A CONCEPTUAL METHODOLOGY FOR STUDYING THE GEOARCHAEOLOGY OF FLUVIAL SYSTEMS : WITH CASE STUDIES FROM THE OKLAWAHA RIVER (FLORIDA) AND THE RIVER EARN (SCOTLAND)

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A CONCEPTUAL METHODOLOGY FOR STUDYING THE GEOARCHAEOLOGY OF FLUVIAL SYSTEMS WITH CASE STUDIES FROM THE OKLAWAHA RIVER (FLORIDA) AND THE RIVER EARN (SCOTLAND)

submitted by

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ABSTRACT

This thesis explores a conceptual methodology for studying archaeological sites in fluvial settings. The methodology stems from geoarchaeology, an approach to the past that focuses upon the geomorphic context of artifacts or the application of geological principles and techniques to the solution of archaeological problems. The paper will examine its application to fluvial systems in two different geomorphic environments, the Oklawaha River in Florida and the Earn River Valley in Scotland. In these different environmental settings, the geoarchaeological approach makes use of different kinds of evidence available to it. Survey in submerged and eroding river margins offers additional information on site distribution and density within the landscape that can go unnoticed by traditional terrestrial surveys. Through conceptualization and application of the methodology that has developed from these studies, the arbitrary land/water interface can effectively be erased from research areas and rivers can begin to be viewed not as permanent and non-moving barriers, but as significant and dynamic components of the archaeological landscape.

DECLARATIONS

I, Robin L. Denson, do hereby certify that this thesis, which is approximately 68,000 words in length, has been written by me, that it is the record of work carried out by me and that it has not been submitted in any previous application for higher degree.

I was admitted as a research student under Ordinance No. 12 in October 1989 and as a candidate for the degree of Ph.D. in October 1990; the higher study for which this is a record was carried out in the University of St. Andrews between 1989 and 1994.

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I hereby certify that the candidate has fulfilled the conditions of the Resolution and Regulations appropriate for the degree of Ph.D. in the University of St. Andrews and that the candidate is qualified to submit this thesis in application for that degree.

May 5 1994

DATE: Dr. Colin J. Martin

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Figure 1.1 "Chill October" by J. E. Millais, 1870
River Tay, Scotland

Chapter One

INTRODUCTION: DEVELOPMENT OF GEOARCHAEOLOGY AS A METHODOLOGY

The present state of archaeology cannot be divorced from its past state. Glyn Daniel
(source: Willey & Sabloff, 1980)

Introduction

The underlying premise of this thesis is that archaeologists must first understand the natural and physical processes affecting a landscape before attempting to interpret cultural material or site distribution in that landscape. Geoarchaeology is the term used to describe this natural science approach. Its history and meaning are presented in the following sections.

Geoarchaeology: Where did it come from?

Julian Steward (1955) first introduced the concepts and methods of cultural ecology, a holistic approach intended to investigate the effects of environment upon culture. Steward (1955) reminds us of our biological similarities with and culture-bearing differences from other species. He argues that cross-cultural regularities arise from similar adaptive processes.

Cultural ecology differs from environmental determinism. In the latter, cultural and natural areas are thought to correspond because each regional culture represents a direct adjustment to that particular environment. In other words, each habitat not only permits but to a great extent determines a distinctive mode of life (Butzer, 1971). This is a rather rigid interpretation of cultural development, and leaves little room for the role of history.

For the cultural ecologist, adaptations are creative and selective processes that do not take a secondary or passive role in the process of culture change. The environment only places limitations on individual choices and the choices cumulatively lead to a specific and directional form of cultural development or change. Thus, there is an interplay between environment, which sets the parameters, and human choice or creativity. Both jointly determine a culture's development. An archaeologist's job is first to determine the parameters placed on a culture by its environment and then to interpret the process of culture change from the archaeological record.

Geoarchaeology developed within the context of "New Archaeology", which became the centre of archaeological debate in North America during the 1960s. Goals in archaeology rather than techniques were the topic of debate. Butzer, who might be considered the father of geoarchaeology, had long believed that the ultimate goal of archaeology was to determine the inter-relationships between culture and environment, emphasizing research directed towards a fuller understanding of the human ecology of prehistoric communities (Butzer, 1982, 5). Until the late 1960s, however, there was no adequate conceptual framework within which to analyse the complex relationship between culture and environment. Systemic approaches to geo-systems and land/human interaction unified archaeology and geology and helped to establish a new subdiscipline, geoarchaeology.

In response to Willey and Phillips' statement that archaeology is anthropology or it is nothing (1958, 2), Butzer agreed that archaeology and cultural anthropology were symbiotically related. But he also drew attention to the discipline's dependence on geology, biology and geography during its development. Butzer called on archaeologists to form a new paradigm, building on those of cultural anthropology and the natural sciences. He named this paradigm "contextual archaeology" and pleaded

> for deliberate exploration and development of an approach that... transcends the traditional preoccupation with artifacts and with sites in isolation, to arrive at a realistic appreciation of the environmental matrix and of its potential spatial, economic and social interactions with the subsistence-settlement system (Butzer, 1982, 12).

In short, Butzer argued for development of a contextual approach to mainstream archaeology. Cultural ecology, systems theory and contextual archaeology provide the historical background for the development of geoarchaeology, which provided the theoretical means by which multi-disciplinary research was re-introduced to archaeology in the 20th century.

The first mention of multi-disciplinary field research was in 1860 at excavations in Grimaldi Caves, a prehistoric site in France (Butzer, 1971, 6). The Swiss and French prehistoric research from that period was laden with inter-disciplinary overtones, yet there had been and still remains a quiet reluctance to engage in the integration of natural and cultural data (ibid.). That attitude prevails until today. In mainstream archaeology, integration of ecological, geological, geomorphological and archaeological data is not commonplace.

This thesis argues that the contextual approach to archaeology for which Butzer argued in 1982 has not yet been accepted and executed by the discipline's mainstream with respect to the geoarchaeology of fluvial systems. Nor have archaeologists incorporated existing sources of natural data into their archaeological site archives. Contextual archaeology's goals are more likely to be achieved when geo-data collection is integrated into archaeological data collection. Likewise, comprehensive sources of data for sites found in riverine environments can be attained with an approach rooted in contextual archaeology and geoarchaeology.

Contextual archaeology is heavily dependent on research in archaeobotany, zooarchaeology, geoarchaeology and spatial archaeology. In this thesis, emphasis will be placed on geoarchaeology and its application to riverine-specific environmental settings. The point of the research is to illustrate that a conceptual methodology which incorporates a clear geomorphic understanding of fluvial systems, one that makes use of all forms of available evidence, including those obtained through sub-aqueous techniques, is a practicable and academically profitable methodology to employ in river basin research.

A contextual geoarchaeological approach is needed in order to address in fluvial environments the theoretical issues raised by Steward (1955) and Butzer (1971) concerning cultural adaptation. I contend that this approach depends upon an understanding of the processes at work in fluvial environments. But before considering fluvial geomorphology in chapter two and its effect on river basin landscapes and the archaeological sites they contain, geoarchaeology will be defined and its development discussed in the remaining sections of this chapter.

What is Geoarchaeology?

Geoarchaeology is the contribution from earth sciences to the resolution of geology-related problems in archaeology. Hassan states

> Its scope is wide, encompassing (1) locating archaeological sites, (2) evaluating their geomorphic

> landscape for site catchment activities and site location, (3) studying regional stratigraphic and microstratigraphic materials for relative dating and recognition of lateral and vertical distribution of activity areas, (4) analyzing sediments for the elucidation of site-forming processes and quantification of microarchaeological remains, (5) analyzing palaeoenvironments, (6) studying artifacts to determine manufacturing practises, procurement range, trade, and exchange networks, (7) modeling cultural/ environmental interactions, (8) conserving archaeological resources, and (9) geochronology (1979, 267).

The special feature of this approach is its focus on the deposit. The archaeologist spends much of his field time digging and the majority of what comes out of the ground is sediment. Archaeological material need not necessarily be any more interesting than the strata underlying it or overlying it, since the deposit should be studied for its context within a sequence of geological processes. Yet very rarely has the nature and origin of the dirt itself been studied by the scientific means available. The potential offered by particle size analysis, chemical analyses and other methods of geomorphological research are yet to be fully explored by archaeologists (Renfrew, 1976).

Geoarchaeology is an approach that focuses on the geomorphological context of the artifacts (Gladfelter, 1977). Sediment properties are acquired from parent material during transport as a product of the depositional micro-environment and from in situ post-depositional alteration. The job of the geoarchaeologist is to differentiate these inputs so as to be able to recognize sedimentological conditions broadly contemporaneous with human activity, and to document phases or cycles of morphogenetic change that hold stratigraphic relevance.

Gladfelter's (1977) description of geoarchaeology is less broad than that of Hassan's (1979) quoted above. Hassan (1977) provides a comprehensive literature review of early geoarchaeological work broken down into nine geoarchaeological topics. He introduces the term archaeological geology and uses it as a synonym for geoarchaeology. He expands on Gladfelter's first definition by noting an emphasis shift in archaeology from historical reconstruction to understanding land-man relationships:

> These concern the relationship between the geological setting of a region and settlement location, the nature of site-forming processes, the recognition of activity areas in archaeological sites, the role played by geological processes in distorting or preserving the archaeological record, and the dynamic relationship between man and the earth (Hassan, 1979, 267).

In a fluvial setting, for example, it is crucial to first understand the site's environmental parameters during occupation and the fluvial processes affecting the site in order to reconstruct its cultural sequence.

Hassan singles out Butzer (1971) as an excellent example of the broad scope of geoarchaeology in contemporary research. Davidson and Shackley (1976) and the development of archaeological geology within the Geological Society of America is another example. However, Rapp and Gifford (1989) note a strong difference between Butzer's and Hassen's emphases in geoarchaeology. Butzer and geoarchaeology are seen to pursue archaeology with the help of geological methodology whereas archaeological geology and Hassan are seen to pursue geology with an archaeological bias or application. Gladfelter (1981) responds to the debate by stating that

> Geoarchaeology ... is concerned with the form and process of landscape. Processes affecting landforms are non-cultural and cultural, and the dynamics of these processes occupy spatial and temporal dimensions. Therefore, this geoarchaeology is concerned with site formation and with the transformation and recovery of data. Techniques that address these tasks come from the geosciences in general and none of the specific 'geologic' expertises outlined by Rapp (1975) or Hassan (1979) are excluded de facto from an application (Gladfelter, 1981, 346).

Gladfelter's opinion of geoarchaeology characterized by its integration with Rapp and Hassan's archaeological geology seems most acceptable to understanding human interaction in river environments. I agree with both Gladfelter and Butzer that an integrated scientific approach is not achieveable without fundamental changes in concepts within the archaeological mainstream. Butzer correctly (1982, 42) states that geo-archaeologists themselves must contribute actively toward implementing a contextual approach in training and research. Gladfelter (1981, 355) adds that geoarchaeological involvement must occur at all stages of these investigations: design, excavation and analysis -- and Butzer points out the lack thereof in most archaeological field projects. They mutually affirm and I concur that training and education of geoarchaeologists is incoherent and/or lacking. Gladfelter (ibid.) pushes for the subdiscipline to examine critically its methodology, training and experimentation in geoarchaeological research. Like Gladfelter, Butzer (1982,42) sees a need for geoarchaeologists to extend their roots deep within archaeology rather than to rely on an unlimited supply of outside technicians and services. Butzer and Gladfelter concur that complete integration of geology and archaeology will better serve the discipline.

Gladfelter's appeal for examination and development of a unifying methodology in geoarchaeology has been taken up. Stein (1987) is one example. Archaeologists are being indoctrinated into describing archaeological deposits using established classification systems from the natural science field of pedology. Another example of progress is the increasing number of geoarchaeological research projects being reported. An overview of those related to fluvial systems is presented in Chapter 3. Finally, those projects and their directors are influencing the academic nature of archaeology as the importance of this approach is made apparent to young, academic professionals. Worth (1988) and this thesis exemplify the results of that influence.

Geoarchaeology: Its Potential Contribution to other Disciplines

The potential contribution that geoarchaeology can make to other disciplines is equally significant. Given a few examples, the reciprocity becomes clear. Unquantifiable, but nonetheless significant to understanding geomorphic history are the cumulative observations of archaeologists working on individual sites (Saucier, 1981). Archaeologists work on a scale that allows them intimate knowledge of a small piece of the earth's surface relative to the broad scale view usually required in geomorphology. Second, archaeologists seek dating controls in geological sequences and geomorphologists date their sequences by archaeological inclusions (Pearson, 1986). Seen in this light, the two disciplines are complementary and interdependent -- both requiring independent chronometric aids (Butzer, 1980). Third, the specific relationship of a cultural horizon to a geomorphic event can provide direct palaeo-environmental information. If environmental reconstruction is seen as an archaeological goal of higher attainment over matters of stratigraphy and chronologies, then the importance of applying geological methodology in archaeological research is even more apparent (Butzer, 1971). Fourth, the properties of soil profiles recognized in archaeological or geological contexts permit deductions concerning cultural or environmental reconstructions that are as valuable as those derived from palaeo-botanical evidence.

In short, all archaeological research can benefit from the interdiciplinary application of earth science perspectives. However, there are areas associated with particular landscapes and landforms for which the application of the geoarchaeological approach seems absolutely essential. Archaeological sites associated with inland waterways are an example. Inland waterways can include coastal environments that are marine as well as estuarine, lacustrine and riverine settings.

All inland waterway areas are undergoing relatively high levels of geomorphic change. When high rates of geomorphic change are taking place in environmental settings with a history of anthropogenic interaction such as that associated with rivers, then the case for utilization of a geoarchaeological methodology is particularly relevant. Chapter two will discuss why archaeologists should study fluvial systems in geomorphic detail, the history of geomorphologic research in fluvial settings, the effect of fluvial processes on the landscape and the morphology of a typical river system.

Chapter Two
THE FLUVIAL SYSTEM

Running water is the most important of all the processes which fashion the landscape (Judson, 1982).

Figure 2.1 Glencoe in the spring, 1992. (R. Denson, photo)

Why study rivers?

Human interaction in river environments is borne out of our basic need for survival. All animals including humans require water to exist. Waterways provide not only water but also an abundance of other elements essential to life. A river environment provides excellent opportunity for exploiting a range of ecological zones - hinterland, valley, delta and sea (Larsson, 1983). This combination of zones readily accesssible from one source ensures optimal production of biomass and facilitates a more than tolerable level of subsistence.

Rivers, like the veins and arteries of our bodies, provide life-giving nourishment for the earth's surface. Their reaches spread across the terrestrial landscape like branches of a tree. In this form, running water is the most important of all the processes to fashion the landscape (Judson, 1982). Without rivers and the water flowing through them, life on earth would not survive in its present form.

Since our bodies are composed of 97 percent water, human biological need for water has predominated our interaction with it. We must consume it in order to survive. In the 20th century our daily lives would dramatically alter if water stopped flowing into our homes. But prehistoric peoples had an even greater dependence on water. Consider, for instance, the hunting strategy of paleo-indian populations. Their water sources were used by other animals with a similar biological need -- game animals (Webb & Martin, 1974) -- whose meat was also necessary to humans for survival. These animals could be surprised at river crossings as well as at cenotes and other water holes (Milanich and Fairbanks, 1980) and more easily dispatched as they moved sluggishly through the water. Hunting along waterways therefore was more effective and less laborious.

Our dependence and utilization of water is so accepted that predictive models for locating palaeo-indian sites in North America include vertical and horizonal proximity to water variables (Wood, 1978). Because the river systems set up natural boundaries in the environment, rivers also serve as cultural boundaries. For example, Florida's cultural areas are described by drainage basins and the associated cultural groups within them. (See figure 4.5).

The cultural areas and groups appear to be defined by Florida's fluvial geomorphology.

We can assume that prehistoric people were quick to learn the efficiency of water transport and its effectiveness for travel as well. A large majority of travel and trade in prehistoric times occurred on water. Indeed, this remained the case until the 19th century (Johnstone, 1980).

McGrail (1987) points to the better landing conditions found in rivers and estuaries. These inland and inshore waterways provided shelter from tides and wind and offered safer landings on their beaches of fluvially derived sediment. When such a landing place gave access to the hinterland, it could well become an inland trading centre (ibid.). Transport from this centre would proceed either up-river on a smaller vessel with less draft or into the interior via tracks or roadways.

Boats associated with inland waterways are among the most prolific in the maritime archaeological record. Log rafts used entirely and bundle rafts used primarily in inland waterways have worldwide distributions (ibid.). In Florida, prehistoric logboats or canoes (as they are commonly known) number well over two hundred. This is, by far, the largest number of prehistoric and early historic watercraft found in the world (Newsom and Purdy, 1990).

During the 1990 and 1991 summer droughts, more canoes were exposed. So many so, that archaeologists could not keep up with recording those being identified along the newly exposed margins of Florida's inland waterways. This illustrates the preservation capability for archaeological material in river environments and also to the need for better management of cultural resources associated with inland waterways.

In my opinion, the importance of inland waterways for trade, travel and transport has been to a certain extent neglected by both archaeologists and historians. Archaeologists must begin to look, even get wet, in fluvial environments and to take an aquatic perspective upon their landscapes. Archaeology and history do not stop at the water line , a very arbitrary boundary that has fluctuated with sea level and changing climatic conditions. Sources of evidence available from sites being affected by water have been neglected and future research in fluvial systems should include this aquatic perspective.

For example, the land-based activity -- especially overland advancement -- of the Roman empire has been highlighted in the literature. Even Paul Johnstone, a maritime historian and archaeologist, states

> It is easy to forget that in the seventeenth century it was quicker and more comfortable to go to London from Newcastle by sea than it was by road and how much more would this principle have applied in all earlier times, except perhaps the Roman (Johnstone, 1980, 156).

Recently, archaeologists and historians have successfully applied a maritime perspective to Roman sites associated with inland and inshore waterways. Colin Martin (1992) presents this balanced, more progressive perspective. He builds an argument for the army's systematic use of water transport to support its various operations in the frontier areas of northern Britain (Martin, 1992, 3). He includes Strabo's famous description of the river routes through Gaul...

> The course of the rivers is so happily disposed in relation to each other that you may travel from one sea to the other, carrying the merchandise only a short

> distance and that easily across the plains, but for the most part by the rivers, ascending some and descending others. (Geography 4.1.2)

Although Rome's celebrated road system is rightly emphasised as the mainstay of the empire's formidable network of inland communications, river transport was widely used wherever it was available. Martin suggests that Agricola's strategy was to defend coastal supply bases in default of secure land lines of communication by sending the fleet ahead to plunder at various points.

> A carefully synchronized shuttle service of liburnians [type of vessel], stock piling supplies at pre-planned replenishment points, may be seen as Agricola's solution to an otherwise intractable logistical problem (Martin, 1992, 12).

Martin's overwelming evidence includes data on the efficiency of different modes of Roman transportation by sea, river or land. These calculations have been done by many other researchers of various cultures at different stages of development. Although they all suffer in some way from fragmentary evidence, their result is the same. Clearly, it is more efficient in terms of labour and energy to transport by water rather than by land (Martin, 1992; McGrail, 1987).

The early trading centres located on the major rivers in northwest Europe are reasonably well documented, but to date there is little evidence that the middle and upper reaches of British and Irish rivers were similarly used (McGrail,1987, 273). This is unfortunate, in that rivers were so crucial to the development of early trading centres (Needham and Longley, 1981).

It is more likely that evidence of human interaction is present but not yet identified. It is well accepted that the first centres of civilization in Egypt, Mesopotamia, the Indian sub-continent and China developed in major river valleys. Indeed, the largest city centres of the world today are still located on rivers -- many being situated there historically because they WERE early trading centres.

In 1990, over 90 per cent of the world's population ~~was~~ ere living on ten per cent of its landmass. That 10% constitutes occupation of riverine and coastal environments. Likewise, 95 per cent of all lower paleolithic sites in Britain are identified in alluvial deposits (Wymer, 1976). These observations can lead us to assume that occupation has been concentrated in riverine and coastal environments in the past as it is in the present.

In conclusion, our presence in these geomorphological zones stems from a long rooted history of interaction in river environments that is based on our biological need, survival instinct and intelligence. Consequently, our need to study rivers is equally matched by our need to understand their impact upon the landscape.

The history of fluvial geomorphology and palaeohydrology

Fluvial geomorphology is concerned with the effects of running water on landscape development. Geomorphology means the study of landforms and fluvial geomorphology implies landforms developed through fluvial activity. Until the 17th century, the prevailing opinion was that most landforms had been created in their present form and were unchanging (Thornbury, 1978) although the Greeks had suggested that the earth's surface changed through time. Only in the 18th and 19th centuries did naturalists begin to realize that landforms were products of erosion and deposition, and that the landscape's character depended on the dominant process at work.

In the United States prior to the Civil War, opinion had varied as to the importance of erosion by surface water and the sea. Survey reports from the West supported and re-enforced the importance of fluvial erosion in shaping the landscape. The American school of geomorphology was formed on this concept. Geologist William Morris developed the geomorphic cycle of erosion and a classification system of landforms according to their origins (Leopold, 1982, 526). The geomorphic cycle states that landforms pass through stages of erosion and are characterised as either young, mature or old (ibid.). This system over-simplified the process but served as a useful starting point for discussion and further development of early geomorphological theory.

Having achieved very little significant research in the mid 1900's, fluvial studies have since grown to be probably the most prolific branch of modern British geomorphology (Gregory, 1987). Geomorphology had been over-interested in denudation chronology (Tooley, 1987) through its link to early sea level research by Baulig (1935). Baulig was concerned with understanding surface erosion and contemporary shoreline processes. Since that time, aerial photography has improved researchers' abilities to view topographic detail. More attention is being given to the influence of climate upon landforms, and pedology has developed as a tool for better understanding of geomorphic history. By integrating physics and chemistry research, geomorphologists are also taking a more quantitative approach to the study of geomorphic processes (Thornbury, 1978).

By the 1970s palaeohydrology was considered a useful tool for post-glacial research (Gregory, 1987). It had become difficult to consider earth surface processes and landforms in isolation from other aspects of environmental change such as vegetation and ecologic history, climatic and hydrologic activity (Starkel et al., 1985, 204). Denudation studies declined and an interdisciplinary approach to geomorphologic research began. Sedimentology, Quaternary geology, palaeoclimatology, palaeoecology, and geoarchaeology became integrated with palaeohydologic research. Contributing to the emergence of contemporary palaeohydrology was a greater interest in river geomorphological processes through its study of terrace deposits, sequences and Holocene alluviation (Gregory, 1987).

Palaeohydrology is the science of the waters of the earth, their composition, distribution, movements and significance prior to the existence of continuous hydrologic records (Starkel, et al., 1985, 203). The unique relationship which exists between bed form and stream power allows for ancient river flow regimes to be reconstructed based upon stratigraphy and bed form preserved in geological section (Gladfelter, 1977). With this information, palaeohydrologists build models used to interpret or reconstruct past hydrologic regimes. Since most archaelogical sites are located in alluvial valley bottoms or terrace deposits, classification in terms of their mode of sediment accretion is important (Gladfelter, 1977).

The value of palaeohydrology in archaeological investigations is two-fold. First, it provides background information on fluvial palaeo-environments especially in areas where in-situ riverine sites are preserved or where there are derived artefacts whose relationship to the sediment is uncertain. Second, it enables riverine sites that have been preserved to be understood more clearly in terms of their fluvial contexts (Cheetham, 1976). Since fluvial activity is likely to be a significant formational process affecting these sites, knowledge of its effects is essential for accurate interpretation of the associated archaeological record.

The affect of fluvial processes on landscapes and archaeological sites

One effect of fluvial activity on landscapes is floodplain development. The nature of the deposit depends on the morphology of the river which forms it, the river morphology itself being dependent on climate, discharge, sediment load and slope (Miall, 1982). These variables constitute the raw ingredients of fluvial process. Combined, they result in floodplain development. The general factors affecting floodplain construction and consequently the archaeology therein are presented in Figure 2.2.

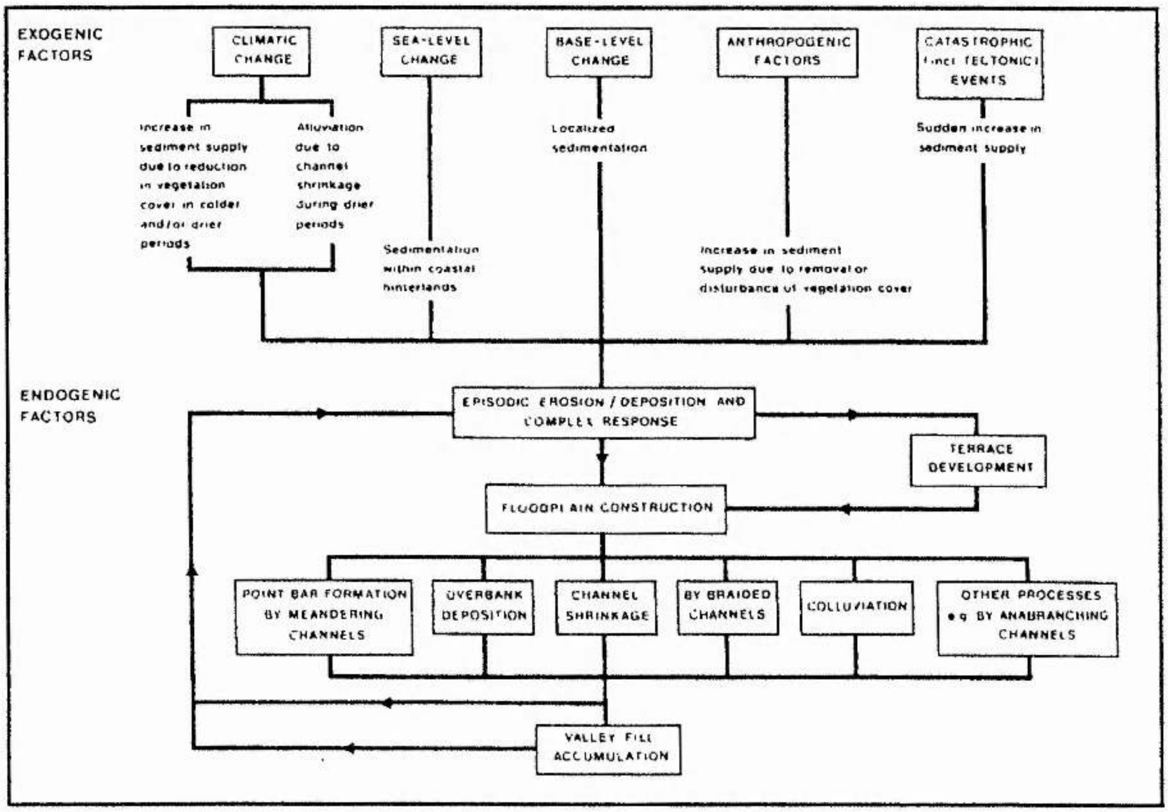

Figure 2.2 Some general factors of floodplain construction, valley fill accumulation and terrace development (from Burrin, 1985)

Alluvial cycles reflect complex ecological re-adjustments to channel and floodplain geometry that involve rainfall, seasonality, intensity and periodicity, as well as runoff, ground cover, sediment calibre and amount. The critical and immediate variables are ground cover, runoff and sediment supply. The ultimate variables are climate and human activity (Butzer, 1970).[1]
Archaeological sites in alluvial settings can be affected by either lateral or vertical accretion. Lateral deposits result from channels changing their location as they shift across non-cohesive bed materials and vertical accretion results from channel overflow and inundation of the adjacent lowlands (ibid.)

Archaeologists have provided clear evidence that the lateral shift of channels is completely natural and to be expected. The number of archaeological sites in floodplains decreases significantly with age simply because as floodplains are modified by river migration, the earliest sites have the greatest probability of being destroyed (Schumm, 1977, 132). Examples of archaeological sites being affected by erosion or deposition are found in chapter three, a review of geoarchaeological research in floodplain environments.

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[1]Schumm and Lichty (1965) believe that distinctions between cause and effect in the molding of landforms depend on the span of time involved and on the size of the geomorphic system under consideration. As the dimensions of time and space change, cause-effect relationships may be obscured or even reversed, and the system itself may be described differently (ibid., 110). During a long period of time a drainage system or its components can be considered as an open system which is progressively losing potential energy and mass (erosion cycle), but over shorter spans of time self-regulation is important, and components of the system may be graded or in dynamic equilibrium. During an even shorter time span a steady state may exist. Therefore, depending on the temporal and spatial dimensions of the system under consideration, landforms can be considered as either a stage in a cycle of erosion or as a system in dynamic equilibrium.

Fluvial activities also affect past population's choice of site location. In addition, the site's preservation and ultimately its discovery, recognition and interpretation are affected by non-cultural processes related to stream flow and flooding. Bettis (1992, 119) states that "the impact of these processes on the archaeological record is usually not considered on a landscape scale." Turnbaugh's (1978) study of north-central Pennsylvania notes an active preference of prehistoric peoples for terrace locations and implies that terraces hold a certain significance in terms of differential preservation (Turnbaugh, 1978, 604). Campsites, villages and activity stations were selected as part of a cultural formation process pre-determined to some extent by the population's understanding or appreciation of local stream activity (Turnbaugh, 1978, 593). Site selection, in turn, determined to a certain extent differential preservation probabilities among site types. He concludes that

> Local aboriginal populations tended to situate their long-term settlements well away from flood-prone areas, while, at the same time, seasonal camps or activity areas which were established during the flood-free part of the year could be set up with little regard for the potential high-water mark (Turnbaugh, 1978, 604).

The differential preservation due to location between sites in flood-prone areas and those on higher ground could be archaeologically mis-interpreted in this instance to place greater emphasis on village-type settlement sites over seasonal activity areas. It is important to note, however, that all the factors affecting preservation rates among site types are likely to be undetermined at present.

Once it is accepted that fluvial activity does affect archaeological resources, it becomes nesessary critically to acquire, analyse, and interpret archaeological data with the expectation that fluvial action has introduced bias into the record. The bias can affect our ability to interpret site locational preference through differential preservation of sites lying within the floodplain from those without it. Distributional data should also be considered relative to the overall collection or survey strategy of the individuals or agency studying them (Turnbaugh, 1978, 605).

A bias in the distribution of artifacts within a site can result from fluvial action. If geoarchaeological techniques are applied to these deposits, then the process can be identified, quantified and therefore better understood.

A Typical River Morphology

It is clear that understanding the impact of natural processes upon the landscape is paramount to accurate archaeological interpretation. What may not be so clear is the basic morphology of a river system, the observable physical processes of river development that are characteristic of all river systems. By first understanding a model of river development, actual river systems then become easier to comprehend.

A typical river can be divided into three subsystems (Hamblin, 1985, 158). The headwater, tributary or upper reach primarily erodes the landscape and is responsible for collecting the water and sediment and channeling it to the main trunk. The main trunk stream acts as a transportation system between the upper reaches where erosion dominates and the lower reach where deposition dominates. Both accretion and deposition occur in the main trunk portion of a river. The lower end of the river is a dispersing subsystem where most of the sediment is deposited in an alluvial fan or a delta, where the water is dispersed into the ocean.

River channels can also be described as either straight, meandering or braided (See Figure 2.3) (Selley, 1978; Selby, 1985, 268). Alluvium in braided (or sometimes called anastomizing) rivers is characterised by sand and gravel channel deposits excluding any fine-grained overbank silts and clays. There is generally no

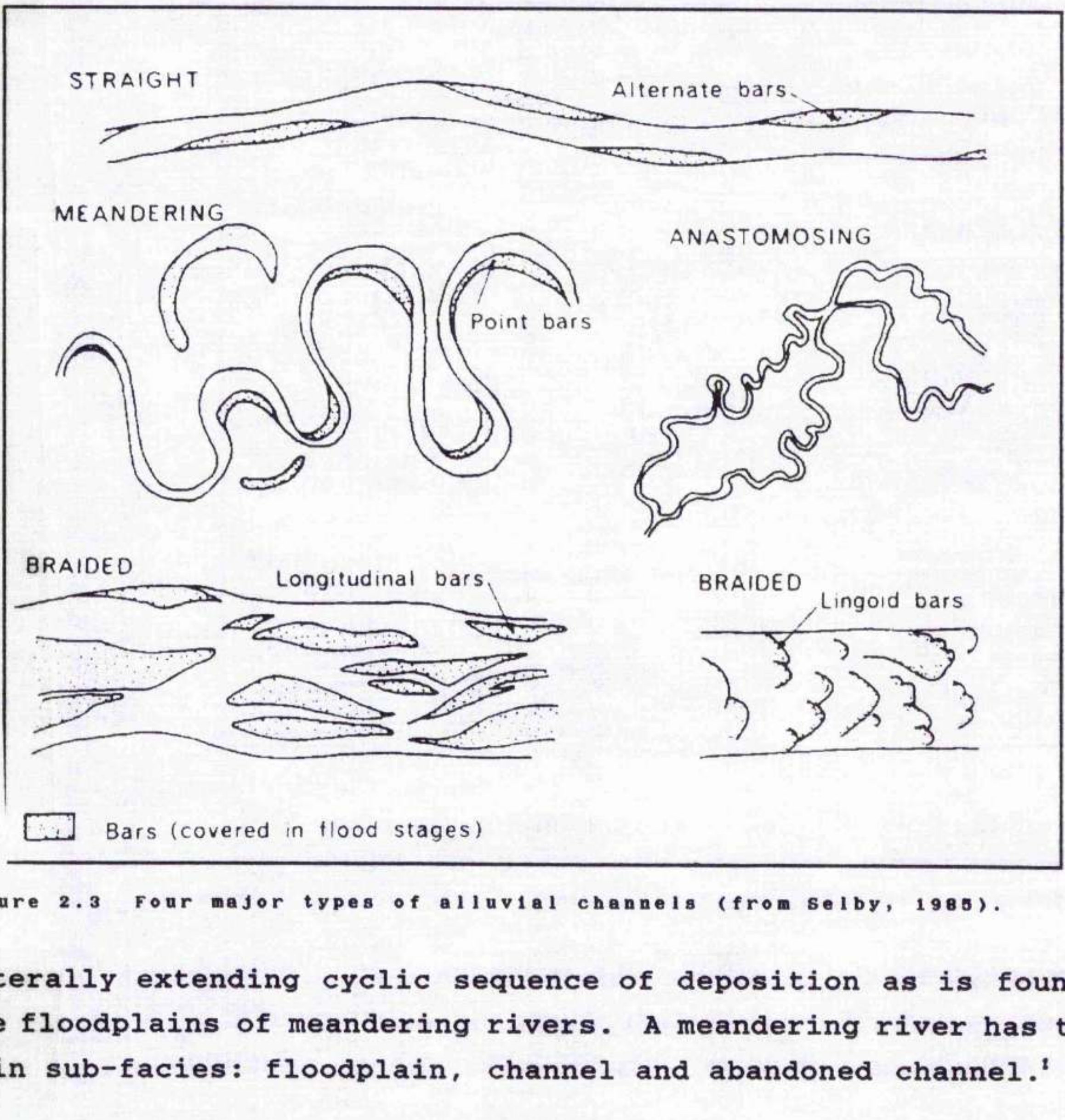

Figure 2.3 Four major types of alluvial channels (from Selby, 1985).

laterally extending cyclic sequence of deposition as is found in the floodplains of meandering rivers. A meandering river has three main sub-facies: floodplain, channel and abandoned channel.[1] The

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[1]There are five parameters which define a sedimentary facies: the geometry or overall shape of the sediment, the lithology, the sedimentary structure, the palaeo-current patterns which are determined by the orientation of the sedimentary structure, and fossils (Selley,

floodplain sub-facies of a meandering river is composed of very fine sand, silt and clay deposited on the overbank areas of the floodplain. At the base of the meandering channel sub-facies there is an erosion surface overlain by extra formational pebbles, intraformational mud pellets, fragmented bones and waterlogged wood. This surface originated as a lag deposit on the channel floor and is overlain by a sequence of sands with a general vertical decrease in grain size. The abandoned channel sub-facies is similar to floodplain deposits but are distinguishable by their geometry.

Finally, there are three types of channel bar deposits. First, there are longitudinal bars which form only in gravel-floored rivers. They consist of low gravel mounds elongated parallel to flow and are commonly cut by minor channels. Second, transverse bars are oriented perpendicular or oblique to the flow. They are composed of gravel or sand and normally contain a steep downstream terminus called a foreset that the bedload moves down as it is carried by the current. The bars migrate downstream, preserving the foreset in the deposit as planar cross-bedding. An alternative to transverse sand bars is planar bedding which usually forms under conditions of rapid flow. Planar beds do not have ripples or any internal structure other than lamination. Longitudinal and transverse bars are most common in braided streams. Third, compound bars are formed by junctions of smaller bars as large islands, sand flats, or bank-attached features. A point bar (See Figure 2.4) is one example of a compound bar (Miall, 1982).

1978). A sedimentary sub-facies is a finer description of a sediment based on some characteristic that differs within the facies.

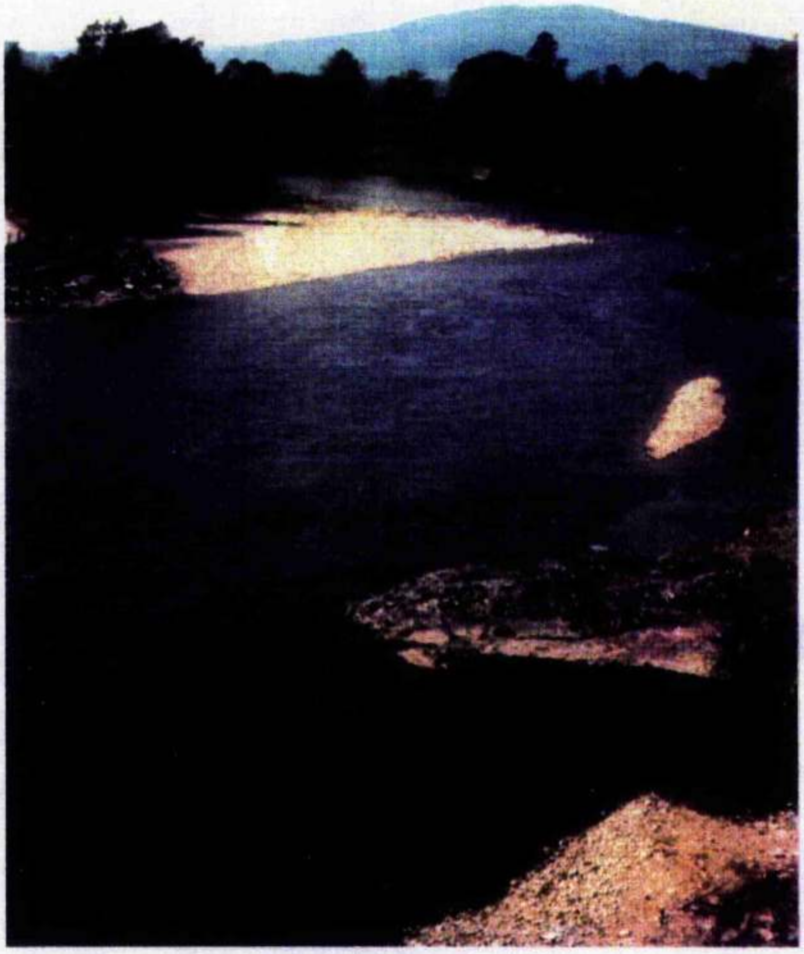

Figure 2.4 Example of a point bar, River Tummel above Pitlochry (R. Denson, photo).

All rivers act under similar principles of erosion, transport and deposition but one river may have several different types of channels at different locations along its length (Selby, 1985, 268). Deposition and its resulting features are equally comparable among all river systems. When archaeological sites are being eroded by channel migration, then the archaeological material is subject to the depositional action described above. These fluvially modified deposits including cultural material then become the future archaeological record from which cultural activity is interpreted. If the formational processes affecting archaeological sites are not studied and quantified, we cannot expect to understand the deposits formed by similar processes in the past. Interpretation of alluvial deposits in dry lands must be studied in relation to contemporary environments (Butzer, 1971). The deposits themselves reflect the conditions of deposition and tell their own story in relation to the contemporary balance of vegetation, runoff and erosion.

In this section, the processes of erosion and deposition seem simple, almost straight-forward. But with so many variables affecting the basic model presented, changing river morphologies create a broad spectrum of fluvial emvironments. What is not so consistent in fluvial processes is the material on which river systems have to work. There are many forms and types of lithologic surfaces and the affect of running water on them is varies as well. A river system's character is affected by its lithologic nature or parent material, and its slope, vegetation, climate, and a host of other, more minor factors. This is an important point to remember when we begin to consider river systems from Florida and Scotland in chapters four and five.

Chapter Three
GEOARCHAEOLOGICAL WORK IN FLOODPLAINS: A CRITIQUE

Nobody ever got a single truth
without talking nonsense fourteen times first.
Fyodor Dostoyevsky
(source: Willey & Sabloff, 1980, 181)

Introduction

In this chapter, geoarchaeological research in floodplains is critically examined to illustrate the development of the thesis methodology and to serve as a springboard for discussion of the approach used during the Oklawaha and Earn River studies presented in this thesis. Research projects from nine geographical regions covering three continents -- America, Africa and Europe -- are reviewed in the critique. The publications span the 1980 decade and are ordered to emphasize development within the field of geoarchaeology through time and space. The example's geographic spread illustrates the effectiveness of the geoarchaeological approach in different climatic zones (such as the Sahara desert and the polar regions of Alaska) and its variability in terms of development pace and results.

