DRAFT

Archeological Survey of Catoctin Furnace, Cunningham Falls State Park and Adjacent Areas

Frederick County, Maryland

John Milner Associates
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Prepared for
State of Maryland
Department of General Services
Department of Natural Resources

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1981

TABLE OF CONTENTS

ABSTRACT

In the spring of 1980 John Milner Associates conducted an archeological survey of the Catoctin Furnace site under the sponsorship of the Maryland Department of Natural Resources. The project was undertaken to provide data useful for interpretation and stabilization, planning future research and park master planning and management. The intensive field survey combined systematic non-biased and informant-directed locational strategies. Identification was aided by on-site informant interviews and detailed mapping, clearing, and limited subsurface testing.

In addition to domestic and community structure foundations, feature evidencing mining, ore washing and transporting, and charcoal production were located and described. Additional features include remains of ironworking plants, other industrial features, and segments of the race system.

The data are analyzed to explore technological requirements of ironworking and their influence on social organization. Locational factors and spatial patterns of the plantation model observed at other nineteenth century furnaces are discussed, and problems with the model's application to Catoctin are identified. The impact of technological and economic changes following the Civil War are related to both technological and social changes evidenced at the site. Factors contributing to Catoctin's unusually long production span, but eventual decline, as an industrial center are also discussed.

Management and planning needs and guidelines are presented based on the site's archeological potential for providing important information about technological and social changes. A research design for an interdisciplinary program of investigation to realize this potential and to aid in further development and interpretation of the site is offered.

ACKNOWLEDGEMENTS

Individuals and agencies too numerous to list provided valuable information and assistance throughout the project. Several, however, have made contributions that directly guided the project and significantly added to its results. Fieldwork and feature identifications were aided greatly by the knowledge and assistance of William G. Renner, Mr. and Mrs. Clement Gardiner, Marie E. Burns, Roger Penwell, and Eugene Anderson. The cooperation of these and other area landowners was essential and is gratefully acknowledged. Charles Sandy, Park Manager, Cunningham Falls State Park, supplied additional information and was especially helpful and cordial in providing coordination during the field phase of the project. Kenneth G. Orr freely shared information gained through his years of experience at Catoctin. In addition to his extensive archeological fieldwork, Orr has recorded much of Catoctin's oral history and, to a large degree, is responsible for the awareness and sensitivity of Catoctin Furnace residents toward archeology and toward the site.

Funding and contract administration by the Maryland Department of Natural Resources and Department of General Services were of primary importance to the project. Their foresight and concern for proper management of the state's resources is expected to produce tangible and enduring benefits for the state's citizenry. Tyler Bastian, State Archeologist, Maryland Geological Survey, Division of Archeology, has been instrumental in the project from its inception, and has provided invaluable guidance and coordination throughout. His efforts are largely responsible for the success of this project as well as numerous preceding investigations. Aerial photographs provided by the Maryland State Highway Administration were of considerable utility in both the field and reporting phases of the project. The interagency review panel's active involvement in guiding fieldwork and reviewing the report is also sincerely appreciated.

I. INTRODUCTION

The Catoctin Furnace site, located in Frederick County, Maryland, includes industrial and domestic remains of iron mining and processing enterprises along the eastern slope and base of Catoctin Mountain, about four miles west of the Monacacy River (Fig. 1). The site is on land administered by Cunningham Falls State Park and the Department of Natural Resources, and on land under multiple private ownership.

An intensive archeological survey of the Catoctin Furnace site was conducted under the sponsorship of the Maryland Department of Natural Resources by John Milner Associates. An original Request For Proposals for the project was issued in March, 1977, but due to a very limited response no award was made at that time. The Request For Proposals for the project was significantly revised by Tyler Bastian and Joseph McNamara of the Maryland Geological Survey, Division of Archeology, and was reissued in February, 1979. A contract was awarded to John Milner Associates in November, 1979, on the basis of a Professional Services Proposal authored by Alex Townsend. The revised RFP, the Proposal, and discussions with the inter-agency review panel, provided primary guidance for the design and execution of this project.

The purpose of the project is to generate data necessary for accurate interpretation and stabilization of the site, to facilitate the planning of future, but as yet unspecified, archeological investigations, and to aid in overall site management and park master planning (Bastian and McNamara 1979:1). As the first phase of an envisioned long-term archeological research program, the project's general objectives were specified (Bastian and McNamara 1979:3-4) as follows:

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.

In addition to artifact collections and standard field records, the end products of this project include this report, and information drafted onto copies of base maps provided by the state. The base maps consist of eighteen sheets, 24 by 36 inches, that include indices and present the site area at a scale of 1 inch to 200 feet and contour intervals of 5 feet, and the central area at a scale of 1 inch to 50 feet with contour lines at every 2 feet. Information obtained during the project and plotted onto the base maps includes the survey boundaries, feature locations and identifications, and distinguishes among features located from historic and other references, features located but previously unknown, and feature locations that have been conjectured but not verified. The base maps are submitted under separate cover and are to be made available to qualified researchers by the state.

As reflected by the above stated project purpose and general objectives, primary emphasis was to be placed on information necessary for preservation and interpretation of the site for public understanding and appreciation. It was also realized, however, that the survey data could be applicable to broader anthropological, historical, and technological research. Indeed, as is argued later in the report, it is believed that the maximum public enjoyment and benefit of the site depends upon the full elucidation of cultural and technical phenonmena evidenced there. Recommended steps to achieve this goal are included in the final section of this report.

First, however, it is necessary to provide a brief background of the site and to review the accomplishments and questions raised by previous historical and archeological investigations. This information is presented in the following chapter. Chapters III and IV describe the field and laboratory methodology employed, and the findings of the survey. The survey data are summarized and analyzed in Chapter V. Chapter IV includes a discussion of the project's success in meeting the goals stated above, and highlights special problems encountered, how they were addressed, and how they might be avoided by future researchers. The final chapter suggests a research design for additional archeological work at the site and presents a framework upon which long-range Park master planning may be based. In keeping with the project objectives, features discovered during the survey but not directly related to the historic values of Catoctin Furnace are not eludicated in the text but are reported in Appendix A.

II. PREVIOUS INVESTIGATIONS AND HISTORICAL BACKGROUND

This investigation of Catoctin Furnace has been preceded by a long line of earlier reports and accounts. Authored from a variety of points of view and with disparate goals and purposes, these reports have presented a wide range of information but have not been synthesized into a unified and definitive history of Catoctin Furnace. This shortcoming, as perceived by some, results both from the narrow focus of previous investigations as well as the tremendous variety and richness of Catoctin's historical resources. The need for such an undertaking is more fully discussed in later sections of this report. The purpose of this chapter, however, is to discuss the nature, accomplishments and shortcomings of previous research, and to extract from them a synopsis of Catoctin's history. Rather than presenting detailed summaries of each earlier report, specific information is cited throughout the following sections in discussing and interpreting the findings of this investigation.

Major existing reports about Catoctin can be grouped into three broad categories - Early Student, Early Reminiscences, and State Stimulated. The Early Student reports have been concerned with Catoctin both directly and indirectly and have been the source of several still unanswered questions. The earliest and perhaps most controversial reports were made by J. H. Alexander, and have been repeated by numerous subsequent writers. His statement of a second furnace being constructed in 1787, "about three-quarters of a mile further up Little Hunting Creek, and nearer the ore banks" (quoted in Singewald 1911:146) has been the springboard for various conjectures about the location of Catoctin's original stack. It bears repeating, however, that Alexander's informant, James Johnson, was a descendent of co-owners and operators of the furnace, although he is considered to be a secondary source (National Heritage Corporation 1975:6). Lesley (1859:50) adds to the controversy by stating that Catoctin's furnace "No. 2 was built in 1857 <u>alongside</u> of No. 1" (emphasis added).

The outstanding report of the Early Student group is Singewald's 1911 publication of a revised portion of his 1909 dissertation. Although Singewald's

(1911) primary emphasis is on Maryland's iron ores and the status of the iron industry, he also provides an historical account of Catoctin's mining and ironworking industries and mentions other secondary industries as well. Of equal value is the reporting of his field examination of both industrial and geological features at Catoctin. His detailed descriptions and interpretations remain the most complete and accurate investigation of Catoctin from geological and industrial points of view.

The first archeological investigation at Catoctin was undertaken in 1936 by Enslow, a student archeologist sponsored by the National Park Service and the Works Progress Administration. With the exception of scant references in weekly reports (Orr and Orr 1975) no field notes, records, or reports of the work are available. Based on information provided by Mentzer, Orr and Orr (1975:7-8) have provided the most complete account of the 1936 excavations. The absence of first-hand reporting of the investigation is particularly unfortunate because it removed important portions of the archeological record at very sensitive locations in the primary industrial area.

The last of the Early Student reports is Norman E. Waesche's 1936 paper on the Economic History of Catoctin Furnace. As an interesting note, Singewald's (1911:147) historical sketch of Catoctin Furnace is based on information provided by L. R. Waesche, "at one time manager of the property."

During the time of the Early Student investigations dealing with Catoctin, the site was also the subject of popular newspaper accounts and reminiscences. Articles by Fraley (1924), a Catoctin merchant, and Lantz (1925) in a newspaper feature, are important for reasons other than the information they provide. Both articles present historical accounts of Catoctin, sometimes based on questionable data, such as Catoctin's relationship to James Rumsey's steamboat, but are important as documentation of public interest and pride in Catoctin's history. Lantz's (1925) article begins, "Motorists in increasing numbers are visiting the old Catoctin Furnace Iron Works, which have played so important a part in American history."

Following years of neglect, a flurry of historical and archeological investigations have been conducted during the last decade, primarily under the direction and sponsorship of various Maryland state agencies. Conducted on both in-house and contract bases, the investigations have characteristically been limited in focus and scope. Although these projects have been conducted by professional investigators, it must be noted that much information in their reports was gathered from local residents and knowledgeable amateur investigators. Their input has been invaluable to most of the reports discussed below.

