The remnants of a second dam was observed in Little Hunting Creek west of U.S. 15. It is a stone and concrete base, completely submerged at the time of fieldwork. A cast iron gate on the south bank has a raised inscription indicating a patent of April 27, 1907. An abandoned channel follows the natural topography into the race pond. These features are discussed by Orr (1980:10) and are attributed to post-furnace developments undertaken by Lancelot Jacques.

Secondary Industrial Features

In addition to the primary industrial emphasis, iron production, numerous ancillary industries were also established at Catoctin. Some of these played a supportive role, meeting both domestic and industrial materials needs, and others increased the exploitive efficiency by making use of ironworking byproducts and diverse natural raw materials. Archeological evidence and previous investigations of these features are summarized below.

Although the 1808 Varlè map identifies a merchant or grist mill on the furnace property (National Heritage Corporation 1975b:7), both Catoctin's saw and grist mills are first documented in a public sale notice of 1841 (Contract Archeology Inc. 1971:22-23). The 1860 manufacturer census (National Heritage Corporation 1975:14) indicates that both remained in operation and,by at least that time, the grist mill was driven by steam. Somewhat confusing, however, is the 1880 census which lists a custom mill with a one hundred bushels per day capacity operated by an overshot wheel and one hand. No mention is made of steam power (National Heritage Corporation 1975:card file). Heite (1980:7-8) notes that water power was an important byproduct of ironmaking before the introduction of steam power, and he traces reuse of the tailrace water by means of a lower raceway system at Catoctin.

The sites of the saw and grist mills lie in a low depressed area between a segment of the raceway and the abandoned railroad bed. Various conjectural maps agree on the general locations but have the specific site identification reversed. Thompson (1976:104) and Maryland Geological Survey (1970) indicate the grist mill to the north of the saw mill. In both his sketch

map (1975) and during on-site interviews, Renner maintains that the saw mill was upstream, north, of the grist mill. He relates, "Mind you, when I came here, the water wheels of the saw mill were still there - great big old chestnut log and it had spokes - and a big wide paddle - had a stone bearing." He further supported his interpretation of the locations by noting one of the mill wheels was removed from the southern site, adjacent to his property. A stone mill wheel and bearing, reportedly from the sites, are currently being used for decorative purposes at a private development along Little Hunting Creek.

Field investigations of the area revealed a stone foundation at the northern site, identified by Renner as the saw mill (Fig. 11). The foundation is about 12 feet square and is a maximum of two courses high. It is located against a steep bank at the northwest corner of a deep depression. Survey to the south, through very dense vegetation, failed to locate evidence of an additional structure or other features. Renner indicated that stone from the grist mill and a related retaining wall were removed for reuse and that construction of the railroad bed involved considerable earth moving in the area.

An additional industrial plant near the saw and grist mills diversified Catoctin's industrial base and provided an outlet for a byproduct of the mining operations. A paint mill was operated for a time between 1888 and 1892 to produce blue, red, and yellow ochre from the clay matrix of the Blue Mountain Ore Mine (Singewald 1911:147). It was incorporated as Catoctin Paint Company in December, 1888 with a capital stock of $120,000 and an office at Catoctin Furnace (National Heritage Corporation 1975:card file). The paint mill, as identified by Renner, lies west of the saw and grist mills on the rim of the large depression. The feature includes brick and stone rubble in a depression about 17 feet wide and adjacent to a mound about 4½ feet high and nearly 20 feet across. A 1 foot high stack of bricks and stones is about 12 feet from a second concentration of rubble, a possible foundation line. The floor between them contains scattered and dry-laid brick. A small gully flanked by brick rubble leads from the top of the depression and terminates abruptly at the mound.

Another concentration of brick rubble was observed about 110 feet to the north and across the raceway. No foundation line, associated artifacts or other features were located.

Immediately east of Route 806 and the standing furnace stack are the superimposed remains of both the furnace shops and a later, ca. 1914, stave mill, according to Renner. The complex of above ground features appear to evidence the stave mill rather than the shops due to their materials, configuration, and orientation. Another local resident indicated the shops had been located to the west of and underneath Route 806. Major structural features on the site include a concrete-on-brick platform about 15 by 17 feet, and two concrete slabs each about 4 feet by 3 feet and about 10 inches apart from each other. The concrete on brick platform contains numerous linear horizontal slots and supports a vertical construction of brick and concrete. The construction is at the east end of the platform and measures 5 feet 5 inches by 2 feet 3 inches at its base. It rises from the concrete base in four courses of brick to a height of 2 feet 1 inch. To the north of the concrete slabs is an area of brick, stone, and mortar rubble that extends for 7 feet 8 inches to a wall of roughly cut stone, 1 course wide and at least 4 courses deep, with a mortar cap. North and 2 feet from the wall is a concrete-with-gravel, open box 11 feet 3 inches long, 6 feet 4 inches wide, 4 feet 6 inches deep, and with walls 8 inches thick. A threaded iron pipe, 1 inch in diameter, was visible extending 5 inches from the interior wall. The box closely resembles a similar container observed in the manor house ruins and identified by Renner as a water reservoir. A mound of brick and stone rubble extends westward from the box for about 4 feet. East of the box 2 courses of flat cut stone on a brick and concrete base extend parallel to the box for a length of 5 feet 6 inches. A rectangular mound of brick, stone, and mortar continues eastward for about 24 feet to two stone foundation corners. Two 6 inch wide channel rails protrude between 6 and 7 feet from the ground opposite each other along the north and south edges of the mound. A third channel rail extends less than 2 feet up at the northeast stone corner. Further to the south a railroad rail post was observed embedded in concrete, and to the southeast there is a series of three concrete and slag

post molds which included waste iron and sheet iron. A single square concrete post on a stone and mortar base lies further to the south.

To the north of the remains described above is a large rectangular mound identified by Renner as the site of the furnace stables. The mound is about 120 feet by 40 feet and about 3 feet high. It is adjacent to a slight, semi-circular depression that extends northward for about 95 feet. According to Renner the structure was constructed of stone.

In the same general vicinity, east of Route 806 and south of Little Hunting Creek, a rectangular patch of contrasting vegetation was observed in a shallow depression. Since similar areas of contrasting vegetation had previously been observed in association with structure ruins, test excavations were undertaken to explore for archeological deposits. Six post-hole tests were excavated at 5 feet intervals across the contrasting vegetation. Bits of slag, furnace glass, and charcoal were encountered but other artifacts, features, or cultural strata were absent.

Evidence of a secondary, and poorly documented, extractive industry at Catoctin is "an old flint quarry" mentioned by Singewald (1911:200). Features include a ramp of milky quartz gravel and earth, and a graded area to the west. The ramp is a narrow flat-topped ridge over 10 feet above the surrounding terrain with a steep slope at its eastern end and a more gentle incline climbing from the graded area.

Neither available documentary sources nor local informants have provided definitive dates of operation or other information about the flint quarry. Local residents believe the quartz was shipped some distance away to be used in the production of flint glass. Orr and Orr's (1977:81) contention that it was "mined by McPherson for use in the making of porcelain" is questionable on technological grounds. Its use in flint glass seems more tenable but remains unsubstantiated. It should be noted that a lens of milky quartz gravel, interpreted as a previous driveway to Auburn, was discovered at site 18FR320 a short distance to the east (John Milner Associates 1980:10).[7]

Other Possible Ironworking Sites

Limited subsurface testing was undertaken at an area hypothesized by Orr and Orr (1977:77-80) and Renner (personal communication) to be a significant but unconfirmed iron working site, possibly the location of the original furnace stack at Catoctin. Secondary evidence has been reported by Orr and Orr (1977:77-80), John Milner Associates (1980:3-4), and others, and will not be repeated here. It should be noted, however, that Renner has described the stratigraphy he remembers from an excavation for garage footings. He observed layers of red and yellow sand with charcoal and other debris (Orr and Orr 1977:77; personal communication) within a few feet of the base of a reaceway berm segment.

Investigation began by mapping the raceway segment, modern construction and disturbance, and the excavations of two test units. Test unit 1 was placed between the garage and race segment, and revealed stratigraphy in general accordance with Renner's description (Fig. 12). Alternating layers and lenses of coarse-grained yellowish brown sand and brown silty clay were observed extending from 1/2 to 2 feet below the surface. Numerous small fragments of furnace glass and an abundance of charcoal were observed in the alternating sand and clay deposits. Artifacts recovered included two small fragments of clear, colorless bottle glass, and one fragment of opaque green glass, none of which were useful for dating the strata. Slag samples from the alternating sand and clay lenses ranged from glassy to dull and stoney in texture and from buff to light green in color. They contained a relatively low, .46 percent of iron.

Overlying layers contained twentieth century bottle glass fragments and other modern artifacts. Slag from the uppermost levels was also mixed in color and texture, but retained a surprisingly high content of iron, 5.86 percent. The yellowish brown sand contained numerous flecks of reddish oxide similar to that observed at site 18FR320 (John Milner Associates 1980).

Heite (1980:12) discusses the formation of oxide particles at hammer forges but it seems likely sparks produced by a furnace stack in blast, or open hearth casting, could also be responsible for the occurrence of oxide particles.

The combined evidence indicates some type of ironworking at the vicinity, although specific functional or temporal interpretations require more intensive excavation and anaylsis.