These projects all share one trait -- a lack of survey or field investigation within the river systems themselves. Questions such as, how is the river presently transporting archaeological material, or what is the nature of the cultural deposits being affected by fluvial processes in the contemporary landscape, are not being addressed. Perhaps these questions remain unanswered because mainstream terrestrial archaeologists have been unable to cross the arbitrary land-water interface that exists in the contemporary landscape, to adopt an aquatic perspective, and to commense with what may be referred to as non-traditional survey techniques.

In support of this observation, I offer the following comment from Bettis (1992, 120): "The inability of traditional pedestrian survey and shallow testing strategies to adequately sample the archaeological record is a result of two conceptual problems: (1) the belief that the present landscape more or less reflects past landscapes, <i.e. where the river/water is today, is where it was yesterday> and (2) failure to consider that the archaeological record has passed through an environmental filter in which burial, alteration and destruction has occurred <see chapter two for discussion of this point with respect to fluvial processes>."

I do not mean to imply that the geoarchaeological research presented in this chapter is typical of mainstream archaeology. In fact, these studies are doing more to consider the effects of fluvial action on the landscape than most. However, they are not taking the opportunity to observe the ongoing formational processes taking place in a pertinent geomorphic component of their research area -- the active river channel and floodplain.

In the active river channel and margins, there are archaeological sites being altered by the same processes that formed the alluvial sites now potentially under terrestrial investigation. The degree of completeness with which we can deduce the conditions of deposit of ancient strata is in direct proportion to our knowledge of recent sediments and the factors determining their attributes (Allen, 1965, 89). Our success in the field of archaeological site interpretation is in direct proportion to our willingness to apply data on recent sediments to the past. The value of archaeological research in fluvial settings then, depends on archaeologists developing a better understanding of the effect of fluvial processes on archaeological sites in the contemporary world.

One typical, yet troubling example of an archaeologist's perspective on archaeological sites in direct fluvial contexts illustrates the need for studying the effect of fluvial process on archaeological sites. Drew (1979) outlines possible archaeo-geomorphic contexts for early human sites (pre-11,200 years bp) in North America. He emphasizes a geomorphic approach and chooses certain environmental settings for their positive preservation capabilities. Drew ranks alluvial sites second only to basin sites in terms of their potential to produce these early site types. Basin sites include lakes and springs but underwater sites are dismissed because they "offer us no quick and easy answer to our problem." This idea is erroneous because, in fact, underwater sites offer the exact answer to our problem of understanding fluvially derived deposits. These sites are actively in the process of fluvial derivation. Drew effectively dismisses one-half of the environmental settings potentially holding early human sites because they are geomorphically complex and he does not understand the conditions under which they form nor the methodology with which to study them.

I now turn to the examples of geoarchaeological work in floodplains. The examples begin with historical development of geoarcheology in Europe and then, in North America.

Rhine/Meuse Delta, Holland -- The generalized nature of the observations and descriptions are indicative of the age and location of this study . The text presented here is similarly styled to that of the publication by Louwe Kooijmans (1974) in order to provide a flavour for early geomorpholgic research in archaeology in northwest Europe. For obvious reasons, great consideration is given to sea level changes -- both regional and local -- and its effect on the western Netherlands landscape.

"Geological conditions in the western Netherlands are peculiar... Old landscapes are often covered with later deposits, so that the opportunity of discovering archaeological terrain is reduced with increasing thickness of the deposits. In large parts of the area, these old deposits have been considerably affected by later erosion, or have even completely disappeared and been replaced by younger sediments. All information for a given period of time has thus disappeared from such an area, except from a few small districts, which are called archaeological windows" (Louwe Kooijmans, 1974, 18).

There is a comparable situation in the river area where the prehistoric deposits have been eroded by the meandering nature of later river courses. They are only preserved when they encountered back-swamp conditions during later times (vertical accretion). Between the river clay area and the younger sea clay a great part of the south Holland peat area has been preserved. This is the largest of the geological and archaeological windows present in Holland. Besides former river courses, a large number of Early Holocene dunes have been spared, the so-called donken, which have not become overlain with peat.

Finds dredged from the main river courses are not included in the study due to their "unreliability in terms of datable context" (ibid.,36). Finds were predominantly prehistoric, from 2500 BC to 700 BC. Settlements were found within the following deposits: outcrops of the Late Glacial/Early Holocene subsoil or donken, the coastal barriers and the older overlying dunes, and the highest marine, estuarine and fluviatile deposits (i.e. natural levees of creeks in the marine tidal flats, natural levees of estuarine creeks, inversion levees and stream ridges in the peat area, and natural levees in the river clay area) (ibid.,36). Three sites located in these differing geomorpholgic deposits were excavated and their geomorphologies compared.

Thames River Valley, Britain -- The Royal Commission of Historic Monuments (1960) published a report for field archaeologists on river gravels and their potential archaeological loss via commercial extraction. Areas in which detailed surveying was needed and sites at which excavation might yield valuable results were identified. Previously, the extent and importance of early occupation of the river gravels had been revealed mainly through aerial photography. Enclosures, circles, cursuses, pit-alignments, boundary lines, and earth ridges were the most prevalent crop-marks.

Aerial photographic survey of Britain's landscape seems to dominate the inventory of archaeological sites identified. This technology can create a bias in the inventory but also can provide a form of evidence useful for gearchaeological research in Britain's fluvial systems. The Earn river valley case study in chapter five will pick up on this point.

As a result of the RCHM publication, the Oxfordshire Archaeological Unit undertook a survey of the river gravels of the Upper Thames area between Lechlade in Gloucester and Goring in Oxfordshire. "There is now a shift from the pot-type and rigid-period approach to one in which the landscape is viewed as an ever-changing whole"(Benson and Miles, 1974, 3).

The secondary aim of this survey was to renew interest in problems faced by rescue archaeologists working in situations where destruction in river valleys was occurring before sites could be recorded. Several years later the same theme still highlights the literature.

> "River gravels may preserve organic evidence, sometimes of great antiquity but their exploration is heavily mechanised giving little opportunity for archaeological observation" (Coles, 1990, iii).

Progress has been made in the Thames river valley. Wymer (1976) mapped the location of palaeolithic finds to show a concentration of major sites at the confluences of large tributaries. The horizontal distribution implies either that the river valleys were favoured regions for lower palaeolithic hunters or that denudation of the higher ground was so great during stages of the Pleistocene that upland surfaces were swept clean of archaeological material which became constituents of the gravel sediments. Geoarchaeological techniques such as micromorphology applied to these alluvial sequences can identify processes in the record as minute as single flood events but application in the Thames valley has been negligible (Wymer, 1991). The Southern Rivers Palaeolithic Project (Wymer, 1992) continues to survey palaeolithic sites in the river gravels of southern Britain.

Britain's attention to archaeological sites in fluvial settings has grown markedly in the past decade. The National Rivers Authority held a conference in June 1990 to increase awareness of the cultural heritage under its control. Co-operation and communication between water authorities and archaeologists is improving. Likewise in January 1991, the British Museum hosted a conference entitled "Archaeology under Alluvium" sponsored by The Ready Mix Corporation, a major gravel extractor. This was the first time that fluvial geomorphologists, geologists, and archaeologists had met to discuss the topic in Britain.

Archaeologists working on sites along the River Thames had long since looked to geological research for information about the river's geomorphology in prehistoric times. Likewise, geomorphologists have used archaeological evidence to date Holocene transgressions in the Thames valley (Devoy, 1980). In this way, the Thames river valley research illustrates the chronometric value of integrating archaeology and geomorphology.

In terms of archaeological interpretation, excavations at Runnymede, Egham (Needham and Longley, 1981) demonstrated a greater antiquity for organized exploitation of Thames borne commerce than had hitherto proven possible.[1] The **Runnymede** site is not likely to have been concerned merely with the exploitation of riverine and floodplain resources, but more specifically with control of traffic and consequent manipulation of exchange routes (Needham and Longley, 1981). Siting and waterfront may be viewed as intimately connected with river borne commerce if evidence suggesting a settlement of comparable wealth, involved in specialized production, able to acquire foreign material, and possibly even attract foreign expertise is taken into account. The rewards gained and anticipated through such control and manipulation might in fact have conditioned the siting of a settlement in this inconvenient location with its inherent flood risk (Turnbaugh, 1978). In this light, the site illustrates an early stage in a logical development towards the waterfront quarters of Roman and medieval London.

Waterfront excavations in the city of London have equally been concerned with matters of fluvial geomorphology (Milne, 1985). The excellent preservation of wood constructed Roman quays is evidence of the preservation potential of archaeological material found in

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[1] Other sites in riverside locations yielding indications of comparable status and date as **Runnymede** include Old England, Brentford (Wheeler, 1929) and Wallingford (Collins, 1948-9) and suggest tentatively a recurring pattern in the Late Bronze Age landscape.

fluvial deposits. Unfortunately, rescue excavation and developer driven research on London's waterfront in the past have not systematically included application of geoarchaeological techniques such as sediment analysis or micromorphology. Nor have there been other geoarchaeological research projects within the Thames river valley for comparison of the impact of humans on the landscape.

Lower Mississippi Valley, U.S.A. - There is probably no major region in the United States that can rival the lower Mississippi Valley in intimacy and length of association of archaeologists with geologists, geographers, engineers, botanists and pedologists (Saucier, 1981, 8). Fisk (1944) produced a geological description of the valley which became well known because of its contributions to alluvial morphology and process. Later, significant problems were identified with its absolute chronology, emphasis on structural control, theory of origin of loess, concept of valley entrenchment and conclusions regarding absence of changes in river discharge.

Saucier (1981) addresses the new geological finding that had largely been inaccessible to archaeologists until recently (ibid.,7). New interpretations of terraces, braided stream surfaces, meander belts and subdeltas and their effect on archaeology are discussed. He identifies a change in river discharge and channel form about 11,000 to 12,000 years ago due to abrupt climatic warming. He also explains a new prediction for finding buried sites in the deltaic plain as old as Middle Archaic rather than just Late Archaic or Woodland as had been believed previously.

Guccione et al. (1988) continues research into the relationship of prehistoric settlement to environmental features in the lower Mississippi valley. The purpose of this study was to add a temporal dimension to settlement pattern studies by examining the evolving environmental conditions during the Holocene and its impact on human settlement patterns in a single area, Big Lake, Arkansas. The archaeological examination consisted of 54 km of drainage ditches intersecting the relict braided stream terrace and backswamp of the modern Missississippi river meander belt. The survey included a shovel test every 200m to a depth of at least 50 cm, surface collection and test units. Aerial photography, field examination and lab analysis of Quaternary deposits were the methods used to investigate the geology. Cores were taken and exposures sampled. Grain size analysis included dry sieving for gravel and sand fractions and the pipette method for silt and clay. Pollen analysis was obtained from two deep cores which were located in backswamp and inactive channel environments. Radiocarbon dates were obtained on whole soil samples and used to calculate sedimentation rates and estimate the age of lithologic and palynologic units.

Shifts in the physical environment involved changes in sedimentation and erosion patterns, vegetational and climatic changes as well. The earliest sites, 11,500 BP through to 7,000 BP years, were located on the braided stream terraces. The locus of sites shifted from the braided stream level during the Woodland and Mississippian periods when rapid changes in environmental adaptation and political systems occurred.

The lower Mississippian research includes conclusions on environmental control of human settlement and site location strageties.[1] Seven major resources critical to human settlement in

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[1] Settlement space is a simplified model of the environment as reflected in the outcome of location choices. To the extent that human decisions concerning location of sites are rational, they are rational with respect to a bounded view of the alternatives and consequences that affect the outcome of

the Lower Mississippi basin are identified. They are water, safety from hazards, food resources, arable land (after agriculture became established), location comfort, construction materials and firewood. These variables were correlated by weighting the individual parameters for several sites and testing them for beta correlation coefficients.[1]

Studies of site location strategy define variables in terms of the region's geomorphological and archaeological context. The variables chosen are directly related to the morphology of the region under investigation and the known archaeological sites. Proximity to water and ecotone had the highest coefficients and therefore contributed most to the lower Mississippian model. Arable soil had the lowest correlation. Sites most likely to have been occupied were high in elevation with well-drained surfaces, in close proximity to a stream course. It is also possible that the model is biased in favour of such sites because it excludes survey of lands currently undergoing active fluvial process.

In another fluvial study, Wood (1978) uses 15 Folsom period (9000 - 8000 bc) sites from the central Rio-Grande valley to test site location strategy. The five distance variables in this case are (1) horizontal distance to nearest water, (2) vertical distance to

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decisions. In other words, a cognitive model of the environment rather than its reality must be utilized for predictive modeling techniques. Our determination of critical variables may be different from what seemed critical to persons living in the past.

[1] The methodology to determine settlement space utility is described by Wood (1978) as the cost incurred to obtain required quantities of resources, where the cost is represented by distances between sites and resources. Studies of this kind should note the possibility of landscape change in terms of distances between sites and resources.

nearest water, (3) distance to overview, (4) distance to hunting area and, (5) distance to potential trap. Three functional site types are presented: base camp, processing and armament camps. Three nodes of site diversity are possible: (1) multiple purpose, (2) multi-purpose with armament or processing dominant, and (3) limited activity sites. The three kinds of sites represent three relatively distinct location strategies.

The results indicated that base camps were selected to be near running water, major hunting areas and potential trap areas. Proximity to running water indicates the expectation of more permanent residence. The key variable for armament sites seems to have been proximity to overview, selected as a vantage point for observing game movements. Processing sites may have been located near water because of post hunt activities such as hide soaking.

All results indicate that water is the important variable in determing site location strategy. Why then, don't the models of site location strategy seek surveys to include those archaeological sites in direct association with the water, a deficiency that was discussed in the opening paragraphs of this chapter?

The Mississippi examples given illustrate the evolving complexity and shift in emphasis of fluvial geoarchaeological research in the lower Mississippi during the period between 1944 and 1988. Fisk's (1944) work provided the geological framework for the initial debates. Saucier (1981) modified and corrected the geological and geomorphological findings of Fisk and began to include paleohydrologic data for site prediction and modern preservation potential. Guccione et al's (1988) study on site location strategy incorporates modern geomorphologic features with a developed understanding of evolving environmental parameters during the Holocene and their impact on human settlement patterns and our contemporary ability to interpret them. Geology, paleohydrology, environmental reconstruction and their effect on our contemporary ability to interpret archaeological site distribution and density in the landscape are the building blocks of fluvial geoarchaeological research.

Central Alaska, U.S.A. -- This study is similar in approach and presentation to the Guccione et al. (1988) study presented in the lower Mississippi section. However, the central Alaska study seems to develop its methodology at a faster rate rather than over a forty year period and suffers from a more complex geomorpholical history than the lower Mississippi. This is a particularly interesting study to consider in relation to the Scotish case study presented in chapter five because Alaskan geomorphic processes are somewhat more similar to Scotland than Scotland or Alaska to the Mississippian example. Clearly, the Florida case study in chapter four is less geomorphically comparable to Scotland and Alaska, than to the lower Mississippi, the Savannah or to the study on the lower Flint River in Georgia.

The Alaska research described here has attempted to develop a survey strategy for Late Pleistocene (30,000 - 10,000 years bp) sites in the north-central foothills of the Alaska range (Hoffecker, 1988). By combining predictive site location models with historic geomorphological studies of the foothills area, a strategy was devised in order to identify the sampling contexts with the highest potential for yielding sites of this age.

The challenge in developing a geoarchaeological survey strategy for Pleistocene sites is not simply to plot hypothesized prehistoric settlement patterns onto palaeotopographic and palaeoenvironmental matrices, but to integrate this information with the historical geomorphology of the region in order to select optimal depositional contexts for concentrated sampling. The survey failed to produce sites in the desired time range. However, a description of the project's theoretical development evaluates the negative evidence and provides an illustration of the importance of an applied geomorphological approach to archaeological survey.

The late Pleistocene record is comparatively well represented in the foothills, although deep loess deposits, which possess the greatest potential for a detailed stratigraphic sequence, appear to be rare. First evidence for sites of Pleistocene age were from Dry Creek. Its relatively deep aeolian stratigraphic context was recognised to be one of its most important features. The success of the Dry Creek excavations led to an expanded project which set the stage for the current research. However, the expanded project suffered from numerous problems including shallow perma-frost and poor sampling techniques. The fundamental shortcoming was lack of adequate knowledge about the quaternary geology of the survey area -- specifically, the lack of information about the age of the sedimentary context being sampled. It seems that the prime sedimentary layer targeted was, in fact, older than the sites for which they were searching. The restructured project was designed to collect and analyse the pertinent geologic data in order to develop a more effective archaeological survey strategy.

The earlier survey work had revealed a preference for sites which were located on promotories formed by the intersection of the medium/high terrace edges and side-valley streams during the 30,000 - 12,000 BP interval. Various types of open air sites are often found in this topographic position, especially in the Russian plain and in Siberian valleys (ibid.). These sites are typically buried in loessic coluvium (loess reworked as slope wash) or less commonly, alluvium. This locational preference may reflect an attempt to optimize several variables pertinent to the function of the site -- they provided a well drained camp area and immediate access to a clearwater stream.

The primary goal of the second project was to develop a later Quaternary geologic/palaeoclimatic framework for the foothills region and to identify suitable sedimentary contexts for sampling archaeological sites of the 30,000 - 12,000 BP time range. The first step indicated that the suitability of the loess was severely limited as a sedimentary context for sites. Alternative geomorphic contexts for sites included glaciofluvial outwash, side-valley fan alluvium, loess colluvium and primary frozen loess. Each of these deposits were accumulating in the foothills during the 30,000 - 12,000 time interval.

Glaciofluvial (Late **Wisconsinian**) outwash possesses the combined virtues of abundance and reliable temporal assignment. Its drawback as a depositional and palaeo-topographic context for archaeological sites is that the artifacts, features and associated debris are likely to be severely distributed or largely dispersed by high energy streams flowing across the braided periglacial floodplain.[4] Side-valley fan alluvium offers a datable context of sufficient age, favourable burial conditions (fine grained units formed by low-energy fluvial and alluvial processes) and a palaeotopographic focus. However, chief disadvantages are their size, since the topographic focus within the fans is lacking, and their recent alluvial cap makes them uneconomical to excavate. Loessic colluvium is a common sedimentary context for Palaeolithic sites in northern Eurasia (ibid.). Occupational lenses are generally contained in loessic slopewash derived from primary aeolian sediment overlying medium terraces in the major river valleys. The low energy deposition process offers minimal disturbance to artefact distributions and features, and rapid burial limits weathering. The frozen primary loess is impractical

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[4] In Britain, the riverine gravels that contain lower palaeolithic remains are the equivalent geomorphic context.

to sample and survey, although a number of sites in primary loess contexts appear in central Asia and Europe.

The new survey strategy which was developed for the 1980 research was designed to sample a newly identified context of potential significance: the contact between the base of the terminal Pleistocene/Holocene loess and the uppermost portion of the outwash or alluvial facies of the river terraces. Testing was concentrated on a palaeotopographic setting common to terminal Pleistocene sites, outer terrace margins adjacent to side-valley streams. Limited chronological control was problematic because the contact between the base of the loess and the top of the outwash or alluvium represents an unconformity.

Test results were not presented. The paper concludes with a synthesis of the region's historic geomorphological studies and prediction and sampling strategies for potential archaeological contexts. Future testing efforts should be concentrated on the alluvial fans which provide the most promising combination of palaeotopographic setting and depositional context (minimal disturbance and reliable dating).

Savannah River Valley, U.S.A. -- Geoarchaeological research in the upper coastal plain portion of the Savannah river valley focuses on the palaeoecological significance of humans (Brooks, et al., 1986, 293). The project illustrates the effectiveness of an interdisciplinary, cooperative relationship between archaeology and the natural sciences in an attempt to reconstruct the valley's cultural history. Archaeological data were essential for palaeoecological reconstruction due to the fluvial and estuarine processes affecting the landscape. Cultural material from proper vertical sequences in sites where formation was in conjunction with fluvial activity were essential for establishing chronological controls. Three categories of archaeological sites within specific fluvio-geomorphic settings were observed: raised terrace/point bar sites, river swamp point bar sites and estuarine shell middens (ibid.,295).

The modern environments associated with the sites used in the study were not representative of the local conditions existing during the initial or subsequent occupations. Sediment accumulation in backwater environments, sea-level changes, and changes in subsistence-settlement patterning document concurrent shifts from higher to lower energy flow regimes. For example, point bars which are high energy features were the focus of many occupation sequences. In many instances, the lateral movement of channels away from the point bars marked the end of more intensive occupation. Subsequently, the sites have become surrounded by estuarine marshes or floodplain swamps (ibid.,305).

The Savannah river valley has also been the venue for Early Archaic (10,000 - 8,000 years bp) settlement modelling. Anderson and Hanson (1988) hypothesize a band-level annual mobility model along the river's course. Low population densities are assumed and a band is defined as 50 to 150 individuals.

> The hypothesized annual settlement round is characterized by the use of logistically provisioned base camps during the winter, and foraging camps through the remainder of the year. Annual movement was toward the coast during the early spring, back into the Upper Coastal Plain and Piedmont during the later spring, summer and early fall, with a return to the winter base camp in late fall. (Anderson and Hanson, 1988, 267).

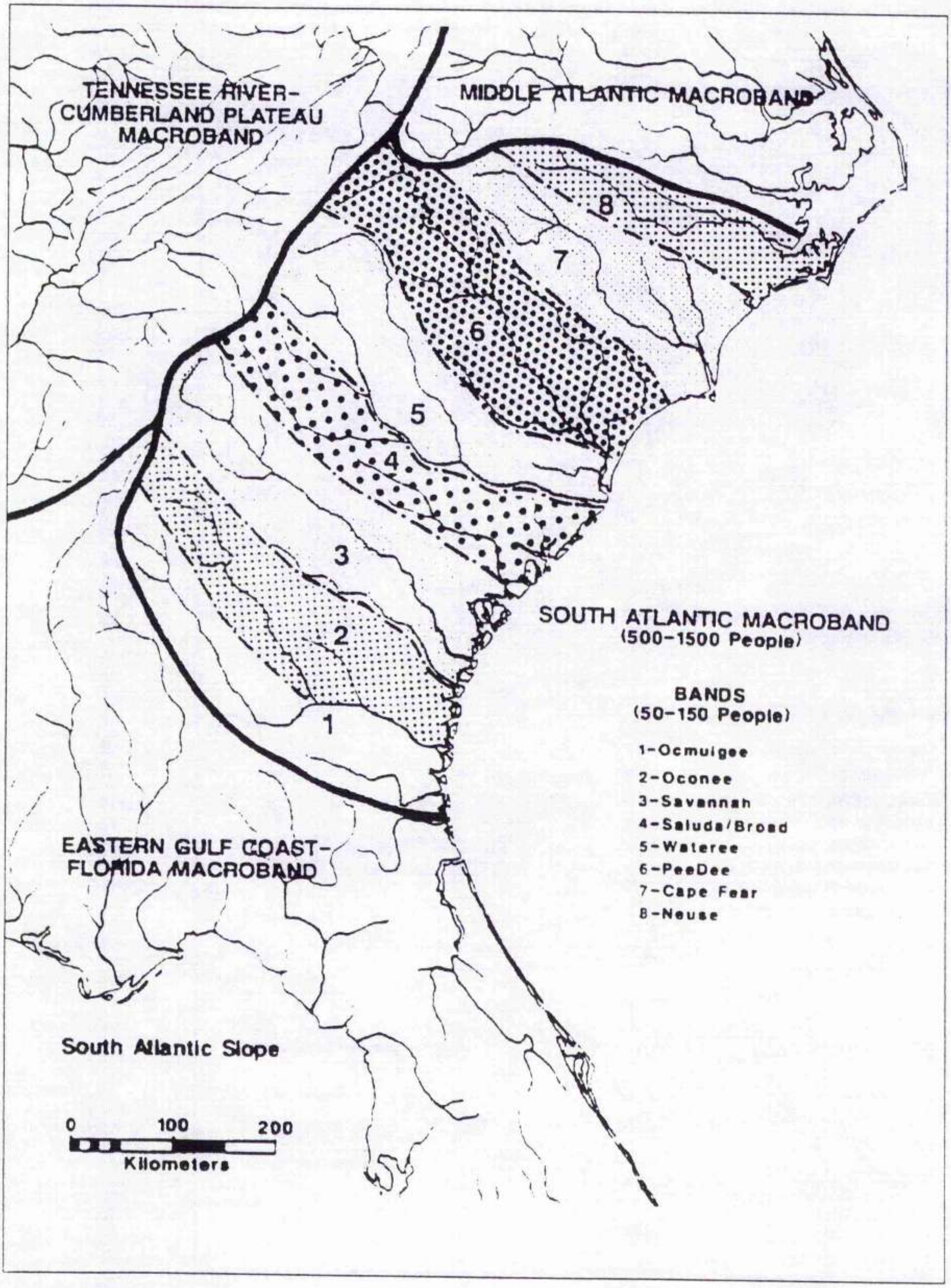

Figure 3.1 Hypothesized model of Early Archaic band-macroband distributions over the South Atlantic Slope (from Anderson & Hanson, 1988)

The return to the winter base camp may have incorporated side trips to other drainages, for aggregation events by groups from two or more different drainages. Figure 3.1 illustrates the drainage basins of the South Atlantic Slope, the associated cultural groups from the Early Archaic period and their relationship to each other. Please note the close proximity of the Eastern Gulf Coast-Florida macroband since it contains one of the two river basins subject to investigation in this thesis.

Central Georgia, U.S.A. -- Mississippian (1000 - 1400 A.D.) occupation of the middle Flint river region is postulated to have been associated with the river valley and in particular with the wide expanse of floodplain existing downstream of the fall line (Worth, 1988, 7).[5] Below the fall line, the gradient drops to 1.8 feet per mile and the river channel begins to meander on this comparatively level and expanded terrain (ibid., 20). In virtually every major river flowing from the Piedmont through the Coastal Plain of southeastern America there exist clusters of Mississippian mounds in the fall line zone. Since none of these regions have been subjected to extensive archaeological survey, there is little to no evidence regarding spatial distribution of Mississippian occupation around these centres. Nor have there been any studies to determine the preference of Mississippian cultures for site locations in the fall line floodplain (ibid., 4). Data from this two year survey and two previous excavations support the hypothesis that mound centres were situated in fall line floodplains and therefore central with respect to Mississippian populations to serve them as administrative centres (ibid., 9). It is thought that floodplains were attractive to Mississippian cultures

[5] The fall line is defined as the portion of the river below which no rapids exist.

primarily due to the high fertility of the soils comprising them (Ward, 1965).

Worth's M.A. thesis is presented here to illustrate the growing emphasis in archaeological education towards understanding the geomorphic contexts of archaeological sites on a regional and intersite level. It is especially pertinent to human interaction in river environments because the study concentrates on a riverine system and uses a geomorphological approach. In an attempt to establish a spatial distribution of Mississippian sites in floodplains, Worth neglects to survey the river and its margins for Mississippian sites actively being destroyed by fluvial processes. If the archaeological sites being eroded on the river margins were older than the period under investigation, then indications of the river's past geomorphology would have been gained. The location of Mississippian sites with respect to the river in modern times also may not represent their spatial relationship in the past.

North Carolina, U.S.A. -- The Haw river valley, one of three that drain the Piedmont Plateau in southeast America, contains stratified archaeological sites 1 km downstream from its fall line-like feature, similar to other southeastern river systems (Larsen and Schuldenrein, 1990, 161). Because episodic flooding correlates with discrete cultural components, rates of change in the history of floodplain alluviation can be interpreted from the depositional sequence. Three river terraces exposed above the present floodplain are attributed to Pleistocene cut and fill activity resulting from eustatic sea level change. Four periods of high sedimentation rates are identified during the Holocene: 10,000 to 9,000 years bp, 7,000 to 6,000 years bp, 4,500 to 4,000 years bp and the past 1,500 years. These intervals of high sedimentation (on the order of centimeters per century) are separated by intervening episodes of little or no accretion (centimeters per 2,000 years). The episodic pattern emphasizes the variability in the depositional history of the former floodplain during human occupation of the Haw river valley.

The richest archaeological occupations are embedded in discrete graded beds that record episodic overbank flood events. The tops of the graded beds are often marked by secondary interstitial iron oxides and clays derived from weathering of the contemporaneous and subsequent floodplain surfaces. Based on detailed archaeological dating of the stratigraphic sequence, the overbank flood events were temporally determined. Integration of sedimentological and archaeological analyses, aided by the lamellae's indication of disturbed versus undisturbed stratigraphy, made it possible to reconstruct environmental changes within the alluvial floodplain sequence. Future comparisons between the 10,000 year Haw river sequence and other stratified sites across the Piedmont should furnish major insights on the human ecology of this archaeologically rich area.

Oregon, U.S.A. -- The proposed John Day Narrows Archaeological District represents a spatially coherent group of sites that span 6,000 years and are situated about a common geomorphic feature, a narrow pass in the John Day River. The purpose of this study was to recover information being lost at one site, the Morris site, from reservoir construction and its resulting erosion. Early to mid-Holocene in age, the landform at that time consisted of a low-lying, river margin gravel bar, which was subject to frequent erosional and depositional events.

Mass wasting caused downslope slippage. The Morris site is now buried within a river terrace. Major factors influencing the shape of the terrace and its depositional history are apparent (Schalk, 1987). First, consider the river itself. Shifts in the river's channels and bars, changes in the level of the river's bed, and changes in the river flood regime would have affected the site prior to reservoir construction. The frequency, duration, seasonality and intensity of river processes would have affected the use of the terrace by prehistoric populations as well. Second, construction of the reservoir increased the water level thus allowing wind-generated waves to begin undercutting and slumping of sediments blocks along the terrace's margins. Third, near the eastern margin of the terrace there is a gravel bar. Its presence marks an important accretive process upon the terrace and the site. Fourth, wind due to the shape and orientation of the John Day Canyon appears to be an important factor in the site's history. Finally, vegetational growth has helped to stabilize the area whereas rodent burrowing has been responsible for vertical and horizontal redistribution of some site sediments and their artifacts.

Six cultural strata are defined. The artifact content of the deeper deposits were low and non-diagnostic. Cultural use surfaces were scattered and discontinuous and difficult to detect during excavation. The historic and underlying prehistoric deposits have been recently (within the past 90 years) deformed by bank erosion and slumping along the river margin of the terrace. This is directly linked to the reservoir construction at that time.

The Morris site illustrates a developing problem in archaeology. How does reservoir construction affect archaeological sites? Most areas of the world are currently retaining water in man-made reservoirs. Decisions about where to place new ones or how to maintain water levels in those previously built are having an effect on cultural resources. In fact, major portions of both river systems subject to investigation in this thesis are hydrologically controlled and include reservoirs. Clearly, further investigation of man-made inundation effects upon archaeological sites is necessary (Lenihan, 1981).

Eastern Sahara, Africa -- This example illustrates the necessity to remain flexible within a geoarchaeological approach and to utilize appropriate technology when natural or cultural conditions require it. In the Sahara, remote sensing techniques provided the key to unlocking crucial evidence of alluvial sites buried in aeolian sands. Shuttle imaging radar was used to help geologists identify the palaeodrainage networks of the area in relation to the ancient Nile River. Previously, there were no stratified Acheulian sites in the western desert. Three radar river types were identified buried beneath the aeolian sands. The radar rivers provided a newly recognized geomorphic context for locating stratified sites and for defining their temporal relations.

Investigators wanted to know if the margins of these fluvial channels contained in-situ archaeological material. Results of several back-hoe excavations of two radar river channels revealed Acheulian handaxes, flakes, and cores from nearshore alluvial sediments, surface and shallow subsurface locales (McHugh et al., 1988). The assemblages were typologically middle to late acheulian, dating from .15 to .5 million years age.

Geoarchaeological work in conjunction with the shuttle imaging radar indicated three major periods of human occupation in this region before early prehistoric times: (1) late Acheulean assemblages (Homo erectus) associated with ancient river deposits and later with tufa mounds, (2) middle palaeolithic occupation (Homo sapiens neanderthalensis) associated with both alluvial deposits and dunes, and (3) neolithic artifacts mostly limited to playa and aeolian deposits except where they have been lowered by deflation to older alluvial surfaces. This sequence attests to the increasing severity of the climate with time (McCauley et al., 1982).

Some areas produced unrolled, unabraded artifacts in their original geological and archaeological context. Middle palaeolithic and neolithic assemblages were numerous along the edges of the channels and bordering interfluves in an area where none had been identified before. Archaeological investigations, in turn, provided age estimates for poorly defined geomorphologic episodes and identified locales where the palaeolandforms are no longer recognizable.

River Surveys: Archaeological investigations of underwater sites

The geoarchaeological work in floodplains discussed above was concerned primarily with terrestrial sites in alluvial environments. All exemplified a geoarchaeological approach in the sense that they began with an understanding of regional geomorphology and applied it to the various sources of archaeological evidence available. None included observation of active floodplain development associated with archaeological sites in the channel's course or along its margins. In fact, all were terrestrial surveys or excavations in alluvial deposits away from the contemporary river channel's course.

In this section, description of projects performing archaeological survey in river channels or along river margins is presented. The range of methodological techniques utilized for surveying in river systems is extensive, including some which do not emphasize a geoarchaeological approach. Although there is very little literature in archaeology about river survey or excavation, the examples presented here are not exhaustive. They illustrate the subdiscipline's development and their geographical distribution, in some instances, mirrors the geoarchaeological work in floodplains presented above.

Underwater investigations of archaeological sites in fluvial environments share common features. For the most part, river archaeology in the past has been oriented towards the collection of objects themselves. Rivers are most often viewed as repositories for artefacts, a place for disposal of unwanted material, accidental loss and votive offerings (Fox, 1987). The majority of finds from rivers have been found by dredging, not systematic survey (Bradley, 1979) although a river survey does not necessarily preclude an object oriented approach. River crossing sites and their finds are a notable example (see Dean, 1977; Ruegg, 1983). As a result, river archaeology has concentrated more on the objects and the cultural formation processes affecting river finds rather than on the geomorphological processes affecting archaeological sites in fluvial systems.[6]
River finds include a higher proportion of weaponry than the material recovered on dry land (ibid.). This comparison ignores the nature of the archaeological record in rivers and makes no allowance for the limited perspective inherent in the method of data collection used in the past. Finds actually deposited in rivers were unlikely to be recovered and thereby recycled as would similar artefacts on land. These types of river finds I suggest, make up only a minority of archaeological material actually situated in river channels.

Erosion and deposition of fluvial systems at work in the landscape have extracted cultural material from what were previously terrestrial sites and entrained them in modern river deposits. Unfortunately, the methods and attitude by which most river finds have been recovered are insufficient for understanding the effects of these processes on the associated landscapes. Lack of

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[6] In Florida, most river finds are considered to be from a specific type of archaeological site, a kill site (DHR, 1991, 34). This, too, is a narrow view of the cultural sites that river finds represent.

understanding by archaeologists and river divers on the need to quantify data on fluvial processes through application of a geoarchaeological approach typifies the nature of previous archaeological river survey. Multi-disciplinary teams are needed to collect the data available from archaeological sites underwater and to quantify the action of fluvial processes upon them.

The Southeastern Piedmont of the United States is a prime region for river survey development with a geomorphological approach. Two projects are presented as examples of the broad range of sites and methodologies currently being used to identify cultural resources in river systems. First, Mulberry Mound (38KE12) near Camden, South Carolina is a late-prehistoric period site known in the historic period as the town of Cofitachequi. It was visited by at least three Spanish expeditions and the first English explorer to travel into the interior of South Carolina (DePratter and Amer, 1988, 5). In the second example, an underwater survey utilizing remote sensing techniques to identify cultural resources likely to be affected by hydraulic borrow pit construction in the Savannah River, Chatham County, Georgia is presented.

The Mulberry Mound site at the confluence of Wateree river and Big Pine Tree Creek first attracted the attention of antiquarians early in the 19th century (Furguson, 1974, 57). At that time it was noted that one of the mounds was being washed away by the Wateree river and that the prehistoric occupation levels were visible in the profile (ibid.). Two further terrestrial excavations and five field schools were held at the site before any systematic underwater survey was undertaken. Fifty metres of the Mulberry site had been actively destroyed by river erosion over the past 150 years. The size and quantity of the materials recovered during a four day underwater investigation in 1985 far exceeded that recovered during the several previous field seasons of land archaeology (DePratter and Amer, 1988). Three discrete areas within the creek as well as several units in the river along the eroding mound face were collected. Limited excavations to a depth of 30 cm were conducted in both the creek and the river.

Since the artefactual material obtained from the underwater portion of the site represented a substantial increase in cultural material for that time period in South Carolina, funds for further investigation were obtained. The new project was designed to study the depositional character of the creek bed and its relationship to cultural material. Conducting surface collection along the creek areas previously surveyed in 1985 provided artefact deposit rates and showed how the creek bed had morphologically developed over a three year period. Investigation of the river bottom adjacent to the site indicated changes to the fluvial regime and an overall reduction in erosion due to a small log jam upstream. Additionally, a joint land/underwater survey of sand bars in a 5.5 km stretch of the Wateree river was executed. The land crew collected artefacts from the exposed sand bar surfaces while the underwater crew worked below the waterline.

Thirteen of the 16 sand bars investigated contained artefacts. No prehistoric artefacts were recovered upstream from the creek although one sand bar included historic artefacts. Ceramic sherds tended to be found along an entire bar, although in some cases they were concentrated in the upstream portions of the bars. Most sherds were recovered from parts of bars composed of gravel and rocks rather than pure sand. Ceramic sherds located in the river channel tended not to tumble in the current but remained on the bottom once they had dropped out of the current. Neither were ceramics present in scour holes or around obstructions. The researchers felt that concentration of sherds in the river downstream from the mound complex were indicative of unidentified sites previously located along the river's margins.

The Mulberry mound research illustrates a well integrated geoarchaeological approach to studying terrrestrial sites being impacted and re-distributed by fluvial process. The Savannah River borrow pit construction survey project shows a comparative lack of emphasis on fluvial process and a narrower approach to fluvial archaeology. The aim of the contract company's river survey was to identify any cultural material likely to be affected by hydraulic borrow pit construction. A combination of high resolution side scan sonar and proton precission magnetometer were employed to identify the submerged cultural material (Tidewater Atlantic Research, 1988, 7). Although the authors point out that evidence of both prehistoric and historic habitation may have been redeposited and preserved in the survey area (ibid.), no attempt was made to identify prehistoric material during the survey. Apparently, the dominant definition of cultural material in the second example was limited to shipwrecks.

The borrow pit survey report begins with a geomorphological overview of the Savannah river in an attempt to appear geomorphologically sound.[7] However, its discussion of the area's significance begins in 1733, nearly 10,000 years after man's uncontested arrival in the southeastern Piedmont of the United States. The remote sensing devices used were not suitable for identifying pre-historic sites. Of the 32 targets identified in the river channel (no searches in the submerged or exposed margins were mentioned), 19 were identified as modern debris and 13 required further investigation. For those 13 and because of the high cost of on-site research designed to identify and assess each, avoidance -- meaning no extraction within a certain distance of the anomaly -- was provided as an effective option. No data concerning the impacts of this option can be identified, but

[7]Many good geoarchaeological research projects conducted by staff members of the South Carolina Institute of Anthropology are currently underway in the Savannah River.

dredging the area surrounding a site could expose the target area to dramatic changes (ibid.,60). Clearly, there are methodological differences apparent between the Mulberry mound survey and that of the Savannah river borrow pit survey.

In Florida, a combination of archaeological and geological research was used as early as 1960 to locate submerged cultural resources in Florida's springs (Cockrell, 1980). The Warm Mineral Springs project (Clausen, et al., 1975a & 1975b) and excavations at Little Salt Springs (Clausen et al., 1979; Brown and Cohen, 1985) began in the 1970s. However, the geomorphic nature of still water spring sites in the karstic topography of Florida differs from the fluvial or riverine settings previously described in this chapter.

In addition, the nature of Florida rivers is slightly different from other southeastern rivers discussed in the text due to Florida's marine origin and karstic topography. While more research has been published about the still water sink hole sites in Florida, the rivers represent larger areas of more concentrated finds and have greater potential for developing land/human interaction models (Dunbar et al., 1988, 443). Two such river sites are the Guest Mammoth kill site in Silver Springs run (Hoffman, 1983; Hemmings, 1975 and Neil, 1958) and the PageLadson site in the Aucilla river (Dunbar et al., 1988).

Although the Silver Springs project offers little scope for geoarchaeological review, the research in north Florida at the PageLadson site is germane to the discussion of underwater geoarchaeological work in fluvial settings. Since 1983 survey and excavation in and around the Aucilla river have been the subject of many joint archaeologist/sport diver projects (Richardson, 1988; Willis, 1988) including investigation of the Aucilla river channel into the Gulf of Mexico and onto the continental shelf (Dunbar, 1988).[1] The Aucilla river site at PageLadson has yielded a stratified sequence of waterlogged deposits dating back 18,000 years. Organic preservation is excellent. Archaeologically, it provides cultural material in association with Pleistocene mega-fauna that became extinct in Florida 10,000 years ago. More important, this Late Palaeo-indian to Early Archaic habitation site can contribute to our understanding of paleo-environmental change in north Florida during that time.

Recent field investigations have shifted emphasis away from typical artefact collection to sampling procedures designed to aid in environmental reconstruction. Pollen, archaeobotanical and zooarchaeological analysis of sediments strategically sampled from a pleistocene/holocene stairway-like unit is underway. Clearly, the contextual approach to archaeology called for by Butzer (1982) is being pursued at the PageLadson site. Future work may include micromorphological analysis to assist in determining the origin, depositional and post-depositional processes associated with the sediments preserved by the river and in archaeological contexts.