The initial report in this group, and numerous subsequent reports, have been undertaken by the State Highway Administration in conjunction with its planned dualization of U.S. 15. Contract Archaeology Incorporated (1971) conducted the first survey of land to be affected by the proposed dualization, and presented the first attempt to combine historical research, informant interviews, and archeological research into a survey of the core site area. The authors (Contract Archeology Inc. 1971:11) begin the report by stating their contract limitations including, time allocated and a restriction to the State Highway Administration's right-of-way. These two factors, spatial limitations based on non-archeological concerns and limited time and budgets, have been characteristic of subsequent archeological investigations. The following year three quite different, but all significant, manuscripts were produced. A Nomination to the National Register of Historic Places was prepared by the Maryland Historical Trust (Rivoire, et. al. 1972), a series of popular articles was published locally (Mentzer 1972), and a letter report detailing professional observations and opinions about Catoctin's mining features was submitted (Fauth 1972). Acceptance of Catoctin to the National Register insured continued consideration of its historical and archeological values, and officially recognized the Historic District's significance. The nomination was also important because it included an inventory of the known important standing structures, ruins, and archeological features. Mentzer's (1972) articles are outstanding for his descriptions of Catoctin Furnace and its place in the history and technology of iron production. Perhaps more importantly, the articles remain unsurpassed in providing for public knowledge and appreciation of the historical importance of Catoctin.

Written for a different audience, Fauth's (1972) report marks a broadening of the multi-disciplinary approach to understanding Catoctin's surviving features. Geological expertise was sought to answer questions about limestone and ore pits raised by earlier archeological and documentary evidence.

State agencies continued their interest and investigations into Catoctin and produced two additional manuscripts in 1973 and 1974. Bastian (1973) of the Maryland Geological Survey, Division of Archeology, produced a summary and analysis of information about mining at Catoctin and specifically discussed the significance of the Blue Mountain mine. Undertaken in response to a proposed landfilling program, Bastian's report provided a concise and thorough presentation of the information then available. The following year the Maryland Historical Trust (James 1974) prepared a history of land transactions concerning the furnace property and owners. Two additional reports were prepared during this time period, also at the behest of the state of Maryland. Robbins' (1973) report on the state's iron industry during the Revolution was prepared for the Maryland Bicentennial Commission. Its survey of the state's ironworking sites includes a description of Catoctin's major above ground remains, a synopsis of its history, and a discussion of its interpretive potential. Perhaps Robbins' most important contribution is his recognition of the diversity of Catoctin's potential values. He (Robbins 1973:53-55) points out Catoctin's role in Maryland's economic and industrial activities during the nineteenth century, and notes that due to its long production span, it evidences the major technological changes that occurred in domestic iron production. He goes further, however, by emphasizing the company town aspect of Catoctin. Noting the survival of the village of Catoctin Furnace, with intact structures, Robbins (1973:54) recognizes "Catoctin Furnace is a rare opportunity to examine the growth, through the entire 19th century, of a small industrial town."

In 1974 the Maryland Department of General Services, Office of Engineering and Construction, and the Department of Natural Resources contracted for a study of the feasibility of stabilizing the standing furnace stack and retaining wall. A major contribution of the ensuing report (National Heritage Corporation 1974) is a photographic and drawn record of the wall and stack, in addition to soils data. The report was also important in realizing the dearth of readily applicable hard data despite the background provided by the above cited references. Concerned with maintaining the historic appearance of the site they (National Heritage Corporation 1974:vii) caution:

> It is essential that a thorough historical research and archaeological investigation be made prior to full scale stablization of the walls. It would be highly conjectural to rebuild the ruinous portions of the retaining wall with the scant evidence presently available.

Three projects conducted in 1975 further attest to the state's active and varied interest in Catoctin Furnace. Conrad (1975) of the Maryland Geological Survey, Division of Archeology, submitted a report to the Department of Transportation detailing his reconnaissance of the area to be affected by the proposed dualization of Route 15, exclusive of the Historic District. Conrad (1975) reported six prehistoric sites and an historic cemetery but noted, "...limitations of time and manpower, along with widely varying survey conditions, prevented complete coverage of the area under consideration."

The second 1975 report (Orr and Orr 1975) was prepared for the Department of General Services, Office of Design and Construction, and the Maryland Geological Survey, Division of Archeology. The purpose of the five day excavation program "...was to record and preserve the archaeological features and artifacts which might be affected by the restoration of the casting shed" (Orr and Orr 1975:1-2). Although numerous expected industrial features were recorded, a comprehensive investigation was precluded by the limited time and scope, and the ancilliary nature of the project. As the Orr's (1975:1) noted, "Laboratory analysis of the artifacts and comparisons of the finds with the literature, as required in a complete report, remain to be undertaken in the future." A significant contribution of the project was its solicitation and use of information provided by knowledgeable local sources. Although he had been interviewed by earlier researchers, the involvement and knowledge of William Renner had not previously been reported to such an extent. Renner (1975) produced a sketch map of the furnace and community structures, both extant and known from memory and oral tradition, and has played a major role in the location and interpretation of numerous features considered in subsequent investigations.

The final project conducted in 1975, prepared for the Department of Natural Resources, Land Planning Services, was more broad in scope, and is the only in-depth survey of documentary evidence pertaining to Catoctin's socio-economic history. Although two summary reports were submitted (National Heritage Corporation 1975a, 1975b) the project's major contricution was an indexed card catalogue of over 1,000 entries relevant to Catoctin.

Unique in that it was prepared without assistance from the state, Thompson's (1976) report on western Maryland's iron industry was undertaken in an effort to better understand the role of the iron industry in the economic history of the Chesapeake and Ohio Canal. Thompson's report (1976:iii), "...was written mainly from deed books, chancery records, will books, and the like," and provides a history of land transactions and of iron masters at Catoctin.

The state's involvement continued, however, with an additional project conducted by Orr and Orr (1976) for the Maryland Department of Natural Resources, Land Planning Services. "The basic purpose of the excavation was to assist in locating positions for the [temporary shoring] cleat bases which would least disturb the adjacent archaeological remains, and to recover and record whatever materials of archaeological natüre [that were] disturbed by the pits" (Orr and Orr 1976:1). As with the Orr's previous report (1975), this project was limited to salvage of archeological remains in the core industrial area that were disturbed for other, non-archeological, reasons.

Archeological investigations in conjunction with the U.S. 15 dualization, and the involvment of the Maryland State Highway Administration, greatly intensified in 1977. The Orrs were contracted to conduct archeological survey and testing along the corridor selected for U.S. 15 dualization. Their investigation made use of consultants in geology and ironworking technology, and relied heavily on the knowledge of Renner and other local residents concerning the locations and functional interpretations of features within the highway corridor. A total of 92 features, at 21 "checks" or sensitive areas, were recorded and evaluated (Orr and Orr 1977:89). Although restricted to the proposed highway corridor, the Orrs' report is important in that its coverage was more comprehensive than earlier surveys, and it considered both domestic and industrial remains outside the standing stack area. In addition, it provided a basis for the largest-scale program of archeological investigations yet undertaken at Catoctin.

As a continuing step in its U.S. 15 dualization project, and in response to federally based legal requirements, the Maryland State Highway Administration undertook a program of mitigative excavations at Catoctin. Thirteen of the "checks" identified by Orr and Orr (1977) were selected for more intensive excavation on the basis of their potential significance and the degree and type of impacts expected from the dualization of U.S. 15. The excavations began in the summer of 1979 with Kenneth Orr as project director. Excavations were conducted by Orr, Mid-Atlantic Archaeological Research Incorporated, and John Milner Associates (formerly National Heritage Corporation). Although the final reporting of these efforts is still in preparation, and in the case of ironworking site 18FR320, additional excavation is planned, interim and preliminary reports have become available during the course of the project reported herein. The wide variety of sites investigated indicates additional information pertaining to Catoctin's industrial, social, economic, and religious activities will be forthcoming.

Industrial features examined by Orr (1980:Part 4) include a race pond and raceway segments, a portion of the ore railroad, iron mines and the charcoal road, and limestone quarries. Investigation of the Spring-Bathhouse site may facilitate inquiry into questions of status and socio-economic organization. Mid-Atlantic Archaeological Research (1980) conducted excavations at a prehistoric lithic scatter, an historic cemetery, a domestic structure foundation, and at the Blue Mountain Ore Bank. Analysis of skeletal and artifactual data recovered at the cemetery is expected to allow a better understanding of the social and religious activities of the people interred there, and to provide information about Catoctin's community organization and its stability or changes through time. Excavations at the structure foundation, identified by Orr and Orr (1977:34) as a miner's house, were limited to the impact area of U.S. 15, immediately west of the foundation. Initial analysis indicates the structure was a dwelling, probably occupied from about 1825 to the early twentieth century (Mid-Atlantic Archaeological Research 1980:18).

Site 18FR320, under investigation by John Milner Associates (1980), is the southernmost industrial site known at Catoctin. Additional excavations, expected to be conducted in the spring of 1981, are necessary to fully define the site's chronology and the industrial processes pursued there.

Numerous historical overviews have been written about Catoctin, each written from a particular point of view, with differing primary concerns and information available. National Heritage Corporation (1975b) organized its historical data into periods based on the people associated with ownership and operation of the Furnace. Based on archeological and oral history data, Orr and Orr (1977:91) outlined Early, Middle, and Late Catoctin periods, and a Post Furnace period. Others (eg: John Milner Associates 1980:3-7) have summarized background information relating to a particular site or problems under investigation. Contract Archaeology Incorporated (1971:37) has presented a chronological summary of Catoctin's ownership and furnace developments in chart form. It is reproduced here (Fig. 2) as a concise historical sketch useful for quick reference, but does merit some elaboration and qualifications.

An exact date for the beginning of industrial development at Catoctin has not been firmly established. Pearse (1876:19) and Swank (1892:254), both secondary sources, indicate the first furnace at Catoctin was built in 1774. Based primarily on deed records, others (Contract Archaeology Incorporated 1971:10, National Heritage Corporation 1975:4) advance a date slightly before or after 1776. A 1770 patent for "The Mountain Tract" was issued to Benedict Calvert and Thomas Johnson "for the purpose of Erecting and Building an Iron Works" (National Heritage Corporation 1975b:4). A deed recorded in 1803 indicates "Good Will" and other tracts were purchased by the Johnsons for 100 tons of pig iron in 1776, and that a furnace had been erected on "Good Will" (National Heritage Corporation 1975:4). The delay in recording the transaction may reflect a deferred payment schedule, allowing the furnace to literally pay for itself. It should also be remembered that Catoctin's earliest industrial activity appears to have been mining rather than iron smelting. Singewald (1911:148) indicates ore mined at Catoctin was used at the Hampton Furnace, constructed between 1760 and 1765.