Test unit 2 was placed about 70 feet north of the one described above in an effort to further define the nature and extent of ironworking deposits. The topsoil, dark brown clayey loam, contained a fragment of twentieth century bottle glass and a single fragment of furnace glass. The underlying layer of dark yellowish brown silty clay produced only a single large nodule of dark green furnace glass, which contained a moderate, 4.36 percent, iron content. No charcoal or sand layers were observed. The third layer was culturally sterile, undisturbed clay with cobbles and pebbles. From the evidence produced by test unit 2, it appears that either the ironworking area is quite small, or test unit 1 happened to be placed near its northern limit. Future testing south of test unit 1 is likely to be more productive in terms of defining the nature and extent of ironworking in the vicinity. Site 18FR320 lies within about 800 feet of the test area but is of unknown relationship to it. Differences observed in the slag recovered from the units may indicate that a variety of raw materials or technological processes were used in the area, or that the slag was produced elsewhere, from a variety of sources and then redeposited on the site.

One location outside the area covered by the topographic base maps and the general survey area has been the subject of a variety of conjectures. It is at a crossroad and Little Hunting Creek downstream from Catoctin. A nearby resident believes it is the site of Catoctin's original furnace stack. He cites bits of charcoal in the soil and a knoll suitable for use as a ramp to charge a furnace as evidence. Renner remembered being told it was the site of Michael Zimmerman's blacksmith shop, and that a church and houses once comprised a small community in the vicinity.

Heite (1980:10) briefly discusses the area and suggests still a different ironworking function for the site. He notes that an iron roller was used in 1804 to make the beginning of the 1742 Mill Place tract, and he also refers to a nearby mill seat. Heite's inspection of the roller, erroneously

held to be part of James Rumsey's steamboat or of the iron-clad Monitor by some local residents, led him to suggest a rolling and slitting mill might have once occupied the site. The roller, set into a concrete and stone base, is cast as one piece but for clarity is described in three parts (Plate 14). The basal segment rises 4-1/2 inches from the base, is round in section with a diameter of 9-1/4 inches. The middle segment, also round, has a diameter of 5-1/4 inches and is 4-3/4 inches high. The top segment is also 4-3/4 inches high but has four flat faces that taper from 4-3/4 inches wide at the bottom to 4-1/4 inches wide at the top.

Although a brief surface reconnaissance of the area revealed no conclusive evidence, available documentation supports Renner's interpretation of the area. The 1858 Bond Map indicates a school at the southwest corner of the intersection and a blacksmith shop at the northeast corner.

Heite's identification of the roller as from a rolling and slitting mill is probably correct. Although there is some confusion in the literature, the Johnson's are known to have operated at least one rolling and slitting mill. Singewald (1911:146-147) quotes Alexander:

> Shortly after the erection of the first [Catoctin] furnace, the same company built the Bush Creek forge, consisting of a finery and chaffery, on Bush Creek, two miles above its mouth, and made from three to four tons of iron per week. A slitting and rolling mill was also erected at what is now [1840] called Reel's Mill, but abandoned after a few years. The forge became the property of Colonel James Johnson and was operated until 1810.

Swank (1892:254) and Robbins (1973:50) appear to repeat the same information from Alexander, but Thompson (1976:63-64) implies the rolling and slitting mill was constructed at Bush Creek. He (Thompson 1976:63-64) notes, "...Bush Creek Forge, was later supplemented by a rolling and slitting mill" and adds:

> The Bush Creek Forge ceased operation sometime in the decade of the

> 1790's. The rolling and slitting mill proved unprofitable almost from the beginning, closing its doors after a few years of operation.

At about the same time the Johnsons divided their property and ironworking holdings. It seems not unlikely that a roller from the then recently defunct mill would have been used to mark one of the transferred property's corners.

Manor House Ruins

The ruins north of the standing furnace stack and between U.S. 15 and Maryland 806 are referred to as the Iron Master's House, or the Catoctin Manor House. Although detailed architectural recordation is beyond the scope of this project, a concise description of the dwelling is reproduced below from the Nation Register Nomination Form (Rivoire, et. al. 1972):

> The CATOCTIN MANOR HOUSE ..., or Iron Master's House ruins... stand to the north of Stack #2. It was originally a two-story structure of an "end-hall" plan c. 1800. The roof was an "A" frame and there was a massive chimney flush with the gable. The exterior of the building has been stuccoed and scored to give an appearance of dressed stone construction.
>
> By the mid-nineteenth century, Catoctin Manor House had developed into a formal, five-bay, center-hall dwelling, resulting from a two-story extension onto the west end. A short time later a two-story wing was built to the north thereby forming a "T" plan. The north end of the north wing has late nineteenth-century stone buttresses built to reinforce a cracked wall.

In addition to the plan as described above, Renner identified a two-story porch on the front (eastern side) of the dwelling and a single story porch on the southern side. Large flat stones adjacent to the structure's western side are the remains of a flagstone patio according to Renner. The dwelling is in a semi-collapsed condition with the roof, floors and some interior walls fallen in. The structure is quite unstable and rapidly deteriorating.

The primary emphasis of this report, in regards to the Manor House ruins, is in identifying and recording associated outbuildings and features. The functional interpretation of features is from an on-site interview with Renner and a sketch map prepared by him (1975). Features are detailed as follows.

Immediately west of the house ruins is a circular pit about 5 feet in diameter with a stone rim and an iron I-beam across the top. A 1 inch diameter iron pipe runs from the direction of the dwelling into the pit. Contract Archaeology (1971:fold-out map) identified the pit as a well, although Renner maintains the pit was a cesspool for the kitchen drain. Renner's interpretation is supported by an advertisement for sale of the property (Jacques n.d.) that claims, "water is furnished from one of the numerous mineral springs on the tract."

A second pit, about 3 feet in diameter and located north of the dwelling, was identified as a privy by Renner. According to him, it is brick lined and was covered by a small frame structure with two seats. It was in use until about the mid-1920s.

A stone retaining wall runs westward from near the southwest corner of the dwelling for about 25 feet, then makes a right angle turn and continues northward for an additional 115 feet. Portions of the wall are now covered with earth and, in some sections, the stone has been removed.

Set into the bank behind the retaining wall is a subterranean structure identified by Renner as the root cellar (Plate 9). Its interior dimensions are 20 feet 6 inches long by 8 feet wide, and the arched ceiling rises above the floor 5 feet at the front and 6 feet at the rear wall. The arched entrance is about 3 feet wide and 4 feet 1/2 inch above the exterior ground surface. Two steps of cut stone descend 10 inches from the exterior ground surface to the floor of the cellar. The arched entrance is constructed of cut and roughly dressed stone. Mortar and concrete is present between the stones on the south side of the entrance and the arch, but only small chinking stones were observed in the interstices of

the stones on the north side. The interior of the cellar is constructed of undressed, roughly cut, and finely finished stone of various sizes. Mortar or concrete is only associated with the arched entrance. The floor is of uncovered silty loam. An iron pipe, 2-1/2 inches in diameter, enters from the ceiling near the rear of the cellar and runs on top of the floor toward the entrance. The area behind the retaining wall and on top of the cellar was identified by Renner as flower and vegetable gardens.

A large cast iron artifact was observed at the southwest corner of the retaining wall (Plate 10). It is 1-3/4 inches thick, 3 feet 9-1/2 inches long, and 2 feet wide. One of the long sides is interrupted by an approximately semi-circular indentation with a radius of about 10 inches. One surface is fairly smooth but the underside was very pitted and appeared to have been roughly cast. The artifact had no design or identifying marks.

A subterranean stone foundation north of the dwelling was identified by Renner as the springhouse (Fig. 13, Plate 1). Its basic floor plan is one of two rectangular rooms with a small alcove at the southwestern corner. The alcove is 4 feet long east-west, 3 feet long north-south, and 4 feet 8 inches high. In contrast to the rest of the foundation, the alcove wall contains brick covered with concrete, and had a small amount of standing water in the bottom. The larger of the two rooms is about 17 feet 4 inches east-west and 10 feet 7 inches north-south, and about 3 feet 10 inches high. It is constructed primarily of dry laid stone but has some brickwork at its southeastern corner. Five stone steps descend to the interior floor at the south wall 8 feet 9 inches east of the alcove (Plate 12). The steps are of cut stone, from 1 foot 1 inch to 11 inches long, with treads 1 foot wide, and rises of 7 inches each. The steps are flanked on both sides by dry laid stone. Rather than forming a right angle, the southeastern corner of the larger room rounded to meet the interior wall. An opening 2 feet 4 inches wide in the interior wall joins the larger room to the smaller, easternmost room. The southern wall of the smaller room was not visible due to dense vegetation and accumulated humus.

Its additional two courses lie outside the line of the larger room's northern wall. An opening 2 feet 5 inches wide is in the smaller room's eastern wall. The floor of the structure was obscured by dense vegetation but appeared to be uncovered earth.

About 30 feet east of the springhouse is a low, roughly rectangular mound identified by Renner as the site of the carriage house. No additional surficial evidence was observed, nor was time available for archeological testing.

A semi-collapsed structure, about 17 feet by 8 feet, and located east of the carriage house mound, functioned as a corn crib according to Renner. The structure is of ballon frame construction with vertical wood siding. It has wire nails and a corrugated metal roof.

An additional feature, located immediately east of the dwelling, was identified by Renner as the site of the ice house. It is evidenced by a low mound approximately 12 feet on a side overgrown with vegetation.