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[1] In a similar study Larsson (1983) investigates submarine river banks in the Strait of Oresun, between Denmark and Sweden. Four mesolithic sites were found by following streams of present rivers into the sea and out to presumed submerged deltas as far as 20 metres below sea level. The sites were formed in clusters at narrow bays or close to the river's mouth where they would have been protected from direct exposure to heavy wave and current action. Knowledge of settlement patterns during the Atlantic period were applied so as to reduce the search area and limit it to locations where settlement remains might reasonably be expected to be found.

Implications of Underwater Archaeological Work in Floodplains for Other Disciplines

The implications of underwater archaeological research in floodplains for other disciplines are numerous. In studies of fluvial geomorphology, archaeological sediments exposed in section by river erosion can provide geomorphologists the opportunity to study one river system through time rather than several rivers at differing stages of development. By comparing sites exposed in modern floodplain sediments with alluvial sites located away from the modern floodplain, sedimentary features can be related to one another and overlapping chronologies developed similar to the way dendrochonological sequences are developed. Archaeological deposits can be of great value in dating Holocene alluviation (Gregory, 1987; Robinson, 1978).

Underwater archaeologists could make in-channel observations of deposition and erosion processes similar to fluvial geomorphologists' observations in terrestrial settings. Leopold (1973) studied the effect of urbanization on channel change in a floodplain from a humid-temperate climate. Rates of change were greater than expected. The increase in the sediment load associated with urbanization resulted in higher banks and the cross-sectional view becoming less trapezoidal and more rectangular. Deposition began to occur less as overbank and more as in-channel deposits. Deposition over the valley floor was observed to be more than 6 inches in thirteen years, most of it occurring exponentially after 1966 (with urbanization). Visual inspection and observations of channel floor activity could assist by recording existing features in-situ (ibid.). This data would aid geomorphologists in their understanding of fluvial processes.

Sea level studies have often used archaeological evidence as indicators of sea level change (Flemming, 1979; Masters and Flemming, 1983). This form of evidence is one of the most consistent and universal indicators of ancient shorelines. Likewise, sites in fluvial environments can also act as indicators of fluvial change (Pearson, 1986). The effects of fluvial processes can be quantified within the context of archaeological site destruction over known periods of time.

To pedology, underwater archaeology provides another source for sites that can increase understanding of anthropogenic and fluvial alterations to soils.[9] Underwater survey within this untapped area for sites will change site distribution and density patterns within floodplains. These studies will develop an understanding of how cultural material is redistributed by fluvial process. Finally, underwater archaeology can provide quantified data on the process of erosion and how it redistributes archaeological material. This information will then assist terrestrial archaeologists working sites in alluvial sediments.

The Approach Used in the Oklawaha and Earn River Case Studies

Like the examples discussed above, the approach used in the case studies for this thesis is fundamentally rooted in the geoarchaeology described in chapter one. Geoarchaeologists must first develop an understanding of the natural and physical processes affecting the landscape before beginning to interpret cultural resources or site distributions within them. When working with archaeological sites in river basins or fluvial systems, the

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[9] See Collins & Shapiro (1987) for an example of archaeological sediments used to determine anthropogenic alterations to soils.

importance of understanding the natural processes increases due to greater geomorphic activity in and around fluvial systems as described in chapter two.

The approach presented in this thesis is a five step process. First, when considering a river basin for archaeological analysis, begin by obtaining information on the geology of the region, both solid and drift. It is necessary to determine what are the primary geomorphic processes creating the soils and the landscape and therefore affecting the archaeological sites contained therein. If these are processes which are not familiar to you, go back and relearn the basic principles of geology concerned with these unfamiliar processes. For instance, the glaciated landscape of Scotland was utterly foreign to me, an untravelled native Floridian born on a Miocene beach ridge. I was required to relearn basic geological theory about glaciation and its effect on the landscape. Geologic and geomorphologic information will assist the archaeologist's understanding of parent materials, origin of soils and landforms in the basin and in archaeological contexts.

The second step requires analysis of the existing body of data available from government agencies on the archaeological resources previously known in the study area. This is not always as straight forward as it might seem. There are many factors affecting the quality and usefulness of pre-existing archaeological databases -- standardization of terminology among users, change in database function through time, change in our interpretation of a region's cultural history over time and inconsistent reports -- to name a few. Bias in the data collection strategies can also be potentially difficult to overcome. At a minimum, these problems must be identified and corrected, where possible.

Other sources of evidence for archaeological information can also be sought at this stage including but not limited to academic literature searches, oral interviews and historical documentation. As with the geology in step one, if the cultural history of the area under investigation is unfamiliar, seek the basic and accepted archaeological information available on the populations inhabiting the river basin through time.

Integration of the first two steps begins in step three. Once a database of archaeological site types and their attributes is obtained for the research basin, step three involves generation of a project archaeological database corrected from the source database for inconsistencies and non-standard terminology and expanded to include relevant geomorphological fields such as soils, vegetation and landform. Oftentimes, in archaeological databases where these fields already exist, archaeologists incorrectly use terms from the natural sciences. This can be overcome by adopting natural science standards in these fields and assigning each archaeological site in the database with the correct geomorphic information available from the natural science sources.

Once the database is in order and step three is complete, the researcher must query the database regarding the relationship of sites to soils and landforms, and any other outstanding relationships which begin to emerge from the data. In step four, the very nature of the pre-existing database and its bias may seem to create relationships that may or may not exist. Future research might be aimed at determining the precise nature of those relationships. But one point should become clear in step four -- there is value in understanding the natural and physical geomorphic processes of fluvial activity in river basin research. It highlights the gaps that exist in the archaeological record of river basins and establishes possible relationships between sites and associated landforms or geomorphologies.

At this point, given that each river will have a different geology, cultural history and archaeological database, there are numerous forms of evidence that begin to emerge. The task in step four is to remain flexible enough within the approach to recognize the differing forms of evidence that do emerge and to follow those up in future research. The evidence will lead you in different directions depending upon the parameters established in steps one through three. Examination of the two case studies in chapters four and five will illustrate this feature of the approach and be discussed in chapter six.

In the fifth and final stage, field projects are developed and executed in the river basin to test hypothesis generated from the desk-based research described in steps one through four. It is likely that initial survey work will be needed to identify and record previously unrecorded sites in submerged and frequently flooded portions of the river system. These surveys are necessary in order to obtain data on actively eroding archaeological sites and to augment the conventional forms of survey traditionally undertaken on higher elevations of well-drained soils.

Future excavation or research projects on specific sites within a fluvial system will require inter-disciplinary teams of coordinated researchers to grasp the site's full potential. Geoarchaeological project directors must be conscious of the demands of multi-disciplinary research. Interdisciplinary teams require good communication skills among members, pre-planning stages that allow effective exchange of project needs and individual objectives, and adequate report dissemination after the project is complete. Although demanding, the results of such research is potentially beneficial to all concerned.

Chapter Four

A CASE STUDY: THE OKLAWAHA RIVER IN THE SOUTHEASTERN UNITED STATE OF FLORIDA

Introduction

The final section of chapter three sets out the methodology developed in the course of the case study presented in this chapter. The Florida research culminated in a survey project designed to address the nature of fluvial processes impacting on archaeological sites associated with fluvial systems. What developed from that project was a conceptual methodology for working in fluvial environments. The Scottish investigation then followed and allowed for further testing and development of the methodology presented in the final section of chapter 3.

The Florida case study begins with a broad geological description of the southeastern United States. The geomorphology is then refined to cover Florida, the St. Johns River Valley and finally the Oklawaha River, a tributary of the St. Johns and the survey area in which the methodology was developed. Natural resource information concerning climatic conditions, vegetation and soils is included within the geological description due to its interdependence, relationship to landform (Butzer, 1971), and proposed relevance with respect to understanding cultural history within the river basins.

A brief cultural history and summary of previous archaeological research is followed by a history of river diving. Divers are an important source of information for locating cultural deposits in and along Florida's waterways and often their information is not contained in state archives or master site files (MSF).

Creation of the Oklawaha River database developed from my previous desk-based research on the Cross Florida Barge Canal property (Denson and Ellis, 1991) using data from Florida's master site files with additional data fields concerning natural features gleaned from other sources. Finally, the Oklawaha River survey project was initiated to test hypotheses about the numbers and types of sites located in one of Florida's fluvial systems and to quantify changes in site distribution and density patterns as a result of underwater survey in that fluvial landscape.

An attempt to interpret information about the past inhabitants of Florida from the archaeological record must include examination of the modern environment. From a geoarchaeological viewpoint, proper understanding of the features and resources commonly found in a landscape is vital to the reconstruction of its cultural history. It is necessary to observe and thereby become familiar with modern features and their distribution within the landscape in order to make better sense of the encapsulated palaeo-landscape (Butzer, 1971).

Geology of the Southeastern Region

A large portion of the southeastern United States is underlain by a porous limestone formation known as the Floridan aquifer. This system is composed of a sequence of limestone and dolomitic limestone (Tibbals, 1990). These geological formations are mainly Eocene in age -- 36.6 to 57.8 million years old -- and constitute the "backbone" of Florida and the southeastern region. At the base of the aquifer is Palaeocene rock not older than 66.4 million years.

Florida is essentially composed of Miocene beach ridges that formed since it rose out of the sea in the Eocene epoch. Constant weathering and erosion of the limestone has deflated its original thickness and in some places the limestone foundation outcrops on the visible land surface.

The chemical and physical weathering of the marine-laid limestone deposit characterizes the nature of the karstic topography in Florida and its coast today[1]. The climate zone is classified as the Moist Mesothermal and Microthermal province by Butzer (1971, 59). There are four further subdivisions within this middle latitude and Florida's is termed the Humid Subtropics. Because it is situated on the eastern shore of the North American continent, winters are mild (coldest month 2-10 degrees C.), summers hot (warmest month 23-30 degrees C.) with a long growing season of seven to 12 months. There is no snow cover, although moisture is abundant all year round, particularly during the summer.

Florida's vegetation is described as Temperate Woodlands. Deciduous and mixed forests dominate the landscape. Since the deciduous trees require more light, they are widely spaced with a thick canopy that allows little undergrowth. In these conditions, the forest is patchy, easily penetrable and interrupted by glades. In areas where there are fewer trees, growth of herbaceous plants is common.

The soils of Florida are essentially woodland soils characterized by the podsolozation process (Butzer, 1971)[2]. Evergreens tend to

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[1]The Florida coast is a linear clastic shoreline complete with four or sedimentary environments: the fluviatile coastal plain, the oonal and tidal flat complex, the barrier islands and offshore marine lf.

[2]Podsolization is the chemical migration of aluminum and iron and/or organic matter resulting in the concentration of silica in the layer of eluviated or left behind. It is not a single process but rather a combination of processes which bring about translocation in the soil profile. The soluble ferrous iron forms at the sites of eluviation -- usually in the upper regions of the

dominate the sandy soils of Florida but are often accompanied by other species more tolerant of wet soils. The wet soils are typically found in sloughs where water gathers because the land is underlain by clays at these lower-lying elevations.

Physical Geology of the St. Johns River

The St. Johns River is approximately 482 kilometres (300 miles) long and thereby the longest river of the Florida peninsula (WRA, 1984) (Figure 4.1). The river flows north from its source, a swamp in St. Lucie County near Vero Beach, to its outfall in Jacksonville where it enters the Atlantic Ocean (FDNR, 1989).

Ironically, to travel upstream on the St. Johns means travelling down or south into the heart of Florida (Lane, 1986). Its daily average flow is 161 cubic metres per second (5,687 cfs). Since flow rates are directly related to rainfall and June through September provide 55% of the average annual rainfall of 132 centimetres (52 inches), these are the months of common floods and high flow rates. Maximum flow at the river mouth is approximately 1,699 cubic meters per second (60,000 cfs). Springs contribute relatively little to the flow; only five are known to feed directly into the river. The St. Johns is considered to be a 'blackwater' river, as it is stained dark with tannic acids created by decaying vegetation. From its source to its mouth the river drops only 8.2 metres (27 feet), making it one of the flattest rivers in the world. Likewise, the elevation within the catchment does not exceed 250 feet above mean sea level.

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soil profile -- and the insoluble ferric iron firms at the point of illuviation -- or where the translocated matter ends up.

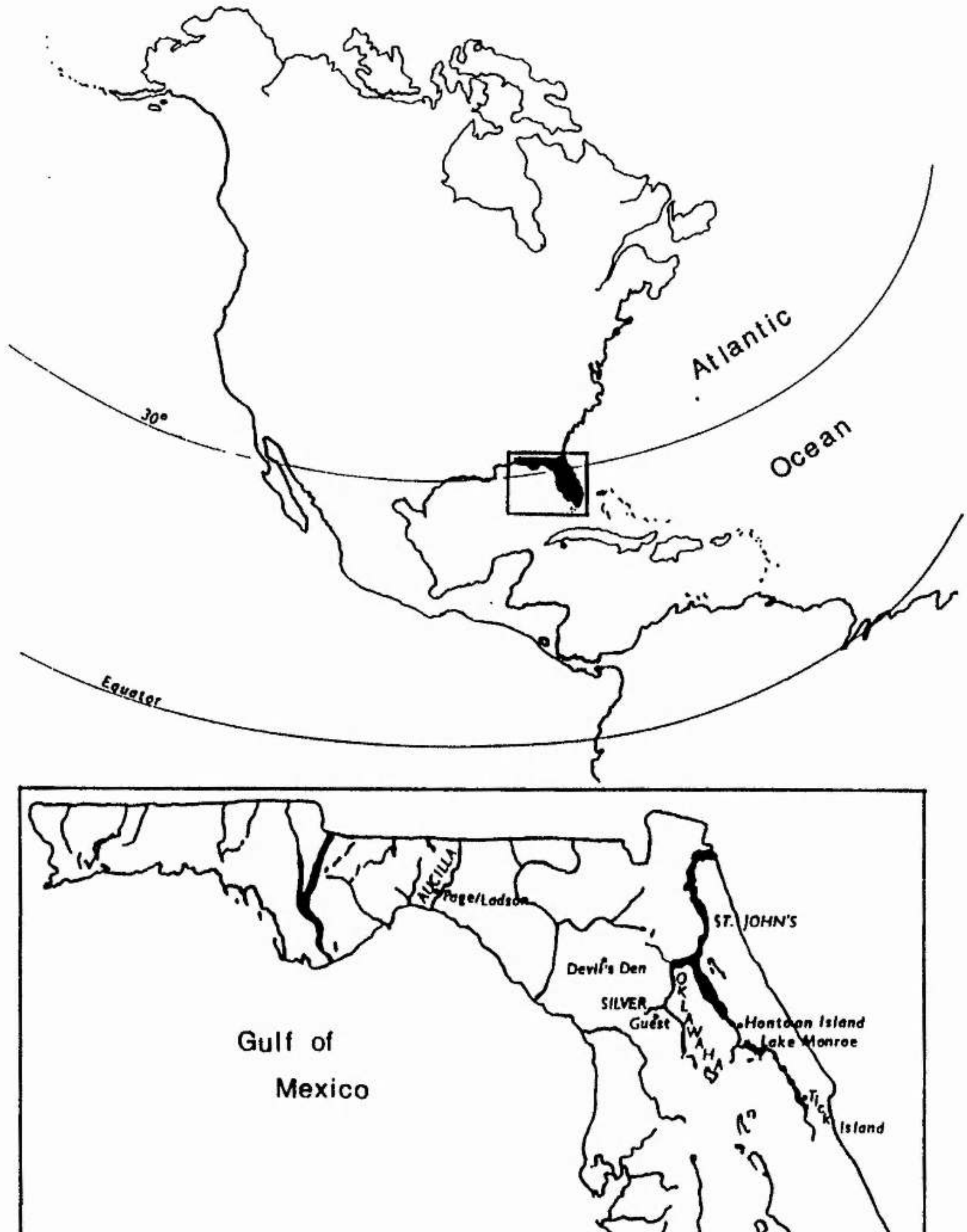

Figure 4.1 Florida and the St. Johns River basin, including sites mentioned in text and other river systems

The St. Johns River has five major tributaries. Starting from its source moving north they are the St. Marks, the Econlockhatchee, the Wekiva, the Oklawaha and the Black Creek/South Fork Rivers. The catchment area is difficult to determine yet almost meaningless because of the karstic nature of Florida's topography. Its watershed is known physiographically as the Eastern Valley and its sluggish flow has created many swamps, lakes and wetland environments. Slash pine flatwoods, longleaf pine sandhills, and scrublands dominate in most areas, while a coastal ecosystem of saltwater marsh near the river's mouth gradually gives way to sand dunes on the Atlantic coast.

The St. Johns River is normally estuarine along its first 96 kilometres (60 miles) although in periods of low water, tides may cause a reverse flow to reach as far as 259 kilometres (161 miles) upstream from the river's mouth. Throughout its headward waters it occupies a broad swampy valley that includes a dozen-odd large lakes. These lakes differ from other inland lakes in Florida in that each one is elongated in the direction through which the river flows. This suggests that the St. Johns River and its lakes are remnants of a once continuous body of standing water, a lagoon left behind by a series of barrier islands created when water levels were higher (White, 1970). The reaches between the lakes of this former lagoon have been differentially filled to make the present flat, swampy floodplain, while the unfilled places persist as lakes in the headward reach and as part of the estuarine environment farther downstream.

The course of the St. Johns follows three geologic fault zones (Figure 4.2). These structures are all post-Late Miocene (5.3 million years ago) in age. The Sanford-Palatka Offset, one of the three faults, has a different history from the upper and lower St. Johns River. This older part of the valley is incised in higher

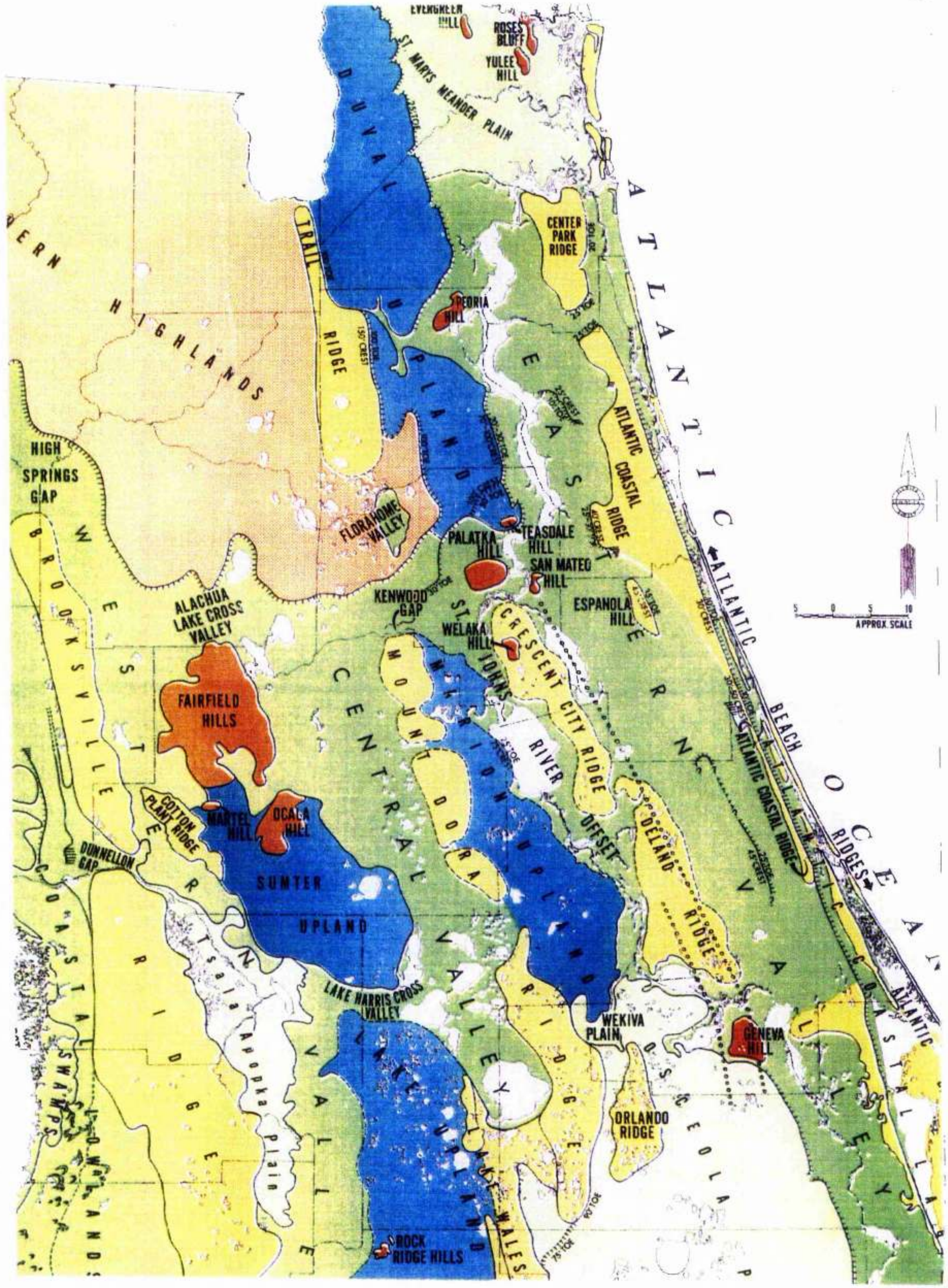

Figure 4.2 Physiographic map of North Central Florida (from White, 1970, Plate 4.A)

land cut during a low sea level stand in Late Tertiary (1.6 million years ago) or early Pleistocene times by what was believed to be an entrenched tributary of the Oklawaha River (White, 1958). The Oklawaha River flows out of still-higher ground to the west and should therefore antedate the St. Johns River. When sea level rose, the lowered surfaces were inundated to become estuaries or sounds. The sediments deposited in them have become part of the modern day floodplains of the St. Johns, Wekiva and lower Oklawaha Rivers. Upon retreat of the inundating sea, the St. Johns became an integrated stream flowing along the relict beach ridge plain to Lake Harney and then jogging westward deflected by solution capture to enter the Sanford-Palatka offset. At Palatka it re-enters the same lower beach-ridge plain and follows it north again until it is deflected seaward by the delta of the sediment-bearing St. Mary's River at Jacksonville. The presence of numerous beach ridges characterize the sediments in the basin as mostly sands with very little clay and silt.

Selection of study area

In Florida, selection of an appropriate river segment from the St. Johns was aligned more with archaeological needs rather than its geomorphological characteristics. Piney Island (8MR848), an eroding prehistoric burial site, had been identified by amateur archaeologists in 1985 (Denson and Dunbar, 1992). Its location on an outer margin of a bend in the Oklawaha River and its continued destruction encouraged identification, recording and quantification of eroding and associated sites within its corridors. The selected segment also meanders quite considerably through a broad, up-to-1.6 kilometres (1 mile) wide floodplain. Its terminal points coincide with major hydrologic features making the 30 kilometre (19 mile) study area a contiguous ecologic study zone.

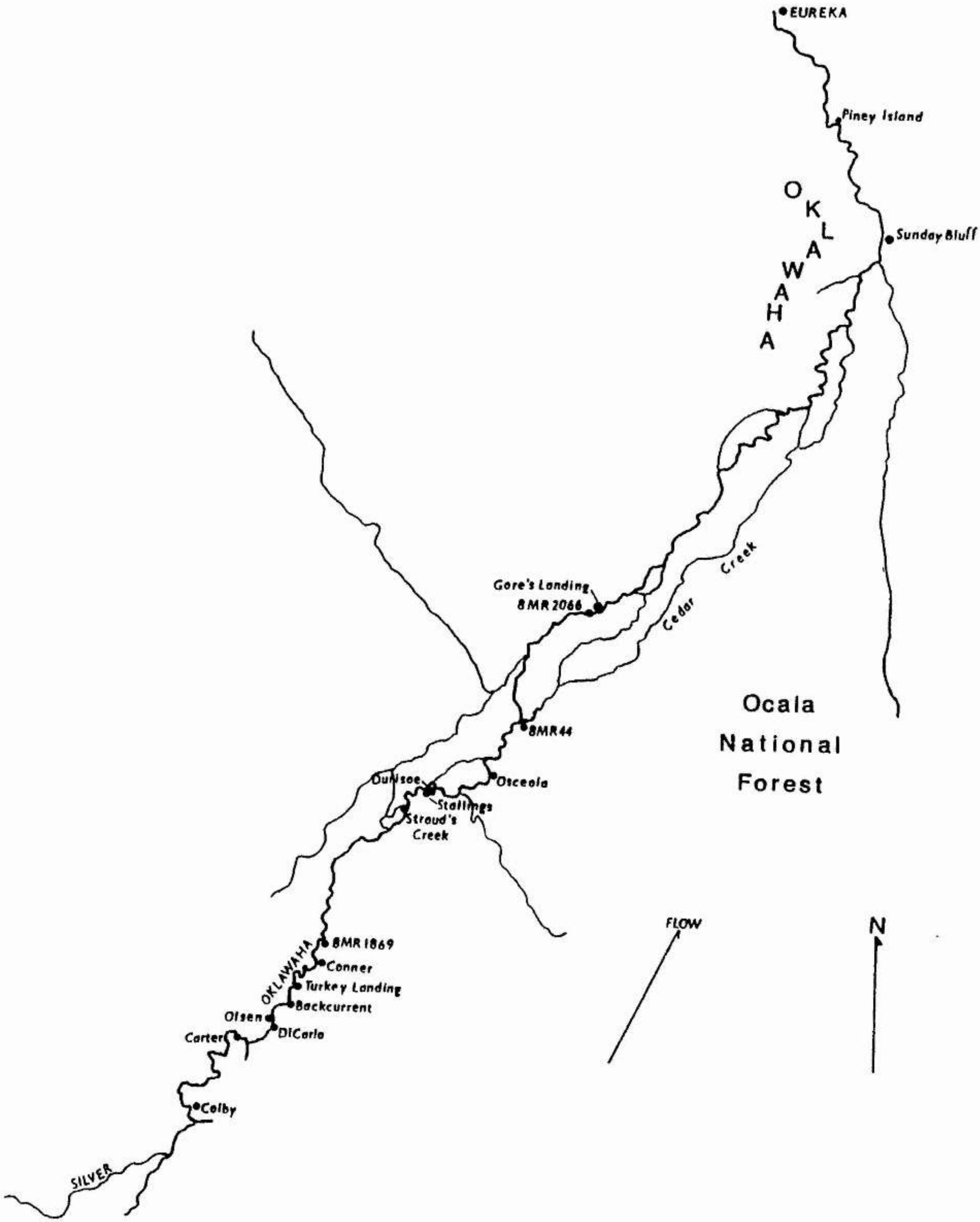

Figure 4.3 Oklawaha Study Area including sites identified during ORS and items in text.

The Oklawaha River study area is defined as that portion of the Oklawaha River starting from its confluence with the Silver River flowing downstream (or north) to Eureka Dam (Figure 4.3). The influx of the Silver River at the upstream terminus dramatically affects the nature of the river and the surrounding ecosystem because it provides 50% of the Oklawaha's total flow. Upstream from the Silver River confluence, the Oklawaha is characterized as a much slower, more eutrophic 'blackwater' river system. Downstream of Eureka Dam, the Cross Florida Barge Canal corridor has been effectively established. The river's water has been pushed out past its normal channel margins and caused to flood the surrounding landscape. The study area represents the only remaining pristine portion of the river system above the Silver River confluence. In addition, the Oklawaha offers the opportunity to examine the effects of canal construction on the river and associated archaeological sites.

The Oklawaha River Valley and Study Area

The Oklawaha River, originating in Green Swamp and running north and east for some 112 kilometres (70 miles), is the major tributary to the St. Johns River. (See Figure 4.1) The Oklawaha River's drainage basin covers 7,200 square kilometres (2,780 square miles), with water quality described as generally good. Silver Springs is the only major spring that flows into the Oklawaha. Its flow, via the Silver River, plays a very significant role in improving the Oklawaha's water quality by diluting the poorer water from the southern lakes. The other major tributary of the lower river is Orange creek. It drains a small chain of lakes north of the study area into the Oklawaha at the town of Orange Springs near the Putnam-Marion county border. Similar to the St. Johns River, the upper Oklawaha is characterized by a chain of lakes which become channelized about half way through its course in the vicinity of Moss Bluff.

Since Florida has little topographic relief, all of which is karstic in nature, drainage divides are often difficult to delineate and frequently not meaningful. This is the case with the Oklawaha's drainage basin. Geologic conditions and a limestone foundation have allowed development of a subdued karst, spring and sinkhole topography indicative of good subsurface drainage. This further complicates any definition of the Oklawaha's surface drainage pattern which is constantly subject to change.

Neither are flow rates for the Oklawaha straightforward. Since construction of the Cross Florida Barge Canal began in the 1960s , the Oklawaha has come under increasing modification and water flow management control. Three dams, at Moss Bluff, Eureka and Rodman, were built to control water level fluctuations and to provide for agricultural and navigational needs. At these dams, the river has been artificially widened, forming lake-like reservoirs. Currently, maximum flow cannot exceed 40.7 cubic metres per second (1,440 cfs) and the daily average nears this maximum at 40.4 cms (1,427 cfs). Maximum flow reported prior to canal construction and control was 161.9 cms (5,720 cfs) (Faulkner, 1970).

The lower Oklawaha is buffered on its eastern margin for approximately 40 miles by the Ocala National Forest. Since the Silver River State Park was formed along its western margin in the 1980's, protection from development along the lower Oklawaha seems relatively assured. The major physiographic feature, the Central Valley through which the river runs, has historically been an agricultural centre, especially in its upper reaches. Agricultural run-off and wastewater associated with food processing plants have severely impacted (and in some cases, still do) the waters in the drainage area causing excessive nutrient loads and reduced oxygen levels (Haslem, pers. comm. 1992).

The soils associated with the Central Valley are mainly Entisols -- very poorly drained, undeveloped soils of the flatwoods and floodplain. Along the eastern border of the river swamp is the Mount Dora Ridge, a dune largely surfaced with clean sand of aeolian origin. The associated soils are increasingly sandy and therefore excessively drained as compared to the soils to the west. These western lowlands or flatwoods soils are poorly drained sands overlying clay.

In 1989, a portion of the Oklawaha included in the study area defined above was designated as an "Outstanding Waterway" by the State of Florida, Department of Natural Resources[1]. The river's pristine nature makes it truly one of Florida's most outstanding natural resources and one worthy of protection. Ironically, the area nominated to be preserved will probably come under greater recreational pressure as a result of its nomination. Erosion-causing wakes of boats and other river craft inflict a quantifiable destruction to stream banks and also, as we shall see, to the archaeological sites they contain. Further examination of these forces at work on the ecological, biological and archaeological communities in the Oklawaha River is needed.

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[1]This segment was recognized because of its important biological, ecological and hydrological characteristics. Three out of five of its biological communities are considered by the Florida Natural Areas Inventory to be imperiled (DER, 1989). These are the scrub oak, sand pine scrub and the blackwater stream. These communities support diverse populations of fish and wildlife including endangered species. The Oklawaha is also noteworthy from an itchyological standpoint because it sustains over 100 species of fish, considerably more than similar rivers in the southeastern United States.

Cultural History and Archaeological Research in the Oklawaha River Valley

Figure 4.4 identifies five major stages through which the indigenous cultures of Florida grew and developed. They are the Paleo-Indian, Archaic, Formative, Mississippian and Acculturative (or Mission Period), each one more fully described as follows:

(1) Paleo-Indian Period -- characterized by skilled hunting of late Pleistocene megafauna with supplementary foraging for smaller game and food plants. Paleo-Indians represent the earliest migration into Florida. These nomadic people left few distinct sites, although tools and weapons characteristic of the Paleo-Indian period are found mostly at riverine sites where game were killed.

(2) Archaic Period -- People became increasingly sedentary collectors and gatherers. The large game animals had become extinct by this time and shellfish began to be exploited. Pottery making begins during the archaic period and some cultivation of plants is practiced.

(3) Formative Period -- denotes the beings of formal, settled communities, with the gradual development of more complex forms of political and religious community organizations. This period is marked by a great deal more regional diversity than had been before, largely due to more precise adaptation to differing local ecological communities.

(4) Mississippian Period -- represents a further complexity of culture resulting in part from intrusion of new ideas and agricultural differences -- namely dependence on corn, beans and squash -- and more centralized political governance, that

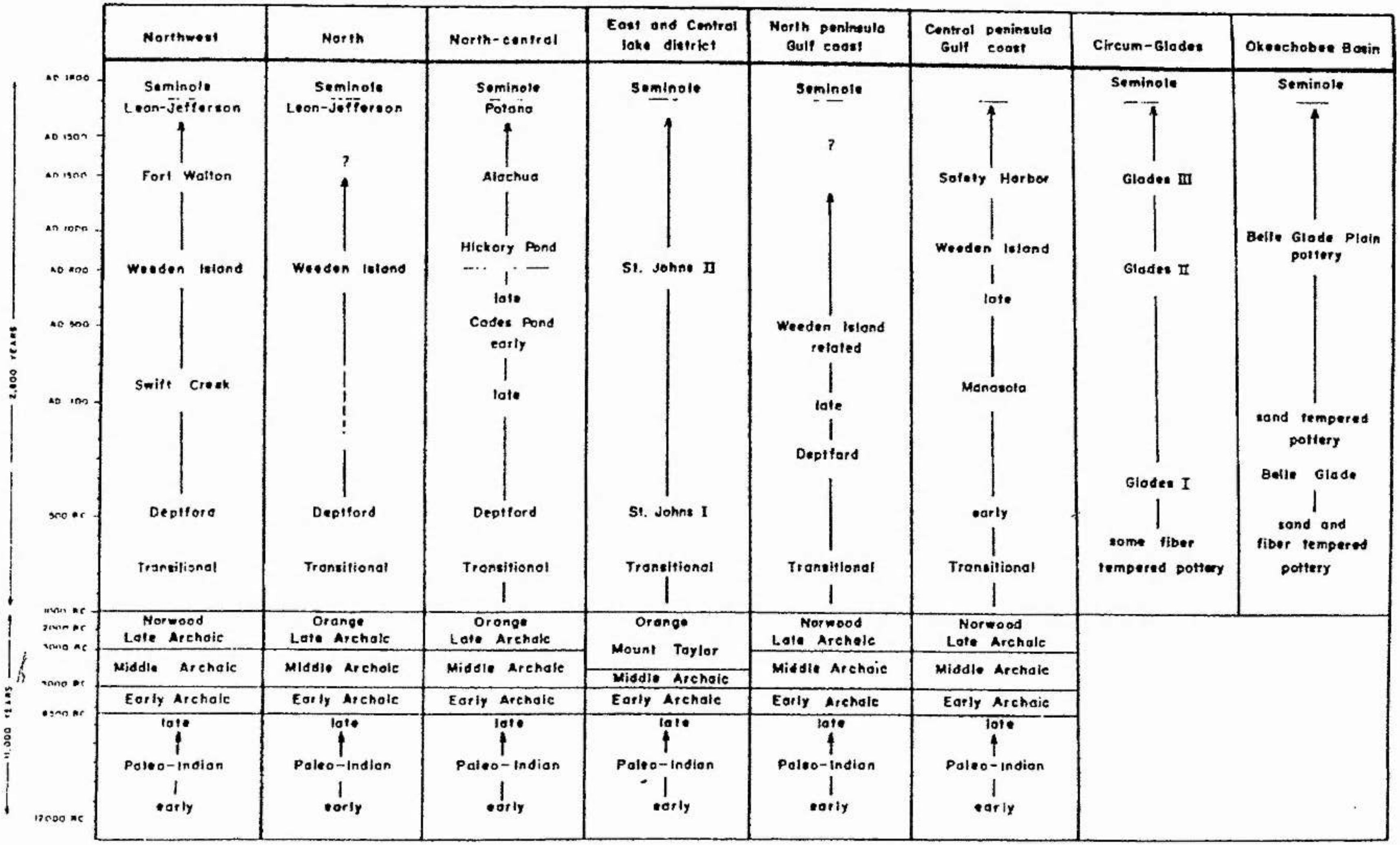

Figure 4.4 Florida's Cultural Period Chart (from Milanich and Fairbanks, 1980, 23).

ultimately came from the Mississippian cultures via the panhandle of the State.

(5) Acculturative Period -- begins with the arrival of the French and Spanish explorers and later, the colonizers. There is a marked decline in the Indian population during this period and a time of great change in their way of life. It is often called the Mission Period after the most prominent feature in its history. It is brought to a close in 1704 with British attacks that effectively brought an end to the Spanish mission system.

The chart's x axis is grouped into geographical areas defined by varied ecological factors: cultural traditions, contacts or lack of them with other peoples, plants available and their seasonal frequency, and animals that could be procured once the necessary technology was learned or developed.

The cultural zone boundaries broadly adhere to those of the drainage systems within the state. The East and Central Lake District including the Oklawaha River Basin conforms very nearly to the drainage of the St. Johns River system (Figure 4.5). The cultural periods associated with the Central and Lake District zone are the Paleo-Indian, Archaic, Mount Taylor, Orange, Transitional, St. Johns I and II and the Seminole.

Wyman (1875) and Moore (1892, 1893, 1894, 1896) provide the first accounts of archaeological examination in and around the St. Johns/Oklawaha Rivers. Their descriptive recordings of the shell mounds along the river margins form the basis of most research in the region. Goggin (1952) developed a model for the northern St. Johns basin that has held up rather well as investigations continued. Sears (1957) reported on sites along the lower St.

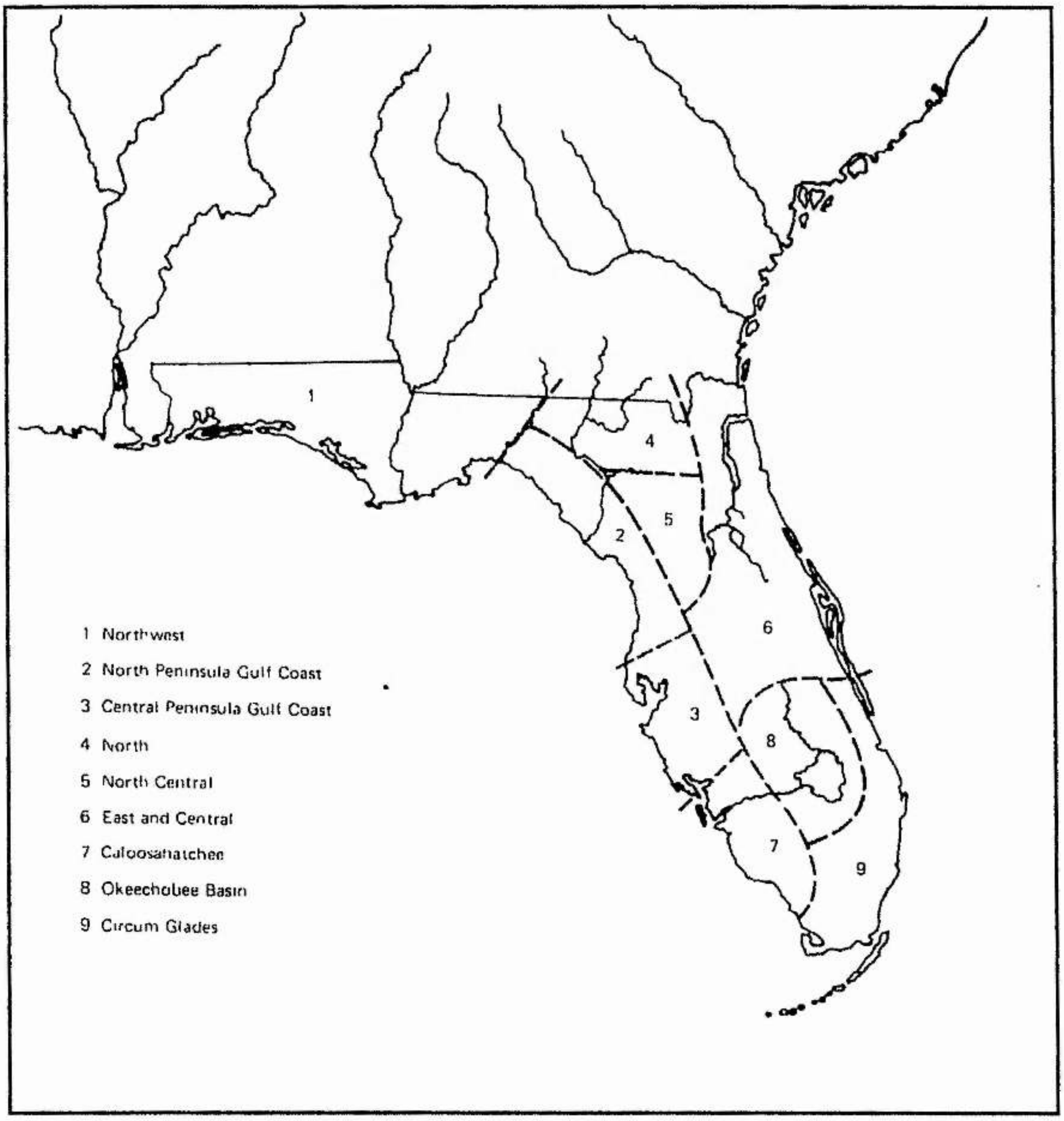

Figure 4.5 Florida's Cultural Areas (from Milanich and Fairbanks, 1980, 22).

Johns, while Fairbanks (1965) and Bullen (1966) studied the effect of Cross Florida Barge Canal construction on archaeological resources in its path. Cumbaa and Gouchnour (1970) and Bullen (1969) reported excavations at two sites within the Oklawaha River study area and research at Silver Springs (Neil, 1958; Hemmings, 1975; Hoffman, 1983) revealed one of the oldest Paleo-Indian sites ever found in Florida. Willis and Wells (1977) and Chance and

Strassburger (1977) offer more recent cultural resource management surveys of the area designed to identify archaeological sites potentially impacted by development schemes. They exemplify the nature of archaeology, or contract archaeology in the recent years. Milanich and Faibanks (1980) provide a useful and comprehensive overview to Florida's archaeology.