From its beginning until 1812 Catoctin was owned by Thomas, James, and Baker Johnson under various organizational arrangements. Following Baker Johnson's death, the furnace was sold to Willoughby and Thomas Mayberry (National Heritage Corporation 1975b:7). Catoctin's role in the War of 1812 has not been definitely established although there are suggestions that it may have produced iron for various ordnance foundries, or for use as ships' ballast (National Heritage Corporation 1975b:8).

John Brien and John McPherson acquired Catoctin in 1820, and are credited with rebuilding and enlarging the original stack in 1831 (Robbins 1976:79-80). Brien-McPherson control of the furnace continued until 1843 when the furnace was sold to Peregine Fitzhugh. Extensive improvements by Fitzhugh led to the formation of a partnership with John Kunkel to ease Fitzhugh's financial problems (Robbins 1976:104-105).

Under the Kunkel family, primarily John B. Kunkel, Jr., Catoctin experienced its period of most intensive industrial activity and development. This is evidenced in census and insurance records (Robbins 1976:105-106), oral tradition (Fraley 1924), and archeological investigations (Mid-Atlantic Archeological Research 1980:18). A major technological change in Catoctin's iron production occurred with Kunkel's construction of the third furnace stack, Deborah, in 1873. Deborah, powered by steam and fueled by coke, marked an important departure from the traditional use of charcoal as fuel. The economic and technological implications of this change will be discussed in a later chapter.

After Kunkel's death in 1885, Catoctin was owned and sporadically operated by various corporations until 1903. In 1905 the property was purchased by Joseph E. Thropp, owner of other furnaces in Pennsylvania. Thropp continued to work the ore banks for a short time but dismantled much of Catoctin's industrial plant (Robbins 1976:108-109; Singewald 1911:148).

Following its abandonment as an industrial center, Catoctin has been the site of lumbering, tourist, and fish production activities. The site remained in private ownership until 1936 when the core industrial area and other portions of the furnace lands were acquired by the National Park Service. In 1954 a portion of the property was transferred to the State of Maryland to be included as part of Cunningham Falls State Park (Mentzer 1970:2).

III. SURVEY METHODS

In order to best accomplish the previously stated project objectives, a four-step strategy of field investigations was employed. These steps included 1) systematic, non-biased, intensive survey, 2) informant and document directed survey, 3) clearing, testing, and detailed mapping, and 4) on-site informant interviews. Each step will be discussed in detail below; however, it is necessary to first discuss the scheduling of fieldwork and the determination of survey boundaries.

The extreme lushness and density of spring and summer vegetation was known from previous experience in the project area, and it was also realized that the effectiveness of the survey could be greatly limited by the resultant obscured ground surface visibility. Accordingly, fieldwork was scheduled to begin, as nearly as could be estimated, after snow cover had dissipated and the ground had thawed, but before springtime vegetation had become established. The desired schedule was met with fieldwork commencing in late March and continuing through late April. The detrimental effects of the vegetative cover were further alleviated by conducting site discovery procedures in the early part of fieldwork, and postponing intensive recordation of identified complex features until near the end. However, even with this optimal scheduling, the survey team encountered numerous areas with impenetrable undergrowth, and throughout the survey surface visibility was severely limited in all areas except those recently disturbed.

It was also recognized from the outset (Bastian and McNamara 1979:6; John Milner Associates 1979:2) that generation of data pertinent to the project objectives could best be accomplished by allowing a flexible definition of the survey boundaries. The researchers were directed to "...cover the entire site" (Bastian and McNamara 1979:6), and were also given a number of specific features to investigate. This required the survey boundary to be determined, and constantly refined, during the course of fieldwork in order to reflect both predetermined parameters and newly acquired feature locational data. The factors presented below, and discussions with the inter-agency review panel during the field period, were utilized in making the field determination of survey boundaries:

1. Specific features identified for investigation in the contract documents (Bastian and McNamara 1979:6, John Milner Associates 1979:2) included: a) standing ruins, races, mines, dumps, and other features in the central site area, b) topographic anomalies north of Kellys Store Road, c) slag piles south of Kellys Store Road, d) source of limestone referred to in Thompson (1979:81),e) large ore pit north of the central site area, f) ore pit west of the Auburn house, g) the cabin sites reported by Orr and Orr (1977:85-88), h) and the banks of Little Hunting Creek for one mile upstream of the Historic District.
2. In order to avoid unnecessary duplication, features included in the concurrent archeological project being sponsored by the State Highway Administration in conjunction with the dualization of U.S. Route 15 were excluded from this project. Kenneth Orr, Project Director of the SHA investigations, provided locational and other information about these sites.
3. Detailed recordation and analysis of standing structures were also beyond the scope of this project.
4. Features identified or inferred by previous investigations, historical documents, and local informants were given high priority for field investigation. A site sketch map prepared by William G. Renner (1975), and interviews with Renner and other residents knowledgeable about local history, provided the basis for the informant-directed survey.
5. Land ownership patterns were also considered in determing the areas to be surveyed. The original intent was to contact all private landowners in the Catoctin Furnace area to request permission to investigate their property. Although over fifteen landowners were contacted in person or by telephone, it was soon realized this idealized intention could not be completely attained within the project schedule and budget. The reasons for this include the

large number of very small parcels with individual owners, difficulty in contacting absentee landowners, and sometimes inaccurate ownership information. In order to maximize the time available for actual field investigations, landowners holding large tracts of land or land with known or suspected features were given highest priority. The most notable exclusions necessitated by the above factors include the cluster of "workers houses" adjacent to Route 806 near the central site area. These parcels are generally less than one half acre in size and although they were visually scanned from adjacent property it was felt the time necessary to contact each landowner was not justified by the likely little additional data to be gained. It is urged that these landowners be included in future architectural surveys and that information about the locations of privies, wells, gardens, and other archeological features be elicited at that time.

6. An effort was also made to completely survey the area covered by the topographic base maps provided by the state. Although areas were excluded for reasons given above, it was felt nearly complete coverage was necessary to ensure the identification of previously unknown and unsuspected site features. It was believed thorough coverage of the core area would provide data more useful for future planning and management than would survey of widespread, disjunctive parcels.

Although the method of determining survey boundaries has been discussed, it should be stressed that the actual delineation of survey limits was an on-going process that continued throughout the course of fieldwork. The above factors were combined with information obtained from preceding field inspection, informant interviews, and priorities expressed by the inter-agency review panel, in order to obtain the most information in the time available. The four steps of actual survey strategy are discussed as follows.

The initial step of fieldwork consisted of a non-biased, systematic and intensive survey designed to locate, as nearly as possible, all archeological features within the area under investigation. It was felt this approach would lead to the discovery and recordation of features previously unknown, and would help insure that important but secondary or ephemeral features were not ignored because of undue emphasis on the better-known or more spectacular features. Accordingly, this approach was applied to all areas surveyed. It was carried out in the field by employing straight-line pedestrian swathing tactics as discussed in the John Milner Associates (1979) proposal. The team of surveyors, usually four in number, covered each area by walking parallel to each other, and maintaining an interval of about 50 feet between surveyors. The parallel swaths were oriented to follow linear landmarks such as highways, streams, or field boundaries, or were oriented along a cardinal compass direction in the absence of visible landmarks. Deviations from the straight-line swaths were made as necessary in areas of extremely dense undergrowth or other barriers, to inspect adjacent areas of increased surface or subsurface visibility, and to more closely inspect natural and cultural features believed likely to contain significant cultural resources. The original swaths were resumed once the barrier had been bypassed or the adjacent area inspected. Upon the discovery of a feature, all surveyors would congregate to thoroughly inspect and record the area, then would return to their respective stations to continue the swathing pattern.

The second step in the field investigations was a document and informant-directed survey in order to take advantage of previous investigations, previously identified historical documents, and the wealth of information available from local informants. Rather than emphasizing land areas as in the first step, the emphasis in the second step was placed on locating specific features or ruins noted by the above sources. Two procedures were employed to implement this step of fieldwork. In one procedure the surveyor would accompany the informant in the field to locate and verify the feature sought, and would return at a later date with the full team to undertake recordation or more detailed inspection as required. In the other procedure, a team of two or three surveyors would attempt to follow written descriptions of feature locations on the ground or would use sketch maps, coupled with verbal directions when possible, to locate features. In the latter procedure surveyors would fan out and comb the area once the general vicinity of the expected feature was located.

Although they are described separately and were generally conducted as separate steps of fieldwork, it should be noted that in some cases steps one and two were combined in a single period of field investigation. This was especially true in surveying the Blue Mountain Ore Bank where topographic features prevented straight-line swathing, and an early sketch map (Singewald 1911:194) of features was available. Survey of this area was accomplished by walking concentric swaths around the rim of the open pit, and by walking meandering transects onto protruding fingers and along the bases and slopes of the actual ore cuts. Greater emphasis was placed on feature locations indicated by Singewald.

Features discovered during either step one or step two discussed above were generally recorded by the full survey team. Each feature was described in field notes and was plotted on base maps. Recordation was enhanced by photographs and/or measured sketches as appropriate. In the case of complex or obscured features recordation was accomplished during the third step of fieldwork.

The third step of fieldwork included clearing, testing, and detailed mapping of selected features and of potential feature locations discovered during the first and second steps of fieldwork. As specified in the contract documents (Bastian and McNamara 1979, and John Milner Associates 1979), the purposes of this step were to determine the function, size, and age of features to the extent possible, and in some cases, to confirm the presence or absence of features. In all cases testing was designed to produce a minimum adverse impact on the feature being investigated, and in no case was it intended to be complete excavation or data recovery.

Several factors were weighed in selecting areas to receive intensive recordation in step three. As proposed (John Milner Associates 1979:3), features thought to be amenable to interpretive development of the site were given high priority. Also as stated in the Proposal, the testing and intensive recordation program was designed to cover as many areas as possible, rather than to concentrate on only one small portion of the total site at the exclusion of other feature locations. The nature and condition of each feature was also a primary determinant in its ranking for step three investigation. Stated simply, features were selected for clearing, testing, and mapping when it was thought the data to be obtained justified the expenditure of time required.

The specific procedures used to implement the step three investigations also varied depending on the above factors. In many cases it was necessary to remove dense vegetation in order to define the size and configuration of features. This was accomplished with standard hand tools and efforts were made to leave the feature and overlying deposits as undisturbed as possible.

