris reserved only one acre of land and the use of his new house. Records indicate that Norris lived in his new house in 1812 and 1813, but when the 1815 taxation assessment was compiled, neither Norris nor his house were mentioned.

Archaeological excavations were conducted in 1982 (Warrick 1983), 1986 (Warrick 1987) and 1990 by Doroszenko. These excavations revealed that the foundations of the Norris house were reused by Barnum to build his house. These foundations had layers of ash

and burnt debris (FIG. 3) indicating stratigraphically, the destruction of Norris's house by fire, its subsequent razing, clean-up and rebuilding.

The oral history associated with Barnum House maintains that during the War of 1812, at Christmas (although no specific year is mentioned), while British soldiers were quartered in the house on retreat from Fort York to Kingston, a fire broke out in a fireplace in a room over the kitchen and demolished the structure (Unterman 1983). After the house burnt down to the ground, the government offered to rebuild it entirely at their expense. Eliakim Barnum spurned the offer, most likely because he did not actually own the property as it still belonged to Norris. Barnum did not purchase the property from Norris until 1814, after which time Norris disappears from Grafton (Cane 1981, Unterman 1983). Barnum rebuilt on top of the earlier house by 1820. No documents have been found to date, however, to substantiate the oral history.

Excavations over three seasons took the form of units of varying sizes, most often 2 x 2 meter units. During 1982 and 1986, the research focused on locating additions that were historically known to have existed on the northeast and north sides of the house (the woodshed and kitchen additions). The location of the burn deposits were found exclusively inside or adjacent to existing foundations indicating that those foundations must have existed at the time that the Norris House was destroyed. In particular, these deposits were found within the foundation walls of the woodshed on the north side of the house and the kitchen addition. Inside the woodshed, impressions found at the western edge of the burn deposits resembled joists/sleepers burned in place. The burn deposits in the eastern area of the woodshed contained a thick layer consisting of brick, mortar, charcoal, and heat altered artifacts. Rapid abandonment of the site was extrapolated due to the nature of the artifacts within the burn deposits. In particular, the presence of personal valuables, for example, a pocket watch and the large quan-

Figure 3. Barnum House. Excavation of burn layers in progress, 1990.



tity of ceramic material, which resulted in a vessel count of 48 items (Warrick 1986: 64).

In 1990, the project completely excavated the woodshed addition that stood to the north of the house and placed units at the front of the house where fire evidence became prominent in the results. Three types of fire evidence were noted: stratigraphic deposits; distinct soils; and heat-altered artifacts.

Layers of ash were noted around three sides of the house. More distinct layering was evident at the front of the house where alternating layers of charcoal, fire-reddened soil, ash, and heat altered artifacts were recorded within layers of plaster, which had been heat-reduced to lime. In front of the house, the deposit appears "compressed." This likely reflects the period of clean-up and razing once the fire had cooled. What this may also indicate is an example of a 90° angle collapse of a wall at the front of the building. Deposits of this type were only found in this location. The layer of charcoal and soot was noted to extend on the west side of the house as far away as 20 meters. This may indicate wind direction during the burning episode.

An examination of the debris field as a whole indicates that the intensity of the fire and area(s) of heaviest damage appear to have been to the south, west and northeast of the house. The clean-up process appears extensive in this case, since the debris field is thin or absent in certain areas around the house, such as the east side. Rebuilding occurred to the rear of the house and of course on the foundations themselves. Debris is minimal in these areas.

Heat altered artifacts primarily consisted of fire-hardened hand-wrought nails, a large quantity of melted window glass, and sherds of ceramics with the glaze burned or melted. Excavations in other areas adjacent to the house have revealed little evidence of fire damage other than that close to the house and to the west.

When Eliakum Barnum acquired the property in 1814, he built on the same foundations as the earlier house. Unfortunately the layout of his house, in comparison with Norris' is unknown other than that the extant house has five fireplaces to Norris' seven. During monitoring in 1990, there was an opportunity to

record the presence of fire evidence right up against the fieldstone foundations at the front of the existing house. This is remarkably similar to the findings of the next case study in Mississauga, Ontario.

Case Study: Benares, Mississauga, Ontario

The second property is Benares, located in today's City of Mississauga, just west of Toronto and now owned and operated as a historic house museum by the municipality. This property has had a history of three separate houses being called Benares. The first two were destroyed by fires while the third is the house that remains standing today.