From an archaeological perspective, the St. Johns River valley remains one of the poorest understood areas of the fastest growing urban region in Florida. Milanich and Fairbanks (1980) describe the St. Johns region's boundaries as hazy and include the Central Florida Lake District in the discussion of the entire east coast aboriginal lifeway. From archaeological work that occurred in portions of the St. Johns basin prior to 1980, Milanich and Fairbanks produced a cultural sequence for East Florida presented in Figure 4.6. Since that time several terrestrial surveys have taken place and caused re-evaluation of these earlier concepts. It is now apparent that separate and distinctive cultural groups existed in what Milanich and Fairbanks described as one cultural zone, the East and Central Lake District (DHR, 1991, 72). Whereas previously the area had been considered of marginal archaeological interest because of its transitional role between the strong cultural centres surrounding it, now archaeologists are beginning to recognize significant and quantifiable variability in the archaeological record within this cultural zone.

These newly identified cultural groups are also defined by their geographical positions with respect to the river -- the upper St. Johns river valley, the middle St. Johns river valley, the Atlantic east coast, and the coastal St. Marys region. The differing coastal and inland environments associated with the sites were operating upon each cultural group thereby creating diversity among them. As Russo (1992: 121) has observed,

Period	Dates	Distinguishing ceramics, other traits, and cultural influences
St. Johns IIc	A.D. 1513 – 1565	St. Johns Check Stamped pottery; European artifacts in some mounds. Burial mounds still present. Severe population reductions due to European diseases.
St. Johns IIb	A.D. 1300 – 1513	St. Johns Check Stamped pottery; some Fort Walton and Safety Harbor pottery and Southeastern Ceremonial Complex objects in mounds. Mississippian influences.
St. Johns IIa	A.D. 800 – 1300	Appearance of St. Johns Check Stamped pottery in villages and mounds; increased use of burial mounds; late Weeden Island pottery and copies in some mounds; some pottery caches in mounds.
St. Johns Ib	A.D. 500 – 800	Weeden Island, Dunns Creek Red (early) and St. Johns pottery in mounds; village ceramics almost all plain St. Johns ware; Weeden Island influences.
St. Johns Ia	A.D. 100 – 500	Village pottery nearly all plain St. Johns ware; Hopewellian – Yent complex objects in early mounds; some possible log tombs. Late Deptford and Swift Creek pottery traded and copies locally manufactured; Dunns Creek Red common. Weeden Island influences appear late.
St. Johns I	500 B.C. – A.D. 100	Village pottery all St. Johns ware, both plain and incised; some Deptford pottery or copies present. Burial mounds appear for first time. All pottery coiled.
Transitional	1200 – 500 B.C.	Village pottery both fiber and mixed fiber – sand tempered; some coiled; bowls common. Decorations include incising, pinching, triangular punctuations, side-lugs. Poverty Point influences.
Orange	2000 – 1000 B.C.	First appearance of pottery; hand-molding (some coiling late); fiber-tempered. Early pottery all plain, later forms incised. Shallow, flat-bottomed bowls and rectangular vessels. First occupation of coastal lagoon.
Mount Taylor	4000 – 2000 B.C.	No pottery. Lithic projectile points mostly stemmed Archaic varieties with triangular blades, Newnan points most common. Contact with other Archaic peoples; increased sedentism.

Figure 4.6 East Florida's Cultural Sequence (from Milanich and Fairbanks, 1980, 148).

> It has been shown that both coastal and riverine sites were occupied throughout the year during the Late Archaic and the people were exploiting distinctively different resources. Thus, by definition, the people in both zones could not be the same hypothesized bands moving seasonally among resources.

Although Russo's research deals mainly with the St. Mary's region and chiefly has a coastal emphasis, he calls for further investigation within the broader cultural zone described by Milanich and Fairbanks. Societies in boundary areas are no less viable than those situated in the cultural "heartland", only more difficult to describe archaeologically (Russo, 1992, 107). His paper, like his research, nicely illustrates the role of traditional archaeological techniques in overcoming problems of chronology and spatial patterning -- for example, the use of pottery analysis, faunal and botanical studies, and absolute dating techniques. Likewise, geoarchaeology could serve to enhance the picture of prehistoric life in the St. Johns region that Russo has so carefully constructed. He concludes

> These difficulties in interpreting areas of "transition" need not dissuade us from the endeavor. Solutions ... may not only help solve practical archaeological concerns within the region, but can lead to a better archaeological understanding of diachronic questions of acculturation and diffusion (ibid., 121).

It seems apparent that rivers and drainage systems have played an important role in acculturation and diffusion of Florida's prehistoric peoples. Likewise, developing an understanding of geomorphic processes associated with the archaeology of fluvial systems deserves further consideration.

Other investigations in the upper St. Johns valley indicate a linear configuration to the settlement pattern associated with the critical resource(s) to be maximized -- in this case, the river (Sigler-Eisenberg, 1985, 54). In one study, most sites were located near the 15 foot contour and became less frequent away from the marsh/riverine system. Although the researcher hypothesized that site density would be greatest along the marsh/mesic hammock edge, no investigation of sites within the river system itself was undertaken. How might this forgone data have changed the resulting site distribution pattern?[4]

Some research in the middle St. Johns valley has come close to surveying in submerged river margins but many have stopped short. Lake Monroe in the St. Johns chain of lakes southwest of the Oklawaha study area has recently been under investigation as a wet site (Purdy, 1992). However, pumps are being used to keep the water out rather than attempting excavation in the wet. Hontoon Island, another wet site in the middle St. Johns valley, was also investigated in this manner (Purdy, 1987) several years ago. Tick Island perhaps exemplifies the worst example of professional archaeology undertaken at a wet site. Archaeological methods were limited to sieving dredged material for artefactual remains (Jahn and Bullen, 1978). After the professional "excavations" were completed, avocational archaeologists diving around Tick Island were successful in collecting in-situ artefacts from around the margins (Waller, pers. comm.). Archaeological research in the future should include examination of both portions of the site, wet and dry.

[4]Evidence from the Oklawaha River Survey suggests that as much as 40 per cent more sites might have been located along the river's margin.

History of Diving in Florida's Rivers - An Untapped Source of Evidence

The first divers to enter Florida's inland waterways in the 1960's obtained some of the finest examples and largest quantities of Paleo-Indian projectile points ever found. Centuries of river erosion had left literally thousands of archaeological objects lying on the river's bed for easy collection. From working and talking with these divers, the need for further archaeological research was evident although what it would require was not so immediately clear. A better understanding of the fluvial processes affecting the sites was necessary.

Early archaeologists faced with river diving enthusiasts and their objects did not believe that river finds were significant. They stated that archaeological material coming from rivers lacked good archaeological context. In fact, the most specific statement made about context and river finds was that the artefact had come from somewhere within the river basin itself. River finds and their contexts were not well understood by early archaeologists and therefore early river finds were deemed archaeologically insignificant.

In time, river divers began to notice patterns in the distribution of objects along the river beds but systematic recording was not commonplace. Eventually, mainstream archaeologists began to consider formational processes and their effects on archaeological sites. The Aucilla River project described in Chapter 2 was originally identified by river divers and brought to professional archaeologists' attention. The project flourished when palaeontologists and archaeologists began to work together with river divers and later, other specialists to record the archaeological deposits and the processes at work on the Page/Ladson site.

In the 1980's, questions about formation processes since the site's occupation were beginning to take precedence over collection of more archaeological material. Understanding fluvial geomorphology, how it affects the sites and our interpretation of them was becoming a necessary part of archaeological research in riverine environments. How were these sites being altered by fluvial processes and how could we extract that information? These sites and their particular problems look to geoarchaeology and multi-disciplinary research for an answer.

Methodology Needed

In 1985 a prehistoric burial was discovered eroding out of the east margin of the Oklawaha River. The efforts of local amateur archaeologist Michael Stallings and sport divers to record the site led to limited auger testing a year later. The testing was performed by the divers and an archaeologist from the Bureau of Archaeological Research. It was clear from the testing that a Early Archaic/Late Paleo-Indian (Bolen) assemblage and human remains were actively being destroyed by erosion associated with the site's location in an outer bend of an oxbow at the Piney Island (8MR848) site (Denson and Dunbar, 1992).

By means of continued monitoring at Piney Island, a quantified picture of erosional damage was gleaned (Figure 4.7). Piney Island represented a cultural resource being destroyed by natural forces. Other sites within the Oklawaha River were suffering the same fate. The need to quantify these sites in order to make informed decisions about their management seemed to be the appropriate next step. It seemed plausible to develop a methodology to locate, identify and record these sites and to develop a better understanding of such an active site transformational process as river erosion.

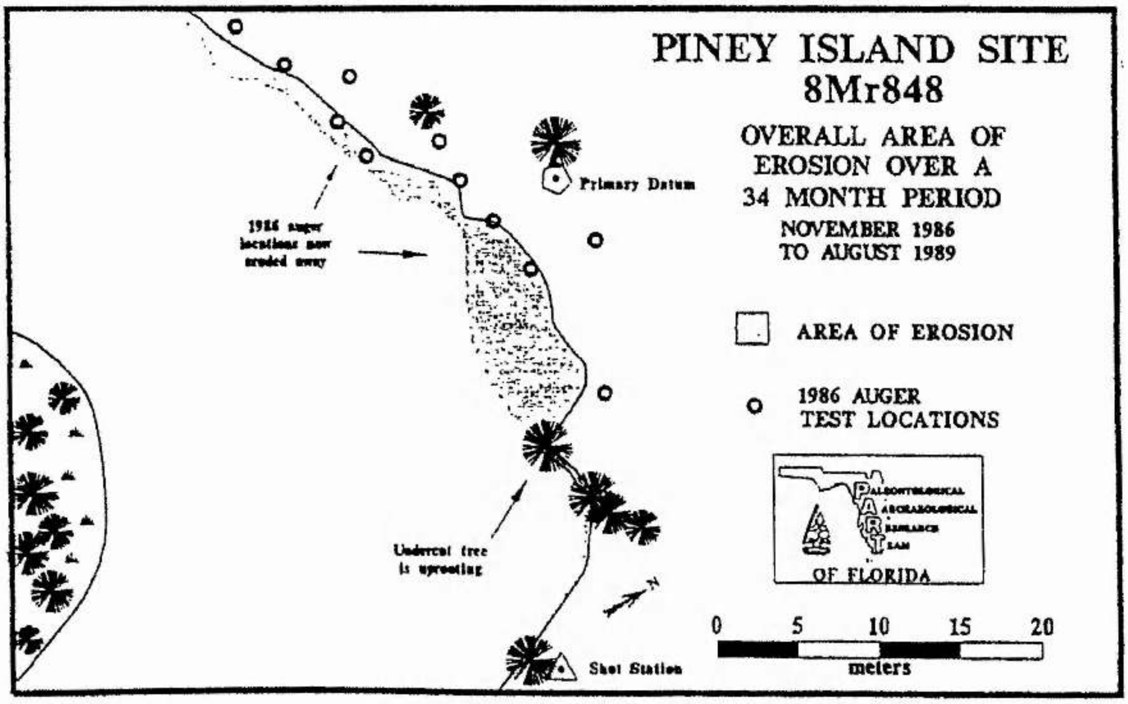

Figure 4.7 Piney Island after 34 months (from Denson and Dunbar, 1992)

Funds were needed, so in 1991 I applied through the Florida Museum of Natural History for a Historic Preservation Grant Award to perform a survey along the eroding margins of the Oklawaha. This proposal was driven by the lack of professional knowledge about erosion and the cultural resources associated with the river in that area and by strong support from amateur archaeologists familiar with the river and sites along it.

The project was financed in part with historic preservation grant assistance provided by the Bureau of Historic Preservation, Florida Department of State, assisted by the Historic Preservation Advisory Council; but, it could not have been accomplished without the assistance of numerous supporters[1]. All work presented on the

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[1]I am especialy grateful to concerned avocational archaeologists -- in particular, Michael Stallings and Ben Waller, and to Dr. William H. Marquardt of the Florida Museum of Natural History.

Oklawaha River Survey was authorized under a 1A-32 Research Permit from the Division of Historical Resources, Bureau of Archaeological Research.

For the purpose of receiving grant funds, the survey's primary objective was to locate, identify, and record sites in the defined region for inclusion in the Florida Master Site File. Due to budget constraints, the survey area was reduced to one-half its original length, allowing for nine miles of river to be investigated, from Silver River confluence to Gore's Landing. The secondary objective involved exploring a methodological approach to geoarchaeological research in river environments. The Florida research therefore served as a testing area for developing the methodology introduced in this thesis. As described in Chapters 1 through 3, a multi-disciplinary approach was necessary -- with soil analysis, geomorphic and palaeontological studies integrated with archaeological research. Only then could a better understanding of the Late Pleistocene and Holocene environments experienced by the early inhabitants of the Oklawaha River valley be attained.

After defining the natural processes at work in the river system, I had hoped that understanding the associated archaeological record and its "stray find" reputation would be less difficult. Then models that characterize the effects of fluvial processes on archaeological sites could be constructed so that effective management of sites located along river margins and their floodplains could be developed. The ultimate goal was to gain a better understanding of the natural environment and the geomorphological processes going on within it in order to better understand past cultural interaction.

The Oklawaha River Survey Database (Appendix 3)

The Oklawaha River study area comprises 19 miles (30 kilometres) beginning at the confluence of the Silver River flowing downstream (north) to Eureka dam and bridge constructed as part of the Cross Florida Barge Canal Project. It is an environmentally contiguous parcel of land now under the protection of various state agencies responsible for preservation and maintenance of Florida's natural resources. Sites located within a two mile radius of the river including those associated with its tributaries or creeks were entered into a relational database. Nearly all 54 sites were within one mile of the present channel, its floodplain not extending more than one mile in either direction.

Since the Oklawaha River study area is included in Canal lands, the Oklawaha River study area database (54 records) shown in Appendix 3 was taken from the larger data set constructed for the Canal Lands Assessment Project (See Denson and Ellis, 1991) and includes the 11 sites identified by the Oklawaha River Survey. It is therefore pertinent to discuss the data collected during the Canal lands project and assess its quality since this project offers a larger sample of the Master Site File's (MSF) records to review.

The original database was a monstrous 342 records of sites located within the Canal lands and was prepared for the University of Florida as part of a management plan for the Canal Authority and the Department of Natural Resources of the State of Florida. An easy-to-use recording form was designed which incorporated key elements from each of the MSF records. The structure of that database and form is presented in Appendix 1.

The Canal Lands Assessment Project database addressed site name, number, type/function, and cultural affiliation, locational information, site investigation type, size and integrity, and information on cultural materials and features present at each site. These data were obtained directly from MSF records. The Cross Florida Barge Canal archaeological site form in Appendix 1 also allowed for the principal investigators to make recommendations for site significance and management when the strength and quality of the information was sufficient.

Careful review of the MSF's quadrangle maps revealed a few inconsistencies such as duplicate site numbers, non-documented sites and non-existent sites. Review of the individual site inventory records led to some further discoveries. The majority of sites recorded on cards prior to 1970 did not contain very specific locational and cultural information. A large number of the earliest investigated sites by Wyman (1875) and Moore (1895) were later relocated and surveyed by Bullen and Fairbanks during the mid-1960's when the first archaeological survey of the proposed canal lands took place.

A number of the post mid-1960's sites were recorded by professional archaeologists working on Ocala National Forest lands located along the entire eastern margin of the study area. Basically, they were operating as archaeological impact assessors trying to stay one step ahead of the pipe lines. This is a reflection of the U.S. Department of Agriculture's Division of Forest Services' committment to locate, identify, and evaluate sites on federal lands in compliance with the National Historic Preservation Act (16 U.S.C. 470, et seq.) and Executive Order 11953 (1971). Unfortunately this impact-related survey has taken place to the exclusion of any other archaelogical research even when Division of Forestry archaeologists knew of important sites being destroyed by looters (Willis, pers. comm. 1990). There were too many pipelines, too many looters and not enough archaeologists to go around.

The products of pre- and post- 1970 archaeological survey can be gleaned from the MSF record by looking at the kinds of sites which were recorded. The pre-1970 surveys emphasize prehistoric sites, particularly middens, shell middens, mounds, and lithic scatters. The post-1970 pattern continues the trend toward the recording of prehistoric shell middens, mounds, and lithic scatters but clearly shifts its emphasis toward historic refuse and artifact scatter sites as well as industrial and special purpose sites such as moonshine stills and turpentine stations. This may be, in part, attributed to the developing impact-oriented nature of government policy on archaeological survey described above.

Geo-physical and natural contextual information for each site was obtained first from locational information provided by the MSF and then verified by other professional sources when available. Soil series data was taken directly from the soils survey books published by the Soil Conservation Service (SCS, 1979; n.d.). Topographic and landform data were presented on the site forms but with little or no consistency between surveyors. Their comments were verified and standarized through soil surveys, quadrangle position and the evaluation of the related physiographic data. The physiographic data for each site were taken from Soil and Water Conservation Society (1989).

The codes for the "Sitetypes" and "Cultures" fields excluding the "Culture8" field described below were given directly by the MSF records. While the codes were designed to permit discrete distinctions between artifact assemblages it seems that this was not always the case at the time of form completion. To correct for this inconsistency, the Culture8 field was reconfigured to assign gross cultural component data and to allow sorting by this characteristic. The symbols in the Culture8 field and their corresponding number of sites within the Oklawaha River study area are identified as follows: P (N=36) prehistoric, PA (N=1) prehistoric with a historic aboriginal component, H (N=5) historic Euroamerican, HA (N=Ø) historic Euroamerican with a historic aboriginal component, M(N=1) multicomponent prehistoric and non-aboriginal historic component and UN (N=11) indeterminate. The majority of the indeterminate sites may fall within prehistory, but as with the majority of the prehistoric sites, a more refined appraisal is not possible within the analysis of field and technical reports relating to their discovery and investigation where they exist.

The majority of the known sites are prehistoric (N=36) and characterized within the MSF as lithic scatters (SCLI, N=12), artefact scatters (SCAR, N=6), middens (MIDD, N=2)), shell middens (MDSH, N=7), and mounds (MOUN, N=6). In addition, there were two sites identified as HABI (habitation) and one remaining site at Piney Island identified as BURP (Burial, prehistoric). The principal investigators believe that the large number of lithic scatters might actually represent a more diverse group of site types. Given the multi-component temporal-cultural nature of these sites -- that is, the sequential or repeated occupation of landforms by distinct and time-displaced cultures -- it is probable that a number of the multicomponment sites are, in fact, different sites at the same location.

Pre-Survey Investigation

There were several sources of information concerning the potential location for sites along the survey area. Information from amateur archaeologists was crucial to the planning stage. In particular, Michael Stallings and Ben Waller offered maps and information about sites in the area and agreed to their associated collections being recorded. The available literature came from archaeological research associated with the Silver River, construction of the

Cross Florida Barge Canal and two sites within the survey area itself -- Colby Landing (Cumbaa and Gouchnour, 1970) and Sunday Bluff (Bullen, 1969). Historical references were associated with the steamboat era along the Oklawaha River (Mitchell, 1947; Mueller, 1988). The Master Site File offered information on 43 sites, only four of which were associated with the river margins. We re-visited these four areas and provided the appropriate updates to the Master Site File Office.

The final pre-survey action entailed obtaining an aerial view of the river valley (Figure 4.8). The evidence of channel switching was grossly apparent from this perspective. Would the ages of the sites along what were now creeks differ from those along the river's main channel? Known sites along the margins of Cedar and Turkey creeks are numerous. Survey in these areas was warranted but poor water conditions, time and financial constraints were too great. Therefore, the creeks within the study area were not included in this survey.

Survey Techniques

The judgmental sampling strategy required that the nine-mile stretch of river be broken into 18 one-half mile sectors. Two eroding margins and one straight-away within each sector would be visually inspected for cultural material. The purpose of checking the straight-away units was to account for our biased search for sites in the eroding margins. However, since this was the area where sites were being actively destroyed and information lost, this met the purpose defined by the survey's secondary objective. Over 30 units within the 18 sectors were visually inspected. In ten sectors, all units were inspected. In two sectors no visual inspection occurred since channel modification through dredging was known to have occurred in the 1800s. The remaining six sectors

Figure 4.8 Oklawaha River at Turkey creek confluence (R. Denson, photo).

were partially inspected due to pre-survey information which led to our knowing of a site's existence. Time and working conditions towards the project's end dictated that we record the known sites to the exclusion of the sampling design in order to fulfil our primary objective. All the new sites were located in areas of a river bend where active fluvial erosion was at its greatest. Only one site was located in a straight-away and that one was being eroded from a tree fall upstream.

Once an eroding unit or a straight-away had been selected for inspection, a subsurface reconnaissance of the river channel was undertaken. When cultural materials or bone beds were located, the diver released a buoy to the surface and followed the scatter upstream. At its upstream terminus, a five-metre-square grid would be placed along the bottom. In cases where the scatter exceeded the five metre square area, a baseline would be appropriately laid to allow collection in metre increments. In most cases surface collection was the rule. However, hand fanning to a depth no greater than 20 centimetres was utilized in some cases. Terrestrial test pits were placed at some sites along the river margin to determine the distribution of materials across the land/water interface. Land crews performed surface inspections of sites located beside dry ground.

Each site's height datum was established in a fashion similar to terrestrial archaeology. A change in apparatus to a capillary gauge or bubble tube (similar to a water level in air) was needed to cope with water heights above given points, usually the four corners of the grid, the baseline termini and any significant topographic features. Then water level was correlated with site height datum through the use of a conventional transit and stadia rod.

The working conditions on the river during the 20-day field project were less than excellent. Current flow and low visibility due to tannin stain in the water made our survey comparable to performing a terrestrial survey at night, in a gale force wind, with a flash light. In most cases the visible distance was within five feet or less. Needless to say, these conditions imposed a strict rigor on our technical ability to accomplish the stated objectives. Pre-set five-metre lines were constructed to ease the problem of placing a five by five metre grid squarely. It is probable that the results of our survey would be different if visibility had been more favourable. However, this is not to say that the survey was ineffective, just that our effectiveness was limited by these less than optimal conditions.

The Crew

The core diving team consisted of six full time and three part time crew members ranging in skills from archaeologist -- both professional and avocational -- to sport divers with and some without archaeological diving experience. My role as project director entailed administrative, managerial, research design development and curatorial functions. Specialist input was contracted for botanical and soil analysis, conservation and curation, and radiocarbon dating. Volunteers were recruited for back-up support. All crew members and volunteers were obliged to attend two weekend training sessions based on a course by the Nautical Archaeology Society designed to standardize the diver's skills, safety, and vocabulary and to inform all participants about the survey objectives and techniques.

Two "open tent" days were held during the field work to inform the public about the project, techniques in river survey, and the need for better community cultural resource management. Persons with information about sites in the area were encouraged to attend. Cumulatively, over 150 people attended the two open days as well as staff members from the Florida Museum of Natural History and the Bureaus of Historic Preservation and Archaeological Research. Two local television news reports about the project and several newspaper releases maintained the local public's awareness of the project.

There were 20 volunteer non-diving participants assisting with the surface jobs related to the underwater survey activity. Their jobs included finds recording, dive log entry, land crew activities, and boat tending. Over 161 (eight-hour) days or 1,291 hours of time were donated by the volunteers. The non-diving volunteers accounted for 499 hours while the remaining 792 were volunteered by the diving crew.[1] The average bottom time each day was 9.11 man hours. The average number of divers to enter the water each day was 5.1 with each entry lasting an average of 59 minutes.

The following description and summary are offered for each of the eleven new sites and three updates to known sites recorded during the survey. They are listed in geographical order starting with the southernmost locality and moving north through the defined survey area. Appendix 4 contains the Master Site File forms for each site.

THE SITES

8MR57 Colby Site (update)

The original investigation at the Colby site as reported by Cumbaa and Gouchnour (1970) does not point to the river as an active agent of erosion to the site. Our investigation affirmed this observation. The site is situated on a bluff located on the interior edge of a river meander and therefore is not being subjected to the greatest erosive forces. We were able visually to inspect both the upper and lower portions of the river associated with the site.

The lower section has been shored up or reinforced with large concrete blocks which have altered the natural flow and redirected

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[1]Although the full time diving crew volunteered their labour, they were paid for use of their equipment.

the strongest lateral-eroding current into the centre of the channel. At this point the water depth is 28 feet. This scour appears to be a result of the current's erosive action. This water depth was not equalled at any other location along the nine miles of channel surveyed. There does appear to be a greater concentration of shell material shifting in the bedload on the downstream side of the site, perhaps indicating that some erosion of the midden has occurred.

The upstream portion of the river associated with the site was later investigated after an interview with the property owner, Mr. Frances Gay, who pinpointed the location of the terrestrial site testing at Colby. Mr. Gay stated that the 28-foot hole on the downstream side of the site had been in the channel prior to the placement of the concrete blocks and that occasionally it was known to "blow back". It seems reasonable to suggest that the Floridan aquifer comes close to the ground surface at this point and on occasions discharges water into the rivers' flow. Could this hole have been more active as a spring, now plugged that served as a resource to the inhabitants of the long-occupied site at Colby bluff?

The depositional nature of the upstream area was not suited for identifying eroding cultural material by visual surface inspection. The channel appears to be infilling along the river's edge associated with the site as evidenced by a two foot thick layer of shifting sand deposited there. The collection of lithics from the river was sparse, consisting of three reduction flakes. Two flakes had no cortex and no evidence of heat treating was visible on any of the flakes.

8MR2061. Carter Site; artifact scatter

The site's location in a meander of the floodplain unassociated with any high, dry land made its identification particularly significant. It is possible that this site has recently been "excavated" by the current due to a tree falling across the channel which has deflected the river flow into the channel bed. This is significant because the site is located above the margin of the bend actually being affected by erosion from lateral migration or meandering. A small area above the site also showed a small peat wall being eroded which may represent the original depositional environment of the eroding material. The peat is characterized as a fibrous peat with quantities of rootmass and plant fiber indicative of a shallow, low energy condition such as occurs in a marsh or river edge/bend environment, but without much influence from surrounding upland environments. Seeds of spatter-dock (waterlily family) and other slow water aquatics are present as are remains of bald cypress, and the shrubs buttonbush and wax myrtle that occur along Florida's river margins. However, no cultural evidence was observed in the peat.

We were unable conclusively to identify the original context of the cultural material due to poor visibility and the need to minimize time spent on each site once located. Our observations of the upstream area indicate that the site's original context was reasonably close to the location selected for placement of the five-metre-square grid. The eroding site was located in the second turn of a series of small meanders cut through the low-lying river swamp topography. No cultural material was observed either upstream or downstream of turn two. This evidence suggests that cultural material is not moving any further than one meander's length downstream.

The presence of Pleistocene megafauna in association with an Edgefield scraper (c.10,000 years) highlighted the potential importance of this late-Paleoindian site. Both the Edgefield and the unifacial scraper found nearby have use-wear along their primary edges. The Edgefield is only lightly used in comparison with other Edgefields in the Florida Museum of Natural History collection from other sites. Two parts of a horn core base from a bison were found and one shows evidence of cut marks. The cut marks and lithics strongly suggest that the area was a kill site. Giant armadillo and sloth were also represented. There were two modified deer tibia in the form of bone pins. Another peculiar bone was the shed horn of a white-tailed deer probably dropped in the winter or early spring. Its weight of 248 grams and eight inch (21 cm) length makes it an extremely large specimen.

The total amount of bone material from this site compared to the others is also noteworthy. There were 47 pieces of bone material collected within a five-metre-square grid and along a six-metre appended baseline running downstream. Differing preservational environments were indicated by variation in color and texture among the bones of the late Pleistocene animals and those of the modern species. The characterization of a second peat sample from the same site is potentially significant to this observation. It was described as a more woody peat with twigs, and small wood fragments being abundantly represented. Further field investigation and depositional analysis of this site are warranted.

8MR2060 DiCarlo Site; lithic scatter

This site is located along a straight-away on the east margin of the river where the elevation rises slowly from the river level up to 50 feet several hundred yards away. The surrounding area has been cleared and a grassy meadow now exists. The site seems to be partially eroding from this grassy bank at a point being weakened in the bank by a deflected current from a fallen tree. The presence of the fallen tree upstream from the artifact scatter has scoured a trough along the margin of the river uncovering the artifacts.

The distribution of finds shows that the majority come from within a one metre radius of each other with a small number being carried further downstream. Fifteen areas, each a metre square, were visually inspected and mapped in relation to a five metre baseline laid along the axis of the trough. There were 36 lithic artifacts and two pieces of glazed pottery indicating a disturbed or secondary depositional environment. A couple of pieces of debitage were also found along the perimeter of the bank just below the level of the water, indicating the bank as the potential source of the eroded material in the channel.

Lithic artifacts from the site included a bifacially worked Cobb-like preform, an end scraper, two bifacially worked bases of points, 16 thinning flakes and 16 reduction flakes. None of the bifacially worked tools or the thinning flakes had cortex. Twelve of the reduction flakes and the end scraper had cortex. Only two of the flakes showed signs of heat treatment. The two bifaces and the end scraper showed signs of use. The mixture of heat-treated and regular thinning flakes suggests that the site had an occupation spanning the Early to Late Pre-Ceramic Archaic (6,500 - 3,000 years BP). The even division between decortication/reduction flakes and thinning flakes, along with the presence of other stages of lithic tool manufacture, suggests that the site was used for all stages of chert tool manufacture and use.

8MR2067 Olsen Site; historic shipwreck

The location of this wreck in low lying sandy mud of the Oklawaha's west bank was made known by a sport diver who had heard about the Oklawaha River Survey from the pre-survey publicity and subsequently joined our crew as a volunteer. The submerged length was 12.9 metres and 4.6 - 4.9 metres wide. The hull planking was 16 cm wide, 7 cm thick and fashioned with metal pins at 60 cm intervals. Cypress trees are growing from the centre of the vessel. Probing indicates a deck structure 40 cm below the sandy mud in the northeast centre section and up to one metre below the sandy mud in the southeast centre section.

On the adjacent bank and approximately 13 metres from the river margin, there are the remains of a steam engine boiler. For the purpose of reporting, we considered the ship and the boiler to be one site and have located and recorded the positions of both finds. Although standard sources were consulted (e.g. Mitchell, 1947; Mueller, 1988) our information is insufficient to indicate the relationship of the hull structure to the boiler or to identify the vessel type.

8MR2062 Backcurrent Site; lithic scatter

The lack of any bone or pottery at this site is unique in this survey. Its location in a 90 degree bend of the river and at a junction with a small creek is also significant. A five metre square grid was placed at the base of a wall face being eroded by the current as it changed course through the turn. A visual inspection upstream of this point, in a backcurrent, still-water environment showed no evidence of cultural material. Downstream, a baseline was placed in the trough running for a distance of 12 metres.

Finds distribution showed the concentration extended the width of the 5 metre square grid perpendicular to the river margin but only remained concentrated for two metres. Within the grid, 29 lithic artifacts were collected including debitage, flake tools, a thumbnail scraper and a hammerstone. The baseline yielded only four lithic flakes. A land crew visually inspected the surrounding territory for signs of cultural activity. Two one-half metre test pits were dug to a depth of 75 cm approximately one-half metre from the river's margin and in line with the underwater grid. The test pits yielded a total of 18 pressure flakes, none with use wear. The stratigraphy showed a dark humus at 20 cm changing to a light yellow sand. At 50 cm below the surface, a reddish, sandy-clay matrix emerged. Flakes from the top 20 cm were interspersed with glass fragments. Below that level, the flakes were not found in association with historical material. No other types of cultural material were found in the test pits in association with the pressure flakes suggesting the site was not occupied in the Ceramic period. The complete lack of pottery fragments on the remainder of the site would tend to confirm this hypothesis.

Because no ceramics are associated with the lithic scatter, it seems most likely that this site was occupied only during the pre-Ceramic period (pre-3,000 years BP). The small turtle-back scraper and other unifacial scrapers favour an earlier rather than a later date during that period. Only three of the flakes had clear signs of heat alteration further suggesting that the principal period of occupation was prior to the introduction of ceramics. A full range of debitage is found on the site, from decortication flakes to an attempted biface. This indicates a lithic workshop of some kind. The hammerstone seems to support this conclusion as well. However, without vertical control of the artifact locations, it is impossible to establish temporal interrelationships of the artifacts with any great certainty.

8MR2063 Turkey Landing; artifact/lithic scatter

The terrestrial site at Turkey Landing appears to be well known by pothunters. The area is heavily pock marked, especially the level ground at the highest elevations and the bluff on the north/northwest part of the high, dry ground. Over the entire area, there were numerous chert flakes on the surface.

The river channel associated with the site was surveyed utilizing a five-metre-square grid laid in the trough at a water depth of eleven to 13 feet. A seven metre baseline was extended upstream of the grid and another was run along a consolidated sand shelf which rested in 5 to 6 feet of water next to the river margin. The finds were evenly distributed along the baselines and throughout the five metre square grid.

No diagnostic artifacts were found in either the land test pits or river survey although three modified deer bones and one additional charred deer bone were found in the grid. One notable deer calcaneum exhibited cut marks on the distal end that suggests butchering activity. The land test pit yielded 39 fragments of debitage and 57 bone fragments of fish, turtle, and snake. Of the 39 flakes, 30 were pressure or retouch flakes and none had signs of use. A single, bifacially-worked, snapped stem was found. It appears to be a stem from an Archaic stemmed projectile point.

Three areas along the bank had formed small beaches with sloping sand bottoms. These areas were each two to four metres wide and subject to wake washing. The sand in these areas was sifted for lithics. The river margin yielded 5 chert flakes, one altered by heat, and 50 bone fragments of turtle, fish, snake, and deer.

The underwater baseline offered six pieces of chert and four of bone. The five-metre-square grid in the trough yielded 16 pieces of chert including one heavily used scraper and three flakes with use wear. Eighty bone fragments of deer, snake, turtle, raccoon, sloth, alligator, and fish, and one pot sherd of Dunns Creek Red also came from the grid.

The principal period of occupation seems to be during the pre-Ceramic Archaic (6,500 - 3,000 BP). The large amount of faunal material indicates a reliance on vertebrate fauna rather than shellfish which are notably absent from the test pit and the shallow bank deposits. Overall, the distribution of finds remained consistent across the water/land interface. The large number of flakes found in the river bank suggests that lithics found in the surface layers of the bottom are eroding from the bank. Even though we failed to find similar numbers of pressure flakes underwater as were found on land, this is probably because we did not screen the material from the underwater grid. Note should be made that the underwater survey at Turkey Landing included hand fanning to a maximum depth of 20 cm.[7]

8MR2064 Conner Landing; steamboat landing/mission/canoes

The multi-component nature of this site is evident from its brief description above and its associated Master Site File number 8MR97 described as a lithic scatter by Ripley Bullen in 1965. The steamboat landing exemplifies a historic refuse pile of debris either deliberately or accidentally interred in the water. Subsequent discussions with Ben Waller highlighted the fact that this site has been known for a long period of time. Thus, this survey basically involved mapping the material which other divers

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[7]This location was the first area worked by the survey crew and hand fanning seemed appropriate given the dispersed nature of the site. Subsequent sites were not necessarily worked in this fashion.

had chosen to leave behind - mostly broken glass from bottles,bricks, pottery, metal and wood.

Ben Waller's collection from this site includes a bell that appears to be an authentic Spanish mission bell as compared with two others located in the Florida Museum of Natural History's collections. It is possible that the mission site might be located in the vicinity of this landing along the higher elevation set back off the river a short distance. Or perhaps the bell was lost overboard at Conner Landing after being displaced from its original mission site. Further investigation should provide information on this question.

Canoes eroding from the peat deposit are being pounded by the current changing direction in the crook of the river's bend. The two canoes were both made from Cypress Taxodium -- a plentiful resource in the Oklawaha River basin.[1] The lower-most canoe was radiocarbon dated to A.D. 1230 + 50 years: this date was C-13 adjusted to A.D. 1260-1284. There were two pottery types associated with the canoe and the peat -- Sand-tempered Plain and St. Johns scored. The peat below the canoes produced a radiocarbon date of A.D. 390 + 50 years which C-13 adjusted to A.D. 535-638.

Composition of the peat sample collected approximately 30 feet downstream has a greater proportion of fine, silty sediment than that of the three other peat samples analyzed from the project area. However, many of the same plant species, or species with the same or overlapping niches, such as shallow-water aquatics or species inhabiting marshy shores are shared with the Carter site (8MR20612) peat sample. One small fragment of metal was recovered

[1]No other canoes of cypress have been identified in any area of Florida except the Oklawaha River basin (Newsom and Purdy, 1990).

from this peat sample. This is noteworthy as its presence may indicate that some form of mixing or modern disturbance of the peat strata has occurred. No lithic artifacts were recovered.

Jim Dunbar, an underwater archaeologist with the BAR, has film footage from a survey undertaken in 1982 possibly of these same canoes being eroded by the river at that time. An erosion monitoring program designed to collect information on the rate and nature of the site's destruction would further improve our developing picture of this site's exposure. Sport divers in the local community have expressed interest in undertaking this task as part of their Nautical Archaeology Society's Part Two training course.

8MR1869 Caldwell Landing (update)

A rather brief visual inspection of the river margin associated with this site yielded little concentration of cultural material, mostly chert and some pottery. Only five lithic artifacts were collected including a heavily used scraper snapped in half. Three others were expedient scraper/flakes with various degrees of use wear. As at the site at Conner Landing, the river margin is running parallel to a 50 foot ridge set back off the river a short distance. The ground gently slopes down from the ridge towards the river and at their interface (unlike the Conner Landing site) the river is 12 to 15 feet below the ground surface. While there may be a site in the area, it is almost certainly removed from the river bank a considerable distance.

8MR2077 Strouds Creek; shell midden

Many shell middens occur along the length of the Oklawaha. This midden is located across from Strouds Creek and is eroding into the river. The underwater bank slopes gently down from the site and is characterized by numerous matted roots protruding into the river. Lithic artifacts were found in a fairly tight grouping around the midden. Three scrapers and two waste flakes comprise the collection. One of the scrapers is bifacially flaked, ten cm long by 2.5 cm wide. Another scraper has the typical spokeshave configuration.

Our investigation of this site was limited due to locating the site on the last day of fieldwork. A general surface collection was obtained in order to produce a representative sample of material from the site. Besides the chert, 14 sherds of pottery -- Sand-tempered Plain and St. Johns plain, and the bones of deer, turtle, and alligator were recovered. Placement of a five-metre-square grid was appropriate for collection at this site, but there was not sufficient time to do so. Further work at this site could address its use as an archaeological indicator of river shift as well as help to develop a regional model of people and resource movement during the Ceramic period.

A visual inspection of the site after the fieldwork had concluded and the visibility cleared showed that the downstream distribution of material was limited. Approximately one-half of the midden has been eroded by the action of the river.

The site's position in the floodplain of the river situated away from dry, high land is interesting. Its comparison with another midden (8MR2068) being eroded by the river within one-quarter mile of this site, and located on the same landform associated with the river begs the question as to whether these sites are contemporaneous. However, this site shows greater deterioration of the shell material, more erosion of a smaller midden and generally poorer preservation of the bone material.

8MR2065 Stallings Site; lithic scatter

The predominant materials associated with this site are lithic artifacts and bone, shell, and pottery, such as are found at the next site discussed, Durisoe shell mound (8MR2068), located just downstream. Both these sites are found as the Oklawaha nears the middle of the Oklawaha River valley. Three creeks or tributaries flow into the river within a one-half mile radius of this area. Stallings Site and Durisoe Shell Mound were collected and reported separately.

At the Stallings site, the collection strategy allowed for survey on either side of a 16-metre baseline aligned through the center of the channel. Along the main concentration of material travelling up the bank at its most downstream point a pendant or amulet was found. The pendant may in fact be an artifact related to fishing technology rather than an item of decorative use. It appears to be made of slate three cm long by one cm wide and drilled predominantly from one side.

There was a wall along the outer edge of the river bend which appeared to have in-place bone material eroding out at a water depth of six feet. The water depth at the baseline's channel terminus was 18 feet sloping up to 14 feet at the base of a six foot wall from whence a stair-stepped appearance began its way up towards the waterline.

The lithic assemblage includes two bifacial tools, three unifacial tools, and 56 pieces of chert debitage. The bone from this area included two pieces of modified deer and another showing subaerial weather cracking. In addition, there were 35 fragments of bone from turtle, snake, frog, possum, fox, and deer.

Although the artifacts collected during the survey were not indicative of the site's age, amateur archaeological diver Michael Stallings has collected Bolen age (9,000 - 10,000 years BP) points from the site along with other well preserved bone. There was an even distribution of finds along the baseline and on either side of it.

Following the river margin upstream from the baseline's point of origin, a creek flows into the river. A test pit placed near the confluence of the river and creek yielded nine bone fragments of turtle, snake, and frog as well as four pieces of chert debitage. It appears that early occupation of this site might have been followed by a downstream shift to the location of the shell midden reported in 8MR2068.

8MR2068 Durisoe; lithic scatter/shell midden

The shell midden at Durisoe graphically represents the effect of erosion on archaeological sites. The midden has been cut by the water since the Middle Archaic and serves as an archaeological indicator of river shift. The post-survey analysis section on soil science discusses the use of total phosphorus counts as an indicator of past human occupation and activity at this site. Phosphorus is suitable not only for locating archaeological sites, but also can be used to estimate population size, duration, and intensity of settlement (Proudfoot, 1976; DHR, 1991, 44).