A stone and mortar wall with two entrance pillars front the property along Maryland Route 806. The pillars are fitted with iron hinges but the gate is absent.

As a footnote, several large boxwoods are near the south end of the dwelling. According to a knowledgeable local resident, other boxwoods were transplanted from the property to Dupont Circle, Washington, D.C., and were later moved to the White House, during Franklin Roosevelt's administration.

Other Domestic Ruins

In addition to the Manor House ruins, six other domestic ruins were located and recorded. The interpretation of these ruins as dwellings is based on their configurations, associated features and artifacts, and information provided by Renner. They are described as follows.

The site of two dwelling ruins is located north and east of Little Hunting Creek. The first is indicated by two stone walls and a roughly rectangular area of contrasting vegetation. One wall is of dry laid uncut or roughly dressed cobbles and boulders. It is about 63 feet long, has a maximum remaining height of 3 feet 8 inches (approximately ten courses of stone), and is about 3 feet wide at its thickest point. The second stone wall is of similar construction and butts against the first at an oblique angle. Immediately east of the second wall, and opposite from the first wall, is a slightly depressed area about 25 by 30 feet containing some loose stone rubble. The area is covered almost exclusively with wild day lilies and stands out in sharp contrast to the surrounding woodland vegetation. This area is believed to be the actual dwelling site although evidence of a foundation was not observed on the other three sides. The longer wall is believed to not have been a supporting member of the structure.

Artifacts collected from the surface near this feature include sherds of both ceramic and glass. Although most were too fragmentary to allow identification of vessel types, pieces of a stoneware crock or jug, a large ironstone pitcher with blue under-glaze transfer printed decoration, and glass bottles could be distinguished. One clear, colorless glass bottle fragment, mold-made and rectangular in shape, has an embossed label that reads: _____OLL & SON/_____CO/(BA)LTIMORE, MD. With one exception, all of the dateable artifacts range from the late nineteenth to the twentieth centuries. The atypical specimen dates to the nineteenth century, some time before about 1860. It is two fragments of a pale blue-green bitters or drug bottle. A rough pontile scar is evident on the basal fragment, and diagonal seams from a two-piece mold extend about two-thirds the way up the neck. It has a straight, applied lip.

The second dwelling ruin is about 80 feet north of the one described above. It is indicated by a leaf and humus covered stone rubble and cobble mound at the head of a roughly rectangular patch of liliaceous vegetation. The mound is 3-1/2 to 4 feet high and about 10 feet in diameter. The area of contrasting vegetation is approximately 25 by 30 feet. No <u>in situ</u> stonework was observed.

Artifacts recovered from the ruin include three reconstructable fragments of a clear, colorless glass, flask-type whiskey bottle with a portion of an embossed label reading: _____SURE/(F)ULL PINT. Other collected artifacts are a fragment of clear, colorless bottle glass, a basal fragment of a white earthenware plate, and a stoneware fragment from an unidentified vessel.

Three additional features were recorded in the vicinity of the above two dwelling ruins. One is a saucer-shaped depression, 10 feet in diameter and 1-1/2 feet deep, located about 10 feet northest of the stone cobble and rubble mound. The second is a pit about 4 feet deep and 10 feet in diameter with spoil around the rim and bisected by a row of loosely arranged stones.

The third feature is an artifact concentration located between and west of the two above dwellings. Artifacts recovered include ceramic, glass, tin, and iron objects, and one oyster shell fragment. All datable artifacts may be assigned to the late nineteenth or twentieth centuries. One of the more informative pieces is a small rectangular ironstone platter with green under-glaze transfer printed rim decoration, evidenced by six partially reconstructable fragments. It has a black printed maker's mark identified by Kovel and Kovel (1953:156f) as belonging to Willett's Manufacturing Company, Trenton, New Jersey, established 1880. Also collected was a fragment of grey stoneware with a brown ferruginous wash and molded fluting on the convex surface. It appears to be part of an unused tobacco pipe bowl. Other vessels represented by sherds include several stoneware jars or crocks, a vitreous china saucer with blue under-glaze printed decoration, a white earthenware soup plate or shallow dish with shallow molded and blue printed rim decoration, and several glass bottles or tumblers. Other culinary artifacts include a flattened spoon bowl or serving piece, and the rim portion of a tin container with a rolled edge and the bottom cut off evenly. Architectural artifacts include a wire nail, two fragments of window glass, and a fragment of heavy, flat-ribbed plate glass that is possibly structural. Two pieces of a leather shoe with metal lace

grommets, machine stitching, and nail reinforcing or repair were recovered in addition to a fragment of a white clay marble, and a small sherd of coarse red earthenware with a poorly applied opaque brown glaze from an unidentified vessel.

An additional dwelling foundation was discovered west of U.S. 15. It is comprised of a low mound of stone rubble, and brick fragments, about 19 feet in diameter (Fig. 14). A vaguely defined rectangular arrangement of stone rubble extends out from the mound for almost 20 feet. One brick fragment was observed with impressed lettering reading "PREM/ FIRE RP/". Artifacts collected from the surface include a rim sherd of an earthenware cup with blue under-glaze transfer printed decoration, and two small fragments of vitreous, undecorated china from unidentified vessels. These artifacts date from the late nineteenth or twentieth century.

About 30 feet west of the above foundation is a square platform, 2-1/2 feet on a side and made of dry-laid stones. A second associated feature, a circular pit 15 feet in diameter and 5 feet deep, is located 60 feet northeast of the foundation. A final associated feature is a barely visible road trace about 20 feet east of the foundation. It is about 10 feet wide, trends north-south, and could be followed for only 90 feet.

Another dwelling ruin was identified 420 feet southeast from the one described above. It is indicated by a low rectangular mound of earth and stone rubble, and scattered stone, brick fragments, and domestic artifacts (Fig. 15). The rectangular mound is about 30 feet by 12 feet and rises 2-1/2 to 3 feet above the surrounding ground surface. No distinct foundation lines were visible. Artifacts recovered from the ruin vicinity include one fragment of a two-tone stoneware crock with yellow banding, one undecorated and unmarked fragment of a stoneware vessel that may be a chamber pot, a pale blue-green glass drug bottle neck, and a pale blue-green glass bottle with part of an embossed label that reads, "____ELLIN'S/____FOOD." The reverse side reads, "LARGE SIZE." A

cast iron stove fragment, parts of a leather shoe, and glazed and unglazed brick fragments without mortar were also observed on the site. All of the dateable artifacts are from the late nineteenth or twentieth century. One feature, an earth and stone rubble mound, was identified 25 feet east of the dwelling ruin. It is 11 feet 6 inches in diameter at the base and is about 2 feet high. In the center of the mound is a depression 5 feet 6 inches in diameter and almost 2 feet deep.

Another dwelling ruin is located on the Auburn property west of U.S. 15. It is a distinct stone foundation partially obscured by vegetation (Fig. 16). The eastern wall is 30 feet long and one course of stone wide. Three vertical courses of stone remain at its southern end and the northern end is six courses high. The structure's northern wall is 20 feet long and six to seven courses of stone high. The southern wall is only 8 feet long and one to two courses high. Parallel to the eastern wall and 8 feet west of it are the partial remains of another wall that is a maximum of two courses high.

Features associated with the above foundation include a low stone rubble mound 10 feet in diameter and 50 feet to the north, a modern property line monument, and a spring head with dry-laid stone lining. None of the dateable artifacts associated with the structure are earlier than the late nineteenth century. They include two basal fragments of undecorated and unmarked ironstone table ware, one undecorated rim fragment of a stoneware crock, one small fragment of a vitreous earthenware plate base with part of an unidentifed, green printed maker's mark, one fragment of pale blue opaque glass from an unidentified vessel, one pale blue-green glass bottle neck fragment with a pronounced mold seam, one neck fragment of a stoneware jug, one sherd of clear and colorless bottle or jar glass, one fragment of white earthenware with wide, shallow molded flutes from an unidentified vessel, and one fragment of stoneware, also from an unidentified vessel. An additional artifact recovered from the site is a rim fragment from a porcelain jar with a green printed decoration. It is very poorly potted and decorated. Other collected

artifacts include a fragment of an ironstone bowl with a shallow molded decoration, a basal fragment of a pale green glass bottle or jar probably made by an automatic bottle machine, and two reconstructable fragments of a stoneware crock. The crock is undecorated and unmarked, and measures 7-1/8 inches in diameter by 7-7/8 inches high.

The final domestic ruin is somewhat unique in two respects. It is believed by local residents to not be associated with the furnace or mining community although it is thought to have been constructed in the mid-to-late nineteenth century. It is also a more substantial and better preserved structure than those described above. The two end walls are nearly complete, the back wall is almost 1/3 standing, and the front wall has collapsed outward. The mortared stone and stucco structure is graphically described in Figure 17. Only recent artifacts were observed in the vicinity. The only possibly related features are two stone rows believed to be fence lines.

Three additional dwelling foundations within the survey area have been previously located and tested in conjunction with the U.S. 15 dualization archeology program. Two of these, designated "check 20" by Orr and Orr (1977:85-88), yielded early nineteenth century artifacts and lie within 50 feet of each other. According to Renner's sketch map, 6 houses were once in the vicinity, although intensive surface survey of the area failed to identify evidence of any additional structures.