On Sunday, November 11, 1855, the first Benares (originally constructed circa 1835) was destroyed by fire. The Town of Streetsville's *The Weekly Review* reported the fire on November 17, 1855:

Fire—We regret to state that the dwelling of Captain Harris in this township was destroyed by fire, Sunday last, whilst the family were at church. It is supposed that the fire originated in consequence of an accumulation of soot in one of the chimneys. The kitchen attached to the house was preserved, together with a portion of the furniture, though the latter was considerably damaged. We learn that the amount of insurance upon the building was 700 pounds, but the loss will considerably exceed that sum.

The story, as told by the Harris descendants is as follows: one Sunday morning, as Captain Harris and his family were returning from Church, they spotted smoke on the horizon. By the time they reached Benares, the fire was well underway and little could be saved. Although the stone building was a ruin, the attached kitchen was saved, as were a few small items of furniture, notably a coffee urn and a small table. These artifacts are currently part of the Benares collection (Garden 1995: 29).

During the summer and fall of 1856, Harris and his family presumably lived in another building, sometimes referred to as "temporary" (Benares II) and sometimes referred to as

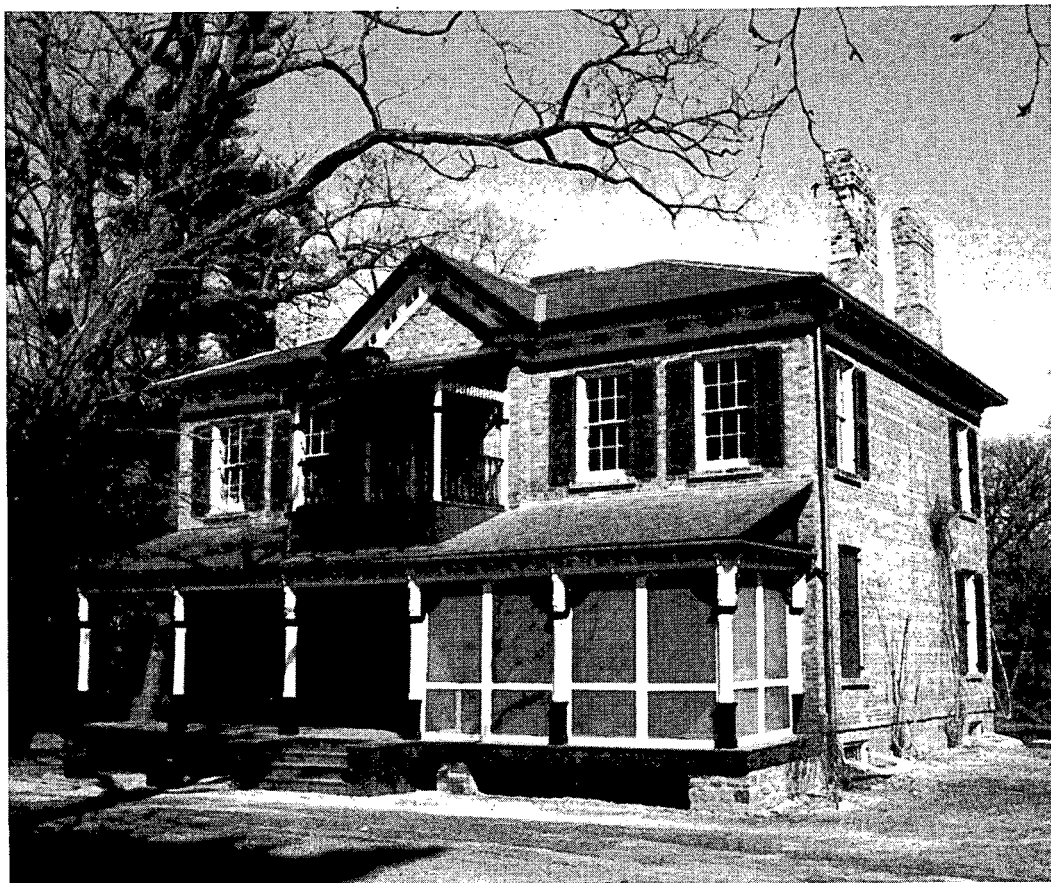


Figure 4. Benares Historic House Museum in Mississauga, Ontario.

a wooden or log building on the property. Tragedy struck again that winter, however, when Benares II was destroyed by fire. This time, the fire occurred at night and was discovered by Harris' daughter, Lucy. Lucy, suffering from chilblains one December night went out onto a second-story balcony to get snow to relieve her itching. While there, she smelled smoke. Arson was suspected as Lucy had seen two men running across the front field and footprints were found in the snow. As Captain Harris was a Justice of the Peace, the culprits were thought to have been individuals who did not agree with the Justice's verdicts (Garden 1995: 29-30). Oral history plays a larger role at this property than at Barnum because of the generation to generation retelling of the story of the fire within the same family.