A profile in the midden has showed an interesting deposit at the base of the midden just below the midden/water interface. The calcium carbonate from the shell has leached down through the midden to form a calcitic-limestone looking layer at its base. This horizon is resting on a sand horizon fining upwards and decreasing in calcite with depth. The presence of this calcitic layer was indicative of the original size of the midden being eroded. A close inspection of the midden surface at the water interface to estimate the midden's size was accentuated by the abrupt absence of the calcitic horizon. From this method it was possible to estimate that approximately one-third of the midden has been displaced by the river.

A five-metre-square grid was placed at the bottom of a 13 foot trough aligned with the river margin and sloping from the waterline down to seven feet where a six foot wall drops into the trough. The finds appeared to be slipping down the sloping margin and falling into the river's trough where they may be carried downstream only a short distance -- under ten metres. A large amount of bone was collected -- over 100 pieces of raccoon, deer, turtle, fish, rabbit, alligator, snake, and possum. One modified bone along with 24 pot sherds described as Orange Plain, Sand-tempered Plain and St. Johns Plain were collected. The lithic artifacts, totaling 49, were mostly undiagnostic except for one Putnam type, Middle Archaic stemmed point.

Three post hole test pits along the land portion of the midden produced mostly bone with very little pottery and lithic material. The amount of bone seemed greater at the midden's centre -- the high point at the river margin -- and became less concentrated from post holes farther away from the river. A total of 93 bones from fish, snake, box turtle, bird, rabbit, and dog were identified along with four pot sherds, one of semi-fibre tempered chalkware, three of Sand-tempered Plain and two pieces of undiagnostic chert.

8MR2Ø76 Osceola Landing; artifact scatter

The river channel associated with this high bluff called Osceola Landing has infilled over the course of the last ten years. What once was a rubble bottom littered with cultural debris has now been covered over with a two foot thickness of sand within the bend of the river. At the beginning of the straight-away and downstream from the highest portion of the bluff, the river depth drops from six to eight feet and the rubble bottom resumes for a short distance. A general surface collection in this area of the river was selected as a representative sample of the type of material associated with this site. Twenty-five lithic artifacts including two bifacial scrapers, one unifacial scraper, five utilized flakes and 42 pot sherds of Sand-tempered Plain, St. Johns Plain and Chattahoochee were collected within a small surface area in the rubble zone.

Further downstream from the collection area, there was a peat shelf stretching across the entire width of the river channel. Examination of this predominantly degraded leafy tissue offered a different scenario to its depositional regime. The sample was distinctive in having additional tree species represented, including swamp dogwood, ironwood, and hickory, along with the aquatic and river-edge taxa. The combined assemblage of trees, grape vine and a small legume is suggestive more of the surrounding terrestrial environment than the vegetation of the river itself. The bluff or some amount of slope in the vicinity of this peat sample may have resulted in the mixture of terrestrial and damp ground vegetation observed. A greater frequency of charcoal, including live oak, which occurs on better-drained soils, is supportive of a slope-wash situation contributing to the formation of this peat. Small fragments of fish bone and one larger fragment of mammal bone were also recovered from this sample.

Inspection of the bluff produced no cultural material. Most of the bluff consisted of a thin layer of soil overlying a clay horizon. It seems likely that the slowed stream velocity due to the Cross Florida Barge Canal management practices has led to increased sedimentation at this bend. It is not clear whether the site was once situated on the top of the bluff or along its margins at elevations closer to the river's elevation. Sheet erosion seems to have played an important part in the formation of this site, perhaps to a greater extent than that of lateral erosion from river shift. Further discussion of this process and this site is presented in the post-survey analysis section of this chapter and Chapter 6.

8MR44 shell midden (update)

This site was originally collected in 1944 and reported in the Master Site File by Goggin in 1957. A river survey of the margin associated with this site showed no marked evidence of a midden's being in the area. The visual inspection did not indicate grid collection was warranted in that only one pot sherd of Sand-tempered Plain, one bone point, and six turtle bones were identified and recovered.

8MR2066 Gore's Landing; artifact scatter/logging centre/barge

The river channel and margin at the present location of Gore's Landing is littered with evidence of past logging activity. A visual inspection of the river and the surrounding landing showed the location of a slipway running down to the water's edge for loading timber. There were chains, logging spikes and other associated metal fasteners in the river channel. No grid was established or materials collected. On the final day of camp breakdown, two crew members identified a barge on the opposite side of the river and just downstream from the slipway. One sherd of St. Johns Plain and a ceramic bead were located along the water's edge at the slipway.

Michael Stallings reports that, like the site at Osceola Landing, the river downstream from the slipway site has infilled with sand within the past five years, covering over other cultural material eroded from the landing.

Post-Survey Analysis of Lithic Artifacts

The movement of chert materials is one of the best preserved aspects of prehistoric trade. Unfortunately, no systematic analysis of the movement of chert has been attempted in the Oklawaha River basin. The eastern part of Central Florida is devoid of chert resources. The central and western thirds, on the other hand, are richly endowed with chert. The border between the regions is the Oklawaha River. A population controlling the river would be in a pivotal position to control the flow of lithic materials both up and down the river and across its banks.

The sites section listed above incorporates the data recovered from the lithic analysis. However, some interesting observations about the timing and location of sites in the survey area can be made. The two Paleo-Indian sites (Carter, 8MR2061 and Stallings, 8MR2065) are both located in the middle of what is now the river swamp. This may reflect a lower, more intermittent river/water level flow than now exists. If the Paleo-Indian (pre-10,000 years BP) artifacts were utilized and dropped where they were found, then the river and sea levels must have been lower and/or the climate substantially drier. In contrast, the pre-Ceramic Archaic sites (Backcurrent, 8MR2062 and Turkey Landing, 8MR6063) dated 6,500 to

3,000 years BP both are located on higher ground indicating a change in water level to a relatively higher, perhaps modern river water level and sea level. This notion is supported by the knowledge that the rising late Pleistocene sea level finally stabilized in the Gulf of Mexico region about 5,000 years ago (White, 1970).

The Ceramic period or 3,000 years BP sites are located back in the modern river swamp, but this time the sites show people depending on a new food source. They are also using the shell to spread on top of the what-appears-to-be swampy ground. Remarkably, there seems to be a good deal of continuity in the lithic collections between pre-Ceramic Archaic and Ceramic periods. Clearly heat-treating was discovered and utilized before ceramics came into use. The lack of change in lithic tools may reflect the reliability of that technique in producing easily flakable material.

Macrobotanical Analysis of Peats

Four samples of peat matrix were analyzed for plant remains and peat composition. The samples were recovered from three general localities; the Carter site (8MR2061, sample numbers E-1-21 and 22), Osceola landing (8MR2076, sample no. O-1-1), and Conner landing (8MR2064, sample no. H-1-1). The focus of the analysis was to investigate the nature and variety of riverine peat deposits along the Oklawaha River and examine their potential for distinguishing past depositional environments and associated fluvial processes.

Sample volumes were standardized to one or two litres for inter-sample comparison. Each sample was prepared for analysis by partitioning the sample contents into particle-size fractions by gentle washing through nested sieve series with mesh sizes of 4 mm, 2 mm, 1 mm, and 0.42 mm. Following partition, sample components were examined directly under a dissecting microscope. All remains recovered with the 4 mm size fraction were identified and sorted into sample components (e.g., seeds, twigs root and wood). Material recovered in the 2 mm and finer sieves was scanned for seeds and charcoal fragments, but not otherwise sorted. Due to time constraints, it was not possible to analyze all size fractions from each sample. All 4 mm fractions were completely processed; the 2 mm fractions from all but sample E-1-22 (Carter) were analyzed; only the 1 mm component of sample H-1-1 (Conner) was analyzed; and none of the 0.42 mm fractions underwent analysis.[1]

Seeds were identified with reference to pictorial guides (e.g., Martin and Barkley 1961), treatises on aquatic and wetland plants (e.g., Godfrey and Wooten 1979), and comparative specimens housed at the Florida Museum of Natural History. Wood was identified according to three dimensional anatomy with the aid of a compound microscope and a dissecting microscope with enhanced magnification. Wood identification ensued with keys to anatomical structure (Panshin and deZeeuw 1980; Newsom n.d.), along with reference to comparative wood specimens.

At least 20 plant taxa were identified among the samples analyzed. Figure 4.9 lists the plant identifications. Not surprisingly, the overall plant assemblage is dominated by aquatics and species of damp-ground environments. The individual peat samples, however, proved to be quite distinctive in terms of species present and general sample composition. These basic differences in sample

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[1]All materials that were not analyzed in this stage of research will be stored and curated, along with processed fractions. All sample components have been placed in sealed plastic bags with distilled water.

Taxonomy	Common Name	Habit[5]	Habitat[1]
Amaranthaceae	anaranth fam.	annual	wet ground
Brasenia schreberi	water shield	perennial	slow-water aquatic
Carpinus caroliniana	ironwood	tree	wet woods, floodplain
Carya sp.	hickory	tree	wet-drained woodland
Cephalanthus occidentalis	buttonbush	shrub	water edge, swamps
Ceratophyllum demersum	coon-tail	perennial	slow-water aquatic
Cornus sp.	dogwood	tree	wet woods, floodplain
Cucurbita pepo	gourd	vine	?floodplain, anthropogenic
Cyperaceae	sedge family	herb	wet ground
Leguminosae	bean family	herb/vine	?upland
Myrica cerifera	wax myrtle	shrub	swamps, floodplain
Najas guadalupensis	water nymph	perennial	aquatic
Nuphar luteum	spatter-dock	perennial	slow-water aquatic
Nyssa sylvatica	black gum	tree	swamps, floodplain
Polygonum sp.	smartweed	perennial	swamps, marsh edge
Quercus sp.	oak	tree	floodplain to upland
Rhynchospora corniculata	beak-rush	perennial	swamps, marsh edge
Scirpus validus	bulrush	perennial	shallow water
Taxodium distichum	bald cypress	tree	swamps, wet woodland
Vitis sp.	grape vine	vine	wet-drained woodland

Figure 4.9 ORS Plant Taxonomy (identifications by L. Newsom).

composition are reflected in the relative volumes of the sample size fractions (Figure 4.10). Samples with coarser material (e.g., twigs and wood fragments) have greater quantities of materials in the larger size fractions (60% of sample E-1-22 is < 1 mm, compared to 36%, 25%, and ca. 4% for samples E-1-21, O-1-1 and H-1-1, respectively). Conversely, samples with proportionately finer remains and silty sediment lose more material through the smallest sieve (82% of the sample matrix from H-1-1 passed through the smallest sieve -- 0.42 mm.

Macrobotanical Identifications from Oklawaha River Survey Sites				
SAMPLE No:	H-1-1	O-1-1	E-1-21	E-1-22*
SITE:	Conner	Osceola	Carter	Carter
PEAT TYPE:	fine/silty	leafy	fibrous	woody
Sample volume (ltr)	1.000	2.000	2.000	2.000
Sieved Volumes (ltr)				
4.0 mm	.005>1%	.100 5%	.200 10%	.300 15%
2.0 mm	.005>1%	.200 10%	.225 11%	.425 21%
1.0 mm	.030 3%	.200 10%	.300 15%	.485 24%
0.4 mm	.150 15%	.475 24%	.350 17%	.750 37%
>0.4 mm	82%	51%	47%	3%
TAXONOMY:				
Amaranthaceae			2	
Brasenia schreberi	1			
Carpinus caroliniana		2		
Carya sp., wood		2		
Cephalanthus occident	2	8	1	
Ceratophyllum demersum			2	
Cornus sp.		1		
Cucurbita pepo			1	
Cyperaceae			1	
Leguminosae		5		
Myrica cerifera	1		5	
Najas guadelupensis	1			
Nuphar lutea	3		6	
Nyssa sylvatica			3	
Polyponum sp.			1	
Quercus sp., nut hull	1		1	
Quercus sp., cap	1			
Quercus sp., abort. nut.		1		
Quercus, sp., gall	1			
Quercus. sp., leaf	+	+		
Rhynchospora cornic.	11	2	8	
Scirpus validus			1	
Taxodium sp., seed	9	18	61	2
Taxodium sp., cone			1	
Taxodium sp., leaf	+	70+	+	+
Taxodium sp., wood	1			2
Vitis sp., seed	2	3		
Vitis sp., tendril		4		
ud. seed		2		
ud. fruit, cf. Najas	2	3	5	
ud. spiny fruit		3		
ud. fruit with operculum		1		
ud. bud, cf. Ulmus		2		
charcoal fragments	1	17	6	4
algae	+	+	+	
bone fragements		4	1	
immature gastropod	+	+	+	
small diam. twigs, 4mm	3	65	81	110
small diam. wood, 4 mm	5		70	10
root material, 4 mm	4	13	79	40+
ud. detritus, 4 mm		.001 ltr	.080 ltr	.275 ltr

Figure 4.3 ORS Peat Sample Analysis (by L. Newsom).

One plant identification from the Oklawaha River Survey is noteworthy because of its potential archaeological importance. A single seed of cucurbit gourd (Cucurbita pepo) was identified in sample E-1-21; no additional remains of the plant, such as gourd rind, were discovered. This small, possibly wild gourd has a long history of association with prehistoric human groups in eastern North America (Heiser 1989; Watson 1989).[11] The present find is significant because it broadens the record of the gourd's previous geographic distribution in Florida. It is now extinct in Florida and most, if not all, of eastern North America. Ascertaining the age of the seed should be done at some point, because of gaps in our knowledge of the temporal record. Presently, Cucurbita gourd is known from Terminal Pleistocene, Late Archaic, and Ceramic Period sites in Florida (Newsom 1987 and laboratory data; Russo et al. 1991). The relatively small size of the seed from E-1-21 (7.5 mm long, 5.375 mm widest, 0.65 mm thickness, width:length ratio = 0.710) is potentially important as a possible indication of its wild versus domesticated status. This, again, has bearing on our understanding of the plant's co-evolution with human groups in Florida.

Soil Analysis

One major goal of this project was to demonstrate the importance of a knowledge of soil science in helping to recognize the possible location of both terrestrial and underwater archaeological sites and the forces or natural processes working on the soils at these sites. In order to plan for future educational and recreational use and development for the Oklawaha River, more information is

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[11] Gourd remains from sites along the St. Johns river (Newsom 1987; Russo et al. 1991) have helped to shed light on the co-evolution and possible domestication of this gourd that might have culminated in the summer squashes such as yellow crookneck.

needed on the location of submerged, partially submerged and erosion-threatened archaeological sites. Soils data were used to "reconstruct" the depositional environment of the study area and to relate the soil forming processes to archaeological sites underwater (See Appendix 5).

Survey participants collected soil samples from 12 sites in the river. These samples along with the soils sampled in transects of the floodplain and terraces by the soil scientist were taken to the Soil Genesis and Characterization Laboratory at the University of Florida. The samples were analyzed for particle size, pH, organic carbon, and total phosphorus, the results of which are presented in Appendix 5. The particle-size analyses included determining the following size fractions of sand: very coarse, coarse, medium, fine, and very fine. The percentage of silt and clay were also determined. From these analyses the ratios of fine sand to total sand, very fine sand to total sand, and medium sand to total sand were calculated on a clay-free basis. These ratios help to locate any discontinuities or differences in the parent materials of the soils and sediments sampled (Arnold, 1976; Birkeland, 1974).

When a soil profile produces a horizon that depicts a change in the parent material coupled with an increase or jump in the organic carbon present, then it is likely that a buried A horizon exists. A buried horizon indicates an old land surface which has been stable enough for a soil to form, but which later becomes unstable and begins to aggrade. This is the case in the soil profiles associated with the Osceola Landing site (8MR2076). The lower Osceola profile was located on a foot slope, and was originally thought to have been an excellent area for human occupation. However, we now understand that considerable erosion has occurred from the higher lying bluff nearby, and that the erosion has deposited sediment (and perhaps artifacts) onto the foot slope.

The soil boring taken near the river at this site showed a buried A horizon at a depth of about 123 cm. Any artifacts present in their original context would be buried below that depth. Several more borings were made in a transect moving away from the river. These borings showed that the A horizon is thinner, and the depth of the clayey Bt horizon is less going up the slope to the bluff's top. The boring on top of the bluff showed that almost all of the A horizon had been eroded away. There was only about 8 cm of a mixture of A and B horizons overlying the clayey Bt horizon. Several centimetres of soil have been eroded away from the bluff and side slope onto the foot slope and river below. It seems likely that the sites were previously located on the top of the bluff at Osceola Landing and are now being translocated in the cumulative soils developing in the foot slope region.

Even more erosion has taken place at upper Osceola Landing, where the river is eroding into the clayey bluff. The boring taken on the bluff, adjacent to the river, showed that the original A horizon had been eroded away completely. The clayey Bt horizon was exposed on the surface and is not being directly eroded into the river. The boring taken just north of the bluff in a lower elevation area had about 62 cm of medium and fine sand overlying the clayey Bt horizon. This depth of sandy material is more typical of the depth that would be expected of sand over clayey material.

The majority of the soils in Florida are high in medium and fine sand in the surface layer (A horizon) and in the subsurface layer (E horizon), and low in clay content. The total sand content is usually over 90 per cent in most soils, and the clay content is less than 5 per cent. Because of the erosion from the bluffs and side slopes along the Oklawaha River at Osceola Landing, the sand content was lower and the clay content was higher in the soils and sediments sampled along the river.

Future research into the causes of a shift from stable, soil forming conditions to unstable, cumulative soils in the areas associated with high, dry bluffs is in order. It would be useful to establish a time frame for these events and consider the possibilities of some episodic or catastrophic explanation (Schumm and Lichty, 1965; Wolman and Miller, 1960). It is notable that the soil profiles in areas not associated with bluffs do not illustrate any change in parent material or depositional environment.

In the remaining profiles, the sand content was not less than 90 per cent in all the samples, except for one. The clay content was higher than would be expected with many of the samples having a clay content of more than 10 per cent. These differences in the sand and clay contents from what would be expected are good indicators of the erosion, deposition and mixing of soils and sediments that has occurred along and in the Oklawaha River.

The organic carbon content of the soils and sediments sampled were quite low. This would be expected because the area has undergone considerable erosion and little organic matter would develop during this instability. The area through which the river originally flowed was a swamp with a high proportion of peat and muck. The river has changed course over the years because of erosion and deposition, much less peat and muck remains. Some samples of organic materials were collected from a vertical wall in the middle of the river channel (Area I). The samples contained a considerable amount of sand, silt, and clay. This further points to migration of the channel, subsequent erosion and deposition along and in the river.

The pH of the samples was determined in water, $CaCl_2$ and KCl. The results show a wide range. For example, in water, the pH values ranged from 3.76 to 8.06. Samples 47 through 52 (8MR2068) and 53 through 57 (peat and peat/shell wall in section I of the river) were consistently high, ranging from 6.95 to 8.06.

A number of morphological features of soils may be indicators of human activities (Collins and Shapiro, 1987, 173). These include abrupt, smooth boundaries between layers, dark colours or dark layers extending to greater depths than expected, mixings of clay with sand in lower layers, and soils with high contents of total phosphorus. At the Durisoe site (8MR2068), five samples were subjected to total phosphorus counts. Three were taken from the midden showing a decrease in phosphorus with depth, 6,710 at the base decreasing from 2,593 to 1,007 within 130 cm. The samples taken from the same level as the midden's base just outside the upstream and downstream termini represent the background phosphorus available in the local environment. These were 688 and 578ppm, respectively.

More data of this kind accumulated within a certain site and compared to other sites in the area will begin to allow for interpretation of population size, duration, and intensity of settlement as well as establishing a relative chronology. In this study there was a very good correlation between the total phosphorus content and areas in which human activity was expected. Five samples do not allow for many conclusions, however, they do represent and illustrate the ability of soil science analysis to assist archaeologists in reconstructing cultural activity in river floodplains.

The Importance of Underwater Survey to the Archaeological Investigations of River Systems: Relationship of soils and topography to sites in the Oklawaha River Survey

The soil classification for each site was obtained from the corresponding soil survey maps. Figure 4.11 lists the 11 new sites

SITE TYPE	DESCRIPTION
BURP	Paleo-burial
HABI	Habitation site
HOME	Home
HOUS	House
INDU	Inundated
MDSH	Shell mound
MIDD	Midden
MLLU	Upland mill
MOUN	Mound
SCAR	Artefact scatter
SCL	Lithic scatter
STIL	Still

Key Tables to Site Types
and Drainage Categories

CATEGORY	DESCRIPTION
E	Excessively drained
MW	Moderately wet
SP	Somewhat poorly drained
P	Poorly drained
VP	Very poorly drained

SITENAME	SITE_NUMBER	SITE_TYPE	TOPOGRAPHY	SOIL_SERIES	DRAINAGEC	CULTURES
OLSEN	8MR02067	WREC	FLOODPLAIN	ANCLOTE SAND	VP	H
TURKEY LANDING SITE	8MR02063	SCNQ	FLOODPLAIN	TERRA CEIA MUCK	P	M
CONNER LANDING SITE	8MR02064	ABOB	FLOODPLAIN	TERRA CEIA MUCK	P	M
GORE'S LANDING	8MR02066	SCAR	FLOODPLAIN	HOLOPAW SAND	P	M
OSCEOLA	8MR02076	SCAR	FLOODPLAIN	IBERIA CLAY-TERRA CEIA MUCK	P	M
DICARLO SITE	8MR02060	SCNQ	FLOODPLAIN	ASTOR SAND	VP	P
CARTER SITE	8MR02061	SCNQ	FLOODPLAIN	ASTOR SAND	VP	P
BACKCURRENT SITE	8MR02062	SCNQ	FLOODPLAIN	ASTOR SAND-EUREKA FINE LOAMY SAND	VP	P
STALLINGS	8MR02065	SCNQ	FLOODPLAIN	TERRA CEIA MUCK	P	P
DURISOE	8MR02068	MDSH	FLOODPLAIN	TERRA CEIA MUCK	P	P
STROUD'S CREEK	8MR02077	MDSH	FLOODPLAIN	TERRA CEIA MUCK	P	P

Figure 4.11 Underwater and partially submerged sites identified during the ORS project 1991. Six sites were located in terra ceia muck.

identified during the Oklawaha River Survey, 1991 with pertinent geomorphological data and soils included. Combined with the 54 sites known from the Master Site File (MSF), the soil series field identifies only two basic groupings within the soils. One is terra ceia muck, a highly decomposed, organic deposit usually associated with wet or moist, low energy environments that can be interpreted as very old riverine deposits. The second is sand. Since Florida is mainly composed of old beach ridge deposits, the soil is greater than 90 per cent sand. Distinctions between types of sands are not easily identified. Nor are the different sources for the parent material easily determined. There are however, soil science methods capable of determining changes of parent material even within sands. Samples taken during the ORS showed evidence for differing parent material indicated by changes in the soil's composition with depth and across sampling transects. These techniques and their intra-site results are presented in Appendix 5 and are more fully discussed in later sections of this chapter.

The sites situated in the terra ceia muck are useful to examine because they indicate some association with the river's past regime. Of the existing 54 sites known prior to the Oklawaha River Survey (ORS), eleven are located in terra ceia muck (Figure 4.12).

SITENAME	SITE_NUMBER	SITETYPE	TOPOGRAPHY	SOILSERIES	DRAINAGEC	CULTURES
CEDAR CREEK STILL	8MR00825	STIL	FLOODPLAIN	TERRA CEIA MUCK	P	H
EATON CREEK MIDDEN	8MR00016	MIDD	FLOODPLAIN	TERRA CEIA MUCK	P	P
USFS 81-35	8MR00254	SCLI	FLOODPLAIN	TERRA CEIA MUCK	P	P
TTS MIDDEN (PINEY ISLAND MIDDEN)	8MR00255	MDSH	FLOODPLAIN	TERRA CEIA MUCK	P	P
PINEY ISLAND	8MR00848	BURP	FLOODPLAIN	TERRA CEIA MUCK	P	P
OLD SITE EATON CREEK	8MR00014	MDSH	FLOODPLAIN	TERRA CEIA MUCK-ASTATULA SAND, DARK SURFACE 8-17%	VP	P
315 RIDGE	8MR01867	SCNQ	FLOODPLAIN	TERRA CEIA MUCK-HOLOPAW SAND	P	P
NN	8MR00044	MDSH	FLOODPLAIN	TERRA CEIA MUCK	P	PA
GORES LANDING MIDDEN	8MR00030	MIDD	FLOODPLAIN	TERRA CEIA MUCK	P	UN
GORES LANDING MOUND	8MR00031	MOUN	FLOODPLAIN	TERRA CEIA MUCK	P	UN
DELKS LANDING MOUND	8MR00032	MOUN	FLOODPLAIN	TERRA CEIA-IBERIA CLAY	VP	UN

Figure 4.12 Oklawaha study area sites in terra ceia muck known prior to the ORS project 1991.

During the ORS, six additional sites were recorded in the muck (See figure 4.11). Figure 4.13 illustrates site distribution within the terra ceia muck deposit by cultural affiliation both before and after the Oklawaha River Survey. Sixty per cent more sites were identified in the terra ceia muck as a result of the river's survey. By cultural affiliation, one-half of the newly recorded sites are prehistoric and the other 50 per cent are multi-component sites.

Straight comparison between the MSF's 54 known sites and the 11 newly recorded sites is problematical. Recalling the study area description given at the beginning of this chapter, the MSF data includes all sites along a 19 mile corridor whereas the ORS investigated only nine miles of the same corridor. The river survey's distance falls short of the study area's length by a factor of two. The bias can be corrected by assuming that survey of the study area's remaining ten miles would have yielded a similar number of sites. By doubling the number of sites found during the survey a better estimate for the impact of underwater survey on site distribution is attained.[11] Therefore, the following figures include a column weighted for the significant length differentiation noted. Likewise, Figure 4.13 illustrates that rather than 60 per cent, the ORS could have recorded 120 per cent more sites in terra ceia muck than had been known previously within the study area.

Comparison of sites in Terra Ceia Muck by Cultural Affiliation					
Cultural Affiliation	Sites in TC Muck known before ORS	Sites recorded during ORS	ORS x 2	% Δ	% Δ x 2
P	6	3	6	50	100
PA	1	0	-	-	-
H	1	0	-	-	-
HA	0	0	-	-	-
M	0	3	6	(x3)	(x6)
UN	2	0	-	-	-
TOTAL	10			60	120

Figure 4.13 Composition of sites in terra ceia muck, by cultural affiliation, both before and after ORS project 1991.

Another useful method of determining the effect of underwater survey on site distribution patterns is grouping by cultural affiliation. Figures 4.14 through 4.18 list the known site data with respect to their gross cultural assignments: prehistoric (P), prehistoric with historic aboriginal component (PA), historic Euroamerican (H), multi-component (M) and indeterminant (UN).[12]

[11]This is a marginally acceptable means of sampling and full survey of the entire 19 mile length would have been best. However, funds to survey the entire study area were requested but only one-half the amount was received.

[12]Since there were no historic/aboriginal (HA) sites identified in the Oklawaha study area, no table is provided.

SITENAME	SITE_NUMBER	SITETYPE	TOPOGRAPHY	SOILSERIE	DRAINAGEC	CULTURE 8
PINEY ISLAND	8MR00848	BURP	FLOODPLAIN	TERRA CEIA MUCK	P	P
AMY'S DREAM	8MR00230	HABI	UPLAND LACUSTRINE	DELKS SAND-TERRA CEIA MUCK	SP	P
USFS OCA 90-14	8MR01969	HABI	UPLAND LACUSTRINE	POMELLO SAND	MW	P
SUNDAY BLUFF	8MR00013	MDSH	FLOODPLAIN	ASTATULA SAND, DARK SURFACE 8-17%	E	P
USFS 81-61	8MR00262	MDSH	FLOODPLAIN	ASTATULA SAND, DARK SURFACE 8-17%	E	P
COLBY LANDING	8MR00057	MDSH	FLOODPLAIN	ASTATULA SAND (?)	E	P
OKLAWAHA RIVER SHELL MOUND II	8MR00224	MDSH	UPLAND LACUSTRINE	POMELLO SAND	MW	P
DOUBLE BRIDGE MOUND B	8MR00149	MDSH	FLOODPLAIN	SELLERS SAND	VP	P
TJ'S MIDDEN (PINEY ISLAND MIDDEN)	8MR00255	MDSH	FLOODPLAIN	TERRA CEIA MUCK	P	P
OLD SITE EATON CREEK	8MR00014	MDSH	FLOODPLAIN	TERRA CEIA MUCK-ASTATULA SAND, DARK SURFACE 8-17%	VP	P
EATON CREEK	8MR00015	MIDD	FLOODPLAIN	ASTATULA SAND 0-8%-ASTATULA SAND, DARK SURFACE 8-17	E	P
EATON CREEK MIDDEN	8MR00016	MIDD	FLOODPLAIN	TERRA CEIA MUCK	P	P
PETERSON'S MOUND	8MR00146	MOUN	UPLAND LACUSTRINE	ASTATULA SAND, DARK SURFACE 0-8%	E	P
PALMETTO LANDING MOUND 6	8MR00024	MOUN	UPLAND LACUSTRINE	DELKS SAND	SP	P
SHINER POND MOUND 2	8MR00019	MOUN	UPLAND LACUSTRINE	DELKS SAND-POMELLO SAND	SP	P
BUCK MACDONALD MOUND	8MR00145	MOUN	UPLAND LACUSTRINE	PAOLA SAND, MOD. DEEP WTR 0-5%	E	P
COFFEE POT MOUND	8MR00141	MOUN	MARGIN	POMELLO SAND	MW	P
DOUBLE BRIDGE MOUND A	8MR00148	MOUN	FLOODPLAIN	SELLERS SAND	VP	P
LAKE CHARLES UNIT 5, NO 1	8MR00819	SCAR	UPLAND LACUSTRINE	ASTATULA SAND, MOD. DEEP WTR 0-8%	E	P
USFS 81-57	8MR00248	SCAR	UPLAND DRY	ASTATULA SAND 0-8%	E	P
314-A	8MR01876	SCAR	UPLAND LACUSTRINE	PAOLA SAND, MOD. DEEP WTR 0-5%	E	P
LAKE CHARLES UNIT 5, NO 3	8MR00820	SCAR	UPLAND LACUSTRINE	POMELLO SAND	MW	P
LAKE CHARLES UNIT 5, NO 2	8MR00831	SCAR	UPLAND LACUSTRINE	POMELLO SAND	MW	P
USS #89-2 OCALA	8MR01916	SCAR	UPLAND LACUSTRINE	POMELLO SAND	MW	P
USFS 81-60	8MR00247	SCLI	UPLAND DRY	ASTATULA SAND, DARK SURFACE 8-17%	E	P
NN	8MR00232	SCLI	UPLAND LACUSTRINE	DELKS SAND	SP	P
USFS 81-52	8MR00243	SCLI	UPLAND LACUSTRINE	DELKS SAND	SP	P
USFS 81-63	8MR00263	SCLI	FLOODPLAIN	DELKS SAND	SP	P
USFS OCA 87-3/SHARPES FERRY 52 SCATTER	8MR00851	SCLI	UPLAND LACUSTRINE	DELKS SAND	SP	P
USFS 81-51	8MR00242	SCLI	UPLAND LACUSTRINE	DELKS SAND-POMELLO SAND	MW-SP	P
GORES LANDING BORROW PIT	8MR00080	SCLI	FLOODPLAIN	HOLOPAW SAND-ANCLOTE SAND	P	P
USFS 81-53	8MR00244	SCLI	UPLAND LACUSTRINE	POMELLO SAND	MW	P
USFS 81-54	8MR00245	SCLI	UPLAND LACUSTRINE	POMELLO SAND	MW	P
FORE LAKE WEST	8MR00519	SCLI	UPLAND LACUSTRINE	POMELLO SAND	MW	P
USFS 81-35	8MR00254	SCLI	FLOODPLAIN	TERRA CEIA MUCK	P	P
315 RIDGE	8MR01867	SCNQ	FLOODPLAIN	TERRA CEIA MUCK-HOLOPAW SAND	P	P

Figure 4.14 Prehistoric sites known in Oklawaha study area prior to ORS project 1991.

SITENAME	SITE_NUMBER	SITETYP1	TOPOGRAPHY	SOILSERIES	DRAINAGEC	CULTURE 8
NN	8MR00044	MDSH	FLOODPLAIN	TERRA CEIA MUCK	P	PA

Figure 4.15 Prehistoric-aboriginal sites known in Oklawaha study area prior to ORS project 1991.

SITENAME	SITE_NUMBER	SITETYPE	TOPOGRAPHY	SOILSERIES	DRAINAGEC	CULTURE8
PLUM TREE HOUSE	8MR00147	HOUS	UPLAND LACUSTRINE	ASTATULA SAND, DARK SURFACE 0-8%	E	H
USFS OCA 87-2/ SHARPES FERRY 52 SAWMILL	8MR00850	MLLU	UPLAND LACUSTRINE	DELKS SAND	SP	H
UPCHURCH LUMBER CO CAMP	8MR00143	INDU	UPLAND LACUSTRINE	POMELLO SAND	MW	H
USFS OCA 90-15	8MR01970	HOME	UPLAND LACUSTRINE	POMELLO SAND	MW	H
CEDAR CREEK STILL	8MR00825	STIL	FLOODPLAIN	TERRA CEIA MUCK	P	H

Figure 4.16 Historic-aboriginal sites known in Oklawaha study area prior to ORS project 1991.

SITENAME	SITE_NUMBER	SITETYPE	TOPOGRAPHY	SOIL_SERIES	DRAINAGEC	CULTURE8
EATON CREEK	8MR01874	HABI	FLOODPLAIN	POMELLO SAND-ASTATULA SAND 0-8%	E-MW	M

Figure 4.17 Multi-component sites known in Oklawaha study area prior to ORS project 1991.

SITENAME	SITE_NUMBER	SITETYPE	TOPOGRAPHY	SOIL_SERIES	DRAINAGEC	CULTURE8
EATON CREEK	8MR00017	MDDN	FLOODPLAIN	SELLERS SAND	VP	UN
GORES LANDING MIDDEN	8MR00030	MIDD	FLOODPLAIN	TERRA CEIA MUCK	P	UN
SHINER POND MOUND 1	8MR00021	MOUN	UPLAND LACUSTRINE	DELKS SAND	SP	UN
SHINER POND MOUND 4	8MR00022	MOUN	UPLAND LACUSTRINE	DELKS SAND	SP	UN
PALMETTO LANDING MOUND 5	8MR00023	MOUN	UPLAND LACUSTRINE	DELKS SAND	SP	UN
SHINER POND MOUND 3	8MR00020	MOUN	UPLAND LACUSTRINE	POMELLO SAND	MW	UN
PALMETTO LANDING 7	8MR00025	MOUN	UPLAND LACUSTRINE	POMELLO SAND	MW	UN
GORES LANDING MOUND	8MR00031	MOUN	FLOODPLAIN	TERRA CEIA MUCK	P	UN
DELKS LANDING MOUND	8MR00032	MOUN	FLOODPLAIN	TERRA CEIA-IBERIA CLAY	VP	UN
FLA BARGE CANAL 29	8MR00097	SCLI	FLOODPLAIN	DELKS SAND	SP	UN
BUTTERBUTT LANDING	8MR01869	SCNO	FLOODPLAIN	DELKS SAND	SP	UN

Figure 4.18 Sites known prior to the ORS project 1991 which have unknown cultural affiliations.

However, the usefulness of sorting sites by their gross cultural assignment is limited by its generality. Analysis of the MSF data did not allow for greater distinctions to be made without further investigation of the primary archaeological material. The vast majority of sites are identified as prehistoric (N=36) but no differentiation between cultural periods within the prehistoric era is possible with any consistency. The artifact assemblages from the sites must surely be indicative of some differences, but as is discussed in a previous section in this chapter, the cultural sequence for central Florida is far from well documented or understood.

The problem of gross cultural componency aside, Figure 4.19 provides a breakdown on the prehistoric cultural affiliation by site type. Thirty-three of thirty-six known prehistoric sites are situated in upland lacustrine or floodplain topographies (from Figure 4.14). Obviously, all of the ORS site topographies are floodplain and the six newly recorded prehistoric sites increases the total number of known prehistoric sites by 16.6 per cent. Again, correcting for length -- known prehistoric archaeological sites in the Oklawaha study area are increased by 33.3 per cent as a result of the Oklawaha river survey.

Comparison of Pre-historic Sites by Site Types				
SITE TYPES	SITES KNOWN	ORS	%Δ	%Δ x 2
BURP	1			
MIDD	2			
MDSH	7	2	28.5	57
MOUN	6			
SCAR	6			
SCLI	12	4 (SCNQ)	33.3	67
HABI	2			
TOTAL	36	6	16.6	33.3

Figure 4.19 Comparison of Prehistoric sites in the Oklawaha study area by site type.

Breakdown of the site types shows that two types are most affected by inclusion of the river survey data; shell middens and lithic scatters increase by 57 and 67 per cent, respectively. The site type codes suffer a similar problem of generality as discussed for gross cultural affiliation groups. Like cultural affiliation groups, site codes are only as useful as the consistency with which they are defined and utilized.

There is some concern for the variability observed in the MSF data because of the many different site recorders and their site code choices. For instance, during the ORS four lithic scatter sites (SCLI) are identified as non-quarry sites (SCNQ). None of the 36 known sites are identified as such, however 12 lithic scatters (SCLI) are recorded. For our purposes, we have considered those sites to be comparable. Is there any actual difference between our sites and those previously known? In general terms, I think not, only a varying degree of accuracy among the codes available to site recorders. Utilization of prescribed forms and site codes does not lend itself to solving this problem of generalization.

Comparison of Cultural Affiliation Groupings for known and ORS Sites					
CULTURAL AFFILIATION	SITES KNOWN BEFORE ORS	ORS	TOTAL	%Δ	%Δ x 2
P	36	6	42	16.6	33.3
PA	1	0	1	0	
H	5	1	6	20	40
HH	-	-	-	-	-
M	1	4	5	400	800
UN	11	0	11	0	
TOTAL	54	11	65	20.3	40.7

Figure 4.20 Comparison of cultural affiliation groupings for all sites in the Oklawaha study area.

Figure 4.20 compares the previously known sites from the MSF with those recorded during the ORS by gross cultural affiliation groupings. To summarize, prehistoric, historic and multi-component sites were most affected by inclusion of the river survey data. The apparent dramatic increase in the number of multi-component sites (800 per cent) is, most likely attributable to differences in recorder selection rather than some apparent difference between the sites themselves. The projected 40 per cent increase in historic sites and 33 per cent increase in prehistoric sites located during river survey are more reasonable projections for the study area. However, temporal differentiation within the prehistoric sites is lacking and its absence makes any further discussion of the most affected sites speculative. If the results are weighted for the shorter length of river surveyed compared to total study area length, then 41 per cent more sites were identified in the Oklawaha study area than had been previously known. Clearly, survey of the Oklawaha River's bed and margins changes the site distribution and density patterns of prehistory and history within the study area's landscape.

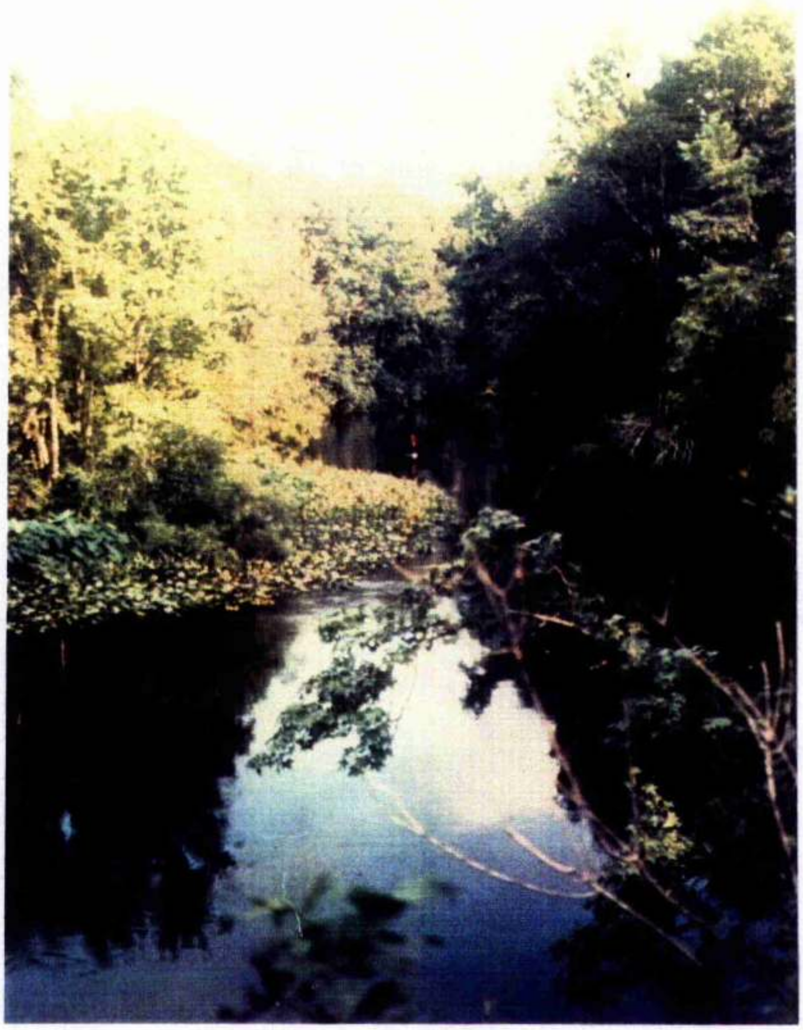


Figure 4.21 Oklawaha River at Osceola Landing (R. Denson, photo)

Summary

During the Oklawaha River Survey, multidisciplinary applications were utilized to quantify erosion and increase our understanding of transformational processes at work in the Oklawaha River Basin. Thorough investigation of the geomorphology of the river basin and its associated cultural resources have aided our understanding of its prehistoric landform utilization.