In addition, during step three fieldwork, features that could not be accurately plotted on the base maps due to their isolated location or obscured visibility were located by means of a transit and tape or compass and pace traverse. Each traverse was tied to permanent features previously plotted on the state base maps. Detailed transit and tape mapping was also conducted in areas of dense or complex features concentrations, and in areas selected for subsurface testing.

It should be noted that the state base maps were found to be extremely useful for maintaining horizontal control of feature and artifact locations. In many areas simple feature locations could be plotted directly on the field maps by careful observation and map interpretation. In areas requiring more detailed mapping or in the absence of visible landmarks, points well defined on the base maps and in the field were selected as mapping control points. Caution should be used, however, when relying on the base maps to provide vertical as well as horizontal control. Although they were found to be acceptably accurate in the more level core site area and eastward, contour lines in the western portion of the site on Catoctin Mountain were found to be too generalized and inaccurate to identify small flats or drainage channel details. Minor discrepancies between the 200 and 50 feet scale maps were also noted in the rendering of topographic features.

Another difficulty was in the field identification of the exact points for which elevations were given on the map. Although outside the scope of this project, vertical control for future work at the site could be greatly facilitated by plotting the locations and elevations of State Highway Administration bench marks onto the base maps. These bench marks are readily identified in the field, usually as a chiseled square on the top of concrete culvert headwalls. It would be a simple and very useful undertaking to transfer the vertical data from existing maps, and would require no additional fieldwork.

Actual subsurface testing was accomplished by shovel and trowel excavation of square units, two feet on each side, and at one location, by a series of small units excavated by standard clamp-type post hole diggers. All excavated matrices were screened through 1/4 inch mesh hardware cloth. Photographs and measured drawings were made of each test unit prior to backfilling. The locations and results of the subsurface testing program are presented in later sections.

The final step of fieldwork consisted of an on-site review and discussion of major features with William G. Renner. Notes were made on field maps and the interview was tape recorded. In addition to aiding in the identification of some features, Renner was able to point out the locations of additional features that are sealed under pavement, or are otherwise not detectable by normal surface or subsurface inventory procedures.

All artifacts recovered from test units were retained. Collections of surface artifacts were made when it was thought laboratory analysis would add additional data, and when the artifacts were thought to be of intrinsic or display value. The locations of collected artifacts were plotted on the base maps and recorded in field notes. The locations of some artifacts observed but not collected were recorded in a similar manner. Collection techniques varied from straight-line systemtic swathing in cultivated fields to intensive but less systematic searching in areas of heavy vegetation and limited surface visibility. Post-field treatment of the artifacts is discussed below.

All artifacts recovered during the surface survey and subsurface testing programs were cleaned, labeled as to provenance, and cataloged on forms provided by the Maryland Geological Survey, Division of Archeology. Distinctive and informative artifacts were also photographed. All iron artifacts recovered were cleaned by manual removal of superficial corrosion followed by electrolytic reduction. They were then stabilized by impregnation with a mixture of beeswax and paraffin. Ceramic and glass artifacts were washed and identified by type, and by vessel when possible, to aid in determining the function and age of associated features. Results of the artifact analysis are presented in a later section.

Additional laboratory work included preparation of the state base maps and hard-line drafting of the field graphics. Information plotted in the field on prints of the base maps was inked onto mylar copies of the base maps. Information identified on the maps includes areas surveyed and test unit locations, features inferred from existing sources and whether or not they were located, and previously unknown features that were discovered during the project. In order to protect the features from uncontrolled artifact collection and other vandalism, the base maps are not included in this report. As noted earlier, they are available to qualified researchers from the Maryland Geological Survey, Division of Archeology.

IV. SURVEY RESULTS

One hundred twenty-four features or groups of features of archeological interest were identified and recorded during the field survey. The problems of organizing and presenting this body of data in a coherent manner useful for both management needs and archeological interpretation are exacerbated by the wide variety of type, size, and significance of features. It is therefore necessary to explain the organizational framework in which the features are ordered and described.

A commonly used organizational framework is to type and describe groups of similar elements in sections titled, for example, artifacts, features, and structural remains. This approach was rejected because it was believed to obscure important associations and spatial clusters. Another approach considered was to spatially stratify the survey area and to describe features according to their location. This approach was also rejected because it would have isolated functionally related features from each other and would have fragmented discussion of linear features such as road beds and raceways. The cautions of South (1979) notwithstanding, the decision was made to identify the features as they related to the whole site, and to then describe them accordingly. This approach is believed to most clearly reflect the project goals and is directed by the site's two major areas of significance; its technological record and its community organization. To guard against incorrect identifications, feature-specific analysis and interpretations are also included.

As expected, the majority of identified features relate to ironworking activities. These features are organized into the procurement and processing of essential raw materials, the physical plants in which the raw materials were converted to iron, and byproducts of the process. Following description of features of the raceway system, industrial features only peripherally related to iron production are discussed. The Manor House ruins and other domestic features are then detailed, and are followed by descriptions of two structures that served more community-wide functions. The chapter ends with a discussion of isolated artifacts that may relate to the historic qualities of Catoctin. In the interest of clarity, features recorded but not related to ironworking or the furnace community are briefly reported in Appendix A.

Blue Mountain Ore Bank

The large open-pit ore mine immediately west of US 15 and about 1-1/4 miles north of the standing stack is known as the Fitzhugh-Kunkel or Blue Mountain Ore Bank. As summarized by Bastian (1973), it was probably first worked about 1857 and remained active until 1912. The mine was serviced by a narrow gauge tramway, probably operative when the mine was first opened. Mining excavation was by means of a steam shovel possibly as early as 1876, and a second shovel was put into operation in 1906 (Bastian 1973:5). The mine cut is now reforested and has a thick leaf mat on all but the steepest slopes, although lateral erosion and sloughing of the cut banks has occurred. The historic appearance of the mine has been further altered by a modern sanitary land fill in the northeastern section. Survey of the Blue Mountain mine and vicinity recorded evidence of the tramway system, steam-powered equipment, prospecting efforts, and other features and artifacts.

Two groups of small circular pits with tailings around their perimeters were recorded on the north rim of the Blue Mountain mine. The pits range from about 10 to 20 feet in diameter and from 6 to 10 feet deep. One pit was partially filled with modern trash and was near an abandoned road trace. They appear to be prospect pits as evidenced by their size and shape, arrangement, and location, although Singewald (1911:199) states, "no prospecting has been done northeast and southwest of the present [summer of 1908] openings." It is possible the pits were dug after Singewald's investigation in order to determine the then unknown extent of ore deposits to the northeast. Additional features observed on the mine's northern rim include an extensive network of small ditches and eroded channels, and a linear trough-shaped depression, about 8 feet wide and 4 feet or less deep, lined with loosely consolidated stone cobbles. In the absence of documentary or field evidence for hydraulic mining it may be speculated that these features were intended to channel surface run-off away from the mine pit in order to prevent bank erosion.

An isolated wrought iron tool of undertermined function was recovered from the southernmost rim of the Blue Mountain mine (Plate 4). The tool has a tapered tang 4 inches long, presumably to accept a wooden handle. One face of the tang has three shallow grooves cut diagonally. The shaft is rectangular in cross section, with rounded corners, and measures 3/8 by 15/16 inches. About 9 inches from the tang the shaft flares and flattens into a semi-elliptical paddle or blade, about 6-1/2 inches long and 4-3/4 inches wide, and slightly offset to the long axis of the shaft. The curved portion of the blade is about 1/16 inch thick and has several indentations possibly caused by hammer blows. The straight portion of the blade is less than 1/32 inch thick and terminates in an irregular and pitted edge. Fragments of the edge are turned in both directions suggesting the blade may have been broken by repeated back and forth bending. An elliptical hole near the end of the blade has slightly raised lips on both surfaces which may indicate the hole served as a pivot. Comparison with numerous secondary sources (Partridge 1973; Smith 1966; Sonn 1928; Tomlinson 1860; Tunis 1965; Watson 1968) and catalogs (Arnold and Walker 1974; Brombacher n.d.; Shannon 1873) has failed to identify the tool by name or function.

Another single artifact, a large boiler part, was observed on the floor of the mine in a narrow cut between two of the main ore cuts (Plate 1). It is made of cast iron sheets 1/4 inch thick joined by rivets. The basal portion is 53 inches long and has two parallel sides with semi-circular ends measuring 49 by 33 inches. Inside the basal portion is a 25 by 18 inch sheet of iron with evenly spaced holes 3 inches in diameter. The basal portion is topped by a cylindrical stack 33 inches in diameter and 129 inches long, aligned flush with one side of the basal portion. It could not be determined that the boiler is from one of the two steam shovels used in the mine or from one of the steam engines used to propel the ore tramway cars.

Other features observed on the floor and slopes of the Blue Mountain mine are several segments of railroad rails embedded in the ground. The rails are as illustrated in Figure 3 and Plates 2 and 3. Their arrangements are described as follows:

1. One linear rail segment protrudes about 2 feet from the ground surface at an angle of about 45° from horizontal and is separated from

an arched rail segment by about 10 feet. The ends of the arched segment in the ground are about 3-1/2 feet apart and the top of the arch is about 3 feet above the ground. The two rails are located on the floor of the mine at the toe of the cut slope.

2. Three linear rail segments protrude from the ground 3 feet or less at various angles and are in front of one arched segment. The rails are spaced from 3 to 5 feet apart in a meandering line and are located on a steep cut slope about 1/3 the way up the slope.

3. Five linear rail segments protrude from the ground about 2-1/2 feet and are placed in an approximately straight line. Spacing between the rails varies from 2 to 8 feet. One arched rail segment is about 30 feet from the nearest linear segment and is offset about 10 feet from the alignment of the linear rails. A second arched segment is across standing water from the linear segments and is about 110 feet from them. The rails are located on the floor of the mine.

4. A single linear rail segment protrudes about 1-1/2 feet from the ground at an angle. It is located in a narrow cut between two main ore cuts.

The above features appear similar to one described by Orr and Orr (1977:63) from near the washer dump pond located between routes 15 and 806, south of the standing stack. They suggest the feature functioned as a terminal bumper to stop ore carts at the end of a railway line. The variety of configurations and locations of the features described above, and the absence of associated railroad beds, argue against that interpretation for these features. It is postulated that they may have been used as anchors for heavy equipment, or to hold shoring in place.