After the second fire, the Harris family chose to rebuild on the site of the first Benares; this construction project took approximately two years to complete (1857-1859). This third house was built using the stone from the first house and was placed almost immediately in front of the surviving summer kitchen wing.

Major archaeological investigations took place during 1991 on the 5.7 acre property over a six-month period. Extensive excavations were carried out surrounding the 1859 house and the 1835 summer kitchen (FIG. 4). Additional work occurred adjacent to the foundations of the stable, bake oven, dairy, and potting shed. All excavation units were 2 x 2 meters or larger and were excavated by hand. This research preceded the Jobs Ontario restoration project, which immediately followed the field season (FIG. 5).

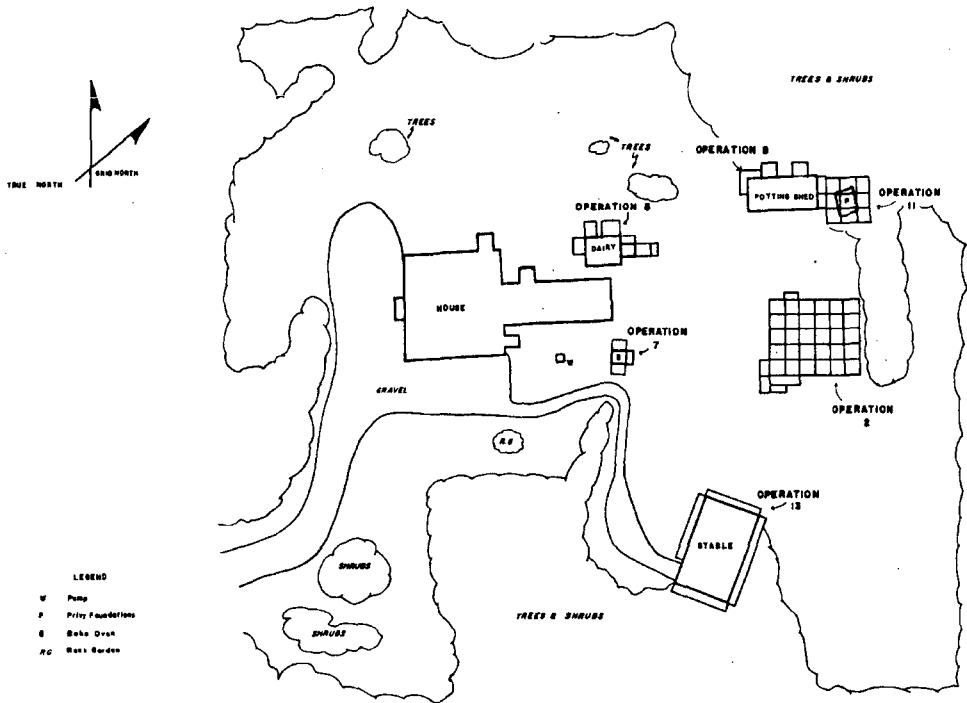


Figure 5. Site Plan of excavation area surrounding Benares in Mississauga, Ontario.

Evidence of fire at the existing house site (circa 1859) consisted of a single stratum that was found on all four sides of the house and summer kitchen. This layer consisted of a dark brown silty sand with charcoal inclusions. This layer, found in each of the 23 units excavated, was thin, and measured less than 10 cm (4 in) thick (FIG. 6). The levelness of the stratum and the absence of either fire debris or artifacts suggests that the area around the house was cleaned up and leveled with most of the larger

debris removed. This is a form of “landscaping” that occurred after the fire and/or during the building of Benares III (circa 1857–1859). Where the burn layer occurs in those units that have remains of the original 1835 house foundations (Benares I), the burned soil abuts right up against the foundations, indicating that this fire occurred after the original building was constructed. Furthermore, the burn layer lies on top of the relic topsoil layer. While monitoring construc-

Figure 6. Burn layer behind Benares I summer kitchen.