This survey has provided 11 new sites and 3 updates to the Florida Master Site File. But far beyond the mere recording of unknown sites, this project has integrated both amateur and professional expertise in an attempt to better understand human interaction in the Oklawaha River Basin. Amateurs familiar with locations of sites, palaeontologists who could identify remains of extinct and extant pleistocene fauna, soil scientists with abilities to interpret fluvial landforms, and botanists who could assist in environmental reconstruction have come together to aid archaeological interpretation of each site's type, age, function, and significance.

Before we can begin archaeological site interpretation in fluvial settings, a better understanding of the natural processes at work on these sites is necessary. This survey and its research is only a starting place for understanding fluvial processes in the Oklawaha River Basin and its impact on associated archaeological sites. This project was borne out of cultural ecology, systems theory and contextual archaeology. In addition, the information gained from local river divers about what they had seen helped shape the research design for this initial project. More archaeological projects with a contextual approach are needed in river basin research. The final chapters consider the options as well as provide another example from a Scottish river basin.

Chapter Five
A CASE STUDY: THE EARN RIVER IN THE MIDLAND VALLEY OF SCOTLAND

Introduction

The case studies in this thesis have aided the development of the methodology presented in chapter three. The second study presented in this chapter utilizes the same approach as that of the Florida case study but with differing results. No survey work has been undertaken in the Scottish example (yet). However, there is sufficient historical documentation and evidence from early research to explore more fully the sources of evidence available in this study area before making recommendations for undertaking research-based survey in the field.

The second case study begins with a brief description of the Scottish physical landscape, climate, and soils. A close examination of southeast Scotland's physical geology due to its complex formation as a glaciated landscape is included in the section on the physical geology of the River Tay. Next, the Earn River Valley which encompasses the case study area is described. Then a brief cultural history for the area is followed by an introduction to the previously known archaeological information and the resulting case study database that developed. Further examination of the database fields produced an interesting section on the relationship of soils to sites in the Scottish case study.

The chapter concludes with investigation and discussion of several sources of evidence for consideration of geomorphologic change in river basins. Evidence from maps, aerial photos and geomorphic studies are highlighted. When determining the potential of a river basin survey to identify and locate sites of archaeological importance through either terrestrial or underwater techniques, the need to consider the full range of evidence available from all available sources becomes clear. The second case study's use of sources of evidence serves to make this point. Chapter six's summary and conclusion also draw attention to these sources of geomorphic evidence and to how the methodology presented in this thesis seeks to make use of them.

Climate, Soils and Geology of Scotland

Scotland's climate is classified as humid temperate, another middle latitude subdivision of Butzer's (1971) Moist Mesothemal and Microthermal province. The humid temperate division displays more seasonality than that of Florida's subdivision, the humid subtropics. Moreover, located on the western margin of the European continent in a maritime context, its winters are cool (coldest month 2-10 degrees C.), summers are warm (warmest month 15-19 degrees C.) and the growing season lasts five to ten months. In the Earn Valley where the study area is situated, there is snow fall, but no durable cover.

The Boreal Coniferous Forest found in Scotland's climate represents a rather uniform vegetation type of densely packed conifers with little or no undergrowth. Scots Pine (Pinus silvestris) dominate the landscape. Their needle-shaped leaves and its evergreen characteristics makes it more favourable for survival in the harsh, cold, and short growing-season environment. The Boreal Forest soils are dominated by chemical weathering although frost weathering and freeze-thaw processes act to open up the rock bodies making them more accessible and susceptible to chemical weathering (ibid., 91).

The predominant geomorphologic activity to affect the Scottish landscape was glaciation during the Pleistocene. However, only two stages of the Quaternary, the Devensian and Flandrian, are visible. (Figure 4.3) The earlier stages are not recognizable or have been obliterated by the effects of the last ice age (Cameron and Stephenson, 1985).

Radiocarbon dates suggest that the Midland Valley, the location of the case study area, was free from ice shortly after 13,000 year B.P. at which time, there would have been a decline in fluvioglacial activity. Between 11,000 and 10,300 years B.P. the climate deteriorated to such an extent that glaciers again formed in the interior portions of the Midland Valley. This period is known as the Loch Lomond Readvance. The interval of warm climatic conditions between the two glacial periods is known as the Windermere or Lateglacial Interstadial. During that time, the climate would have been comparable to the present day. The climate continued to improve from arctic conditions at the end of the late Devensian to a climatic optimum at about 5 to 3,000 years B.P.. It has been cooler and wetter ever since that time.

Physical Geology of the River Tay

The Tay river basin is located in southeast Scotland (Figure 5.1). It and its tributaries drain all of Perthshire and portions of Argyllshire and Angus comprising a total catchment area of 5,031 square kilometres (approx. 2,000 square miles) (Cameron and Stephenson, 1985). It is the longest river in Scotland, 187 kilometres (approx. 117 miles) and has the largest discharge in Britain -- a daily average of 167 cubic metres per second (4,550 cfs). During winter the average daily flow increases to 255 cubic metres per second (9,004 cfs). In a normal year, periods of reduced flow occur in the summer months when evapotranspiration

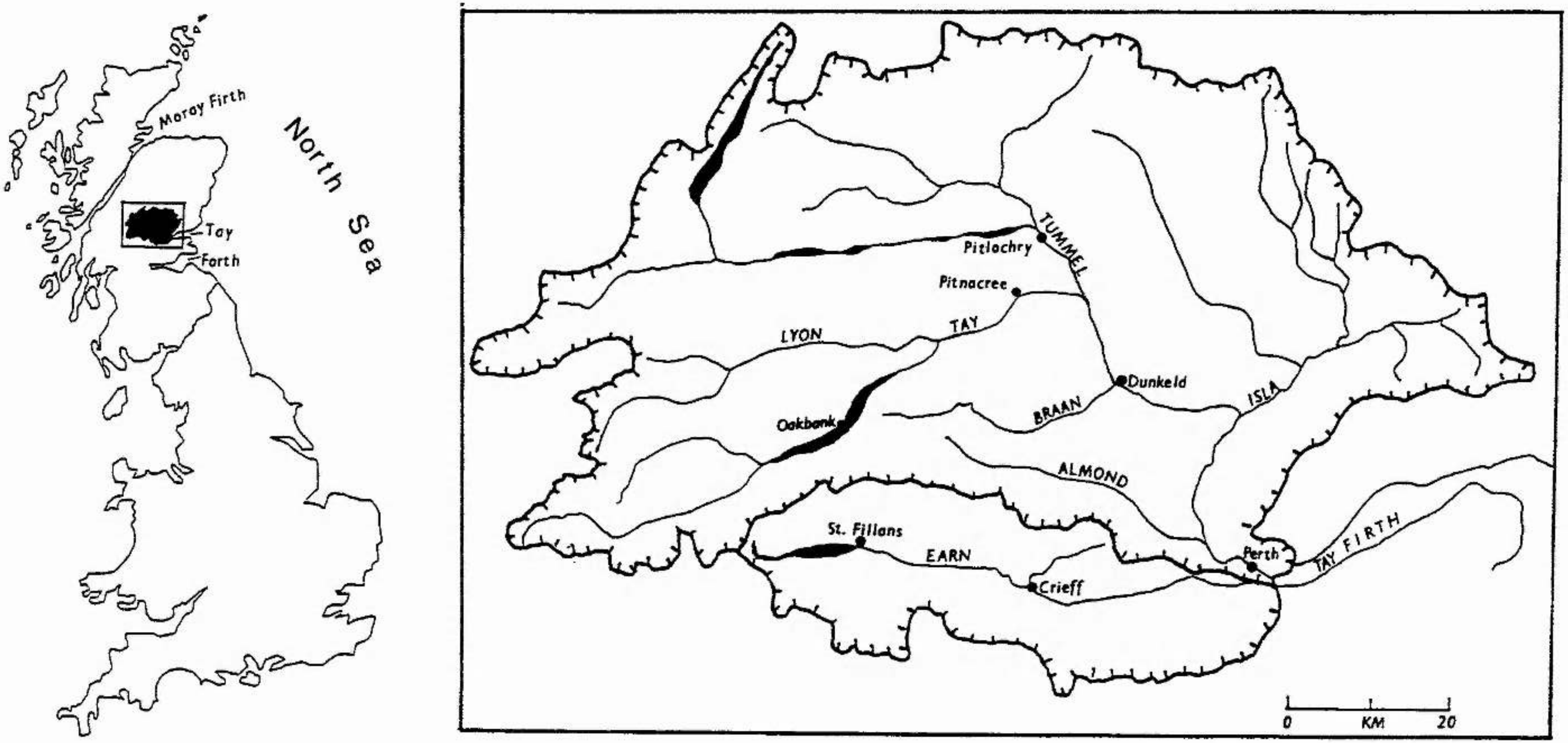


Figure 5.1 Sketch map of catchments of the Rivers Tay and Earn (modified from Maitland and Smith, 1987, 377).

rates are high. Peak flow for the year 1990 was measured at 1,746 cubic metres per second (61,651 cfs) -- a considerable increase over the peak flow average of 1,570 cms or 55,436.7 cfs for the years preceding 1990. In 1990, 1,211 millimetres of rainfall in the Tay Basin represented a 30 per cent increase over the 1941-1970 average. However, annual precipitation varies considerably across the region. In the west it reaches 3,175 millimetres (126 inches) near Argyll but falls to 762 millimetres (30 inches) at Perth.

Its lower reaches are situated in the Midland Valley (Figure 4.2) and its headwaters originate in the Southern Highlands. The Midland Valley is an ancient rift valley or grabenboundedin the north by the Highland Boundary Fault and in the south by the Southern Upland Fault (Cameron and Stephenson, 1985). The basin was established in the Tertiary and overlies Upper and Lower Devonian sandstones bounded on either side by abruptly-rising volcanic hills composed of andesitic and basaltic lavas and pyroclastic rocks. Pleistocene glaciations however, eroded the bedrock and deposited tills and marine sediments of sand, silt and clay (Armstrong, Paterson and Browne, 1985).

The catchment's elevation ranges from sea level to approximately 1,000 metres (3,280 feet) but the river itself only drops approximately 625 metres (2,050 feet). On either side of the Tay basin, the bedrock consists of volcanic, erosion resistant Devonian lavas, 360 to 408 million years old. These hills formed on Lower Devonian age beds of red and grey sandstones and conglomerates and are breached by the Tay, Earn and Forth rivers. The rivers collect, direct and transport the basin's drainage east or seaward into an estuary in the North Sea.

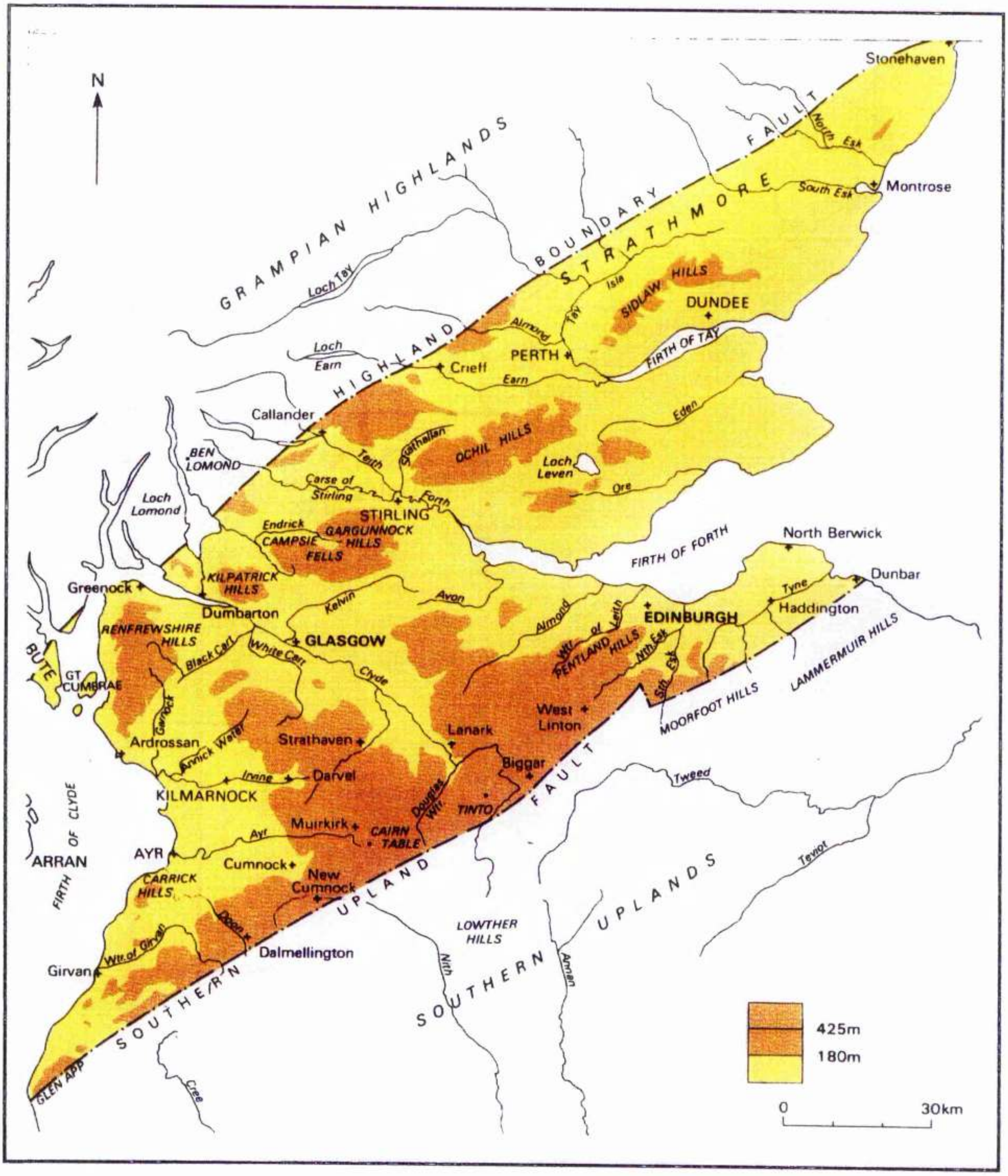


Figure 5.2 The Midland Valley of Scotland (from Cameron and Stephenson, 1985, 2).

The main river channel of the Tay is augmented by other rivers running into its course. To the southwest, these are the Bran, Almond and Earn rivers. To the northeast, they are the Lyon, Tummel and Isla. Generally, the catchment is steep comprising mountains and moorlands, with exception in the lower valleys where there is mainly rough grazing and forestry. The proportion of forested land is nearly constant and relatively small throughout the basin. Many of the hydrological and ecological consequences of forestry are effectively diluted by the large areas of unaffected rough grazing. Water chemistry analysis has showed that total dissolved solids are high at the source and remain constant to the estuary (Maitland and Smith, 1987). In comparison with other river systems there is little chemical change along its course. At the confluence with the River Isla, however, there is an increase in conductance, alkalinity, sodium, potassium, calcium, and magnesium levels. None of the physio-chemical or biological features of the River Tay seem to warrant its recognition for international conservation status (Maitland & Smith, 1987).

Relative sea level studies since deglaciation have been extensively undertaken in the Forth and Tay valleys. The North Sea is optimum for evaluation of variables affecting sea level change. Its area is small enough to have acted uniformly to any past changes in geoid configuration yet it also exhibits a wide range of environments. As a result, other variables affecting sea level change such as isostatic history, coastal morphology, sediment supply, freshwater discharge, tidal range, exposure to storms, long term crustal movements and human activity can be evaluated (Haggart, 1987).

The Tay area sea level studies are significant because they provide information on relative dates and altitudes of shorelines and their associated isostatic recoveries (Figure 5.3). The most obvious

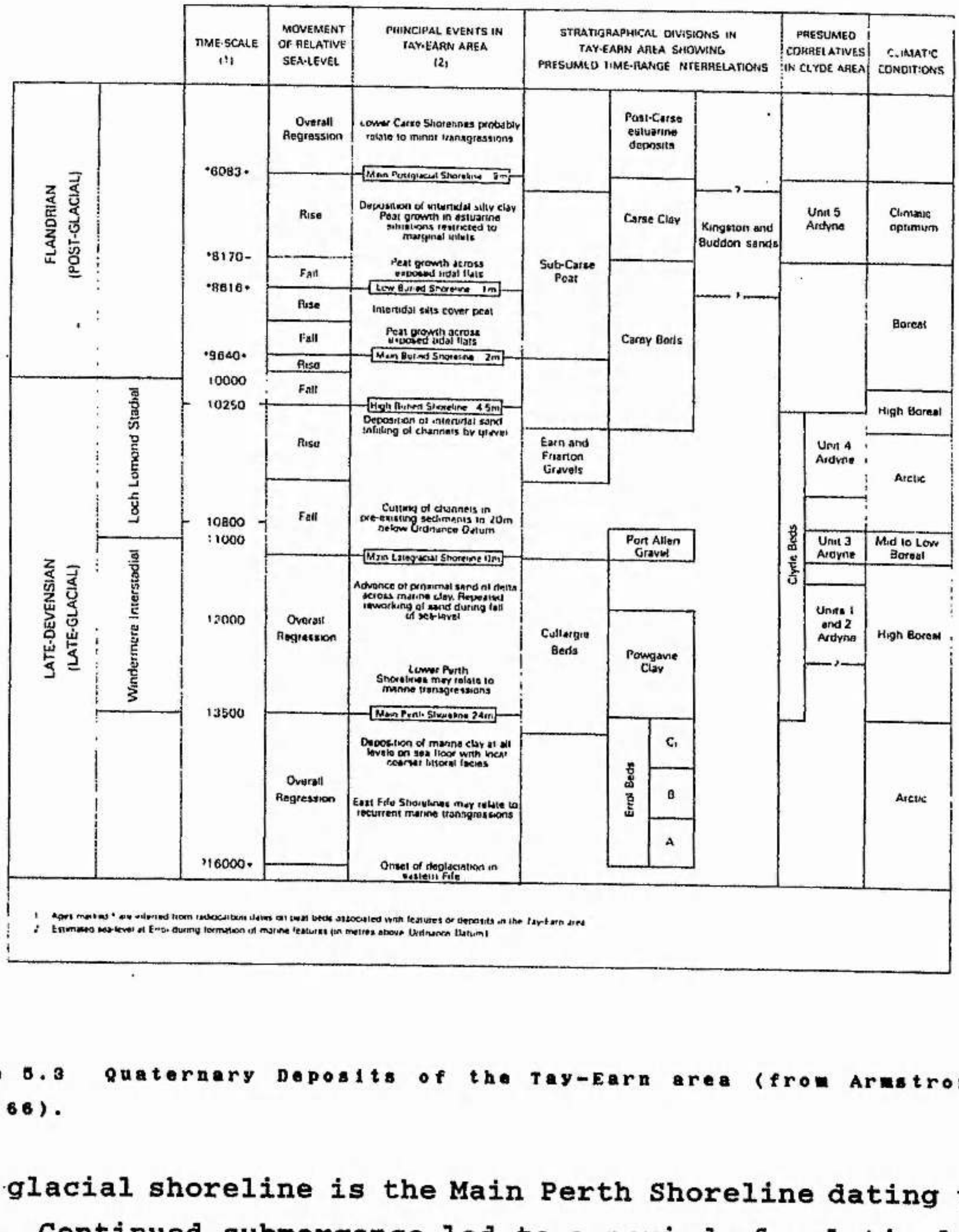


Figure 5.3 Quaternary Deposits of the Tay-Earn area (from Armstrong, et al, 1985, 66).

late glacial shoreline is the Main Perth Shoreline dating to 13,500 B.P.. Continued submergence led to a period of relatively low sea level during which time the Main Lateglacial Shoreline was formed more or less contemporaneously with the Loch Lomond Readvance. A relative rise in sea level following the formation of the Main Late glacial and its subsequent intermittent fall caused the formations of the High and Low Buried Beaches. The Main Buried

Beach stabilized at 2 metres above Ordnance Datum and dates to 9,640 years B.P.

The rate of isostatic uplift in the Tay basin based on radiocarbon samples of peat is computed at approximately 1.49 metres per 1,000 years (Shennan, 1987). This rate is relative to the regional eustatic sea level curve computed by Morner for the west coast of Sweden (Tooley, 1978). Isostatic tilting resulted in the beach sloping eastward from Strathearn (See Figure 5.4). Differential isostatic recovery after glaciation had the effect that the oldest beach now has the greatest gradient outward from the centre of isostatic uplift in the western Grampian Highlands and the gradient diminishes in successive younger shoreline features (Cameron and Stevenson, 1985).

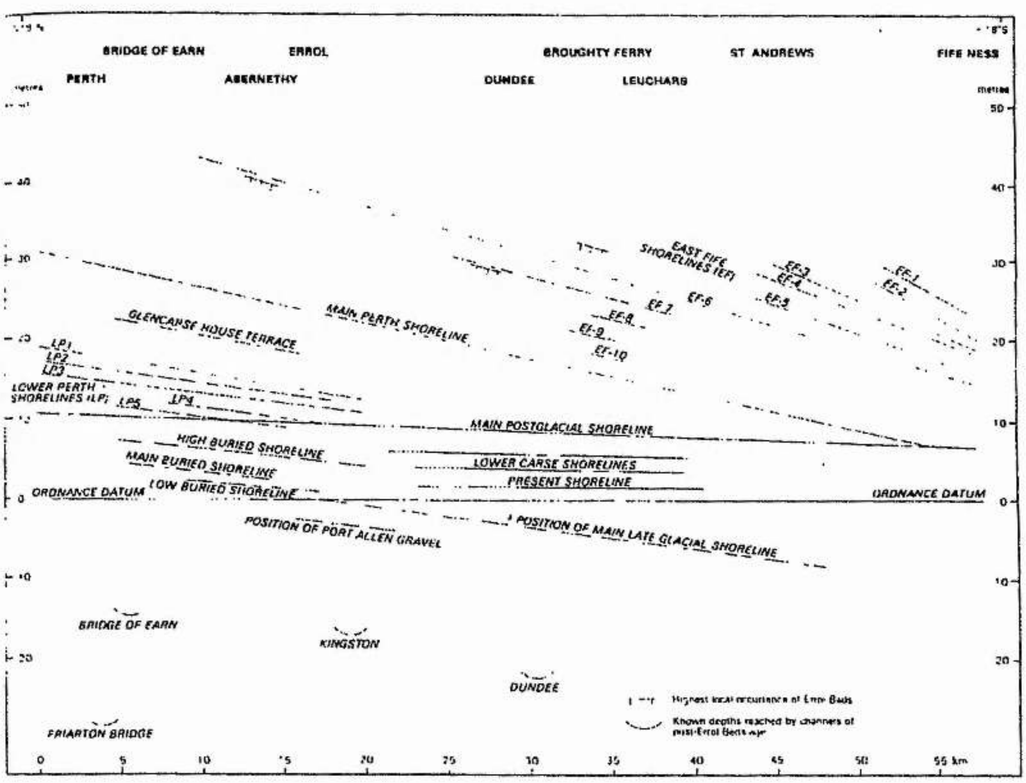


Figure 5.4 Raised shorelines in the Tay-Earn river valleys (from Armstrong, et al., 1985, 73).

Morner's curve after correcting for local variations in the amount and degree of isostatic recovery supports the oscillating theory of Fairbridge on sea level during the Flandrian. Other North Sea sites such as those studied by Haggart in the Beauly Firth provide information on absolute age, environmental change and rates of sea level fluctuation. Although the approaches are so markedly different, there is good agreement between Morner's, the Beauly Firth's and the Tay region's sea level data (Haggarts, 1987).

Selection of Study Area

In Scotland, the process was fairly direct. From visual inspection of Ordnance Survey maps at a scale of 1:50,000, three river segments within the Tay basin that appeared to be actively meandering were selected for further review. These were the River Earn, the River Isla and that portion of the River Tay from its confluence with the River Tummel to Loch Tay. The National Map Library in Edinburgh provided Ordnance Survey maps from the first series (six inch or 1:10,560), surveyed in 1860 and completed in 1866. By using a light table and overlaying the most recent OS maps at a fairly comparable scale of 1:10,000, observations on how far each river segment had shifted in its course over approximately 100 years could be made. The River Earn was the most successful 'meanderer' and therefore selected for further analysis.

More precisely, the Earn river study area is defined as that portion of the River Earn from its confluence with the River Tay to the town of Crieff, approximately 61 kilometres (38 miles) (Figure 5.5). This lower portion of Strathearn exhibited the greatest "meander-ability" across its floodplain. In the geological description that follows, the entire Earn valley is discussed, but the archaeological assessment is restricted to the study area defined in order to keep the database manageable.

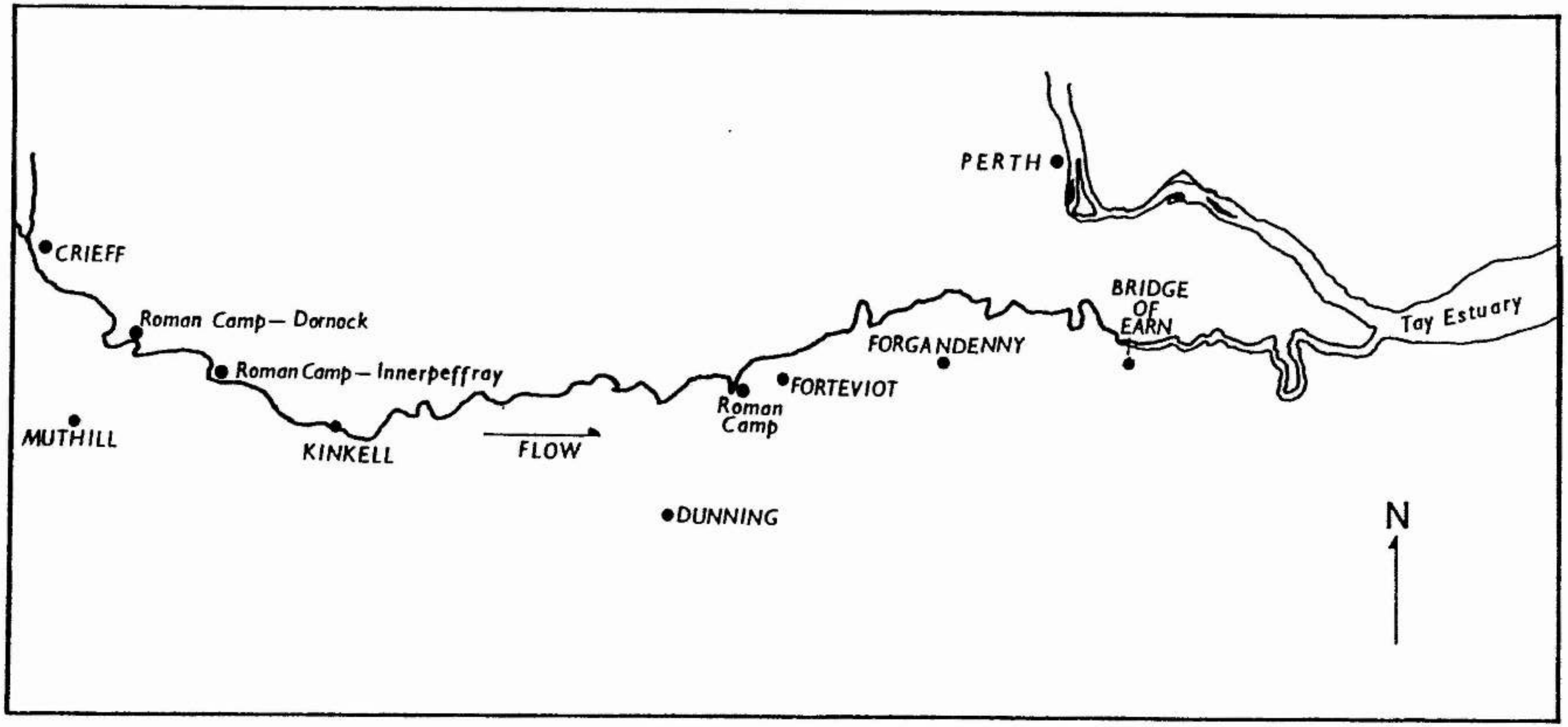


Figure 5.5 Earn Study Area including items in text.

The Earn River Valley and Study Area

The Earn river is approximately 70 kilometres (43 miles) from St. Fillans to the Tay estuary. It originates in the Grampian Highlands of eastern Scotland and extends into the central lowlands (Figure 5.6). The Highland Boundary Fault separates the two -- its lower section being relatively flat in comparison with other rivers in the Tay basin. The River Earn's drainage area is approximately 79 kilometres (49 miles) long and 20 kilometres (12 miles) at its maximum width accounting for approximately 15 per cent of the Tay river basin's drainage area (Al-Ansari, N.A. 1976).

Annual precipitation in the Earn valley from 1916-1950 reported by the Tay River Purification Board varied from 2,320 millimetres (91 inches) at Dubh Choirein in the Grampian Highlands to 965 millimetres (38 inches) at Kinkell Bridge. Daily average flow rates from the Kinkell bridge gauging station were 31 cubic metres per second (1,094 cfs) with a maximum flow of 255 cms (9,004 cfs). The winter average, 41 cms (1,447 cfs), is approximately double the summer's average flow rate indicative of the high degree of evapotranspiration which occurs in the summer months. In 1990, the Earn's peak flow was 328 cubic metres per second (11,581.68 cfs).

There are nine tributaries of the River Earn, six of which enter within the study area. Above Crieff, the Earn is joined by the rivers Ruchill and Turret draining the lands to the south and the Lednock. The Lednock rises to the north between Lochs Tay and Earn and includes an artificial lock used for hydroelectric purposes. Downstream from the Earn-Lednock confluence the river crosses the Highland Boundary Fault after which Old Red Sandstone becomes the dominant form of solid geology. The Ruthven, the Machany Water, the Water of May, the Dunning Burn and the River Farg drain regions to the south of the Earn while the Pow Water enters from the north.

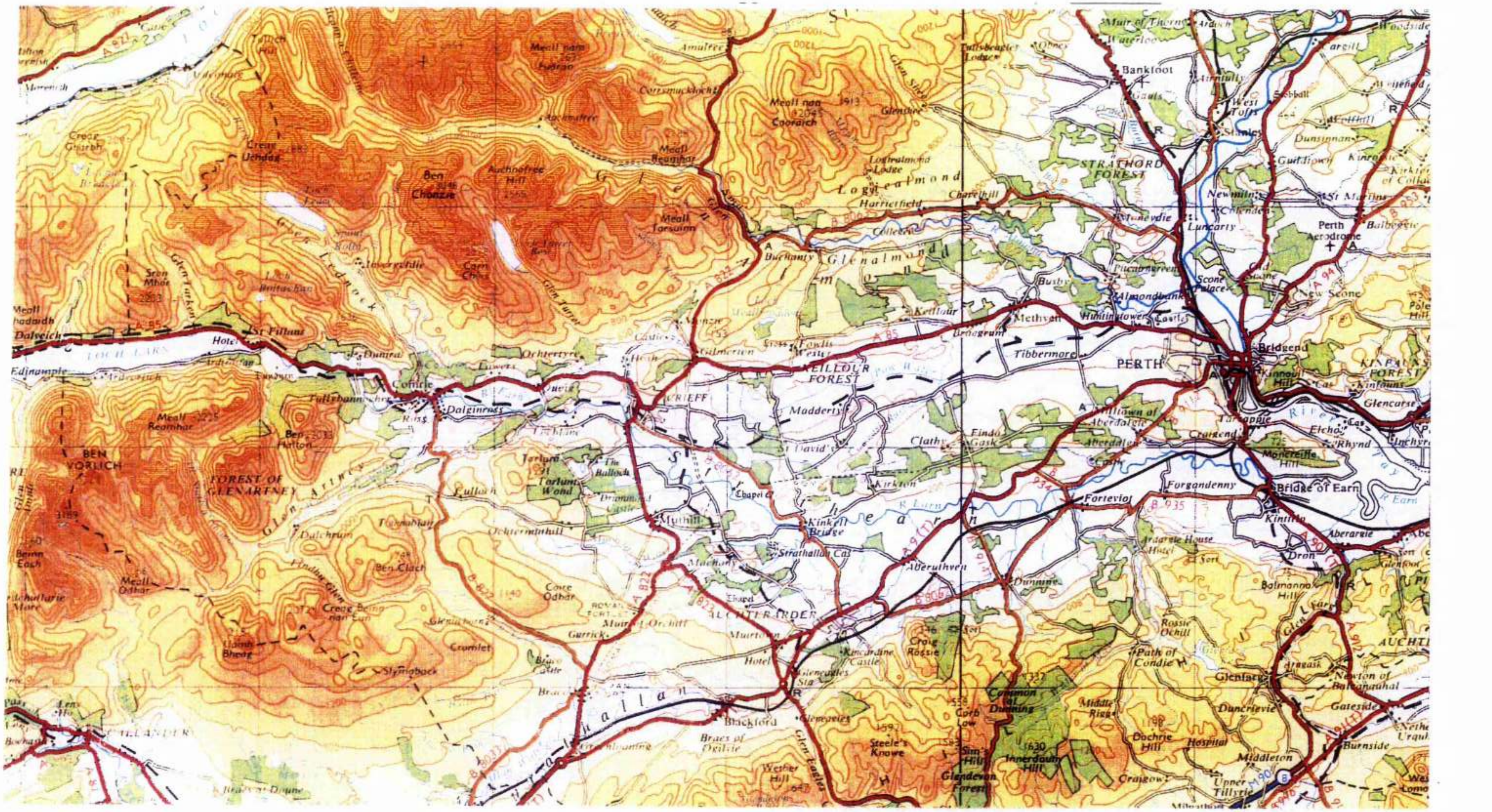
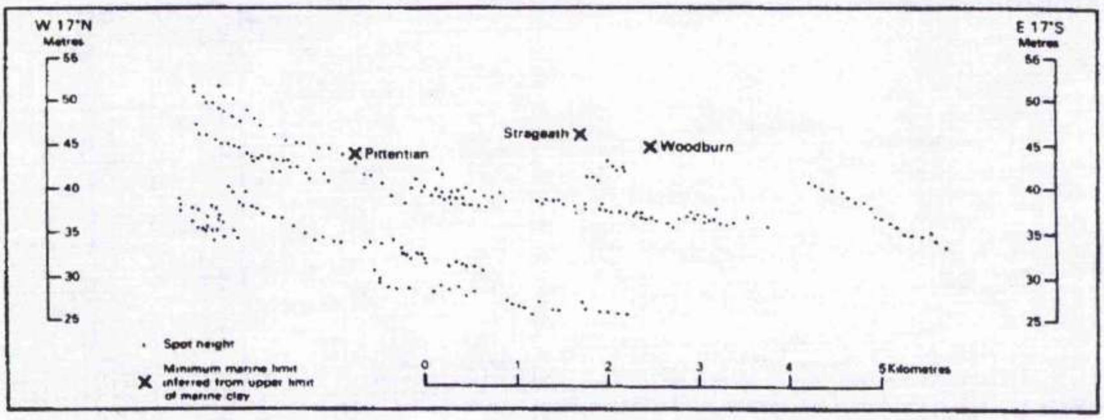
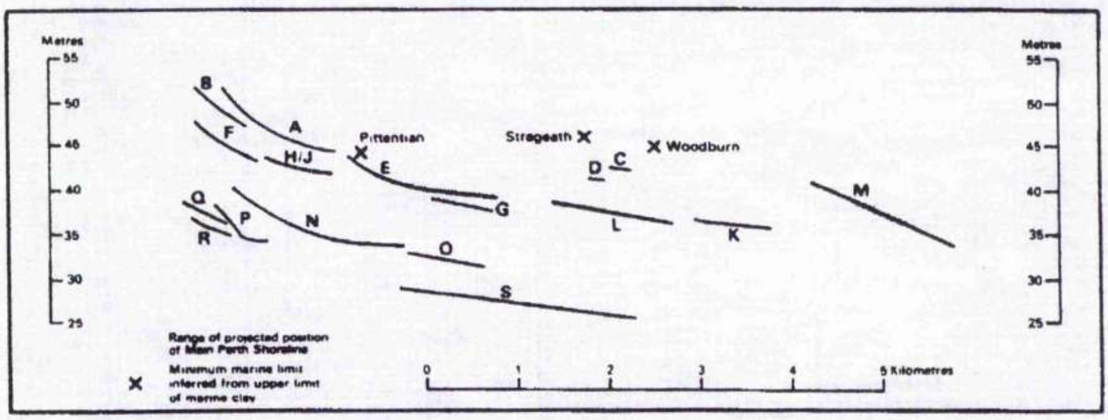


Figure 5.6 The Earn river valley (from Ordnance Survey, 1973).

The river's channel below St. Fillans is shallow and flat bottomed. Occasional pools, knobs of rock and artificial riffles characterize the channel bottom. In the vicinity of Kinkell Bridge the river bed is disturbed by artificial rapids constructed for fishing (Al-Ansari, 1976). From there to Forteviot the bed is of medium gravel with local sand ribbons. Below Forteviot Bridge the gravels decrease sharply in importance so that at the tidal limit, 5 km to seaward near the village of Bridge of Earn, the mobile bed is entirely of coarse sand (Al-Ansari and McManus, 1979). The mean water surface slope at Kinkell and Forteviot are 1.46×10^{-3} and 8.4×10^{-4}, respectively. In the lower reaches, the Earn meanders through terraced alluvium and shows well developed meanders with levees and oxbow lakes. The river's bed of sands and gravels are situated on the northern margin of the valley along an 8 kilometre (4.9 mile) tidal stretch where it enters the estuary. The banks of the river show post-glacial deposits including a prominent peat horizon near the Tay estuary.

The Earn valley below Crieff was deglaciated before the formation of the Main Perth Shoreline or approximately 14,000 years B.P. Figure 5.7 indicates the relative heights of numerous terraces between Crieff and Kinkell Bridge. The Main Perth Shoreline is postulated to agree with the middle series of terraces descending to levels between 30 m and 35 m O.D.(terraces E, F, H/J, G, L, and K, Figure 5.7). These terraces represent fluvio-deltaic deposits entering the late-Devensian estuary of the Earn. Terraces M, N, O,P, Q and R form a lower series of terraces which might be temporally associated with the High, Main and Low Buried Shorelines from Armstrong's diagram in Figure 4.2 and 4.3. Terrace S is the present floodplain of the Earn. The high terraces A and B are interpreted as fluvial features associated with an earlier level of the late-Devensian sea.





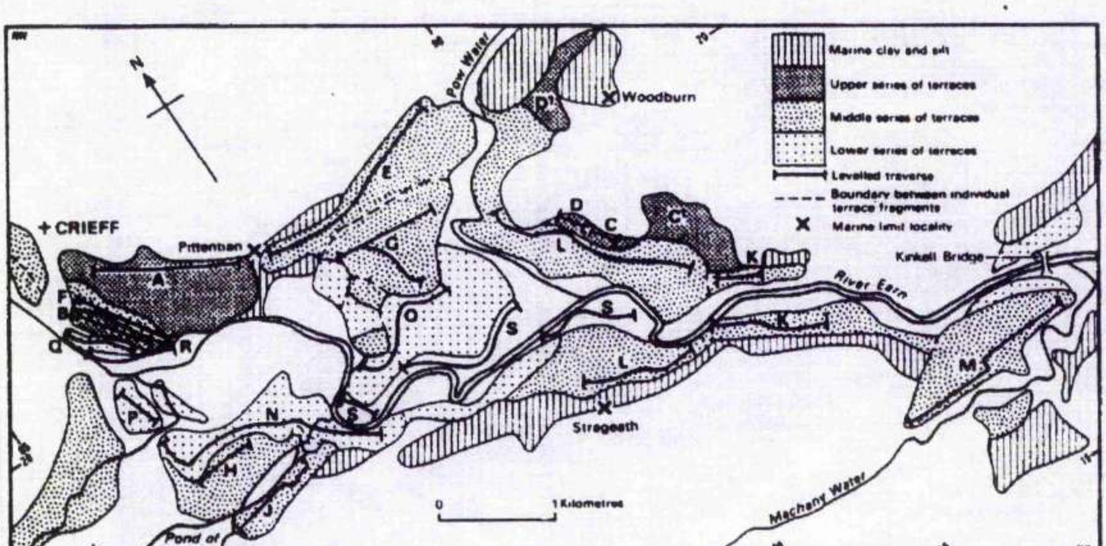


Figure 5.7 Profile and plan of the alluvial terraces of upper Strathearn (from Browne, 1980).

The Cultural Chronology of Scotland

For a general overview, the cultural period chart for Britain is presented in Figure 5.8 compiled from J.V.S. Megaw and D.D.A. Simpson (1979) and Leslie and Roy Adkins (1982). Although many other basic archaeological texts have been published, Megaw and Simpson remain a well-subscribed text on British prehistory. With regard to Scotland, the cultural chart of Britain from the Mesolithic to the Iron age generally holds true.[1] No cultural evidence prior to the Mesolithic period has been found in Scotland. Since that time, however, there are most certainly variations from this general chart in the northern cultures based on their environmental and geographical differences.