The third domestic ruin, identified as "check 7, Carty house, or miner's house" by Orr and Orr (1977:34-39), was further investigated by Mid-Atlantic Archaeological Research (1980). Mid-Atlantic's (1980a:18) excavation west of the foundation recovered information indicating it was occupied from about 1825 into the early twentieth century, and that most of the ceramics date from about the mid-nineteenth century.

Community Structure Ruins

The remains of two structures related to community and social activities, rather than industrial or domestic functions, were identified and re-

corded during the survey. The first to be discussed is the site of a school according to Renner and as indicated on the historic map by Lake (1873:37). It is located north of Kelly's Store Road and is evidenced by a rectangular foundation 36 feet long and 18 feet wide. The foundation is of undressed and dry-laid stone, and surrounds a low, earth-covered interior mound. Around the interior perimeter is a trough-shaped depression containing three 4 inch square posts that appeared to have been recently sawed off near ground level. No associated privys, trash dumps, or surface artifacts were observed.

The second foundation is located on the Auburn property and, according to the owners, is the remains of a church or chapel constructed by a former owner for his wife. They also note the chapel was never used due to her death. The foundation is of undressed stone, laid loosely and without mortar. The northeast corner exposes a construction technique of separate interior and exterior walls with small stone rubble fill between them. Although the southern corners have been disturbed by two large chestnut trees, the foundation sides appear to have been of unequal length. Approximate dimensions are 26-1/2, by 33, by 19, by 43 feet. With the exception of several brick fragments, no associated artifacts were located.

Isolated Artifacts

Numerous artifacts were observed, and in some cases recovered, from isolated contexts. They were all located on the surface, not in direct association with other artifacts or features. Isolated artifacts at least peripherally related to the historic qualities of Catoctin are reported below.

Three fragments of furnace glass, a single brick fragment, and a red earthenware sherd with brown glaze on the inside surface were observed scattered in a plowed field in the southern portion of the survey area. In another nearby field two sherds of porcelain with blue transfer printed decoration and small pieces of furnace glass and vitreous slag were also observed. Isolated slag and furnace glass was also present along Little

Hunting Creek, downstream from the furnace complex. A separate field, west of U.S. 15, contained fragments of brick and oyster shell, a red earthenware sherd with brown glaze on the interior, and a small sherd of dark greenish-black bottle glass.

One of the more interesting artifacts recovered was from near the Manor House ruins but was not directly associated with them. It was in an area with modern beer and soft drink cans, rusted cans and other debris but appeared much older than any of the surrounding artifacts. Its location, configuration, and contents suggest the trash deposit may be a secondary refuse disposal area, possibly related to the later occupation of the Manor House. The artifact of interest is a cast iron hollow ware fragment. It is from an apparently round, shallow plate or bowl with a wide, everted rim. The body of the vessel is quite thin, less than 1/10 inch thick. The bottom is slightly convex and exhibits three noteworthy details. The first is a linear wedge gate scar, 5-1/2 inches long and 1/10 inch wide, typical of products made by flask-casting techniques. The second is a set of three short legs, round in cross section and gently tapering. The legs are less than an inch long and raise the bottom of the vessel only slightly above a flat surface. Three raised letters are also cast into the bottom of the vessel. The first letter appears to be an "8" although it is somewhat indistinct and might be a poorly cast "3" or "B". The second letter is a "D", larger and set slightly out of line with the other two. The third is a "9". The short, round legs, thinness of the body, and vessel shape are general characteristics of later, hot blast or coke fired furnace products (Tyler 1974).

V. ANALYSIS AND SUMMARY

Although analysis and interpretations of specific features encountered during the survey have been reported above, it has been recognized that the data could be used to address questions on a more broad scale. In keeping with the project objectives, this chapter traces the technological, economic, and social changes that occurred during Catoctin's productive span. As will be discussed, technological factors have had the greatest impact on the nature of Catoctin's development. Accordingly, the following discussion is organized around the major technological changes evidenced at the site. It recognizes, however, that Catoctin was also greatly influenced by the economic conditions operating throughout Maryland and the nation, and relates these data to the changes made at Catoctin.

As has been previously noted, Catoctin's first industrial activity may have been mining. It is, however, the construction of Stack I, sometime around 1774, that marks the beginning of commercial ironworking at Catoctin. In order to follow the subsequent changes that occurred, a baseline understanding of factors operative at its beginning is necessary.

Numerous factors had to be considered in locating an ironworking exterprise based on a charcoal fueled blast furnace. The most obvious are the availability of raw materials and workers, and readily accessable markets. Beginning with the latter, it may be surmised that ample outlets were available for Catoctin's products. Frederick, located about 15 miles south of Catoctin, was laid out in 1745 as a regional trading center to aid in the economic development of what was then Maryland's backcountry. It has been estimated that only five years after its establishment, Frederick had surpassed Annapolis in population and had become Maryland's largest town. By that time it had also been linked by road to Annapolis and Baltimore, and was served by other post roads and ferries as well (Porter 1975:345-347). Various primary documents indicate that, at a minimum, military shells cast at Catoctin were being delivered to Baltimore (National Heritage Corporation 1975b:5). The local demand for iron created by Frederick's explosive growth, and access

to Baltimore, would seem to have provided a more than adequate outlet for Catoctin's goods.

Little is known of Catoctin's early work force. Preliminary reporting of the cemetery excavation (Mid-Atlantic Archaeological Research 1980:10-16) indicates an established black population was at Catoctin by the 1790's. The 1790 census lists a total of 126 slaves belonging to Thomas, Baker, and James Johnson (National Heritage Corporation 1975b:card file), but does not indicate their employment nor places of residence. Local informants add that Hession prisoners of war were employed at Catoctin and were fully assimilated into the community after the Revolution. It has also been reported that during Kunkel's tenure as ironmaster, Italian immigrants were employed as miners (Robbins 1973:52). Further identification and understanding of Catoctin's work force require additional archeological and documentary research.

Regarding the third group of locational factors, the availability of raw materials, Catoctin was ideally situated. It's extensive ore deposits were of good quality (Singewald 1911:195) and were accessible. Although the specific sources of Catoctin's limestone are poorly defined, by 1811 a limestone quarry was advertised within 200 yards of the furnace (National Heritage Corporation 1975a). A third raw material, wood for the production of charcoal, was also abundant at Catoctin. Using conservative estimates, Catoctin's early annual production of 600 tons of pig iron (Contract Archeology Inc. 1971:37) would have required 90 acres of wood to be consumed each year.[8] By 1776 the furnace lands encompassed almost 2000 acres (National Heritage Corporation 1975b:4), much of it in timber.

Of the essential raw materials, Bining (1974:39) considered an adequate supply of good ore to be the critical locational factor, due to the omnipresence of extensive forests. Singewald (1911:127), however, has recognized that a combination of other factors may moderate the importance of a particular ore:

> In fact the intrinsic value of an iron ore affects only to a small

> degree its commercial value. The questions of cost of mining, proximity of fuel, flux, and water are the real factors which decide whether an iron ore deposit has any economic value. An excellent iron ore may be so situated that the cost of mining and bringing it to market is prohibitive. The ore itself, the flux, and the fuel are bulky products and the item of transportation is a most important one. When all of these factors are favorable a comparatively low grade ore can readily be utilized at a profit, whereas many high grade ores less favorably situated are absolutely worthless.

Other writers have argued that charcoal, not ore, was locationally dominant. Temin (1964:83), noting the difficulty of transporting charcoal, states that it was usually transported less than five miles even as late as 1874. Rutsch (1974:16) concurs, noting that although other factors were involved, "fuel was the critical element."

Once the criteria had been met in a particular region, two additional factors influenced the selection of a particular site. Water, necessary for cooling purposes and to drive the furnace blast machinery before the adoption of steam power, was needed in reliable and sufficient amounts. Due to difficulties in its transportation and storage, early ironworks were invariably located adjacent to perennial and easily diverted streams. The second site-specific factor is the need for a steep bank, high enough to facilitate charging the furnace stack from the top. The importance of this factor at Catoctin cannot be defined until Stack 1 is identified, but it does have implications for future efforts in that direction.

White (1979:4) has elaborated on the acceptability of particular raw materials by noting that each must meet certain chemical standards, but the economic feasibility also depends upon the cost of their extraction and the efficiency of the smelting operation. A less efficient furnace would require a higher grade of ore and readily available flux to remain economically viable. Similarly, an efficient process could maintain itself with a lower quality ore, 10 to 30 percent iron, according to White (1979:4). Ore from Catoctin's Auburn mine, at 37 percent iron (Singewald 1911:201), compares favorably with the requirements of a cold-blast furnace such as Stack I.

Regardless of its role as a locational determinant, the requirements for an adequate charcoal supply had a profound influence upon social, as well as spatial, aspects of early iron enterprises. The previously discussed transportation difficulties and the extensive landholdings necessary to ensure a dependable supply of charcoal dictated a rural location for smelting operations of Catoctin's scale. In turn, the rural location necessitated a degree of self-sufficiency to support both the physical plant and the community of workers and their families. The commonly resulting community organization has been described by many as a plantation system. Bining's (1973:20) observation is to the point:

> The mansion house, the homes of the workers, the furnace and forge or forges, the iron mines, the charcoal house, the dense woods which furnished the material for making charcoal, the office, the store, the gristmill, the sawmill, the blacksmith shop, the large outside bake oven, the barns, the grain fields, and the orchards were part of a very interesting and almost self-sufficing community. In some respects, the iron plantations resembled small feudal manors of medieval Europe.