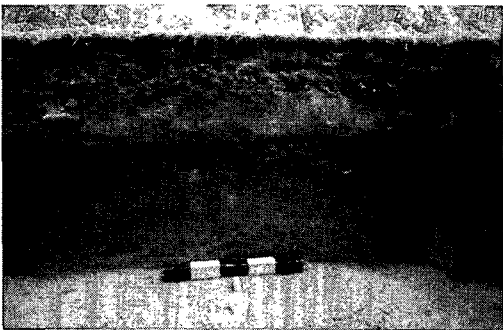
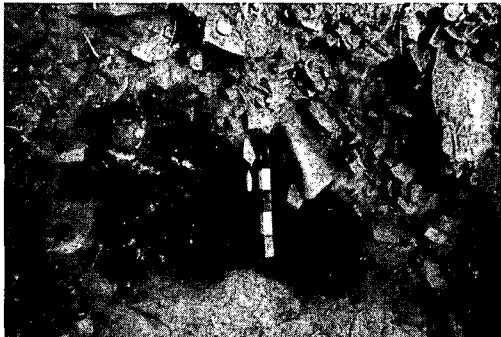


Figure 7. Excavation unit in area of Benares II fire. Note area of dark staining representing charcoal deposit.



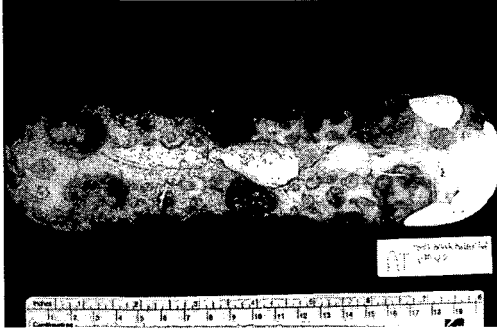


Figure 8. Flow Blue toothbrush holder (lid) with glaze burned off. Note exfoliation of surface.

tion work within the basement of the 1859 Benares, a deposit of fire debris (consisting of charred wood and stone rubble) was uncovered in the basement hallway upon removal of the existing concrete floor. This was the only evidence encountered during the field season that marks the west wall location of the original house in 1835. This discovery corroborates the fact that the third Benares was placed 16 meters (52.5 ft) west of the original plan of the first Benares, hence, somewhat overlapping the first house. Of interest was the fact that the first house did not have a full basement, evidence points to a partial basement under the central portion of the original house, and consisting of only a hallway, a wine cellar, and two small rooms. A complete basement was dug out with the construction of the third house.

Excavation behind an extant outbuilding called the potting shed, to the northeast of the house, revealed evidence of the second fire—the remains of Benares II. The most striking difference is in the analysis which reveals that nearly all of the artifacts below the collapsed building rubble show some evidence of heat alteration, whereas, those above are largely unaffected. Associated with these artifacts are several layers of building debris consisting of Credit River Valley stone rubble (largely undressed), metal roofing sheets, and a number of charred planks. In addition, there are large concentrations of charcoal and fire reddened soil (FIG. 7). The profiles on both the east and west walls of unit 8D (placed close to the north wall of the potting shed) show a definite slope or gradual cut through these natural strata creating a large hole or depression.

Although the very bottom layers have burned, or what is termed fire reddened soil and charcoal deposits, they are virtually free of artifacts. All of the rubble layers sit within this depression, and it is within the rubble layers that the large quantity of heat altered artifacts were recovered.

Several points suggest that this feature is related to a structure that burned down. That this was a dwelling of some sort is evidenced by a high concentration of burned domestic artifacts that came from within the depression in which the rubble sits (FIGS. 8 and 9). The archaeological evidence for the structure itself was sparse. A number of planks, some of which were burnt or charred were identified in the three units. Most of these planks had a north-south orientation and sat directly on top of the grayish-brown sand below.

Because of the large quantity of rubble and debris encountered in these areas, the damage from the fire resulted in the complete demolition of the structure after the fire. While only minimal excavation was conducted in this area, the limits of the building can be surmised by observing the outline of a mound feature. This area was later used as a midden area by the Harris family, which further built up this feature. Excavation units were placed at the southern end of this feature. While only a small portion of this area was excavated in 1991 (three units of 2 × 2 m each), a total of 38,299 artifacts were recovered from this area. Ceramic vessel counts from this assemblage number 301, and consist of kitchen, storage,

Figure 9. Red earthenware vessel exhibiting signs of heat alteration of the body and glaze. Benares II area.