Auburn Ore Bank

According to Singewald (1911:201), the first ore to be smelted at Catoctin was mined from the bank west of U.S. 15, about 1/2 mile south of the standing stack. He states it was first opened in 1774.[1] Access to the mine is by a narrow, almost horizontal cut, about 400 feet in length. The sides of the open pit have slumped and are now covered with vegetation. The floor of the mine was under standing water at the time of the survey. Considerable amounts of modern trash and debris were observed in the pit and a small mound of building slate and other flat stones were found in the entrance. An unexcavated mound near the center of the pit was interpreted by Singewald (1911:200) as a horst of limestone that had not been removed with the surrounding ore. No historic artifacts or features directly associated with the mine were located.

Other Mining Features

A third major ore mine at Catoctin is known as the Big Ore Bank, although it is actually intermediate in size between the Auburn and the Blue Mountain mines. It has been investigated by numerous researchers (eg: Singewald 1911; Orr and Orr 1977; Fauth 1972) but remains poorly understood. In the interest of efficiency, field inspection of the Big Ore Bank was limited to avoid duplication, and because Fauth (1972:2) has concluded, "...the exact nature of the 'ore pits' cannot be determined with certainty on the basis of historical record or direct observation and study...." Analysis of available information pertaining to limestone and ore procurement at Catoctin, and a recommended avenue of additional research, are presented in later chapters. Additional smaller mining features have also been previously examined (Orr 1980:12-15), and likewise are not considered here.

Numerous features interpreted as prospecting pits were recorded during the survey. In addition to those previously described in association with the Blue Mountain Ore Bank, a cluster of four pits was located north of the Auburn mine. They are 10 to 15 feet in diameter and are from 2.5 to 3.5 feet deep. A distinguishing characteristic is a low ring of spoil or tailings around their rims. Two additional pits were located southwest of the Auburn mine, within 40 feet of each other. They are of the same general size and shape as those described above. An isolated pit about 20 feet in diameter and 5 feet deep, also with the characteristic tailings, was also identified south of Catoctin Hollow Road. Three additional pits may also be prospect pits although their appearance varies from that observed elsewhere. The first is located west of U.S. 15 and was much larger than the others. It is somewhat irregular in outline with an average diameter of about 70 feet. Tailings were observed only on the eastern rim. The second possible prospect pit is also irregular in outline, and is 35 feet in diameter. Tailings were present around its rim. The third possible prospect has more of a shaft, rather than pit, configuration. It is about 15 feet in diameter and, although filled with modern trash, it appears to have been much deeper than the other prospects, as evidenced by a high mound of spoil around it. Both the second and third possible prospect pits are located east of Route 806, away from other mining activity.

Singewald (1911:201) indicates intensive prospecting was undertaken in the summer of 1908 between the Auburn Ore Bank and the Big Ore Bank. He notes that most of the prospect holes were too shallow to penetrate the colluvial overburden, and those that did failed to locate ore. The prospecting indicated that ore was present only in isolated pockets, rather than in a continuous deposit as previously believed. Local residents maintain prospecting was conducted "all over the country" during the closing days of Catoctin's iron production.

Sources of Limestone

Limestone, along with iron ore and charcoal or other fuel, are the essential raw materials for iron production. Catoctin's sources of limestone are poorly defined although they have been a subject of at least passing interest in numerous previous investigations. At least part of this interest appears to stem from the evaluation of features and impacts associated with the proposed dualization of U.S. 15. This project was specifically charged with investigating the source of limestone mentioned in Thompson (1976:81).

Thompson (1976:81) quotes the Frederick Town Herald, April 1, 1820 pertaining to a sale of the furnace as follows:

> The mine bank, the ore of which is considered equal to any in the country for castings, is within one hundred feet of the Furnace, and an excellent limestone quarry within a few [200] hundred yards.

An 1811 sale notice, reproduced in National Heritage Corporation (1975a), indicates:

> The limestone quarry is also very convenient, not more than 200 yards from the furnace bank.

In their investigation, Contract Archeology Incorporated (1971:39-40; Fig. 2) references the 1811 sale notice, and without further discussion, identifies an area about 2600 feet south of the standing stack as "conjectured limestone pit." Mentzer (1971:3) strongly disagrees with their identification and suggests the limestone quarry was buried by construction of the existing U.S. 15, or that it was located west of the standing stack and was filled by slag disposal (Mentzer 1972:Ch 16). Orr and Orr (1977: 62-63) identify the area indicated by Contract Archaeology as "check 13," Big Ore Bank, and locate limestone quarries at "check 9" and "check 19," both a considerable distance to the south (Orr and Orr 1977:40-43; Orr 1980:6-7, 25). In conjunction with the Orr's investigation (1977), Maryland State Highway Administration analysized 8 limestone samples. Three samples from near the area of stack II were all petrographically and chemically different. Four samples taken from Orr's check 19 varied from each other but none matched the stack III samples. The sample from Orr's "check 9" was also unlike any of the other samples, and was the most impure of those analysized (Orr and Orr 1977:Appendix 1).

Bastian (1973) has provided a detailed summary of ore and limestone mining at Catoctin and cites two unpublished manuscripts that refer to limestone. Waesche, in 1936, referred to abundant limestone in the company quarry one mile from the furnace, implying a limestone quarry separate from the ore mines (Bastian 1973:2). The other source cited indicates that in 1899 limestone was hauled by wagon to the furnace from the railroad in Thurmont.

It should also be noted that Renner and others believe Spahr's Quarry, located 1½ miles southeast of the standing stack, was the source of Catoctin's limestone.

A brief discussion of Catoctin's ore and its relationship to limestone is in order. Two of Maryland's four major ores, limonites and magnetites, have been mined at Catoctin. The limonites, more important commerically, are of the Cambro-Ordovician group at Catoctin, and are fault contact deposits. As explained by Singewald (1911:190-191), ferriferous solutions are leached out of weathering shale and, upon contact with limestone, the iron is precipitated out. When the shale and limestone are brought into contact by faulting, as is the case at Catoctin, the resultant shattered zone allows considerable infiltration which produces a deposit of iron in the zone. Since contact with limestone was essential for the deposition of iron ore at Catoctin, it follows that the two will be found in related strata and in the same areas. Singewald (1911:197-200) provides detailed descriptions about exposures of limestone in the Blue Mountain and Auburn mines but makes no mention of the limestone's intentional extraction. In describing a ledge of limestone in the Auburn mine he (Singewald 1911:200) states, "This entire mass is probably a horst of unreplaced limestone from around which the ore has been removed," implying that only ore was the object of the mining. His interest in the limestones is toward establishing the geological position of the ores rather than investigating the limestone for its own value. Although he substantiates the wide co-occurrence of limestone and iron ore, Singewald (1911) makes no direct reference to Catoctin's source of limestone. He does, however, provide chemical analyses of limestone samples taken from the Auburn mine which compare favorably with at least one other historic blast furnace flux. White (1978:392) reports that limestone used at the Eaton Furnace near Youngstown, Ohio, "was of a relatively poor quality" due to a high silica content (33.8%) and low calcium content (27.5%). The Auburn sample was of better quality in both respects with a silica content of only 8.91% and a slightly higher, 27.66%, amount of calcium (Singewald 1911:200).

Perhaps the most authoritative modern investigations of Catoctin ores and limestones were conducted by Fauth (1972, 1977). Following a field inspection, Fauth (1972) made several observations regarding the source of Catoctin's limestone that deserve further discussion. Fauth (1972) compared Singewald's analysis of the Auburn limestone with specifications reported in a 1909 reference (Mathews and Grasty) and concluded the Auburn limestone was unsuitable for use as a flux. The disagreement with that reported above centers around the amounts of silica and alumina acceptable. Mathews and Grasty (Fauth 1972) feel the maximum allowable silica-alumina content is 8 percent. Their figure may be accurate for an ideal fluxing agent, but as demonstrated by White (1978), limestone with much higher silica and alumina content could be, and was, used in historic blast furnaces. Fauth (1972:2) does note, however, that although the depth of overburden might make mining of only limestone unfeasible, "It is possible that the limestone uncovered as a consequence of mining of the iron ore might have been utilized at the furnace." He also identifes two additional possible sources for Catoctin's limestone. Regarding Spahr's quarry, Fauth (1972:2) recognized limestone developed in the Grove Formation, and considered it more suitable for flux than Catoctin's Frederick limestone. He further notes that this source of limestone is not covered by significant amounts of overburden and was probably known in the nineteenth century. The other possible source identified by Fauth is the limestone quarries at Cavetown, Maryland, located west of Catoctin Mountain but on the Western Maryland Railroad.

Primary documentation thus far available provides little help in identifying Catoctin's sources of limestone. Several entries in the McPherson Farm Account include hauling limestone and quarry stone for burning lime in 1860, but no mention of source or distance from the furnace has been recorded (National Heritage Corporation 1975:card file).

Kunkle's 1876 patent for "Improvement in Processes of Eliminating Phosphorus from Iron (reproduced in National Heritage Corporation 1975b:45) provides additional information about the use of limestone at Catoctin. Kunkel's innovation was, in essence, use of dolomite as the fluxing agent. As he described it,:

> In carrying out my invention I proceed as follows: When operating upon phosphatic ores I use, instead of the ordinary limestone, a well-known double carbonate of lime and magnesia. The charges of ore, carbonaceous matter and dolomite are fed into the ordinary blast furnace in the usual way, the porportions of ingredients being substantially the same as when ordinary limestone is used as a flux, and governed by like conditions, namely, the relative amounts of oxide of iron, silica, and lime naturally in the ore. Should the ore be extraordinarily phosphatic it is advisable to increase the charge of dolomite from ten to one hundred per cent. A portion of the dolomite may be introduced through the tuyeres.

Dolomite occurs as bedrock south of Woodsboro, about 6½ miles from Catoctin Furnace (Matthews, et. al. 1960:126-127), but has not been reported in closer proximity, although it may occur associated with Catoctin's other limestones.

In order to evaluate and further interpret the above references, a better understanding of iron smelting and of Catoctin's geology is necessary. It is well known that limestone was generally used in iron production as a flux.[2] At high furnace temperatures it combines with impurities in the charge to form slag. White (1980:60) lists the most important slag characteristics as fusibility at a reasonable temperature, fluidity, optimum composition, and desulphurizing capacity, but notes that most historic slags were less than ideal in at least one or two of the characteristics. The acceptibility of a particular flux, however, depended upon several additional factors including purity of the ore, temperature of the furnace in blast, and impurities introduced with the fuel used. For example, the ability to remove sulphur is irrelevant if only traces of it are in the charge, but may become critical if more sulphur is introduced, as would happen with the use of coal or coke fuel rather than charcoal (White 1980:59-63).