The typical spatial pattern is centered around the furnace stack. The ironmaster's mansion was "...built close enough to the ironworks that he could supervise the industrial activity of his establishment" (Walker 1966: 75). The ironmaster's house itself was a focus not only of authority, but also of important community social activities and functions. Workers' houses, sometimes provided by the ironmaster, were located near their workplaces, either the stack or mines. Extensive farms, maintained by the ironmaster or by private owners, were also nearby to supply food and other products to the furnace community. Rutsch's (1974:16) description of New Jersey iron plantations may be equally applied to those of Maryland and other eastern states:

> The typical iron plantation in New Jersey contained the machinery for producing iron from the mine to the casting house, sheds for storing charcoal and limestone, barns for horses and oxen, houses for workers, a farm for the support of all, and a store which recorded wages owed

against commodities purchased by the workers that were not produced on the plantation. Schools and churches were found on larger, more enlightened or more remote plantations. Although the ale brewing houses found in English iron settlements were not part of the American scene, much frequented taverns sprang up near each plantation. The iron master's house or mansion, which was the center of the settlement, served as the home for the iron master and his family, a hotel for visiting tradesmen, and, in many cases, a boarding house for unmarried workers.

Two major difficulties arise in describing early Catoctin's spatial and community organization in terms of the general plantation model. The locations of the key structure, Stack 1, is unknown. The second key structure, the ironmaster's house, is also not defined for the earliest period of Catoctin. Five structures, Wayside, Auburn, Windy Hill, Springfields, and the previously described Manor House, are associated with the Johnsons either by documentation or oral tradition and are believed to date from ca.1800. Of the five, Wayside, Auburn, and the Manor House are situated within sight of ironworking areas and would appear to fit the spatial model. Springfields and Windy Hill may have functioned as well as associated farms in addition to housing the furnace owners. Ancillary structures, such as the stonesmith shop, barns, stables, corn house, store house, and 15 to 20 workers' houses advertised in the 1811 sale notice (Contract Archaeology Inc. 1971:39) have also not been positively identified and dated and are of little value in accessing Catoctin's early community organization. Although the plantation model typical of other early ironworks has not been verified at Catoctin, it provides a useful framework to guide future research into Catoctin's spatial layout, community organization, and social interactions. However, it should be viewed as a model to be tested at Catoctin rather than accepted as an explanation for what has or has not been identified.

Although the furnace complex continued to develop and expand, few major changes, either technological, economic, or social, are evidenced at Catoctin from its establishment until the middle of the nineteenth century. Peregrine

Fitzhugh is credited with laying out the town of Catoctin Furnace in 1848 (Robbins 1973:51). This event may mark recognition of Catoctin's transition from a plantation to a community structure. As Contract Archaelogy Incorprated (1971:41) pointed out, the sale notice of 1841 stressed Catoctin's domestic and community structures but ignored its ironworking plan and capabilities. They hypothesize that financial difficulties beginning in 1811 continued, despite expansion and improvements in the physical plant, and that at the time of the sale, the furnace was not in blast. It may be argued that inability to provide steady employment decreased its influence and control over the community, and was a causal factor in its shift away from a plantation organization. The saw and gristmills operative by that time may evidence the beginning of economic and industrial diversification by providing goods and services only indirectly related to iron production.

Although Fitzhugh is also credited with opening the Blue Mountain Ore Mine (Bastian 1973:3) and establishing the furnace railroad system (National Heritage Corporation 1975b:12), John Kunkel and his son's terms as ironmasters included Catoctin's period of greatest industrial activity and technological change. Shortly after Kunkel obtained one half ownership of the furnace complex in 1856, Catoctin's second furnace stack, the one still standing today, was constructed (Contract Archaeology Inc. 1971:36, 41). Stack II incorporated a steam rather than water powered blast, but retained the traditional technology of charcoal fuel at a time when contemporary furnaces were rapidly adopting hot blast and mineral fuel technologies. Temin (1964:82) notes that in 1840 almost all of the domestic pig iron was made with charcoal, but the figure was reduced to 45 percent in the mid 1850's, and was only 25 percent at the close of the Civil War. Despite the rapid conversion to mineral fuel once it began, domestic manufacturers were slow to adopt the technology of coke fuel that had been used in England as early as 1710 (Tyler 1974:146). Reasons for the delayed acceptance of mineral fuel include technological differences, the great expense of replacing the stack, tradition, and perhaps most importantly, an abundance of wood (Isard 1948:211). Bining (1974:61) states, "the chief reason for the change from charcoal to coke, however, was the unsurmountable difficulty of wood supply." Catoctin, perhaps to a greater extent than many other domestic furnaces, was able to postpone its

conversion to mineral fuel due to its large tracts of timber. Kunkel increased the furnace lands to 11,000 acres during his ownership (James 1974), perhaps to ensure a continued supply of charcoal.

Returning to the site-specific locational factors discussed above, Stack II is located near Little Hunting Creek. Although Stack II was steam operated, water to produce the steam and for cooling purposes would still be necessary. The second factor, a steep bank to facilitate charging, raises an interesting question in regards to Stack II. A series of soil borings (National Heritage Corporation 1974:Part 2, 9) indicates the bank adjacent to Stack II is comprised of about twenty feet of slag and other fill, rather than being a natural knoll as was more common, especially in areas of steep local relief such as Catoctin. Of course it is possible that Stack II's original charging bridge ran from a natural high point and the area between it and the stack was filled by slag during its production span. It is also possible, however, that Stack II was constructed adjacent to Stack I and used its slag heap as a charging ramp. Since both stacks were operating at the same time, it would seem most efficient for them to be located in the same industrial area, as was the case with Stacks II and III. In the absence of other locational determinants it seems unlikely that Stack II would have been removed from the area of Stack I, especially if it required transporting Stack I slag to construct an aritifical charging ramp at the site of Stack II.

Knowledge of Stack II's location facilitates discussion of Catoctin's spatial patterning and community organization. The other key structure, the ironmaster's house, is believed to be that described here as the Manor House, lying within 300 feet of Stack II (National Heritage Corporation 1975b:75). Perhaps the third most important structure for reconstructing community patterns, the company store, was located within 200 feet of the other two structures, according to Renner. Barns, shops, and other related structures are also believed by Renner to have been in this central industrial area. Surviving workers' houses both to the south and to the northeast of Stack II, as well as other nearby industrial and community structures, complete the community of Catoctin at Kunkel's time. The spatial patterning of these structures appears to exemplify the previously described plantation

pattern, although both the scale of the furnace and related operations, and the regional economic and social conditions of that time would have provided a milieu encouraging less isolation than typical of plantation situations. At Catoctin the transition from a plantation to a company town settlement cannot be defined on the basis of intra-site spatial patterning as currently perceived. Catoctin is not unique in this respect, however, as McCurdy (1975:129) writes of Potts-Grove, now Pottstown, Pennsylvania:

> The early plan of the village reflected the nature of its social, economic, and political dependency on the ironmaster almost as clearly as did the traditional arrangement of buildings on an iron plantation.

More subtle factors, such as economic and administrative control, workers' status, and personal interaction spheres, will have to be ascertained in order to fully understand the formation of Catoctin's company town. More precise chronological data on each structure may also allow a refined spatial model capable of tracing such subtle changes.

The most significant technological change at Catoctin is the previously mentioned conversion from charcoal to mineral fuel. Although Stack II is believed to have used charcoal until its dismantling in 1893, anthracite or coke fuel is first known to have been used at Catoctin with Kunkel's construction of Stack III in 1873 (Contract Archeology Inc. 1971:35-36).[9] By this time it may be surmised that even Catoctin's vast woodlands were being depleted. Three additional factors, however, may have contributed to Kunkel's decision to switch to the mineral fuel technology. First, the production of charcoal iron was a labor-intensive undertaking. As stated in Walker (1966:62) the 1848 labor cost of charcoal iron was $12.35 per ton, but was only $2.50 per ton of anthracite iron. In addition, charcoal production was a seasonal activity, requiring a relatively large work force but able to provide only intermittent employment. The second potential contributing factor is the higher stack and greater capacity possible with mineral fuel. Charcoal, under the weight of ore and limestone, tends to compress to the point that the blast cannot penetrate the furnace charge.

Mineral fuel, on the other hand, can support considerably more weight and thereby allows a greater furnace capacity. Catoctin's anthracite furnace had an initial annual capacity of 9,000 tons and was later increased to 15,000 tons, compared to only 3,300 tons for the charcoal-fired stack II (Contract Archaeology Inc. 1971:37). The third potential factor is also technological but concerns the finished product and is also closely tied to industrial and economic changes resulting from the Civil War.

Although Catoctin's direct contribution to the Civil War has not been documented (National Heritage Corporation 1975b:14), it no doubt benefited from the increased prices and demand for iron. Walker's (1966:64) statement describes the situation and introduces an additional factor of great significance at Catoctin:

> The Civil War brought new activity to the charcoal-iron industry. The price of pig iron rose so rapidly that cost of production was no longer a worry. Iron which in normal times had sold for $30 per ton was bringing $80 in 1864 and touched $99 before it began its decline. Prices remained high after the war largely because of the demands of the expanding railroads.