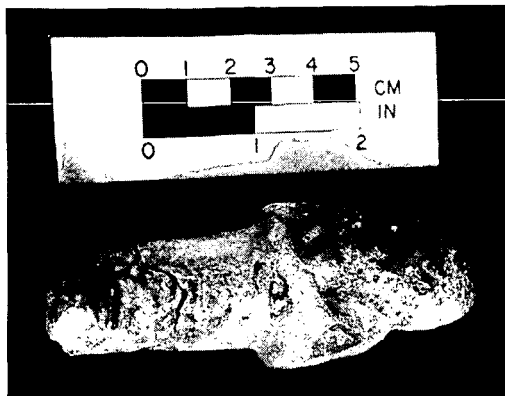


Figure 10. Egyptian shawabti figurine recovered from area of Benares II.

and table wares. Glass vessels numbered 127. Also prominent were the many items of personal value and small items that would have been abandoned during the fire. One unusual example was the clay Egyptian shawabti figurine that dated to approximately 3000 B.C. (FIG. 10). While Captain Harris had traveled far and wide, he was not known to have visited Egypt. This artifact may have been a memento he acquired while in India or Malta.

Conclusions

In their 1985 article, White and Kardulias described a process associated with the razing of a building and provided a list of stratigraphic clues that might assist other researchers in identifying similar activities on a historic site. In evaluating their 1985 article, it was strikingly similar, in terms of stratigraphic composition and cultural activities to the two case studies described above. The major difference is in interpretation. White and Kardulias did not have a documented (i.e. written or oral) history of fire damage within the house that resulted in the need for demolition. In both case studies above, several activities are remarkably similar to those noted at Barnhisel House. These include the absence of construction materials (e.g., window glass, hardware, etc.), which may reflect similar behavior as that noted at Barnhisel house whereby salvageable materials were retrieved during the demolition process, and limited

infilling above the level of fire debris to relandscape the area around the house. The case studies above describe leveling the land as a process directly related to preparing the landscape for a new house on the same footprint as that of the previous house.

There are differences between the Barnhisel case and those presented here. The areas of burning at Barnhisel House for example, were related to burning the building debris after demolition while in the two case studies above, the fire debris and stratigraphic deposits are both related to the event of the fire destroying the house. Furthermore at Barnhisel House the razed building was not re-built whereas in the two case studies above, the buildings that were demolished were rebuilt.

The Benares and Barnum examples in Ontario may represent a different pattern, perhaps one which occurred primarily on rural farmsteads, where demolition and clean-up results in leaving a thin debris field around a structure. In these examples, the existing foundations of the structures were used in the rebuilding process. The owners could not afford to finance an entirely new home. In both cases presented in this article, the extant structures sit on top of the earlier structures in whole or part. At the Benares II site, there is evidence that clean-up was not a major factor, they did not rebuild in that location, rather it became a midden area, and, as a result, the deposits may more accurately reflect a house collapse within its foundations with minimal clean-up activities. Of interest is that the razing of this building did not result in the same pattern as that noted by White and Kardulias (1985). The site of this building was not leveled and the stratigraphic composition is quite different, reflecting the non-utilization of building materials, while the evidence of burning is related to the fire that destroyed the house.

The rural frontier ebbs and flows with soil exhaustion, clear cutting of forests, rise and fall in demand for products, access to national markets, and family life cycles (Adams 1990: 92). Destruction of a home by fire played a significant role in every community's social history, one that usually was emotionally devastating to the family or families involved.

Historically, the impact such an event had on a farmstead tends to be much more murky in the historical record. Archaeological evidence enables an interpretation of the intensity of such events in the absence of first-hand descriptions.

Within this article, two rural sites have been discussed both reflecting similarities and differences in the occupants subsequent reaction to their houses being destroyed by fire. The danger was everywhere. For the colonist, fire, the provider of heat and light, functioned as the man-made counterpart of the sun. As a result, they relied on the hearth and flame during the day and night. The emotional effects of such devastation occasionally was transferred to paper although, in the two case studies in this article demonstrate, oral tradition played a larger role in disseminating the details and possible causes of the actual occurrences. Sites that have been affected by such devastation are significant for they may be able to elucidate archaeological patterning, on a site-by-site basis, of the human response to fire and its resulting damage to the landscape. Moreover, they are significant to the effort to track regional patterns of the development of fire management systems in the community to safeguard it. Households in the 19th century were threatened more frequently by fire than households in the 20th century, and the resulting behavioral response patterns such as landscaping and/or rebuilding are virtually unknown to the general population today. In terms of significance, not every rural farmstead in the 19th century experienced the devastation or loss of their home due to fire and as a result, sites such as these are fewer and merit study within the field of farmstead archaeology. This article is a further step in the development of understanding the cause and process of visible and invisible architectural household changes through time.

Acknowledgements

The author would like to thank the Ontario Heritage Foundation, the Barnum Museum, and the City of Mississauga. In addition, there were many individuals involved during the excavation period at each of these sites. In particular, Mary Catherine Garden and Gary

Warrick have contributed to the discussions regarding this paper that began in the early 1990s after the work at Benares.

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