In conclusion, the suitability of a particular flux depends upon a variety of factors related to qualities of the other raw materials used and to characteristics of the furnace itself. A specific limestone may become more or less suitable as changes in the physical plant, ore, or fuel occur. Since changes in all three of these categories did take place during Catoctin's production span it seems likely that a variety of limestones, from a variety of sources, were used at one time or another. The identification of a single, specific source of limestone, even if possible, would tend to obscure the multiplicity of factors involved in the selection and procurement of suitable fluxing agents.

Water-Filled Depressions

Another group of features sometimes suspected of being associated with prospecting or mining for iron ore or limestone are the relatively large water-filled depressions in the eastern portion of the study area (Plate 15). These features have been refered to as "topographic anomalies" and were specifically targeted for investigation (Bastian and McNamara 1979:6).

Within the study area, the water-filled depressions occur in the colluvial fan, very stony loam, deposits east of Route 806. Although they appear clustered in an area northeast of the standing furnace stack, aerial photographs and local informants indicate the features are also present in a similar geological position both north and south of the study area. They appear as small internal drainage basins, partially filled with standing water. At the time of fieldwork water surface areas ranged from less than .1 acres to almost .5 acres. Local residents indicate the smaller depressions normally become dry in late summer. All except two of the depressions had no visible inlet channel and none had visible outlets. Although the standing water prevented measured profiles from being taken, the depressions appeared saucer-shaped in section, being generally shallow and flat-bottomed. Trees up to 30 inches in diameter were observed in the water of several depressions. Although some of the features were linked by road traces, there was no evidence to indicate that the basins were culturally formed or modified. No dams, ditches, backdirt or other excavated spoil was observed in association with the features, nor were they surrounded by distinct rims.

Blue Mountain Ore Railroad System

As noted above, iron ore extracted from the Blue Mountain mine was transported to the washer and furnace by means of a narrow gauge railway system believed to have been in operation from about the same time the mine was opened (Bastian 1973:4; Contract Archaeology 1971:Fig. 1; Mentzer 1972: Chapter 13). Evidence obtained during the survey confirmed the existence of the railway system and allowed precise mapping of portions of the routes. Associated features are described as follows:

A series of in situ wooden ties with some iron spikes, but without rails, was observed in the mine entrance. As none of the ties had more than one spike each, the gauge of the railway could not be determined. Rather than being on a prepared bed as expected, the ties were underwater in the stream channel that drains the mine. The ties were present for a distance of less than 20 feet and could not be followed eastward to U.S. 15. The fact that two previous archeological investigations (Mid-Atlantic Archeological Research 1980:20-24; Orr and Orr 1977:74-75) were unable to locate evidence of the railway system is explained by the spatial limitations (impact area of the proposed dualization of U.S. 15) imposed upon the investigators. They may also have been misled by an overlay of Singewald's map (1911:194) prepared by the Maryland State Highway Administration, Bureau of Soils and Foundations (Orr and Orr 1977:76). The overlay map indicates the rail beds north of the stream at its crossing of U.S. 15. Investigation between U.S. 15 and Maryland 806 failed to positively identify the railroad bed. The area contains several linear mounds presumed to be overburden from the mine or spoil from the ore washer, but no evidence of their use as rail beds was observed.

Remains of the ore railway system were also discovered east of Maryland 806, associated with the ore washer. In the interest of clarity, descriptions of the ore washer features will be presented following the conclusion of discussion of the railway system. A second series of wooden ties, also with some spikes but without rails, was observed at the ore washer (Fig. 3, Plates 7 and 8). As with the first series of ties, these were also under water in the stream channel. The ties were 8 inches square and 6 feet long. Two of the ties had two spikes each, with a distance of 63 inches between the spikes. It is important to note that the two ore carts described by Orr (1977:33, 1980:18) had axles 48 inches or less in length, and obviously could not have been used on this segment of the railroad. The two pairs of rails of the Frederick Railroad preserved under Route 806 near the standing furnace stack have a gauge of 57 to 58 inches, the same as this set of ties and spikes when allowance is made for the width of the rails.[3] Consistent with this finding, the railroad bed was traced on the ground southeastward for about 3000 feet to the dismantled Frederick Railroad near Bryce Road. The railroad bed is graded and is filled and surfaced with slag. All of the slag observed on this segment is in relatively large nodules with numerous large vesicles, indicative of coke rather than charcoal firing. All of the above evidence is highly suggestive that this railroad segment was used between 1903 and 1912, after smelting had ceased at Catoctin but when ore was being shipped to another furnace at Everett, Pennsylvania (Contract Archaeology 1971:28-29; Mentzer 1972:Chapter 13; Robbins 1973:53). One additional fact, however, argues against this interpretation. The two railroad beds meet at an acute angle that would require the ore cars to make an extremely sharp turn, or else to travel in reverse from the ore washer to the main track, in order to proceed northward into Pennsylvania. On the other hand, ore cars could easily continue southward to the furnace at Catoctin. Unfortunately, no rails or switches remained at the intersection of the beds, precluding a more definitive determination of the ore car routes.

Returning to the ore washer, two terminal road beds, as indicated by Singewald (1911:194) and by a 1911 United States Geological Survey Quadrangle, were identified in the field. They are terraced above the previously described road bed and contour around the base of the washer spoil mound. No associated rails or ties were found.

An additional road bed, the one believed to be the route of the original ore railway, was found intersecting the above described bed about 800 feet southeast of the ore washer. It can be traced southward to a point about 350 feet north of Kelly's Store Road and 500 feet east of Maryland 806, after which it has been obliterated by modern grading. No ties, rails, or switching apparatuses were located. The bed is filled and surfaced with slag, and frothy and homogenous furnace glass. Slag nodules are smaller than those observed on the road bed described above, and in some instances, contain embedded fragments of charcoal. At a small stream crossing the bed is filled to a height of about 10 feet above the surrounding ground surface and it is 10 to 15 feet wide across the top. The bed is graded to a gentle slope southward, consistent with information provided by local informants who indicated the filled ore carts were propelled to the furnace by gravity and were returned to the washer and mine by mules or small steam engines.

Although the ore railroad bed could not be identified with certainty west of Maryland 806, two additional features which may be associated with it were recorded. One is a dry laid stone abutment on the north bank of Little Hunting Creek between Maryland 806 and U. S. 15. It is about 15 feet wide across the base and about 12 feet high. The second feature is another stone abutment of similar construction and appearance, located on the south bank of Little Hunting Creek about 150 feet west of U. S. 15 and slightly west of the race pond's (Orr 1980:9-11, Figure 4) drain. Although neither of these features can be positively identified as part of the ore railroad bridge over Little Hunting Creek, their locations raise an interesting question in light of Contract Archaeology's (1971:48-49) discussion of the railroad's route and two historic maps. As is pointed out, Bond's 1858 map (Fig. 4) shows the ore railroad in a more easterly position than does an 1873 map by Lake (Fig. 5). Contract Archaeology's interpretation of the two maps is that Bond indicates the route just west of the manor house and Lake shows it west of the race pond. In their opinion (Contract Archaeology 1971:49), topographic evidence and field survey "confirms Bond's location and...proves conclusively that Lake incorrectly located the railroad." The location of the two abutments, however, indicates that either or both of the maps could be accurate. Topographic information recently made available on the state base maps, and the field survey reported herein, further questions Contract Archaeology's dismissal of the Lake map. Both abutments are at approximately the 520 feet contour and either could have been used without inordinate engineering difficulty. The area between the two abutments and portions of the race pond (Orr 1980:9-11 and Figure 4) have been drastically altered by construction of U. S. 15, thus preventing assessment of the historic grade. It should be remembered that a fill of about 10 feet was made on the railroad bed further north and similar filling or cutting could have been reasonably accomplished in this area also. It should also be noted that the differences in the Bond and Lake maps may be merely due to disparate cartographic accuracy and standards.

In summary, the route of the ore railroad from near the Blue Mountain ore washer to near the intersection of Maryland 806 and Kelly's Store Road has been defined in the field and on the state topographic base maps. The exact route west of Maryland 806[4] remains problematic but may have been on either side of U.S. 15. The possibility of an eastward realignment of the ore railroad between 1858 and 1873 is also raised.

Blue Mountain Ore Washer

Although the ore washer south of the extant furnace stack has received some attention in recent archeological investigations (Orr and Orr 1977: 60-65), the ore washer associated with the Blue Mountain Mine has not been previously discussed. Singewald (1911:198) briefly described the Blue Mountain ore washer, then in use, as follows:

> [Ore] is loaded on tram cars and hauled by locomotives to the washers which are located on the east side of the Emmitsberg Road [Maryland 806]. Two washers are now used, and there is usually sufficient water available for both. A side track from the Frederick Railroad runs under the washers, and as the ore comes from them it is dumped into cars ready for shipment.

The ore washer consists of a large mound of spoil with five concrete retaining walls at various heights on its northern slope (Fig. 6, Plate 5). Beneath the northwestern-most retaining walls is a shallow channel with dry laid stone on its southern bank. Water is presently fed into the channel by a pipe. The previously discussed series of railroad ties are located in this channel near its western end. Immediately north of this shallow channel is the main stream channel flowing from the Blue Mountain mine. A group of wooden piles and two wooden flume boxes were observed in the main stream channel (Plate 6). According to a nearby resident, the piles were exposed only this spring by lateral stream bank erosion. The wooden flume boxes were not visible until the end of fieldwork, after the water level had greatly receded. The shallow channel returns to the main stream through a buried pipe at its western end. Features are described in detail below.

The washer spoil mound covers almost 7 acres and is about 35 feet high above the ground surface at its northern end. It is now densely vegetated. A test unit (Figure 7) placed on top of the mound at its northern edge confirmed the mound is composed of numerous irregularly deposited, multi-colored silty clays.

Concrete retaining wall number one is 18 feet 3 inches long, 1 foot 6 inches thick, and is 4 feet 2 inches high. It is situated farthest to the southeast of the retaining walls and is about 20 feet from the main railroad bed. The concrete contains small gravel-like pieces of slag and several small stones. Immediately behind the wall, upslope and into the spoil mound bank, are several brick fragments and scattered stones. A secondary concrete retaining wall, 1 foot high and 12 feet long, is 11 feet 3 inches behind the first wall, and is aligned parallel with it.