As has been seen, Kunkel's reaction to the booming iron market was to enlarge and modernize Catoctin's physical plant in order to meet the demand and take advantage of the higher prices. As noted by Walker above, the war and post-war demand was for pig iron and for iron to be used as railroad rails. At about this same time another technological revolution was sweeping the iron industry. The Bessemer process for converting iron into steel made large-scale steel production possible for the first time, and according to Swank (1892:408), "For many years after the introduction of the Bessemer process in the United States it was used to produce nothing but rails." Characteristic of the early Bessemer process is that it required pig iron almost completely free of phosphorus, but benefited from a trace of manganese (Singewald 1911:126-127; Swank 1892:400, 404). Catoctin was at an immediate disadvantage because its ore contained phosphorus "considerably above the Bessemer limit" (Singewald 1911:196).

Kunkel's response to the challenge was two-fold. First, he sought-out, and found, magnetite ore which was much lower in phosphorus than Catoctin's limonites and also contained the desirable traces of manganese. The deposit, located on Catoctin property on a "hill southwest of Catoctin Furnace," produced 15,000 to 20,000 tons of ore but was not developed further, probably due to the cost of preparing it for the furnace (Singewald 1911:313-315).

Kunkel's second response was to develop a method for removing phosphorus from Catoctin's limonite ores. Kunkel's method, patented in 1876, was essentially the use of dolomite, or magnesian limestone, instead of the normal limestone flux (reproduced in National Heritage Corporation 1975b:45). For unknown reasons Kunkel's method was not further developed nor widely adopted (Swank 1892:406). The extent of its use at Catoctin is likewise unknown.

To conclude, the nature of Catoctin's ore may have directly contributed to the demise of Catoctin's iron production. In its earlier period, when much of the demand was for hollow ware and stove plates, phosphoric ore may have been an advantage to Catoctin. Singewald (1911:126) notes that phosphorus makes cast iron more fusible and slower to solidify, making it suitable for intricate molds and thin, ornamental castings. Due to the phosphorus content in its ores Catoctin's cold-blast stacks were able to achieve the same results as more technologically advanced hot-blast furnaces. When the demand shifted to iron suitable for the Bessemer process Catoctin's phosphoric ores became a liability. However, the fact that Catoctin's ore continued to be mined after the smelting operations had been shut down (Singewald 1911:201) indicates other factors also contributed to the end of its iron production.

In addition to its technological impact, the conversion from charcoal to mineral fueled iron production had profound effects on the iron industry and associated communities. The once dominant locational factor, extensive tracts of woodland for charcoal production, was no longer relevant. New furnaces, relying on mineral fuel, were able to locate closer to established

markets and urban centers, and closer to coal deposits, thus gaining an economic advantage over the rural, plantation based furnaces. Harvey's (1975:166) general conclusion seems particularly applicable to Catoctin:

> Small charcoal furnaces prospered on the frontier because they produced for local use the fine quality iron demanded by blacksmiths and small foundries. Iron smelted with coke or raw bituminous coal was particularly suited for rails and heavy industrial castings, but unless their product could be delivered to market cheaply, ironworks using the new smelting process had no hope of survival. Ironworks in the more favorably situated anthracite region, with its network of canals and railroads had no such problem.

Singewald (1911:201), writing closer in time to the end of Catoctin's iron production, indicates the large capital outlay necessary to improve and rebuild the furnace led to Catoctin's insurmountable financial problems. Oral tradition suggests the furnace owners were unable to cope with labor problems and workers' demands. All of these factors, and perhaps others as yet unrecognized, contributed to the end of Catoctin as an industrial center.

VI. EVALUATION STATEMENT

As specified in the project Request for Proposals (Bastian and McNamara 1979:8) the purpose of this chapter is to evaluate the project's success in meeting its initial expectations and to consider how deficiencies might have been avoided. The initial expectations, as reflected in the general project objectives (Bastian and McNamara 1979:3-4) are repeated below to facilitate the following evaluative discussion:

1) to provide knowledge about the early iron industry in Maryland and about the formation of the compact company town associated with it;
2) to stimulate public interest in archeology, the Catoctin Furnace site, and Maryland's past;
3) to provide guidelines for site management and park master planning especially for areas of the site most suitable for interpreting to the public the technological, economic, and social changes through time at Catoctin; and
4) to highlight important areas of the site that may become available for future state acquisition.

Due to the length of discussion, the first objective will be considered last. The second objective, to stimulate public interest, is difficult to measure and, to a large degree, cannot be evaluated until this report has been disseminated. It should be noted, however, that considerable local interest was observed during the project's field stage. Numerous individuals were eager to share their knowledge of the site, and to provide other assistance, and were also interested in the project's findings. In all fairness, however, this interest probably stems more from a local pride in the site, and the more visible previous excavations, than from activities conducted as part of this survey.

The second objective raises an additional point of discussion. Although all of the previous state-sponsored investigations have been undertaken with the ultimate goal of serving the public's interest, little information has

been made available directly to that audience. Previous technical reports are sometimes difficult to obtain even through informal exchange networks among professional archeologists. A single three-page informational pamphlet produced by the state (Puckett n.d.) describes Catoctin's ironworking to the public in general terms but cannot be expected to convey the wealth of information available nor to address the unanswered questions more important to those with even a rudimentary knowledge of Catoctin and ironworking technology. Although this project may help to fill that gap, it has not been directed solely to that end. Detailed descriptions and other information necessary for peer review, as well as management and planning recommendations, are required in this report and are valuable pursuits, but are irrelevant and distracting to the general reader. It is hoped that this report will be of value to the general public, to other professional researchers, and to resource managers, but it is also recognized that a single report cannot be expected to completely and succinctly satisfy the diverse needs of all these audiences.

Information toward the third objective, to provide management and planning guidelines, is presented in the final chapter. Evaluation of its success in meeting the objective would be more appropriate and more meaningful if provided by those who will use the information and those who are responsible for the decisions to implement, modify or ignore the recommendations.

In a similar vein, conditions and events outside of this project will determine the project's usefulness regarding the fourth objective, to highlight possible areas for future acquisition. From the outset this objective has been of the lowest priority. Although areas important to the site but on private land were included in the survey and discussed in the report this project has not been intended to aid in their acquisition. It is believed that acquisition of these areas is unnecessary and, indeed, would be detrimental to the extent that funds and energies would be diverted from the more critical management and proper development of the core site area. Private landowners should, however, be encouraged to protect the significant historical and archeological values of their properties and should be informed of the various financial incentives available toward that end.

Several avenues can be taken in evaluating the project's success in meeting the first objective, to provide information about Maryland's early iron industry and about the development of its associated community. As with the objectives already discussed, more appropriate and more meaningful evaluation will have to come from those who use and build upon the information presented. Perhaps this project's greatest contribution will be in the questions raised rather than in its delineation of previously unknown features. More in-depth and feature-specific research than was possible under the time and budgetary limitations of this project is necessary to fill in the picture of Catoctin's industrial and community development.

It is possible, however, to point out some of the limitations and shortcomings of this project. As with most investigations undertaken on a contract basis the work must be accomplished within a strict time frame. In this project, as with other state-sponsored investigations, the time budgeted was exhausted long before the research potential was fully developed. Additional excavation would have been valuable at many of the features discussed in Chapter IV but was precluded by the necessity to collect at least minimal data about the numerous other features also important to an understanding of Catoctin.

This project also suffered from an unavoidable degree of fragmentation. Standing structures were excluded from this investigation but are a critical part of Catoctin's community patterning and organization. Likewise, features under investigation by the U.S. 15 dualization project are central, both spatially and conceptually, but were excluded from direct investigation. Because both projects were being conducted concurrently, researchers were unable to build upon other's work to the degree that would have been desired. Some duplication and overlap was unavoidable.

An additional problem was the nature of some of the previous documentary research. Although a considerable amount of valuable historical information has been made available, it often has been directed to goals complimentary to this investigation but of a different focus or emphasis. This is not to question

their goals or the value of their work but to point out the need for documentary research directed toward archeological problems and conditions.

The analysis section of this report was also limited by the state of our current knowledge about Catoctin. Although Stack I was in existance about 40 years longer than Stacks II and III combined, it is unknown archeologically. The roles of site 18FR320 and the possible ironworking site reported herein are yet to be defined and incorporated into the technological history of Catoctin. An additional problem is the lack of precise chronological data about other specific features. Such data are essential to a complete delineation and understanding of Catoctin's numerous and rapid expansions and contractions.

As discussed in Chapter III, dense vegetation and the highly dissected land ownership pattern increased the difficulty of conducting the field survey. It is also believed some features are present but were not identified because they lie entirely below the ground surface. Although some exploratory subsurface testing was undertaken in search of buried features, a comprehensive or systematic program of exploratory testing was beyond the scope of this project. In fact, the feasibility of such an understanding would be questionable even without time and budgetary structures. In addition, penetration of the deep fill west of Stack II would require techniques other than usual archeological testing procedures.

Contract Archaeology Incorporated (1971:38-39) recognized another factor that has limited the possibility of identifying features that once existed at Catoctin. They note that with the various episodes of plant modernization some structures were probably modified to serve other functions, or were completely dismantled to provide building materials for new structures. Because much of Catoctin's building and rebuilding was concentrated in the area around Stack II, it may be surmised that evidence of its earliest features has been severely disrupted by subsequent construction. Identification of the earliest features is also hampered by two additional factors. Most obviously, natural processes of decay and depostion have been active on them for a longer time than the more recent features. Secondly,

the earliest features are beyond the time encompassed by oral tradition. The knowledge of Renner and others has been invaluable in locating and identifying more recent industrial and domestic features but does not extend with the same accuracy to Catoctin's earliest period.