After the Roman advance into Scotland in about 79 AD, Scotland's history diverges from Britain as noted in the historical period of the chart derived from Scottish place-name evidence. The Celts who are associated with the Early Christian Period in Scotland, were followed by the Picts in the Tayside region (Walker and Ritchie, 1987, 14). Fife and Tayside formed the southern part of the kingdom of the Picts. Christianity was firmly established in the course of the 7th century and became an important influence on the

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[1] There are some chronological overlaps between the Neolithic, Bronze Age and the Iron Age transitions in Britain's cultural period chart. Cultural charts and their distinct boundaries that define specific periods with differing lifeways are dangerously easy to misinterpret. The abrupt nature of the line between two cultural periods does not necessarily reflect the subtleness of the cultural transition that actually occurred. Perhaps the change in lifeway did occur dramatically fast as with an invasion or migration of one cultural group into another, like the occupation of Southern Britain by the Romans. Or perhaps it occurred very slowly over several hundreds of years in response to environmental factors. In either case, the archaeological point of interest is not only how the cultures changed, but why and to what extent this can be determined from the archaeological record. One must recognize the arbitrary nature of these chart boundaries and utilize them only as general guides or tools for understanding culture change.

Britain's Cultural Periods	
Date	**Cultural Period**
50,000 - 25,000 B.C.	Earlier Upper Paleolithic(EUP)
25,000 - 13,000 B.C.	EUP (or note)
13,000 - 8,300 B.C.	Later Upper Paleolithic(LUP)
8,300 - 4,000 B.C.	Mesolithic or LUP
3,700 - 2,000 B.C.	Neolithic
2,500 - 1,700 B.C.	Late Neolithic
2,000 - 1,200 B.C.	Early Bronze Age
1,200 - 700 B.C.	Late Bronze Age
700 B.C. - 43 A.D.	Iron Age (Roman invasion)
43 - 410 A.D.	Roman
Mid 5th C - 1066 A.D.	Anglo-saxon (Norman conquest)
In Scotland	Celts - Early Christian
North & East Scotland	Picts
1066 - 1500 A.D.	Medieval

Figure 5.8 Britain's Cultural Period Chart (compiled from Megaw and Simpson, (1979) and Adkins,(1982).

style of the Pictish sculptors (ibid.). Archaeological evidence for the Picts predominantly exists as carved standing stones (Ritchie, 1989) although it is believed that many of their social customs such as land tenure were assimilated by later cultures in the area (Driscoll, 1991, 89) and can be inferred from studying their field systems (Driscoll, 1991, 94). The political entity that was unified against Roman invasion, was, by the 6th century, a federation of iron-age tribes under one rule (Walker and Ritchie, 1987, 15). Scottish influence in Pictland during the late 8th and early 9th centuries finally led to a political union of Scots and Picts (ibid.). The ceremonial and symbolic centre of their kingdom known as Alba was at Scone in Tayside. Eventually, as its power was consolidated and the territories of Scotland increased, the centre of royal authority was moved south to Edinburgh and so out of Tayside (ibid.).

The Earn River Database (Appendix Three)

The Earn river study area includes that portion of the Earn valley from Crieff to its confluence with the River Tay, approximately 38 miles (61 kilometres) in length. There are 206 sites listed in the National Monuments Records Office(NMR) within the context of the valley floor and within approximately two miles (3 kilometres) of the present river's course. The Earn river study area sites are listed in Appendix Three. This also includes sites associated with the valleys of the Water of May, Dunning Burn, Garvock Burn, Machany Water, Gelly Burn, and Pinner Burn. These tributary sites are situated on or very near (within 1/4 mile) these lesser water courses -- some which no longer flow. Their inclusion in the Earn river study area database is appropriate based on the assumption that the cultural groups associated with the tributary sites were significantly interacting with each other and to a greater extent with the Earn valley environment as a whole.

The individual database fields were obtained either directly from the NMR or by inference. The location and description fields (Sheet, Num, Ref, and Desc) were lifted directly from the general location and classification fields of the NMR records. By inference, the Indicator(Ind) field logically defines whether the site is indicative of where the river has been or was in the past. Although this determination is subjective, in most cases it was relatively straight forward. For instance, all river finds described as such were considered true for indicating position of the river in the past. All sites relevant to river activity like ice houses, harbours, quays, and bridges were also indicated true.

The most significant site type marked true as indicators were sites clearly missing portions of their features as a direct result of river action. This was the case, in particular, with the Roman camps that were once rectangular and are now missing parts of their circuits. Also, the Erosion(Ero) field, another logical field, was used to indicate evidence in the NMR record other than from the maps themselves that the site was eroding. For instance, the text mentions that the site was eroding, or had been eroded in the past by what we can assume are fluvial means.

In addition to the NMR fields and the subjective fields indicating fluvial erosion activity taking place near the sites, two soil fields were created. The soil information for each site was taken by transferring the locational coordinates to the Soil Surveys of Scotland 1:63,360 scale map produced by Ordnance Survey in 1968 (map sheet 48/49) and 1982 (map sheet 47).

The differentiating criteria for the soil series classification system used in Great Britain are (1)nature of the parent material, (2)textural characteristics within a profile and (3)distinctive mineralogy or colour. (Clayden and Hollis, 1984) Parent material is an historically important characteristic in the development of Scotland's soil classification system. Parent material is equally useful when considering the soils associated with archaeological sites.

In the Earn valley, it is helpful to distinguish between the fluvial terrace formations, tills derived from Old Red Sandstone or Igneous Rock and glaciofluvial deposits. This differentiation plays a crucial part in application of the geoarchaeological approach to the Earn valley and will be more fully discussed in the next section.

The final field, (A) for aerial photography, was added to the database after a careful review of the NMR data made it apparent that sites known ONLY from aerial photography comprised a large proportion of the record. Since no further information was available on these sites concerning their cultural or temporal affiliations, their archaeological value was limited. The "A" field for sites known from evidence other than aerial photography was left blank (N=95). Sites known from aerial photography ONLY were marked A (N=104) while those known from aerial and ground reconnaissance were marked P (N=6).

Aerial photography in Britain has been extremely successful during droughts in locating sites that were not readily observable either because of their vastness or remote location or because no trace of the site remained above ground. Work to develop typologies for sites identified by crop marks has only been moderately successful. Aerial photography's usefulness has been limited by the ability of ground survey teams to keep apace with the flights and further investigate their discoveries. Since over 50 per cent of the Earn valley sites reported in the NMR record are known only from aerial photography, this feature of the NMR record must be taken into account.

Earn Study Area: Relationship of soils and topography to sites

Several points previously mentioned are worth re-stating here before associating the archaeological sites from the Earn valley with soils found in Scotland. During initial phases of research in this case study, the nature of the Tay river's meanderability, slope, floodplain and potential for archaeological sites was investigated. After the Earn valley study area had been selected, the National Monuments Records Office's archaeological data for the entire Tay basin was reviewed. Some observations are worth mentioning since they are pertinent to understanding the importance of using a geoarchaeological approach to studying fluvial systems. First, beginning at or just below Dunkeld, the valley margins are much steeper (i.e. a greater change in elevation occurs between the upland and the river) and a floodplain-type feature exists on either side of the river -- but no sites are identified within it. In the area of the Tay below the Highland Boundary Fault there are not nearly the number of sites affected by river shift as found in the Earn. This might be due either to survey variability in the two areas, the differing nature of the archaeological record in each, or simply that there are not nearly as many sites because occupation was not so dense.

Above Pitnacree the change in elevation between the valley and upland rises to 80 metres (262 feet). What started as a search for eroding sites along the River Tay ended in the highland regions as a need to consider sites which indicate the opposite. The river margins are stable in that area and are -- through their relationship to the increasing slope -- only downcutting or entrenching rather than meandering. There are sites along the margins but none are eroding. Bridges were firmly fixed. Cottages and castles constructed on the upland areas overlooking the river are in no apparent danger of erosion. In fact, their alignment indicates that the river margins have not changed in several hundred years. These sites are therefore archaeological indicators of the river's fixed position rather than its movement. Occupation in the upland areas of the Tay basin as interpreted from the known archaeological sites within their environmental context appears quite different to that known in the Earn valley's.

Turning to the Earn River, geomorphological analysis of the study area's archaeological sites requires an understanding of the development of soil survey in Scotland. Closely following the American classification system, both are based on Russian soil literature from the 1920's (Clayden and Hollis, 1984) and the ensuing development of pedology. The series level of classification is differentiated according to three main properties: the nature of the parent material, the textual characteristics and the mineralogy (ibid.,7). Since parent material is the primary indicator of a soil's association, each archaeological site's soil is identified by its location on the soil survey map and then grouped by their parent materials. This is an effective method for developing relationships between the soils and the archaeological sites. The Earn study area's soil series symbols are grouped into seven general categories of parent materials. These are listed in Figure 5.9 along with the total number of sites for each category (in parentheses), the depositional time period and range of surface elevation.

DESCRIPTION	N^{o}. OF SITES	TIME OF DEPOSITION	RANGE OF ELEVATION O.D.	SOIL SERIES
Flood Plain	58	< 8,800 BP	< 12m	AL, RI[1], BR[1]
1st Terrace - estuarine with raised beaches	8	8,800 - 10,100	12m	FQ, SG
2nd Terrace - late glacial with raised beaches	71	10,000 - 14,000	10 - 32m	HV, CX, CJ
Fluvioglacial terraces & morainic deposits	15	V[2]	V[2]	GE, IW, DN
Tills derived from Old Sandstone	27	V[2]	V[2]	AD, MR, BL, FO
Tills derived from Igneous Rock	6	V[2]	V[2]	SH, BS
Mixed Tills	21	V[2]	V[2]	KV, BU, RU, LR, GA, MY

Figure 5.9 Geomorphic features for the Earn study area based on parent material and soil series data 1:RI & BR = River find and Bridge respectively. They are not soil series symbols but represent modern floodplain features. Hence their inclusion with alluvial(AL) sites. 2: V= variable

In terms of quantity, the second terrace deposits group contain more sites than any other group. It contains more than twice the number of all groups except the modern floodplain. Could this be an indication of biased survey and recording, or an actual increase in human occupation of the second terrace deposits? Or is it simply attributable to some unique site formation or preservation feature this terrace possesses or to the presence of easily worked soils? Examination of other site information such as soil type, erosional features and data source gives further insight into these questions.

SHEET	NUMBER	REF	DESCRIPTION	INDICATOR	EROSION	SOIL	SOIL1	AP
NO 11 NE	022	17191833	JOUG STONE; WESTER RHYND	F	F	AL		
NO 11 NE	047	17191835	FARMHOUSE; WESTER RHYND	F	F	AL		
NO 11 NE	081	17101830	HOUSE; WESTER RHYND	F	F	AL		
NO 11 NW	021	RIV EARN	GOTLAND HORSE-HEAD BROOCH	T	F	AL		
NO 11 NW	022	RIV EARN	STONE AXE	T	F	AL		
NO 01 NE	006	05051897	CROSS	F	F	AL		
NO 01 NE	021	05601750	ENCAMPMENT; MILLER'S ACRE	T	F	AL	GE	
NO 01 NW	011	01951562	CISTS	T	T	AL		
NO 01 NW	016	04901750	PALACE FORTEVIOT	T	T	AL	CX	
NN 91 NE	014	98621743	CASTLE RUIN; GASCON HALL	F	F	AL		
NN 91 NE	020	98051626	MILL DRUMTOGLE	F	F	AL		
NN 91 NW	005	90481787	INNERPEFFAY CASTLE 17TH C	T	F	AL	CX	
NN 91 NW	007	90201833	INNERPEFFRAY CHAPEL	T	T	AL	CX	
NN 91 NW	008	93801621	ST. BEANS CHURCH KINKELL	F	F	AL	HV	
NN 91 NW	012	92851580	EARTHWORK ENCLOSURE	T	T	AL	BL	
NN 81 NE	017	87581975	STONE AXE	T	F	AL		
NN 81 NE	006	88241849	CHAPEL CEMETARY STRAGEATH	F	F	AL		
NN 81 NE	027	88201847	FARMHOUSE STRAGEATH MILL	F	F	AL		
NN 81 NE	036	85981957	COTTAGE DARGILL COTTAGE	F	F	AL		
NN 82 SE	064	85622082	WORKS SOUTH BRIDGEND	T	F	AL		
NO 11 NE	042	16851744	BRIDGE; FARGIE	T	F	BR		
NO 11 NE	076	19591918	PIER; CARNIE	T	F	BR		
NO 11 NE	077	19471814	QUAY FERRYFIELD AT CARPOW	T	F	BR		
NO 11 NW	014	13261848	OLD BRIDGE OF EARN	T	T	BR		
NO 01 NE	044	07051556	BRIDGE; WATER OF MAY	T	F	BR		
NO 01 NW	015	00431784	DALROECH BRIDGE	T	F	BR		
NO 01 NW	052	04901755	BRIDGE FORTEVIOT	T	F	BR		
NO 01 NW	053	00431784	BRIDGE DALREOCH	T	F	BR		
NN 91 NW	026	93411618	WAULKMILL BRIDGE	T	F	BR		
NN 91 NW	028	92331553	STRATHALLAN CASTLE BRIDGE	T	F	BR		
NN 81 NE	032	87511537	BISHOP'S BRIDGE	T	F	BR		
NN 81 NE	041	89991595	KNAPPILANDS BRIDGE	T	F	BR		
NO 11 NW	020	RIV EARN	CARVED STONE BALL	T	F	RI		
NO 01 NW	002	03001800	CARVED STONE BALL	F	F	RI		
NO 01 NW	008	00401780	CARVED STONE BALL	T	F	RI		
NO 11 NE	069	16281850	ENCLOSURE	F	F	AL		A
NO 01 NW	031	03651628	RING DITCH; DRUM OF GARVOCK	F	F	AL		A
NO 01 NW	048	04201810	CULTIVATION REMAINS	T	T	AL		A
NO 01 NW	058	01891558	ENCLOSURE PITS	F	F	AL	CX	A
NN 91 NE	022	98801610	RING DITCHES SOUTH STRATHY	F	F	AL	CJ	A
NN 91 NE	025	99301720	ENCLOSURE (POSS)	F	F	AL		A
NN 91 NE	031	98651742	ENCLOSURE GASCON HALL	F	F	AL		A
NN 91 NE	033	98401680	CROPMARKS HAUGH OF ABERUTHVEN	F	F	AL		A
NN 91 NW	023	90101830	ENCLOSURE MAINS OF STRAGEATH	T	T	AL		A
NN 91 NW	031	90301790	PITS CROPMARKS SOUTH MAINS	T	T	AL	CX	A
NN 91 NW	036	93501550	ENCLOSURE WALLFAULD	T	F	AL	HV	A
NN 91 NW	040	90101530	LINEAR CROPMARKS MACHANY	F	F	AL	BU	A
NN 91 NW	050	92801640	NORTH MAINS CROPMARKS	T	F	AL	CX	A
NN 81 NE	018	89301880	ENCLOSURE AND TIMBER HALL	T	T	AL		A
NN 81 NE	016	89001800	TEMP ROMAN CAMP STRAGEATH	F	F	AL	CX	A
NN 81 NE	022	88901840	ENCLOSURE DALPATRICK	T	T	AL	CX	A
NN 81 NE	025	88911910	RING-DITCHENCLOSURE DORNOCK	F	F	AL		A
NN 81 NE	026	87701890	RING-DITCHES DORNOCK	F	F	AL	CX	A
NN 81 NE	049	89401840	SOILMARKS STRAGEATH MAINS	T	T	AL		A
NN 81 NE	062	88601880	ENCLOSURE(POSS) LINEAR CROPMK	F	F	AL		A
NN 81 NE	063	87001890	ENCLOSURE (POSS) TEMPLEMILL	F	F	AL		A
NN 82 SE	022	85922004	STANDING STONE DARGILL ISLAND	T	F	AL		A
NN 82 SE	066	85902010	PIT-ALIGN ENCLOS(POSS) DARGILL	T	T	AL		A

Figure 5.10 Sites located in modern floodplain of Earn study area.
Total = 58, 40% known from aerial photography only.
Soil Series = AL, RI, BR

SHEET	NUMBER	REF	DESCRIPTION	INDICATOR	EROSION	SOIL	SOIL1	A P
NO 11 NE	023	18261854	CHURCH; RHYND	F	F	SG		
NO 11 NE	037	16841766	FARMHOUSE; CULFARGIE	F	F	SG		
NO 11 NE	043	15471829	FARMHOUSE; ELLOITHEAD	T	F	SG		
NO 11 NE	045	19501807	HOUSE; FERRYFIELD AT CARPOW	F	F	SG		
NO 11 NE	079	18001800	CHURCH; RHYND	F	F	SG		
NO 11 NE	080	18001800	LAIRD'S HOUSE; EASTER RHYND	F	F	SG		
NO 11 NE	060	19641816	RING-DITCH	F	F	SG		A
NO 11 NE	066	19401800	LINEAR CROP MARKS	F	F	SG		A

Figure 5.11 Sites located in 1st terrace above floodplain of Earn study area.
Total = 8, 25% known from aerial photography only.
Soil Series = FQ, SG.

SHEET	NUMBER	REF	DESCRIPTION	INDICATOR	EROSION	SOIL	SOIL1	A/P
NO 11 NE	005	17401700	COIN ROMAN; HOUSE OF CAREY	T	F	CJ		
NO 11 NE	027	17401650	ROMAN TEMPORARY CAMP	T	F	CJ	FQ	
NO 11 NW	016	11331898	CHURCH; CEMETARY DUNBARNEY	F	F	CJ		
NO 11 NW	017	11011862	DOVECOT; DUNBARNEY	F	F	CX		
NO 11 NE	023	06421943	CHURCH: CEMETARY DUPPLIN	F	F	CX	GA	
NO 01 NE	052	05831907	CASTLE; DUPPLIN	F	F	CX	AL	
NO 01 NW	010	01241536	CISTS BLAEBERRY	F	F	CX	AL	
NO 01 NW	025	04831709	HOUSE; HENNHILL	F	F	CX		
NN 91 NE	007	96001500	CIST (BEAKER) BAEILIELANDS	F	F	CX	BU	
NN 91 NE	010	96001500	BRONZE SWORD: BAILIELANDS	F	F	CX	BU	
NN 91 NE	011	97341510	CHAPEL; FORMER PARISH CHURCH	F	F	CX	AL	
NN 91 NE	018	97741610	HENGE; CROPMARK BEAKER	F	F	CX		
NN 91 NE	039	97701610	NATURAL FEATURES	T	T	CX	AL	
NN 91 NW	017	92621621	BARROW CUP-MARKED STONECAIRN	T	F	CX		
NN 91 NW	021	90261836	INNERPEFFRAY SCHOOL	F	F	CX	AL	
NN 91 NW	029	91521604	FARMHOUSE	F	F	CX	AL	
NN 91 NW	043	93011702	MILLEARNE HOUSE	F	F	CX		
NN 81 NE	015	87001900	CAMP FINDAL	T	T	CX		
NN 81 NE	002	89801800	ROMAN FORT STRAGEATH	F	F	CX		
NN 91 NE	029	99201540	CROPMARKS WESTBURN	F	F	CJ		A
NO 01 NE	037	06301774	ENCLOSURE; PIT-GROUP	F	F	CX		A
NO 01 NE	025	07531838	ENCLOSURE; CROP MARK	F	F	CX		A
NO 01 NE	056	07231823	RING DITCH; CROP MARK	F	F	CX		A
NO 01 NE	063	05061664	CROPMARKS	F	F	CX		A
NO 01 NW	001	03901750	TEMPORARY ROMAN CAMP FORTEVIOT	T	T	CX	AL	A
NO 01 NW	021	02101615	ENCLOSURE; LEADKETTY	F	F	CX	BL	A
NO 01 NW	022	02171621	ENCLOSURE; LEADKETTY	F	F	CX		A
NO 01 NW	033	02131574	RING DITCH 2; LEADKETTY	F	F	CX	AL	A
NO 01 NW	036	01971587	RING DITCH 1; LEADKETTY	F	F	CX	BL	A
NO 01 NW	038	01101730	RING DITCHES; ENCLOS CROPMARKS	F	F	CX	AL	A
NO 01 NW	039	02101580	PITS LEADKETTY	F	F	CX	AL	A
NO 01 NW	040	02001580	PIT ALIGNMENT LEADKETTY	F	F	CX	BL	A
NO 01 NW	042	01361526	ENCLOSURE 3 LEADKETTY	F	F	CX	BL	A
NO 01 NW	045	01801564	ENCLOSURE 4 (POSS)	F	F	CX		A
NO 01 NW	047	00801730	PITS CROPMARKS MASTERFIELD	F	F	CX		A
NO 01 NW	051	01101530	SETTLEMENT SOUTERRAIN	F	F	CX		A
NO 01 NW	055	01921580	4 POSTER LEADKETTY	F	F	CX	BL	A
NO 01 NW	056	02121613	ENCLOSURE (POSS) LEADKETTY	F	F	CX		A
NN 91 NE	021	97731647	RING DITCH BELHIE	F	F	CX		A
NN 91 NE	023	99301580	ENCLOSURES CROPMARKS	F	F	CX		A
NN 91 NE	027	97921657	HOMESTEAD PALISADED BELHIE	F	F	CX		A
NN 91 NE	043	98401620	ENCLOSURE (POSS) CROPMARK	F	F	CX		A
NN 91 NW	020	90701795	FORT	T	T	CX		A
NN 91 NW	025	90701820	ROMAN TEMP CAMP INNERPEFFRAY	F	F	CX	RU	A
NN 91 NW	033	92401680	LINEAR CROPMARKS MILLS OF EARN	T	F	CX	RU	A
NN 91 NW	039	90101770	RING-DITCH CROPMARKS PARKHEAD	T	F	CX		A
NN 81 NE	023	89001880	ENCLOSURECROPMARKSDALPATRICK	F	F	CX		A
NN 81 NE	024	88101910	RING DITCHENCLOSURE DORNOCK	F	F	CX		A
NN 81 NE	039	89201810	LINEAR CROPMARKS STRAGEATH	F	F	CX		A
NN 81 NE	046	88001900	ENCLOSURE DORNOCK	F	F	CX		A
NN 81 NE	051	88101900	PIT-ALIGNMENT DORNOCK	F	F	CX		A
NN 81 NE	052	88061953	SOUTERRAIN(POSS) DORNOCK	F	F	CX		A
NN 81 NE	053	89601840	PITSCROPMARKS STRAGEATH MAINS	F	F	CX		A
NN 81 NE	056	88141893	ENCLOSURE (POSS) DORNOCK 2	T	T	CX	AL	A
NN 81 NE	057	88801980	RING-DITCH REDHILLS 1	F	F	CX		A
NN 81 NE	058	88601970	ENCLOSURE REDHILLS	F	F	CX		A
NN 81 NE	059	88601970	RING-DITCH REDHILLS	F	F	CX		A
NN 81 NE	060	89001960	ENCLOSURE PITS POWMILL	F	F	CX	AL	A
NN 81 NE	061	89001990	PIT-ALIGNMENT(POSS) MILLHILLS	F	F	CX		A
NN 81 NE	064	88801800	PITS BET CUILTBURN & STRAGEATH	F	F	CX		A
NN 82 SE	068	86702010	ENCLOSURE BROICH	T	T	CX	AL	A
NN 82 SE	069	86602020	LINEAR CROPMARKS BRIOCH	T	T	CX	AL	A
NN 91 NE	030	98901770	RING DITCHESCROPMARKS	F	F	HV	CX	A
NN 91 NW	035	93771545	RING DITCH WALL FAULD	F	F	HV		A
NN 81 NE	020	88801790	LINEAR CROPMARKS CUILTBURN	F	F	HV	CX	A
NN 91 NE	012	97711643	STANDING STONE; ENCLOSURE	F	F	CX		P
NN 91 NE	013	97681599	BARROW CISTS BELHIE	F	F	CX		P
NN 91 NE	037	97721605	ENCLOSED CREMATION CEMETARY	F	F	CX		P
NN 91 NE	038	97501610	RING DITCHES CROPMARKS ENCLOS	F	F	CX		P
NN 91 NW	013	91941715	EARTHWORK CRAIGSHOT	T	T	CX	AL	P
NN 81 NE	014	87821901	ROMAN CAMP DORNOCK	T	T	CX		P

Figure 5.12 Sites located in 2nd terrace above floodplain of Earn study area. Total = 71, 65% known from aerial photography only. Soil series = HV, CX, CJ.

SHEET	NUMBER	REF	DESCRIPTION	INDICATOR	EROSION	SOIL	SOIL1	A/P
NO 01 NE	012	05081744	CHURCH; FORTEVIOT	T	F	GE		
NO 01 NE	013	06301750	SHORT CISTS	F	F	GE		
NO 01 NE	015	05201750	WHORL; SANDSTONE	F	F	GE		
NO 11 NW	011	13281933	HENGE; CAIRN STONE CIRCLE	F	F	IW		
NN 81 NE	045	86611910	PIT CIRCLE BENNYBEG	F	F	DN		A
NN 81 NE	054	86751914	ENCLOSURE FINDAL COTTAGES	F	F	DN		A
NO 01 NE	028	05301690	SUBCIRCULAR ENCLOS. FORTEVIOT	T	T	GE		A
NO 01 NE	029	05401740	ENCLOSURE BARROW CROPMARK	F	F	GE		A
NO 01 NE	030			F	F	GE		A
NO 01 NE	036	05281734	ENCLOSURE	F	F	GE		A
NO 01 NE	058	05061664	PIT ALIGNMENT	F	F	GE		A
NO 01 NW	019	02641598	ENCLOSURE; INVERDUNNING HOUSE	F	F	GE		A
NO 01 NW	020	02401600	ENCLOSURE; INVERDUNNING HOUSE	F	F	GE		A
NO 01 NW	037	02791601	RING DITCH; INVERDUNNING HOUSE	F	F	GE		A
NO 01 NW	044	03501560	LINEAR CROPMARKS MUIRHEAD	F	F	GE		A

Figure 5.13 Sites located in 3rd terrace above floodplain of Earn study area.
Total = 15, 73% known by aerial photography only.
Soil series = GE, IN, DN.

SHEET	NUMBER	REF	DESCRIPTION	INDICATOR	EROSION	SOIL	SOIL1	A/P
NO 01 NE	022	05651947	CASTLE; DUPPLIN	F	F	BL		
NO 01 NE	053	05501957	WALLED GARDEN; DUPPLIN	F	F	BL		
NO 01 NE	020	07201680	HILL-FORT	F	F	BL		
NO 01 NW	007	02401500	TEMPORARY ROMAN CAMP DUNNING	T	F	BL		
NN 91 NE	002	95801889	WATCH TOWER ROMAN ROUNDLAW	F	F	BL		
NN 91 NE	003	99031919	ROMAN SIGNAL STATION GASK	F	F	BL		
NN 91 NE	006	99761953	ROMAN SIGNAL STAT WITCH KNOWE	F	F	BL		
NN 91 NE	008	96311812	SPRING TRINITY WELL	T	F	BL		
NN 91 NE	009	99101910	ROMAN TEMPORARY CAMP	F	F	BL		
NN 91 NE	034	95991814	WINDPUMP LAWHILL	F	F	BL		
NN 91 NW	002	93191852	ROMAN WATCH TOWER RAITH	F	F	BL		
NN 91 NW	027	91471549	WALLED GARDEN	F	F	BL		
NN 91 NW	030	90131563	FARMHOUSE STEADING DRUMNESS	F	F	BL		
NN 91 NW	046	90671694	WINDPUMP ALLANS	F	F	BL		
NN 91 NE	004	96761883	ROMAN WATCH TOWER KIRKHILL	F	F	MR	AD	
NN 91 NE	005	98211897	ROMAN WATCH TOWER MUIR O'FAULD	F	F	MR		
NN 91 NW	003	94691876	ROMAN WATCH TOWER ARDUNIE	F	F	MR	BL	
NO 01 NE	064	07441776	RING DITCH; NEWTON OF CONDIE	F	F	BL		A
NO 01 NW	017	03601920	ENCLOSURE; UPPER CAIRNIE	F	F	BL		A
NO 01 NW	018	04111901	RING DITCH; THE FOUR ACRE	F	F	BL		A
NN 91 NE	028	99361529	ENCLOSURES (POSS) MAILINGKNOWE	F	F	BL		A
NN 91 NW	014	91601820	ROMAN TEMP CAMP INNERPEFFRAY	F	F	BL	RU	A
NN 91 NW	032	92101760	LINEAR CROPMARKS GELLY BURN	F	F	BL	BU	A
NN 91 NW	037	91701640	RING-DITCHES WHITEHILL	F	F	BL	BU	A
NN 91 NW	038	93401550	ENCLOSURE CALFWARD	T	F	BL	BU	A
NN 81 NE	O44	86501900	PIT-ALIGN PIT ENCLOS BENNYBEG	F	F	FO	DN	A
NN 81 NE	055	86211884	RING DITCH BENNYBEG CRAIG	F	F	FO		A

Figure 5.14 Sites located in tills derived from Old Red Sandstone.
Total = 27, 37% known from aerial photography only.
Soil series = AD, MR, BL, FO.

SHEET	NUMBER	REF	DESCRIPTION	INDICATOR	EROSION	SOIL	SOIL1	A P
NO 11 NW	012	10781838	WINDMILL: DUNBARNEY	F	F	SH		
NO 11 NW	013	11221878	VILLAGE SITE: DUNBARNEY	F	F	SH		
NO 11 NW	023	13551995	FORT: CARNAC OR MOREDUM	F	F	SH		
NO 01 NE	005	09981544	FORT: CASTLE LAW	F	F	SH	BS	
NO 01 NE	043	06721769	STEADING: KILDENNY	F	F	SH		
NO 01 NE	017	17141695	CAIRN	F	F	SH		

Figure 5.15 Sites located in tills derived from Igneous Rock.
Total = 6, 0% known from aerial photography only.
Soil series = SH, BS.

SHEET	NUMBER	REF	DESCRIPTION	INDICATOR	EROSION	SOIL	SOIL1	A P
NO 01 NE	062	07571818	TOWER HOUSE: NEWTON OF CONDIE	F	F	MY		
NO 01 NE	049	07641809	COTTAGE: NEWTON OF CONDIE	F	F	GA		
NN 91 NE	017	99501880	GASK HOUSE	F	F	BU		
NN 91 NW	001	90261580	FORT VITRIFIED CHAPEL	T	F	BU	AL	
NN 91 NW	011	93931504	CIST	F	F	BU		
NN 91 NW	016	92531711	CAIRN CIST	F	F	BU		
NN 91 NW	006	91671846	ROMAN SIGNAL STATION PARKNEUK	F	F	LR		
NN 91 NW	018	92851625	HENGE SITE NORTH MAINS	F	F	RU	CX	
NN 91 NW	019	93101630	RING-DITCHES PROB. BARROWS	F	F	RU	CX	
NN 91 NW	045	94621756	SOUTERRAIN LOWBANK	F	F	BU	BL	A
NN 91 NW	042	92001860	PITS SHEARERSTON	F	F	KV		A
NN 81 NE	019	89231765	ENCLOSURE CUILTBURN	F	F	KV		A
NN 81 NE	038	89501790	FIELD SYSTEM STRAGEATH	F	F	KV		A
NN 81 NE	040	89301790	ENCLOSURE STRAGEATH	F	F	KV	CX	A
NN 81 NE	043	89101770	LINEAR CROPMARK CUILTBURN	F	F	KV		A
NN 81 NE	048	89601770	CULTIVATION REMAINS STRAGEATH	F	F	KV	CX	A
NN 91 NW	015	90401860	CROPMARK ENCLOSURE	F	F	RU		A
NN 91 NW	034	90901790	ENCLOSURE SOUTH MAINS	T	T	RU	AL	A
NN 91 NW	041	91151800	LINEAR CROPMARKS PARKNEUK	F	F	RU		A
NN 91 NW	044	93301630	WAUKMILL ENCLOSURE	T	F	RU	BL	A
NN 82 SE	065	87602050	ENCLOSURE	T	F	RU	CX	A

Figure 5.16 Sites located in mixed tills in the Earn study area.
Total = 21, 57% known by aerial photography only.
Soil series = GA, MY, KV, BU, RU, LR.

GROUPING	SITES KNOWN BY AP ONLY	
	PERCENTAGE	NUMBER
Modern Floodplain	40	23
1st Terrace	25	2
2nd Terrace	65	46
Fluvioglacial & morainic	73	11
Tills from ORS	27	10
Tills from Igneous Rock	0	0
Mixed Tills	57	12

Figure 5.17 Percentages of sites, known only from aerial photography, in the Earn study area by soil series groupings

Figures 5.10 through 5.16 provide the site information by the soils and their parent material groupings. If we reconsider the observations made concerning sites identified from aerial photography, another pattern emerges. In the modern floodplain group, 40 per cent of the sites are identified from aerial photography alone. These are designated by the letter A in the aerial photography field. Sites known from aerial photography in the second terrace deposits are much greater at 65 per cent with another 8 per cent being identified first by aerial photographs then followed by a field visit (sites marked P). In total, 73 per cent of the sites in the second terrace deposits are known from aerial photography. The impact of aerial photography surveying has been much greater on this terrace than any other soil category identified. The per cent of sites known from aerial photography for all soil groupings is presented in Figure 5.17.

If we discard the sites known only from aerial photography -- usually ring-ditches, enclosures, cropmarks, pits and alignments -- another interesting characteristic of the database comes to light. The sites in Figures 5.10 through 5.16 are ordered according to their aerial photography field status. In other words, all A, P, and blanks in the aerial photography field are printed together. Grouping by this field facilitates inspection of site types within each soil category. Generally, the types of sites remain similar across the soil groupings, but a difference appears between the sites known by aerial photography and those known by other means (marked blank). The sites known by means other than aerial photography are usually castles, churches, farmhouses, bridges, mills, Roman signal stations or watch towers (from the till deposits), or single finds such as cists, coins, and swords. The large majority of these sites are fixed structures built from quite solid materials capable of withstanding most processes of site deformation.

Two other trends are noteworthy. First, consider the ERO field designed to indicate sites which are actively eroding and have been indicated as such within the NMR data. The logical field ERO is marked true (or T) when this conditions occurs. The greatest proportion is in close proximity to the river. For example, the floodplain soil group has ten eroding sites whereas the other five groups combined only total nine. These floodplain sites are potentially good targets for underwater investigation. Also there is potential for underwater investigation at some sites located in the second terrace deposits where they come in close contact with the present-day water's course. In particular, the Roman camps at Innerpeffray(NMR site numbers NN91NW25 and NN91NW20, 90701820 and 90701795 O.S. grid coordinates respectively), Forteviot(NMR site number NO01NW1, grid coordinate 03901750) and Dornock(NMR site number NN81NE14, grid coordinate 87821901). They are useful as archaeological indicators of river shift since it can be assumed that they were rectilinear when constructed and the degree to which they have been eroded can be correlated temporally to the past 1,900 years. Early archaeological surveys done in 1967 at the Roman camp in Dornock and aerial photography can be used to quantify the rate of erosion there during the past 25 years. Examination of cropmarks adjacent to the river banks is probably the best method for determining areas of the river channel worthy of investigation (Fox, 1987.)

Second, the IND field is designated true when a site shows some evidence of the river's previous position within the landscape. Obviously, there is a certain degree to which agreement between the ERO and IND fields is expected. Some sites within the floodplain deposits are indicative of past fluvial activity. For instance, NMR site number NN81NE49 (grid coordinant 89401840) is classified as a soil mark known from aerial photography but is likely to be a natural infilled feature from the surrounding valley-like runoff. Other indicator sites in the fluvio-glacial and till deposits are equally interesting in terms of understanding palaeo-hydrologic activity within the Earn river valley. Two sites near Pinner Burn show evidence of extreme erosion but the burn does not presently exhibit that type of fluvial strength. Springs have dried up leaving no trace of their existence except lore. In addition, sites along the banks of tributaries like the Dunning and Ruthven Burns, and the Mechany Water may suggest navigability for small craft in the past. Clearly further investigation of the submerged or once submerged areas near these settlement sites would be prudent.

Other Sources of Evidence

Many sources of evidence are available for studying the geoarchaeology of the Earn river in the Midland Valley of Scotland. These sources can be characterized as primarily geographic and grouped into the following categories: early maps, geologic maps, aerial photographs, modern geomorphic studies and data handling advantages from new technology. Each category of evidence will be discussed in this section with reference to the Earn study area and used to illustrate the importance of this methodology for identifying various sources of evidence when studying the geoarchaeology of fluvial systems. These sources of evidence have come to light because of the nature of the methodology employed to study the archaeology of the river system under investigation.

Use of maps in physical geography is prevalent. However, their application to studying archaeology in fluvial systems is perhaps less well-noted. In many river studies, maps have proved to be the most important source (Hooke and Kain, 1982, 119).

> "Historical sources, particularly maps, have been widely used in the last decade or so to elucidate the spatial

distribution of changes in channels and to understand the controls on channel movement. They have been used to investigate the nature and rates of channel changes and to understand the relation of channel changes to fluvial processes and sediment dynamics. The impact of human activities on river channels has also been a major theme of study" (ibid, 116).

Early Maps - Early maps can be compared with later maps to help determine changes to river channel form. The changes should be viewed in terms of their impact on humans living in the area and on the archaeological resources contained therein. Use of maps for comparative purposes, however, does not occur without difficulties or complications. There are some specific problems in the use of maps for river studies particularly where accurate measurements are required; these stem from factors such as the methods of survey used and the manner of representing the channels (ibid., 120).

In the Earn valley, I have selected four maps sources surveyed and published over the past four hundred years; the Adair Map of 1685, the Stobie Map of 1783, the First Ordnance Survey(OS) of 1866 and the Second Ordnance Survey of 1970. Some of the maps used for comparison are similar in survey and mapping details to others. For this reason, the Adair and Stobie maps are compared to each other, while the first and second OS maps are compared independent from the first set. The comparison of the former set with the latter is difficult due to differences in survey method.

The earliest maps of Strathearn date from the mid to late 1600's. The first example discussed here is attributed to a surveyor named John Adair. Adair took on the responsibility to resurvey the Scottish counties because the first printed atlas of the country

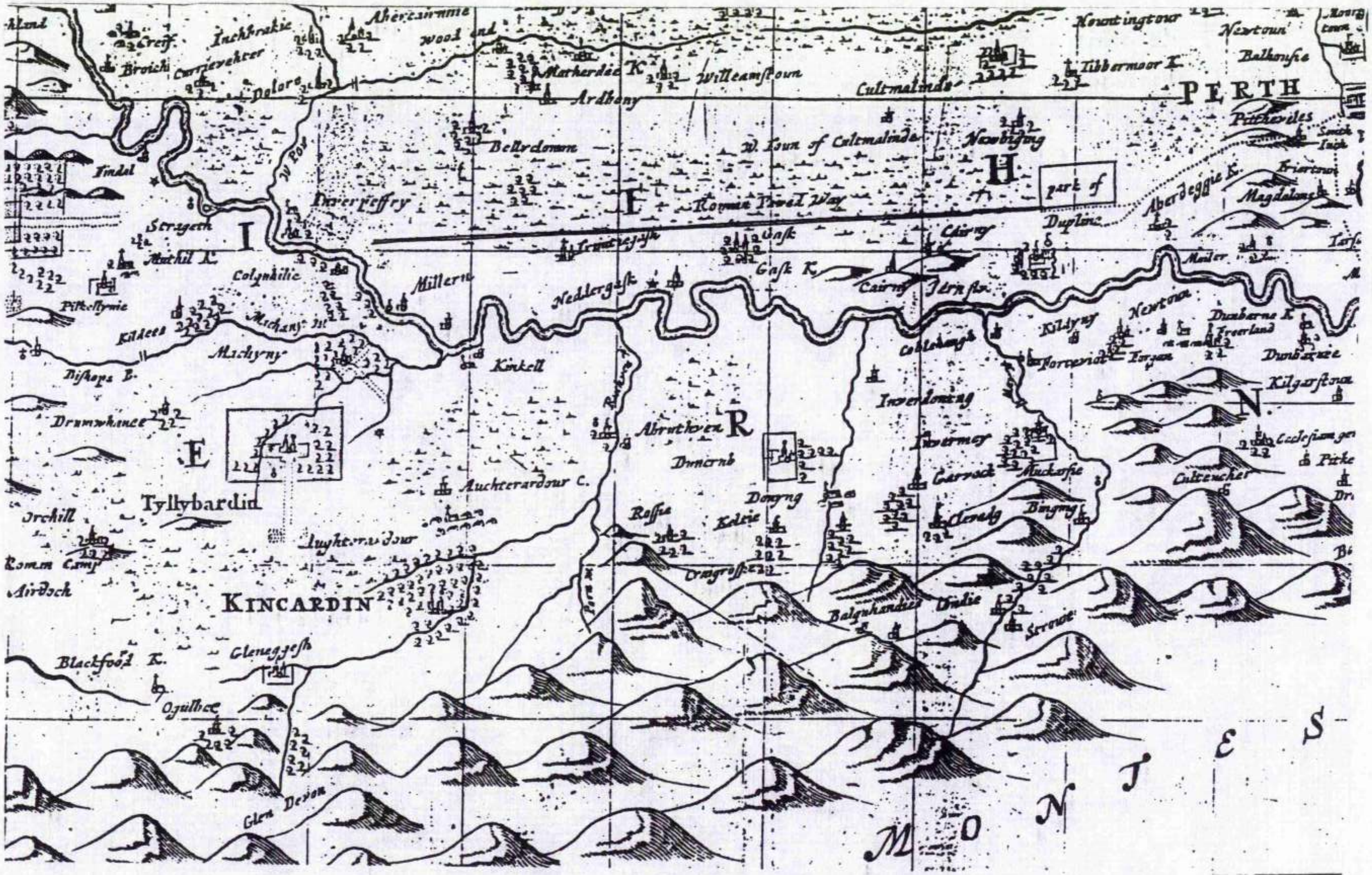


Figure 5.18 Earn valley excerpt from map by John Adair (1685)
Map of Strathearn, Stormont and Carse of Gowrie

by Blaeu in the 1650's was inadequate (Bil, 1978, 41); It had been the work of three authors and contained maps surveyed over a time span of eighty years. Adair's map of Strathearn, Stormont and Carse of Gowrie (1685) is one of his few printed maps[1].