Retaining wall number two, also made of concrete with some slag and small stones, is located slightly northeast of wall number one and is almost 17 feet higher in elevation at the base than is wall number one. It is 23 feet long at the base and 17 feet long at the top, is 12 feet 1 inch high at the front face, and is 2 feet wide at the top. The top of the wall has a groove 9 inches wide and 4 inches deep cast into it for 6 feet 8 inches from its southeastern end. A second groove, 2 inches deep and 4 to 5 inches wide is along the front edge of the top of the wall. A length of 3/4 inch iron rod with the top two inches threaded is located 3 feet from the top of the wall's southeastern end and extends 1 foot out of the concrete. A second threaded rod extends 1 foot 2 inches out from the concrete and is 4 feet 4 inches from the first rod.

Retaining wall number three is 13 feet in front of wall number two, is slightly northwest of it, and is 10 feet 7 inches below it at the base. It consists of a concrete and pebble footing 2 feet 4 inches wide and 3 feet 8 inches high. A concrete slab wall 3 feet 6 inches wide, 3 feet 5 inches high, and 8 feet 9 inches long, is set on top of the footing, 1 foot into the bank from the footing's front edge. The two are joined by rough textured concrete spread along the two meeting faces.

A concrete and slag wing wall is set into the bank, perpendicular to retaining wall number three. The wing wall is composed of two separately cast concrete slabs, 1 foot thick and 5 feet 2 inches high overall. The front edge of the wing wall is against an iron bar 1 inch thick by 6 inches wide that protrudes 3 feet 3 inches from the ground. One surface of the iron bar has a 3/4 inch wide strip raised 1-1/2 inches.

A second test unit placed between retaining wall number three and the wing wall revealed an additional wall connecting the two other walls. After penetrating about 2 feet of mixed yellowish-orange and blue clay the test unit exposed about 1 foot 6 inches of loosely consolidated riprap overlying a concrete and pebble slab wall. The connecting wall is set into the bank about 4 feet 3 inches from the front faces of retaining wall number three and the wing wall. Stone, brick, and mortar rubble was observed around this set of walls.

The last pair of concrete retaining walls, numbers four and five, is located about 190 feet northwest of wall number three and is aligned approximately parallel with the others. Wall number four is 5 feet 8 inches long, 1 foot 8 inches thick, and 3 feet high. A second portion of concrete is 1 foot 6 inches long and is 4 inches from the end of the first. Three pairs of 1/16 inch diameter wire protrude 1/2 inch from the front face of the retaining wall, 1 foot 2 inches down from the top. The wires in each pair are 2 inches apart. The first pair of wires is 3 inches from the edge of the wall, the second pair is 2 feet 9 inches from the first, and the third pair is 1 foot 10 inches from the second.

Concrete retaining wall number five is 12 feet 5 inches in front (northeast) of number four and is 4 feet 8 inches from the diversion channel which it parallels. The wall is 27 feet long, 1 foot 9 inches wide, and 4 feet 3 inches high. A niche 3 inches long, 2 inches wide, and 2 feet deep is set into the front face of the wall at an angle. It is near the center of the wall longitudinally and is about 1 foot down from the top of the wall.

At the northwest end of the retaining wall number five is a dry laid stone retaining wall that extends for 55 feet on the south bank of the diversion channel. The wall is of undressed stone and is about 3 feet high.

In the main stream channel, opposite the diversion channel, is a group of wooden piles set vertically against the stream bank. Immediately upstream from the piles is a slag and concrete abutment, directly above a wooden flume box. The flume is 10 by 20 inches in section and is 3 feet 4 inches below ground surface. A second wooden flume box, 8 inches square, is below the first flume and projects upstream for several feet. Both flumes were nearly filled with sand and silt, and both appeared to extend underground between the two channels. No outlet for either flume could be located.

Also observed in the main stream channel was a bucket presumably from an elevator-conveyor. Its bottom and back are about 14 inches long and about 6 inches high, and it is triangular in section. No additional evidence of an elevator-conveyor system was observed.

The two terminal road beds previously noted are believed to be the railroad beds mapped by Singewald (1911:194) and U.S.G.S. (1911), although no ties, rails, or other direct evidence was observed. The first road bed is about 11 feet wide and runs on top of the secondary concrete wall behind concrete retaining wall number one. It contours around the spoil mound for about 152 feet. The second terminal road bed is 8 feet wide and parallels the first, downslope from it.

One additional feature was recorded at the intersection of the original ore railroad line and the spur line from the Frederick Railroad. It consists of a stone rubble and earth mound 3 by 8 feet and almost 2 feet high

(Fig. 8). Numerous smaller piles of cobbles, and a large stone mound were observed in association. The large mound consists of loosely consolidated, undressed cobbles and boulders. It is 5 to 6 feet wide, about 3-1/2 feet high, and extends for 27 feet. Despite the linear arrangement of the mounds and stone piles, the feature cannot be definitely identified as a foundation. In addition, no mortar, brick, or significant artifacts were observed.

Two additional features identified on the Singewald map (1911:194), the repair shop and the office, could not be positively identified in the field. A concrete slab, 15 by 18 feet, was observed immediately east of Route 806 and may represent the remains of one of these structures. Several local informants indicated the office was moved to Thurmont in the late 1920's and was used as a motel unit.

No evidence of ore roasting was observed although, oral tradition suggests at least some of the ore was heated at the washer. Singewald (1911:127) notes that ores containing more than one percent of sulfur must be roasted prior to their introduction into the furnace.

Charcoal Production Features

Charcoal production entailed cutting and transporting wood to hearth areas, reducing the wood into charcoal, and transporting the produced fuel to storage or use areas. Although the methods of building and tending the reducing fire are well known (eg:Bining 1973:62), little has been detailed regarding other aspects of charcoal production.

Evidence of previous logging is abundant on the base of Catoctin Mountain west of U.S. 15, but cannot be directly linked to charcoal production. Numerous stumps, many of them oak or chestnut, were observed but none exhibited notches indicative of platform sawing or evidence of other early tree-felling techniques. Similarly, numerous eroded skid trails and logging roads were observed but none could be absolutely attributed to the iron working period at Catoctin. It is likely that such features would have been modified as necessary and reused in subsequent logging entries.

Charcoal hearths, level areas upon which the reducing fires were constructed, are the best preserved charcoal production features at Catoctin. They are characteristically u-shaped flats excavated into the mountain side with the rounded end set into the slope, and the spoil used to fill the outer end several feet above the surrounding natural grade (Plate 16). A level hearth was necessary to ensure even burning (Kemper n.d.:8), would have provided a more comfortable work area, and would have helped to prevent smoldering fuel from rolling downslope and igniting forest fires. Investigation of the six charcoal hearths identified is detailed as follows.

The first charcoal hearth examined is cut into a 10 percent slope near the base of Catoctin Mountain. An abandoned road and numerous gullies, possibly abandoned and eroded skid trails, are nearby but no other associated hearth areas were observed. The hearth measures about 44 feet parallel with the slope contour and is 32 feet wide perpendicular to the slope. The back edge is cut 6 feet below grade and the front lip is filled about 3 feet above the surrounding slope. Numerous charred chestnut tree stumps were observed in the immediate vicinity. Vegetation on the hearth included a twin tree with diameters of 12 and 9 inches, a dead tree 7 inches in diameter and a 3 inch live sapling. The surface of the hearth was covered by dry leaves and a mat of leaf mold. Two test units, both 2 feet square, were excavated to gain subsurface information about the construction and use of the hearth. The surface of the flat was first raked clear of leaf mold to expose a very black layer of humic silty clay with many small fragments of charcoal. As no anomalies were observed on the surface of this layer, the center of the flat was selected for test unit 1. A second area, outside the flat and about 20 feet upslope from it, was excavated as test unit 2 for comparative data. It was expected that the unit on the flat would contain at least one thick lense of charcoal, evidence of its use for reducing wood into charcoal, and that the upper test unit would contain undisturbed natural strata with much less charcoal. The expectations were not confirmed, however, as both units exposed nearly identical strata (Fig. 9). The first layer, humose silty clay with charcoal, was slightly thicker on the flat than on the slope. The second stratum in both units was dark yellowish-brown sandy clay with charcoal flecks in its upper portion. This stratum was about 2 feet thick in both units and could not be further penetrated due to large rocks. No artifacts were recovered from either unit. On the basis of the two test units the flat's use as a charcoal hearth could not be confirmed. The amount of charcoal in both units was no more than would be expected from a forest fire, an event evidenced by the nearby charred stumps.

Four additional artificial flats similar in appearance to the one described above were located within about 1100 feet of each other along a trail west of U.S. 15. The trail contours around a 10 to 15 percent slope and although recently improved, it has a well established tread and may be a remnant logging or charcoal transportation road. The flats range in size from 22 feet parallel to the contour and 35 feet perpendicular to it, to 40 by 60 feet along the same axes. The cut into the slope ranges between 2 and 3.5 feet, and the fill around the outer lip varies from 1 to 2 feet. The testing strategy was the same as in the first instance. Test unit 1 was excavated near the center of one of the flats and the second unit was placed upslope, 200 feet in this case, to provide comparative data. Both units were covered with loose leaves and leaf mold. The unit on the flat exposed a layer of charcoal dust and fragments with sandy clay almost 6 inches deep. The corresponding stratum in the unit upslope was only about 3 inches deep and was predominately grey sandy clay, although charcoal flecks and charcoal dust mottling were evident. The underlying stratum in both units was yellowish-brown clay, with some downward leaching of charcoal noted in the unit on the flat (Fig. 10). No artifacts were recovered from either unit. The thick deposit of charcoal on the flat, compared to the traces of charcoal observed upslope, evidences its use as a charcoal hearth.

The last charcoal hearth identified was located on a south facing slope north of Little Hunting Creek near the intersection of two road traces. Although no test excavations were conducted, leaves were removed from the flat to expose a layer predominated by charcoal dust and fragments. A circular depression about 10 feet in diameter and 7 feet deep was observed nearby.

The only comparative literature available is Kemper's (n.d.) description of charcoal making at Hopewell, in southern Berks County, Pennsylvania.

He (n.d.:8) describes the hearths as "simply a flat space 30 or 40 feet in diameter and free of all brush, roots, and stumps," and notes the practice of leveling hearths if a hillside location was selected. Kemper (n.d.:8) indicates all established hearths were preferred over new ones because the accumulated charcoal dust provided a suitable covering for subsequent reduction fires. For this reason, it was not unusual for wood to be transported some distance to an old hearth.