A brief listing of specific features expected, but not yet identified, at Catoctin may be valuable in accessing the completeness of available inventories and in introducing avenues of future research. Some features are known to have existed at Catoctin from available documentation. Stack I, of course, is the most sought after feature. In addition, the 1811 sale notice (Contract Archaeology Inc. 1971:22) lists a stonesmith shop, cornhouses, and a chopping mill that have not been located. The 1856 conveyance of half ownership to Kunkel lists blacksmith and carpenter tools (Contract Archaeology Inc. 1971:42), suggesting two additional shops that remain unidentified. The census of 1860 (National Heritage Corporation 1975b: card file) adds a smithy, a wheelright shop, and a steam foundry. In his 1876 patent Kunkel notes, "...I apply dolomite either in the cupola or puddling furnace..." (National Heritage Incorporated 1975b:45), implying the existance of two additional industrial plants. Subsidiary storage buildings and shops would also be expected. In 1876 the Furnace was also assessed for fifty tenant houses (Contract Archaeology Inc. 1971:43), far more than can be accounted for by standing structures and known archeological remains.

VII. RECOMMENDATIONS

This concluding chapter outlines recommendations for future management and development of Catoctin's archeological resources and presents a multi-disciplinary research design for further investigations. The management guidelines stem from an archeological and cultural resource management bias which, as discussed below, reflects the primary interpretive and research significance of the site. While the research design also reflects an archeological emphasis it is realized that a broadly based program of investigation is necessary to fully realize the site's scientific and educational potential.

An underlying assumption of the recommendations is that the site's primary significance lies in its archeological potential. Although some may envision restoration and reconstruction of the site in order to present a "living iron plantation" similar to Hopewell Village National Historic Site in Berks County, Pennsylvania, such development is not considered to be appropriate for Catoctin. In addition to being wasteful duplication, such development has been precluded by the present alighnment of U.S. 15 which bisects the site. Proposed dualization will further exacerbate the visual and audible impacts that deprive the site of its isolated, somewhat pastoral, historic character. The site, however, is admirably suited for other interpretive themes, including but not limited to, the evolution of industry, the interplay of technological, environmental, and social factors, and on a more specific level, the techniques and contributions of archeological investigation. Development of a comprehensive master plan, recommended as early as 1974 (National Heritage Corporation 1974:18-19), is of the highest priority to reconcile sometimes disparate goals and to direct future investigations. As is stressed in a recent publication outlining the process of resource protection planning (Heritage Conservation and Recreation Service 1980), planning can, and indeed should, begin regardless of the amount or quality of data presently available.

Development of a master plan should also serve to coordinate the efforts of the various state agencies concerned with Catoctin. As was pointed out in

Chapter II of this report, the state has been almost solely responsible for the modern investigations of Catoctin. While this involvement is commendable and is exemplary of a state's concern and responsiveness to its cultural heritage, the efficiency of some of its previous undertakings is open to question. Perhaps the most obvious example is the previously discussed set of problems arising from the concurrent nature of this project and the U.S. 15 dualization archeology program. Although both state and federal policies and procedures are responsible for the present management framework (cf. Patterson 1980), Catoctin may present an opportunity to implement innovative approaches with the primary emphasis on preservation and research rather than mitigation of impacts from other developmental activities. Problems of adequate and timely funding will have to be addressed within a perspective considering other state and national priorities, but increase the need for long range planning in order to gain the maximum benefit from funds that are made available.

On a more specific level, an immediate need is implementation of a program to stabilize and protect Catoctin's architectural and archeological features. Both the rapid deterioration of the features and the rapidly rising cost of stabilization require immediate action to be taken in order to most efficiently use available resources. It must also be emphasized that both feature-specific and site-wide stabilization must be undertaken within a broad program that includes both management and research consideration. A priority ranking of features to be stabilized should weigh factors such as present condition, rate of deterioration, amenability to public display and interpretation, intrinsic scientific value, feasibility and cost-effectiveness. In at least some cases, concomitant documentary and archeological research will be necessary to answer questions of original design and fabric (eg: National Heritage Corporation 1974:5-8). It should be noted that preliminary efforts to stabilize the Manor House are currently underway. It is hoped that these efforts are carried through more successfully than earlier plans to stabilize the retaining wall in the Stack II area. A feasibility study for its stabilization was completed as early as 1974 (National Heritage Corporation 1974), but the recommended stabilization methods have not yet been implemented. Instead, partial and temporary shoring

was installed, resulting in some destruction of the archeological record and an obtrusive, but fortunately not irreversible, alteration of the wall's historic appearance. Although perhaps slowed, deterioration of the wall continues at a perceptible rate.

It should also be pointed out that stabilization and protection does not always entail expensive and complicated engineering procedures. Regarding the retaining wall and Stack II, simple procedures such as repairing deteriorated or missing stonework, repointing and repairing deteriorated brick and mortar, providing better drainage, and removing vegetation would be inexpensive and effective means to significantly prolong the life of these structures (National Heritage Corporation 1974:22, 8). In the case of archeological features, merely avoiding subsurface disturbance in sensitive areas would greatly enhance their survival. Steps in this direction may be easily undertaken by consulting the base maps produced during this project prior to beginning construction or other terrain-disturbing undertakings, and by sensitising construction supervisors and workers to the importance of preserving archeological features and strata.

An additional need, alluded to in the proceeding chapter, is the production of a report synthesizing our current knowledge of Catoctin for the general public. This step would require little or no additional field or documentary research and would allow the public to receive a direct and tangible benefit from the site and from the funds being spent on it. The synthesis, as envisioned here, would be written in a straightforward manner without undue concern with technical detail or analysis. Rather than ignore the current gaps in our knowledge of Catoctin, such a report could emphasize how quickly information is forgotten or destroyed, parallel to the decay and destruction of Catoctin's once imposing physical plant. It is believed that future professional investigations will require site and problem-specific background research of a detail not appropriate for popular publication.

Park master planning should also consider the applicability and appropriateness of various interpretive devices. As discussed above, complete restoration and reconstruction is not recommended. The use of working models and

audio-visual presentations, for example, may be coupled with on-site displays to provide more cost-efficient, but still effective, educational and interpretive opportunities. On-site displays may include *in situ* foundations and artifacts sealed under protective coverings which allow direct observation with a minimum of distraction. If such devices are to be used, excavation should be planned and guided from the outset with that goal in mind.

A major component of the site's master plan should include guidelines for long-range archeological and other research. A comprehensive plan of future investigations is essential to avoid the piecemeal and fragmentary results that have sometimes been the outcome of previous projects undertaken to serve limited and isolated goals. A complete understanding of Catoctin's industrial and social history will require the expertise of researchers from a variety of fields. To be of maximum utility these efforts must be undertaken within a closely coordinated and fully integrated program of investigations guided by the goals and priorities set forth in the master plan. The research design, presented below, is intended to suggest how specific research and management questions may be approached in a unified program of study. In the absence of a master plan, the research design is based on the author's assumptions of priorities and long range goals. Discussion of these assumptions is provided to aid in evaluating the recommended programs, and to provide a base for future planning. In the interest of clarity, the program is presented in two categories to reflect both the technological and social significance of the site.

I. Technological Investigations

The extant Stack II and retaining wall area is given the highest priority for additional archeological investigations. This area, already Catoctin's interpretive focal point, is expected to contain invaluable technological information, as well as the site's most impressive and important structures. Its proximity to the Manor House, workers' houses, ore mines, and other industrial features is expected to facilitate development of the site's educational and recreational opportunities. It is believed that one of Catoctin's most significant attributes is its potential for evidencing the

technological history of nineteenth century domestic iron production. Due to its long production span Catoctin's technological history encompasses the major innovations and influences which shaped the American iron industry. This record is expected to be concentrated in the Stack II area. In light of the failure of intensive, but perhaps not exhaustive, documentary research to provide a clear picture of Catoctin's technological history, archeological investigations hold the greatest potential for contributing to our knowledge of this important aspect of the site.

It must be recognized from the outset that the investigations recommended here entail an intensive and thorough archeological program. Additional small-scale investigations are to be avoided because, as has been evidenced in the past, valuable portions of the archeological record are lost without providing a commensurate increase in our knowledge of Catoctin. Because the Stack II area has been the site of much of Catoctin's industrial activity it is of the greatest importance in defining the technological processes of ironworking. Due to its long operative span and numerous episodes of rebuilding and additions, archeological remains are expected to be quite complex, and in some cases, deeply buried. The utmost precision in excavation and recordation will be necessary to allow complete reconstruction of the site's history.

Archeological research should be guided by a set of specific questions, largely raised by existing historical documentation. The definition of previous primary and support structures' locations will be required but should not be viewed as the final goal. Precise data about their designs and dates of use are also essential to the technological history. Some specific questions worthy of investigation are outlined as follows:

Is the Stack II area also the site of Catoctin's Stack I as implied by Lesley (1859:50) and discussed earlier in this report? If such is the case, is Alexander's reference (Singewald 1911:146) to the present furnace having been constructed three-quarters of a mile upstream from the

first totally incorrect, or is the reference actually to an original furnace predating even Stack I?