At Hopewell the hearths were located throughout the charcoal tracts and were placed, "about the distance of a city block from one another" (Kemper n.d.:8). In contrast, those observed at Catoctin were either isolated, or were clustered within several hundred feet of each other. Another difference is the placement of the hearths in respect to roads. At Catoctin only one hearth was actually bisected by a road, the others being nearby but slightly upslope or downslope from the road. At Hopewell, "The road leading to the pit[5] always went right through the center of the hearth so that the hauler could unload easily and drive out the other side on his way for another load" (Kemper n.d.:12).

Another charcoal production feature expected, but not identified, at Catoctin is the remains of colliers' huts. Since active reduction fires required nearly constant attention, the master collier and perhaps one or two assistants found it necessary to construct standaridzed but fairly crude shelters near the hearths. Kemper (n.d.:8) describes a typical collier's hut as follows:

> The hut was always conical in form, having a base about 8 feet in diameter and a height of about 10 feet. Three-inch poles were used for the uprights, and more slender poles filled the interstices between them. Leaves were used to cover the structure and to form a mat so that the final dressing of topsoil would not sift through the few remaining crevices. A door just large enough for one man to get through was placed on the "pit side" of the hut. A wood stove and rough log bunks were the furnishings of this temporary abode.

Only one feature discovered during the survey, the circular depression associated with a charcoal hearth and described above, might indicate the remains of a collier's hut. Such an interpretation would be based more on the feature's location than on its appearance. Although the topsoil used to cover a hut might be excavated from the hut's interior, such activity would not account for the 7 feet depth of the observed feature.

Primary Industrial Plant

The heart of any iron works is the furnace stack and, appropriately, the center of industrial remains at Catoctin is the standing stone stack. It and the partially surrounding stone retaining wall are the most visible and are among the most significant industrial remains at Catoctin. Detailed verbal, photographic, and drawn descriptions of these two structures are available elsewhere (National Heritage Corporation 1974), and will not be repeated here except to highlight areas of archeological potential. It should be noted, however, that the standing stack is generally considered to be "Isabella," the second of three stacks at Catoctin.

Investigation of the core industrial area concentrated on describing and mapping surface evidence. Although intensive archeological excavation is necessary to provide needed information regarding the technological history of Catoctin, it was not undertaken during this survey. The area has been subjected to numerous small-scale archeological and other excavations focusing on limited goals in 1936 (described in Orr and Orr 1975), 1971 (Contract Archaeology Inc.), 1974 (National Heritage Corporation), 1975 (Orr and Orr), and 1976 (Orr and Orr). Due to the inherent destructive nature of archeological excavations, each has destroyed a portion of the archeological record and has limited the data available for future researchers. It was felt excavations conducted within the scope of this project, due to limited time and funds, could only add to the piecemeal degredation of the site without providing definitive, all-inclusive data. Identification of the features that follow are primarily based on information provided by Renner.

According to Renner an "engine house" with a "motor room" and "two big compressors" was located at the southern end of the retaining wall. In front (east) of this section of the wall are two rectangular pits, each about 11 feet by 4 feet. Wooden beams and threaded rod anchors, apparently for mounting heavy equipment, are still in situ. The retaining wall facing the pits has a row of beam pockets at about mid-height and has a larger slot and a cluster of pockets at the north end.

Another area of archeological interest along the retaining wall is at its northern end. The area currently contains short walls with various architectural features, remnants of a buttressed area of the wall, and an area of slag and earth tailings that may be a collapsed portion of the wall or an intentional opening. The standing architectural features have been described in detail previously (Naitonal Heritage Corporation 1974:I, 6-8; II, 6-8), and has been the focus of numerous conjectural interpretations. Contract Archaeology Inc. (1971:planview) indicated conjectural locations of the original Catoctin Stack I and attached casting house, and the casting house and water wheel house of Stack II, the standing stack. National Heritage Corporation (1974:I, 6) has reported, "Apparently, in this general area there existed at various times a waterwheel, raceway, casting house, one or more charging sheds, puddle mill, bellows house, steam plant and stack, and an earlier iron furnace." They note that specific locations, designs, and dates of these features are problematic and require additional documentary and archeological evidence for their definition.

Subsequent reconstruction of the casting house of Stack II included archeological testing east of Stack II (Orr and Orr 1975). The five-day sampling program was directed toward salvaging features and artifacts that might be impacted by reconstruction activities and toward providing information about the original grade and architectural details to aid the reconstruction.

Additional limited excavation was undertaken by Orr and Orr (1976) the following year in conjunction with the installation of subsurface shoring cleats. Four test units were placed parallel to and south of a segment of the northern wall. The tested area was that identified by Contract Archaeology as Stack I, but identified by Renner (in Orr and Orr 1976:14) as the location of Stack II's waterwheel. At that time Renner maintained that Stack I is located in the area identified by Contract Archaeology Inc. as the water-wheel house. The Orrs (1976:14) concluded, "Our examination of this site appears to reveal the stack 1 east opening arc top, and a brick circle suggestive of a bosh cross-sectioned on top of the presumed Stack 1," but do not provide evidence to support a functional interpretation of either area.

Researchers, informants, and contemporary photographs generally agree on the location of Catoctin's third furnace stack, "Deborah." Renner identified it as a low circular mound east of the retaining wall and engine house. Although it has not been subject to archeological verification, the location conforms to a late nineteenth or early twentieth century photograph of the site (National Heritage Corporation 1974:plate B).

Slag and Other Byproducts

The most voluminous and ubiquitous byproduct of iron smelting is slag. The amount of slag produced depends upon the quality of the ore and effectiveness of the flux used, but something on the order of half a ton of slag for each ton of iron would be expected from a blast furnace (White 1980:57). Some slag was crushed and reintroduced into furnaces to recover additional iron (Lenick 1974:11; Walker 1966:68). Pearse (1976:19) indicates that the Johnson Furnace, located near the mouth of the Monocacy, used "stamp-stuff from the cinder-heaps of old Catoctin." In addition, at Catoctin and elsewhere some slag was used to surface road and railroad beds. Despite these outlets, the output of slag far exceeded the amount that could be put to other uses. The common practice of disposing the excess slag in large heaps is evidenced at Catoctin, primarily along Little Hunting Creek near the standing stack. The largest slag heap is on the east bank, measures over 500 by 200 feet, and is piled about 25 feet above the surrounding grade (Plate 13). The top of this slag heap has a humus and leaf mat surface and is overgrown with vines, briars, and trees up to 14 inches in diameter. Slag exposed on the steep sides is in large, visicular nodules generally characteristic of coke-fired furnaces. Other large slag heaps were observed on the west bank of Little Hunting Creek, across and upstream from the largest heap. This group of slag heaps serves to divert and channelize Little Hunting Creek but whether this is intentional or merely the result of the slag heaps encroaching upon the creek could not be determined.

A feature a short distance east of the large slag heap, but of unknown functional association with it, is a spring head with a dry-laid stone dam about half way across its outlet. A segment of threaded pipe 5 feet long and 3 inches in diameter was observed nearby.

Another slag disposal area is immediately west of the standing stack area, behind the retaining wall. Previously conducted soil borings (National Heritage Corporation 1974) indicate fill material behind the wall consists of a loose mixture of sand, silt, ashes, and slag that reaches a depth of 19 to 24 feet below the surface. A boring in front of the wall revealed approximately 4 feet of sand, silt, and slag fill. Numerous small piles of slag were observed primarily north of the standing stack and isolated pieces of slag were found throughout the surveyed area.

As an adjunct to this project four samples of Catoctin slag were subjected to x-ray fluorescent spectroscopy analysis. Results of the analysis are presented in Appendix B. Unfortunately for purposes of this project, the analysis was done by elements rather than compounds and is not readily comparable to available analyses of other historic blast furnace slags (c.f. White 1980:60).

An additional byproduct of Catoctin's ironworking appears to have been of some commercial value although evidence of it has not been observed in the archeological record. Lesley (1859:588), in his description of Catoctin's ores, notes a high percentage of carbonate of zinc and elaborates on its use:

> The zinc fumes line the furnace with a crust that has to be removed, and from which zinc has been made with ease, and used in the manufacture of the United States standard brass weights.

Oral tradition, reported in detail by Orr and Orr (1977:40-43), suggests another valuable mineral, silver, was mined at Catoctin. Although not the subject of intensive fieldwork, some additional secondary research supports this claim. In his general description of Catoctin ores, Schroader(1917:157) reports the occurrence of silver at Catoctin in both sphalerite and galena, zinc sulfide and lead sulfide ores.[6]

Raceway Features

Several previously unrecorded features of Catoctin's water power system were identified during the survey. Perhaps the most significant is a linear channel located between the standing furnace stack and Little Hunting Creek. The channel varies from 4 to almost 10 feet wide and is 3 to 4 feet deep. An earthen berm, about 4 feet high and 3 to 4 feet wide with a dry-laid stone facing forms the southern bank of the channel. The berm and channel are both heavily overgrown with brush and trees, the largest being a sycamore over 2 feet in diameter. The channel begins with no apparent inlet near a small circular mound and trends southeast for about 200 feet where it transects an abandoned railroad bed through two concrete abutments. A dry-laid stone retaining wall is visible on the bank above one of the abutments.

Another feature was observed adjacent to the channel's southern bank near its northwestern end. It is a vaguely rectangular depression about 3 feet deep, 8 feet wide parallel to the channel and 15 feet long. Two massive stones, one at least 4½ feet long and over a foot wide, were observed in the side of the depression. The channel at the depression narrows to slightly over 2 feet wide and has stone facing on both banks. The earthen berm with stone facing on the south side of the channel is lower at the rectangular depression than elsewhere.

A second channel was observed about 350 feet south of the one described above. It is a wide, 40 to 60 feet, linear depression and unlike the first one, is without a high berm or stone work. It has no observable inlet and trends southerly for about 150 feet before being terminated by a modern structure and landscaping. Small pieces of slag and coal were observed in its bottom.

Another water control feature recorded is a stone and concrete dam located south of Little Hunting Creek between U.S. 15 and Maryland Route 806. It is across a u-shaped channel which slopes downward from both sides of the dam. The dam is 23 feet wide across the top and is 6 feet above the channel in the center. Two iron pipes, 2 inches in diameter,pass through the dam 2 feet above the channel.