Lesley (1859:50) raises an additional question about Catoctin's technological evolution. He identifies furnace No. I as a hot blast charcoal furnace. As discussed previously, hot blast technology did not gain widespread acceptance in the United States until after the 1830's. Was Catoctin's Stack I innovative in its blast machinery from its first construction, or was the hot blast capability added during one of the subsequent rebuildings?

Lesley (1859:50) also identifies Stack II as a steam cold-blast furnace. If Stack I was indeed a hot blast furnace what technological factors caused the newer Stack II to be fitted with less advanced and efficient cold blast apparatus? Why also was steam rather than water power chosen to operate the blast machinery? Was the volume and head of Little Hunting Creek insufficient to power two furnaces simultaneously, and if so, what are the implications for Catoctin's other industrial plants operated by its extensive raceway system? Stack II, as identified by Lesley, seems to be a technological anomaly in its acceptance of steam power but retention of the more traditional cold blast technology.

The priority of the Stack II area notwithstanding, complete delineation of Catoctin's technological history will also require intensive archeological research at other ironworking areas. Anticipated additional excavations at site 18FR320 are expected to shed light on possible secondary ironworking processes at Catoctin. Other possible ironworking areas, identified previously, may require further definition to fill in the perhaps more unique aspects of Catoctin's ironworking enterprises.

A program of chemical, geochemical, and metallurgical analysis is recommended to be undertaken concomitant with archeological investigations at Stack II and other ironworking sites. White (1977, 1978, 1979, 1980) has pioneered chemical analysis of historic slags to reveal a wide range of technological and other information. As he has demonstrated, slag can be used to determine the firing temperature of the furnace which produced it,

and can be analyzed as to its own effectiveness and to allow statements about the furnace's efficiency. Analysis of slag from well defined archeological contexts is expected to be invaluable in identifying features and the technology they represent. Combined with chemical analysis of Catoctin's limestones, ores, and iron, slag analysis can be an extremely important tool for relating particular features to each other and to specific technological periods. Reasons for Catoctin's unusually long life span, but inevitable decline, can be more fully evaluated and understood if based on knowledge of the characteristics of its raw materials and finished products.

An additional avenue of inquiry which is believed necessary to an understanding of Catoctin's technological development entails a comprehensive examination of Catoctin's race and water control system. Archeological and engineering investigations should include all segments of the race system regardless of their location relative to U.S. 15. A well developed history of the race system is expected to greatly enhance our understanding of the industrial plants, ironworking and otherwise, associated with it. It is also expected to provide insight into Catoctin's use of steam power and resultant technological and economic influences.

As evident throughout this report, the location and other information about Stack I, is a vital but practically unknown part of Catoctin's technological history. It is also the subject of numerous legends and conjectures posited by local residents and professional researchers. It is recommended that future efforts to located Stack I be undertaken in the context of more broad documentary and archeological investigations. As discussed above, archeological excavations in the Stack II area may reject or confirm the hypothesis that it is also the site of Stack I. Documentary research has been undertaken on a voluntary basis and is expected to be of great assistance in defining possible locations of Stack I. Overlay mapping of deed and survey records will further enhance our ability to understand the spatial patterning of industrial and social processes evidenced at Catoctin.

II. Anthropological Investigations

In addition to its technological significance, Catoctin's long life span also allows a perhaps unique opportunity to investigate the changes or stability of its associated community. On a macro-site scale a plantation model of spatial organization was presented in Chapter V to describe, though not necessarily explain, Catoctin's community development. Some of the additional data necessary to evaluate the plantation model, and to generate more refined and reliable models, were also presented in that chapter. An interdisciplinary program toward these goals is presented below.

Historical and architectural inventory and analysis of Catoctin's historic standing structures is central to any comprehensive investigation of its spatial and community organizations. Compilation of a comprehensive business history would greatly aid investigation into economic and social conditions of the furnace as a whole and of relationships among workers and between the workers and ironmaster. Specific information of value would include data on organizational forms, managerial control devices, production costs and wages, sales, profits, and losses. Records of the company store would be invaluable in providing information on the community's degree of self-sufficiency, the relations of workers and owners, and perhaps additional information on the furnaces' finished products. Since the site of the company store is believed to be sealed under an active roadway and is not available for archeological investigation in the foreseeable future, its records are of even greater importance.

Additional understanding of the community social organization will require intensive archeological research. Excavation of a variety of domestic structures and associated features will allow better definition of Catoctin's work force and their role in the successses and failures of the iron-working enterprises. Investigations patterned after Otto (1977) can provide information on status differentials not available at Catoctin through means other than archeological research. The social structure, as revealed by status differentials between workers and the ironmaster, and among different groups of workers, is central to understanding the community organization and its changes through time. Such comparison, however, will re-

quire tightly defined artifact collections from a variety of sites in addition to those already excavated. Since such large scale excavations are not likely to be undertaken immediately it is essential that archeological features at the workers' houses, Manor House, and other domestic structures be preserved. Coordinated state and private efforts will be necessary to ensure the survival of features representative of the full range of Catoctin's population.

Several cautionary statements are in order to conclude the recommended program of future archeological and other investigations. Each undertaking, whether conducted on an in-house, volunteer, or contract basis, must be conducted within a well defined and realistic scope. Project goals must accurately reflect the site's master plan, research priorities, and available time, personnel, and financial resources. A thorough small-scale project may be of great utility and long-range benefit, but piecemeal uncoordinated destruction of the archeological record should not be condoned. Features should be preserved in situ unless there is adequate funding to allow complete recordation and investigation of that portion of the record to be affected. It is preferable to leave important research questions unanswered for the time being than to preclude that possibility forever by undertaking projects that are compromised from the outset by goals that are not realistically reflected by the available funding.

In a similar vein particular excavation techniques must be carefully chosen to reflect both characteristics of the specific site being excavated and specific research questions under investigation. Mechanical excavation is expected to be a valuable part of future excavations but must not be employed as an expedient means to uncover foundations at the expense of more fragile and subtle types of data. An underlying theme of the research proposal above is the need for precise chronological control of both technological and social processes operative at Catoctin. Excavations that result in isolated synchronic interpretations may help provide a fragmented picture of the site but will ignore its major significance; that is, its evidence of the processes of technological and social changes that have occurred during Catoctin's uniquely long-lived production span.

FOOTNOTES

1. Singewald (1911:148) indicates ore from Catoctin was at first used at the Hampton Furnace, located about 1.5 miles west of Emmitsburg and constructed between 1760 and 1765. He does not identify a more specific source of the ore but notes Hampton Furnace was short-lived due to a lack of good ore.

2. Although not specifically referring to Catoctin, Singewald (1911:125) notes ores are occasionally found with the ratio of bases to silica such that the ore is completely self-fluxing. Bining (1973:61) adds that charcoal ash also acts as a fluxing agent.

3. A turn of the century mining engineering textbook (Colliery Engineer 1903:§14, p. 62) notes the most common gauges are 30, 33, 36, 42, 45, and 48 inches. The advantage of a wide gauge is its increased stability which allows greater car capacity and therefore a smaller outlay for rolling stock. Advantages of a narrow gauge are reduced construction costs and the ability to better negotiate sharp curves.

4. It should be noted that this discussion has not included the conjectured ore railroad south of the extant furnace stack. Information on that segment may be found in Orr and Orr (1977:60-65), and Orr (1980:18-19). Neither Bond (1858) nor Lake (1873:37) indicate a railroad south of the extant stack.

5. Although the term "charcoal pit" is often used, Kemper (n.d.:8) indicates it means the hearth and piled wood, and does not refer in any way to a hole in the ground.

6. Referenced in a letter of December 30, 1975 from Calvin E. Schildknecht, professor of chemistry at Gettysburg College, to Alice Schooler, National Heritage Corporation.

7. A potentially rewarding means of inquiry into Catoctin's flint quarry might include documentary research regarding John Amelung's New Bremen Glass Manufactory in Frederick County. Established in 1784, Amelung's glass manufactory was the foremeost domestic glass works during the period 1787 to 1794 (McKearin 1941:100-104). In describing his glass works, Amelung (in McKearin 1941:100) noted, "...that the principal materials, as wood and pot-ash, were to be had in abundance..." and [his glass works] ought to be preferred to a number of other Manufactures to which the raw materials must be drawn from other parts." He does not, however, mention locally available flint. Amelung's association with the Johnsons, original developers of Catoctin, is better established. In the description quoted from above, Amelung lists Thomas Johnson, Esq. as providing him with a letter of recommendation. Baker Johnson's association with Amelung is evidenced by a case bottle with the engraved inscription "B Johnson/1788" and authenticated as an example of Amelung glass (McKearin 1941:104; plate 40).

8. Based on 180 bushels of charcoal for 1 ton of iron, and 1200 bushels of charcoal for each acre of wood (Temin 1964:83). White (1979:4), however,

asserts that "...even the most humble stone furnace consumed approximately 250 acres of a forest a year..."

9. Although there is no direct evidence, a mixture of mineral fuel and charcoal could have been used, at least experimentally, in Stack II. Such a mixture of fuels was used in Ohio ca.1810 (White 1978) and at Harford Furnace in Maryland in 1815 (Swank 1892:353).

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