Adair's map has been scrutinized for completeness in two instances by Albert Bil (1977, 1978) who concludes that there is inadequate coverage of roads(Bil, 1977, 43), antiquities are surprisingly absent (Bil, 1978, 104), ferries, although in use at this time, are totally absent from the map (ibid, 105), and the location of actual places has a high degree of accuracy regarding distance and direction (ibid, 105).

Unfortunately, Bil does not concern himself with the accuracy of the river as a topographic feature, but he does present evidence to suggest that the Adair map is more complete for specific categories and places than others (Bil, 1978, 43). Topographic features seem to be unsuitable for comparison in his view (Bil, 1977, 106).

Adair's map of 1685 is comparable to James Stobie's map of 1783 although Stobie does tend to represent the channel features and floodplain in more detail than Adair. Solving the problem of comparable scale presents another complication with comparing maps. Adair's map is drawn at 1 inch equals 1 1/3 miles while Stobie's map is drawn at 1 inch equals 1 mile. In this instance, the differences were corrected by photo-mechanically reducing the Stobie map by 33% for comparison with the original scale version of Adair's map and conversely by enlarging the Adair map by 33% for comparison with the Stobie original.

[1] He was more concerned with survey than with the actual engraving and publication work. In fact, only 11 of his maps were published while some 28 remained in manuscript (ibid, 41).

Another point to consider when establishing the possibility of comparing two maps for geomorphological differences involves consideration of the original purpose for the map. The Military Survey of Scotland completed in 1755 and its resulting map, Roy's Map, was a contender for comparison with other early map sources in the study area. However, closer consideration of its content and presentation style, as a military document, highlighted problems with its usefulness. Whereas Whittington and Gibson (ND) states that "the Military Survey is a very good statement on the overall morphology and on the details of some features... much detail has, however, been sacrificed due to the style of representation that has been chosen" (ibid., 22). His style of representation was not conducive to elucidating changes in the river's course by comparison with earlier or later maps[1].

Closer observation of the Adair and Stobie maps begs the question concerning differences in purposes for these surveys. The Adair map which was commissioned by a then important person in Scotland, the Earl of Perth Lord Drummond, was a map of aesthetic and prestigious value rather than functional value (Bil, 1977, 106) whereas the Stobie map was derived as a functional tool in the course of a county survey. Stobie's map appears more practical for traveling and more consistent in detail -- characteristics attributable to functional maps rather than aesthetic ones (ibid, 106).

Over the one hundred year period from 1685 to 1783, the maps show an increasing amount of human impact on the river via construction of bridges. The Adair maps shows only one bridge, Bridge of Earn,

[1]In spite of these limitations there is still a great deal that the Military Survey does show. These features can be classified into three major headings: those pertaining to larger settlements like towns and villages; those associated with the rural landscape; and those belonging to the cultural landscape like placenames and enclosures (Whittington and Gibson, ND, 15).

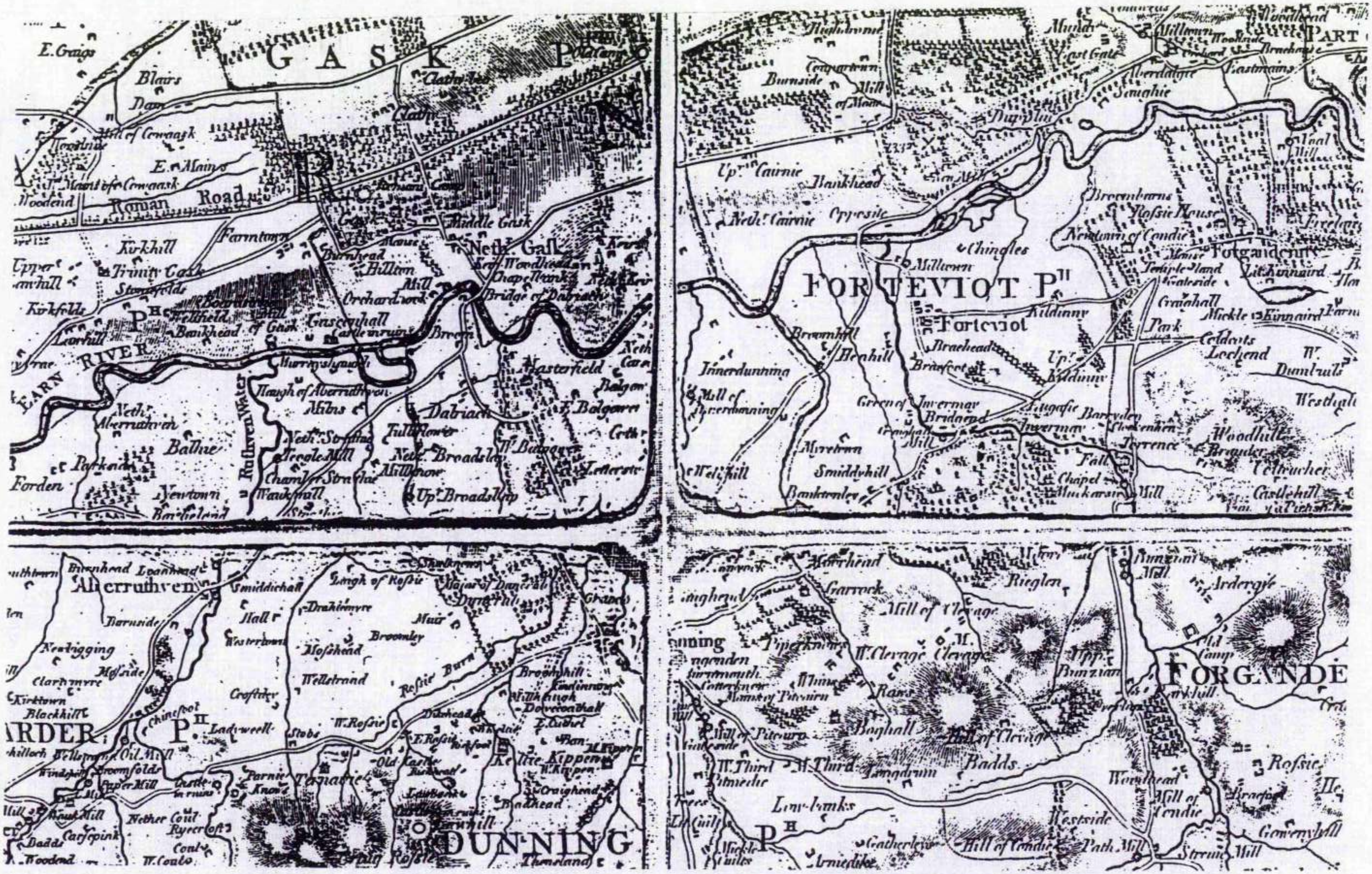


Figure 5.19 Earn valley excerpt from map by James Stobie (1783) "The Counties of Perth & Clackmannon"

whereas the Stobie map one hundred years later shows five; Bridge of Earn, Forteviot, Dalroach, Bridgend (west of Kinkell) and Crieff. Examination of Royal Commission architectural files at the Old Bridge of Earn site (NO11NW14) provides further evidence for river shift and human interaction. The original bridge was built in 1329 with five arches as mentioned in a 1614 document. An additional arch was added to the north bank in 1760 by engineers John Smeaton and John Adams (PSAS, 1912/13, 305-307). Photos, engravings, drawings and plans in the Royal Commission files show that the river had shifted north at this section since 1329, requiring northward extension of the bridge in 1760 (See Figure 5.20).

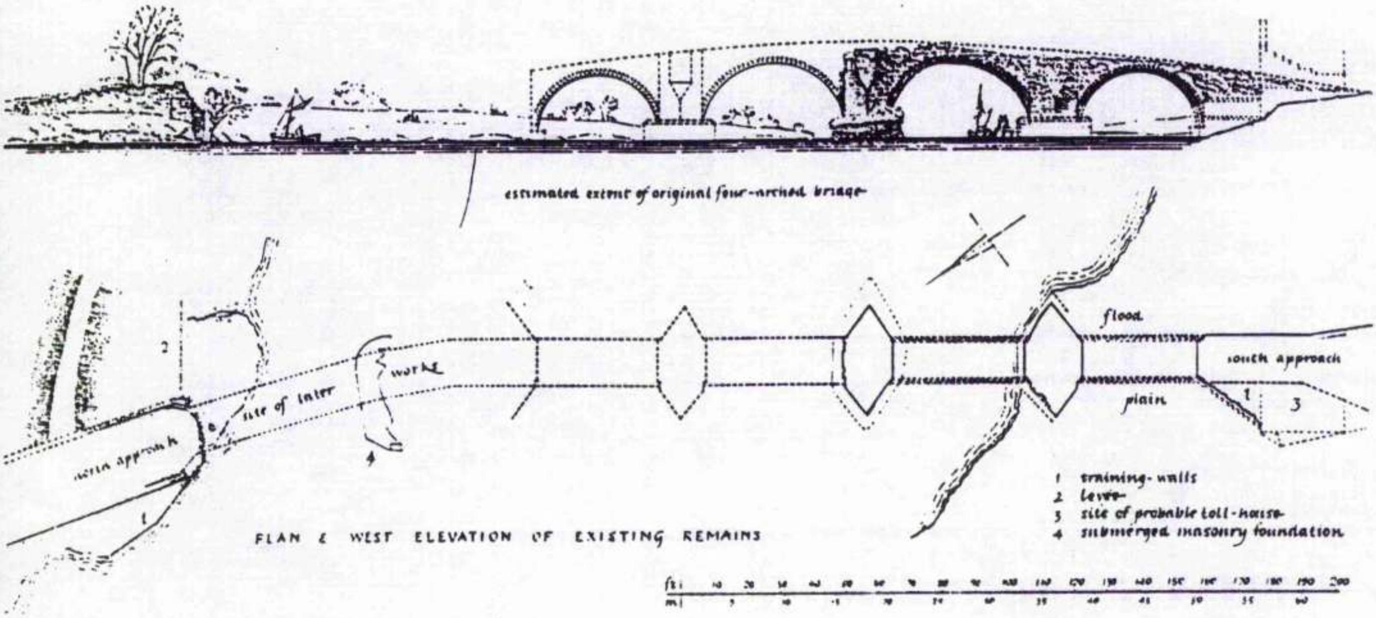


Figure 5.20 Old Bridge of Earn survey and reconstruction drawings from Royal Commission architectural files

Regarding channel change through time and its subsequent affect first on human occupation and second on archaeological resources, comparison of the maps yield the following observations: First, the extreme meander in the river north of Aberuthven on Adair's map has become an oxbow and cut through, effectively straightening the channel at this point. It can be assumed that human occupation in this area was affected by the flood events which facilitated this straightening process. Also, it can be assumed that occurrence of archaeological sites in the vicinity of the river's course both before and after the river channel was straightened have been impacted by the channel change.

Second, there are three segments within the Earn study area that show significant changes in the nature of the river's meanders between 1685 and 1783. The first area shows only minor variations between the two maps in a one mile segment just east of Forteviot and west of Forgandenny. The second area to exhibit evidence for channel change through time is approximately one mile long and located west of the Ruthven Water confluence.

The variations in channel morphology in the second area are greater than in the first area, and Stobie's map seems to suggest channel straightening over the one hundred year period without the obvious oxbow condition that appears in Adair's map at area one. This condition (of channel straightening through time) would be contrary to what fluvial geomorphology suggests should occur unless a similar meander and oxbow condition were initiated and completed in the second area as is apparent in the original survey and mapping by Adair for the first area.

The third area of channel to exhibit signs of change begins at Inverpeffrey and continues for approximately two miles to Crieff. Once again, the Adair map appears to show larger meander tracts than Stobie's map suggesting channel straightening during the one hundred year period. In each case, if channel switching and eventual straightening is modifying the floodplain and associated landscape as evidenced from this map comparison, then human occupation of the areas and the archaeological sites within its path and adjacent to the river's course have been affected by these shifts. Our awareness of these possible changes in these specific areas would prove beneficial when conducting field investigations in the river basin and assessing the presence or absence of associated cultural resources.

The next maps to consider are the Ordnance Survey's first and second edition maps for the Earn valley dating to 1866 and 1970 respectively. As mentioned in a previous section entitled "Selection of Study Area," the first and second series maps were compared using a light table to determine shifts in the channel form not only of the Earn river but also along other parts of the Tay river valley. Many observations and some insights regarding the fluvial geomorphology of the Tay watershed were offered through comparison of these maps[1]. Scales for the two OS maps are comparable but not exact. Modern geomorphic studies applying computer-aided mapping programs can provide a useful tool for making map comparisons and will be more fully discussed in the last portion of this section.

The best example of erosion in the Earn study area from comparison of the OS maps begins east of Dunning and is limited to outer margins of channel meanders. Three areas along the river show evidence of channel change ranging from 100 to 300 feet. Above Inverdunning, the outer edge of a large meander northeast of Broomhill shows evidence for 300 feet of channel migration via erosion. The 1970 OS map identified in Figure 5.21 shows the location and approximate size of a temporary Roman camp (Forteviot) at this meander that has been actively impacted by river erosion and channel migration over the past 1,900 years since its occupation.

[1] For example, see the section entitled "Earn study area: relationship of soils and topography to sites."

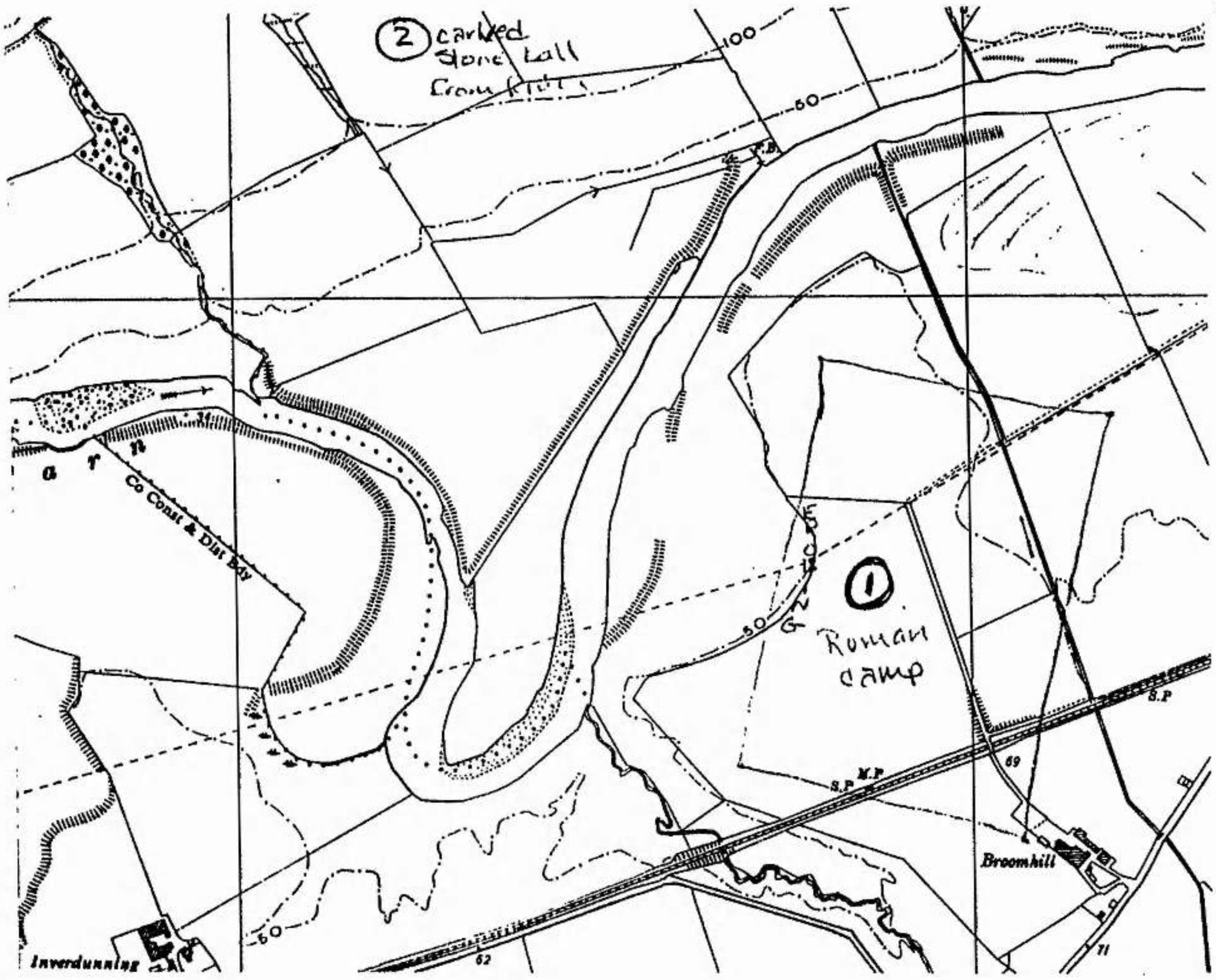


Figure 5.21 Excerpt from 1970 OS map with National Monuments Record data overlaid showing Temporary Roman Camp at Forteviot being eroded

The second area indicative of channel migration begins with the smaller meander due north of Dunbarney village where a major channel shift south, approximately 300 feet, has occurred. Downstream at Horsemill and Gateside near Bridge of Earn, the outer edges of the associated meanders shows evidence of erosion to a lessor degree -- approximately 100 feet.

The last evidence for channel change that arises from comparison of the 1866 and 1970 OS map series begins at the Elliothead meander. The upper and outer meander margin shows approximately 100 feet of shift within one hundred years. Finally, the inner margin of the river's meander at Wester Rhynd seems to suggest deposition over the same one hundred year period.

In summary, comparison of early maps and modern maps provide a tremendous amount of information and insight into the functioning of fluvial systems. The Earn river valley has a complex and dynamic geomorphologic history that has been affecting origination of and subsequent reporting of archaeological sites within the landscape. Future surveys designed to improve identification and recording of cultural resources and subsequently management of archaeological sites in the study area would be enhanced by incorporation of this source of evidence.

Geologic Maps - In the course of developing the archaeological database using available soils and landform information, a problem arose which could be somewhat mitigated through analysis of another source of evidence, geologic maps. The problem is that the published maps for soils and drift are too small scale (1:50,000) to provide the detail needed for plotting national grid coordinates to relate archaeological sites to geological deposits. The detail of the data available lacked quality at the scale required for archaeological analysis. Therefore, I was directed to the British Geological Survey fieldslips, the original 6" inch series OS maps that the field surveyors used when they field-walked and surveyed the area for compilation of the published 1:50,000 geological maps.

The soils and drift maps for the Earn river valley were published in the 1970's. The fieldslips for the study area that date from 1875 - 1879 were reviewed to discern the soil series designations for sites seemingly located on boundaries between two soils on the

1:50,000 sheets[4]. The fieldslip were only partially useful to discern soil map unit boundaries and, in the end, the database was constructed with two soil fields so as to allow for recording of both possible soil types. In addition, the fieldslips offered insight into the Earn valley's geologic development. Review of the fieldslips for the Earn Valley revealed the following information:

(1) Map sheet 109, from Forgandenny to west of Dunning - It is apparent from the map detail that the Ochil Hills have pushed or squeezed the floodplain together therefore encouraging aggradation rather than widespread deposition of sediment in this portion of the Earn valley. The concept of buried land surfaces in this area are supported by the observation that there are two locations characterized as buried forest beds in the fieldslips. The Ochil Hills to the south have created a zone of deflection along with the solid-geology boundary to the north which has lead effectively to the piling up of alluvium into a narrow north/south deposit running from east to west.

(2) Map sheet 108 from east of Ruthven to Innerpeffray - Moving west in the valley, evidence of glacial drumlins increases. Many of the terraces are denuded and the floodplain has expanded in size in this area. It was interesting to note that the deposition of alluvium in burns either follows or has established existing land boundaries which have remained consistent with modern field boundaries. Evidence for the late glacial shoreline is represented by the oldest terrace and the area shows a trend towards an increase in till, loess hills and exposed bedrock.

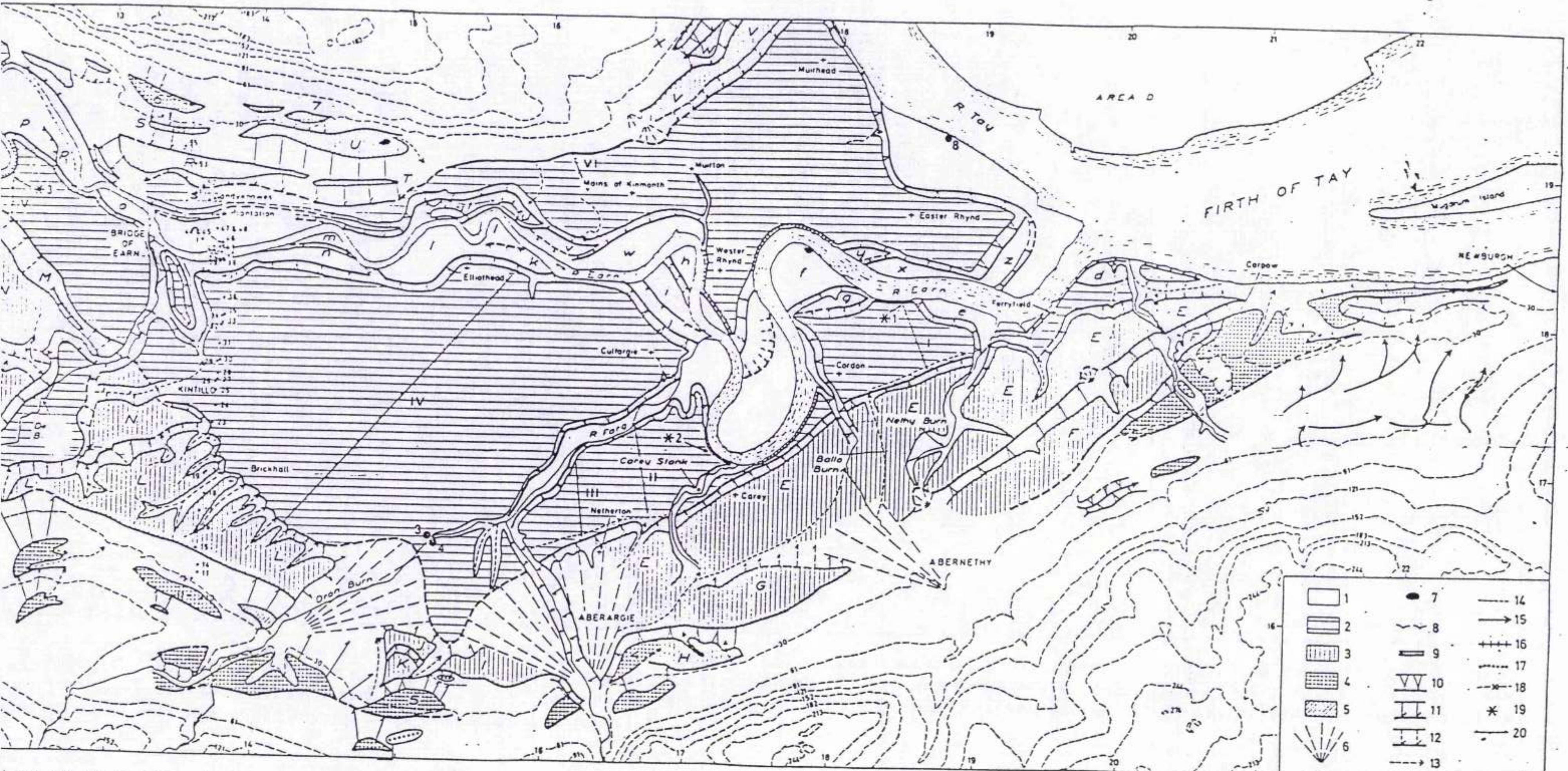
[4] The fieldslips constitute the only geological field surveys ever carried out in the area. The British Geological Survey's archivist stated that some further work may have been carried out in the 1960's, but no evidence was available for that period in the files.

(3) Map sheet 107 from Dornock to Innerpeffray - There is an increase in complex terracing and denudation apparent in this southwestern-most portion of the valley. Basaltic inclusions and a continued increase in drift and till deposits are consistent with our understanding of the region's geologic history and therefore, somewhat to be expected.

Other sources of geologic map information were available from reviewing research and reports by fluvial geomorphologists working in southeast Scotland. Cullingford's (1971) Ph.D. dissertation is the definitive work accepted with modifications on the late and post-glacial relative sea level changes from Fife Ness to Perth and out to Arbroath (Patterson, pers. comm.). The primary modification relates to the location of the Main Perth shoreline that Cullingford places at Dunning in the Earn valley, and Browne (1980) places at Crieff.

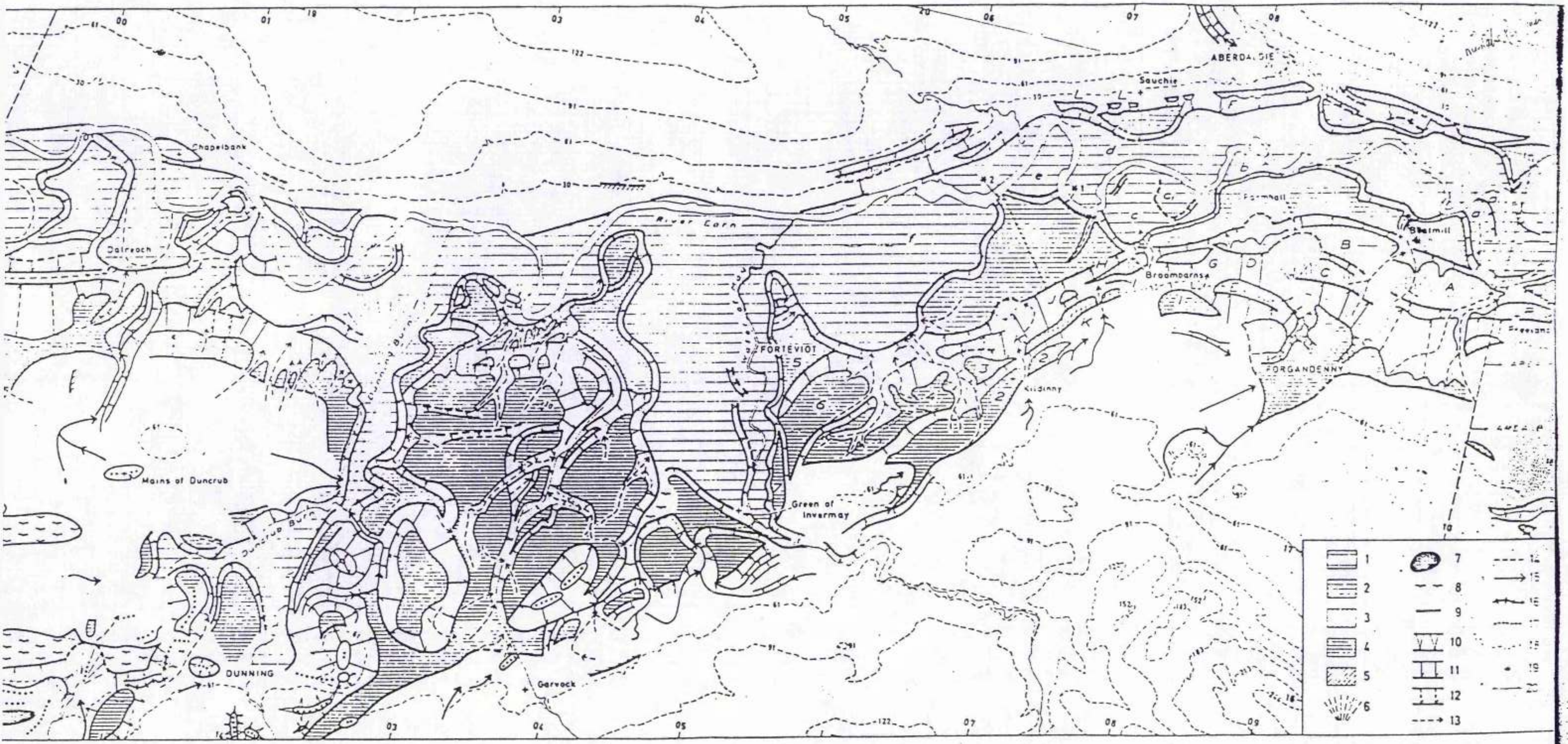
In addition, Cullingford's research included heights for late glacial, post-glacial and Flandrian floodplain terraces and mapping of other landform features such as raised beaches, alluvial fans, and meltwater channels (See Figure 5.22). The alluvial fans at Dunning and Ruthven are interesting to note with respect to their ability to mask archaeological deposits there. Likewise, the extensiveness of the Main Carse deposit associated with Flandrian floodplain development supports the possibility for the existence of buried archaeological sites in these areas.

Aerial Photographs - Aerial photography has played an important role in archaeological survey and identification of possible sites in the Earn river valley (See St. Joseph, 1976, 1978; Alcock, 1984; Maxwell, 1987) as discussed in previous sections of this chapter. Likewise, aerial photographs can also be useful sources of evidence for studying the geoarchaeology of fluvial systems. Information on landform, floodplain development and in-channel fluvial



idge of Earn area. 1. Lower postglacial flat; 2. Main carse; 3. Lateglacial raised beach; 4. Fluvioglacial terrace; 5. Step of unknown origin;
INVESTIGATION BORES
ession; 8. Alluvium; 9. Riverbank section, exposure of carseland stratigraphy; 10-12. Steep, moderate, and gentle slopes; 13. Gully; 14. Linear
nel; 16. Sharp-crested ridge of sand & gravel; 17. Rounded-crested ridge of sand & gravel; 18. Contour (m O.D.); 19. Riverbank exposure studied
The numbered dots are positions of site investigation bores.

5.22 Cullingford's 1971 thesis map of Earn river valley



.ley from Freeland to Aberuthven. 1. Postglacial alluvial flat; 2. Main carse; 3. Lateglacial raised beach; 4. Fluvioglacial terrace; 5. Step of .al fan; 7. Closed depression; 8. Marshy flat; 9. River cliff; 10-12. Steep, moderate, and gentle slopes; 13. Gully or abandoned river channel; . Meltwater channel; 16. Sharp-crested ridge of sand & gravel; 17. Rounded-crested ridge of sand & gravel; 18. Contour (m O.D.). 19. Exposure .ne of bores.

processes can be obtained from careful consideration of aerial photographs.

There are three types of aerial photographs that were available from the National Monuments Records Office(NMR); 1:10,000 verticals flown by staff, 1:25,000 verticals recently acquired from Jas-air, and NMR obliques taken in site-specific areas. All aerial photos from the study area were obtained at the Royal Commission and reviewed to gain an overall picture of the Earn valley landscape. Two applications became apparent. First, fluvial geomorphic events could be hypothesized for areas around known archaeological sites that were exhibiting signs of fluvial activity. Second, the aerials were useful for understanding and observing the channel changes associated with confluences of tributary streams and subsequently could be applied to the study of associated archaeological sites.

The 1:10,000 and Jas-air are approximately 40 years apart in age -- with Jas-air being the most recent (c.1980) -- and therefore good for comparison of channel change during modern times. The 1:10,000 verticals, seemed to provide the best evidence of fluvial process and in-channel features. However, the Jas-air and the obliques taken for site specific locations were better for showing channel change in alluvium or across the landscape.

From the study area, I concentrated on the aerial photographs taken from around the Roman camps at Dornock, Innerpeffray and Forteviot to illustrate the use of aerial photography as a form of evidence for studying geoarchaeology in fluvial systems. This investigation is not unique with respect to using aerial photographs to study Roman camps in Strathearn. However, its application to understanding the geomorphology of the Strathearn landscape with respect to its archaeology may represent a shift in emphasis from previous researchers.

At Dornock, one-half of the rectilinear enclosure is identifiable as a cropmark in the aerial photographs. The portion of the circuit that does not appear in the cropmarks abutts the modern Earn river channel. It is likely that the Agricolan (Maxwell, 1980, 41) camp has been destroyed by erosion because of its position on an outer margin of the meander. It also appears as if some evidence of overbank deposition may be burying potential sites in the area to the north of the Roman camp (See Figure 5.23). Field survey at Dornock including the river channel and margins could shed light on this possibility. It is unfortunate that Cullingford's mapping of landforms does not extend as far west in the Earn valley as Dornock and therefore cannot provide any assistance here although there is a recent survey of Dornock by W.D. Johnstone in 1967 at a scale of 1:2500 which could be used for comparison.

At Innerpeffray, the location of the temporary Roman camp (NN91NW14) dating to the Severus campaign (Hanson and Maxwell, 1983, 65/207) as determined from aerial photographs is some distance away from the present Earn channel and situated with its long axis running parallel to the adjacent Roman road. However, the NMR shows another encampment (NN91NW25) just west of the Severan camp (See Figure 5.24). The OS map shows a modern land boundary that may equate to an earlier course of the River Earn and some details from the aerial photographs support this possibility.

Jas-air indicates possible channel cut-off where the modern land boundary and the previous channel converge and pass through the western-most temporary camp. The 1:10,000 aerials show good examples of alternate bars formed in the newly avulsed portion of the river channel between the cut-off termini. There is no evidence for the camp in aerial photographs showing the land west of the land boundary. Like the camp at Dornock, the rectilinear

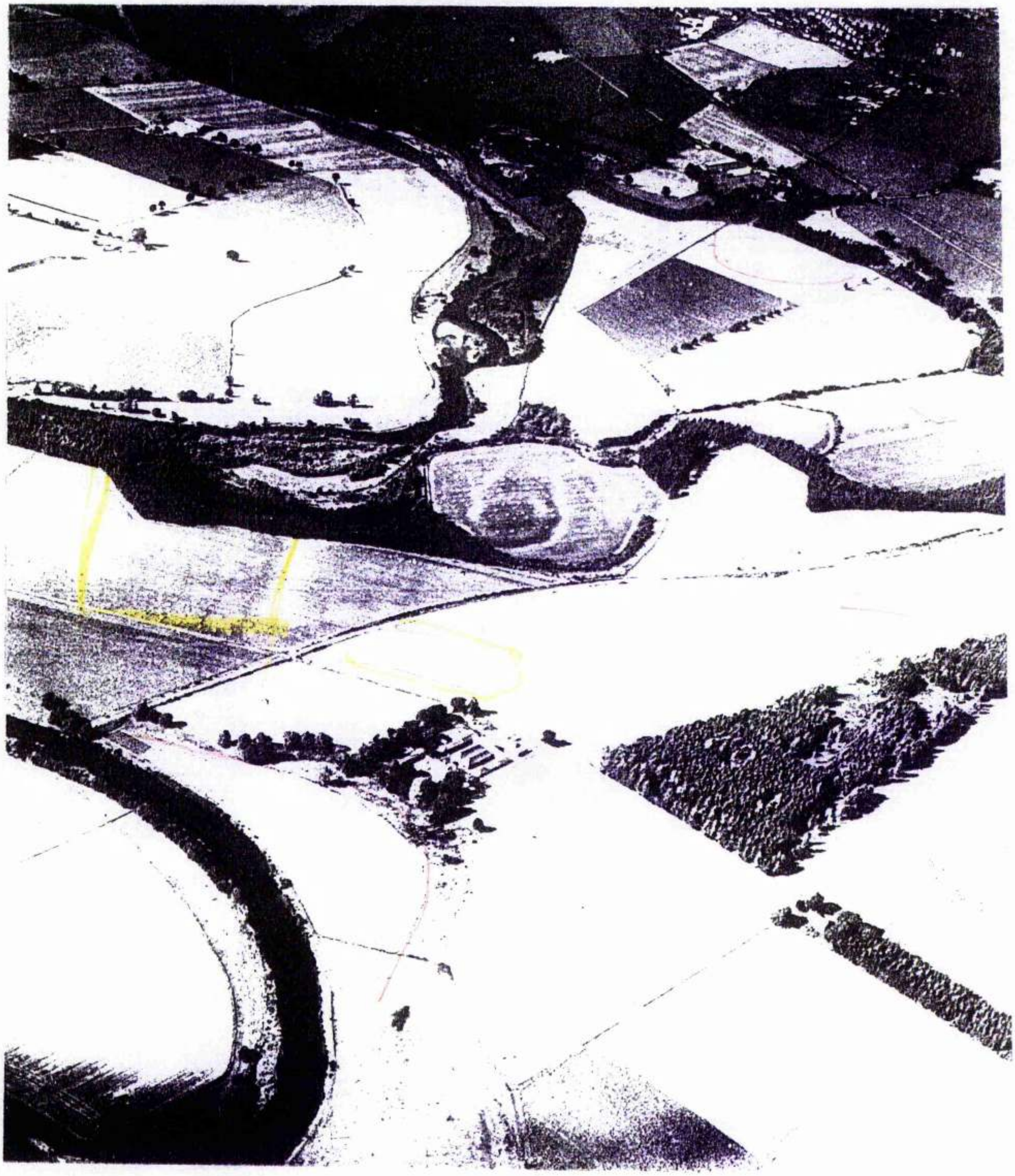
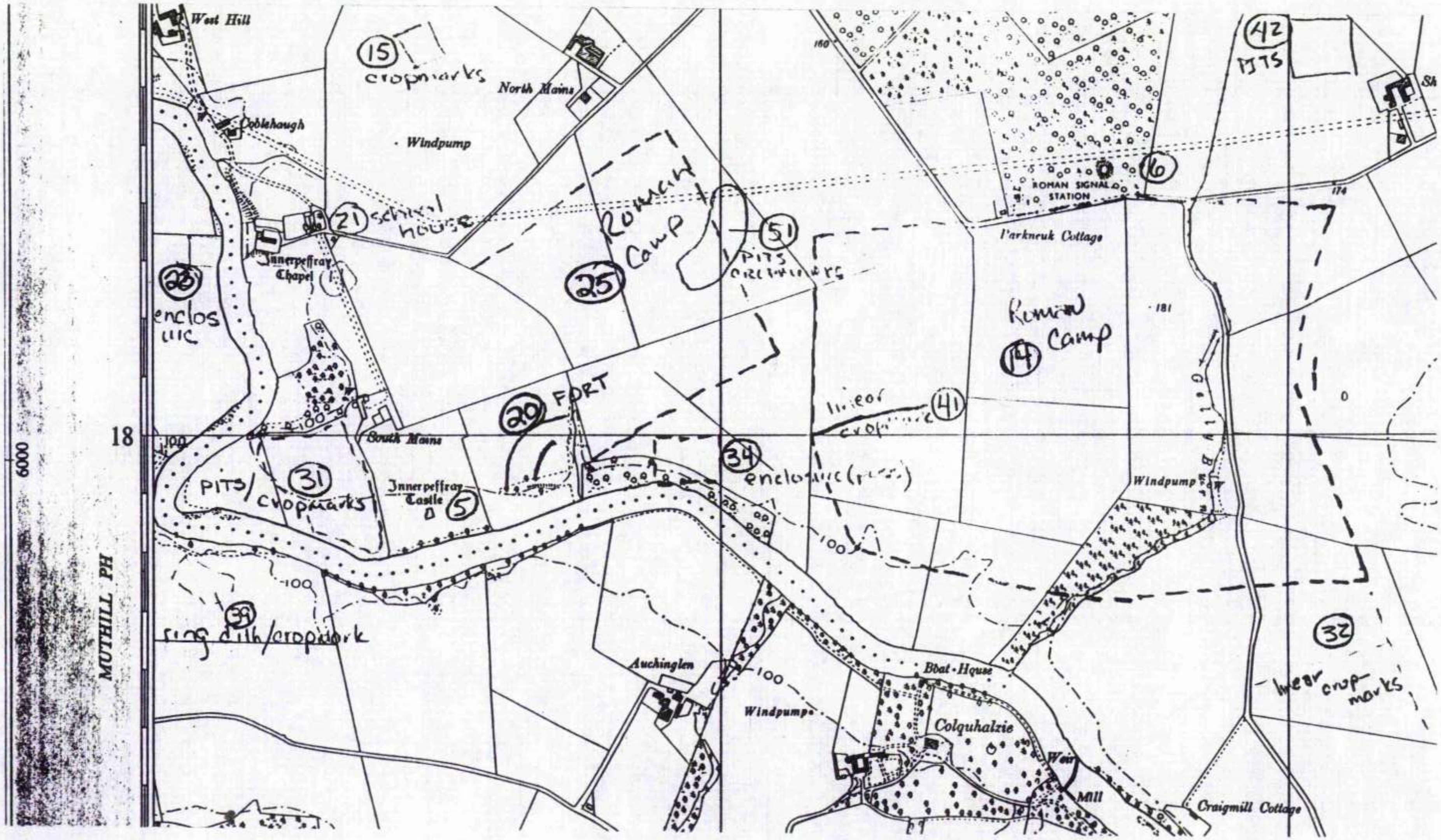


Figure 5.23 Aerial photo by J. Dewar (1970) of Roman temporary camp at Dornock (PT 7472, RCAHMS)


West Hill
Coblehough
Innerpeffray Chapel
South Mains
Innerpeffray Castle
North Mains
Windpump
Parkneuk Cottage
ROMAN SIGNAL STATION
Windpump
Auchinglen
Windpump
Boat-House
Colquhalzie
Weir
Mill
Craigmill Cottage
MUTHILL PH
18
6000
100
181
174
160
15 cropmarks
21 school house
Roman Camp
25
51
PITS
FORT
20
31 PITS/cropmarks
5
34 enclosure
41
Roman Camp
14
16
42 PITS
32
ring ditch/cropmark
enclosure

Roman camp at Innerpeffray is missing portions of its sides but, in this case, it abutts a modern land boundary (or possibly a previous river course) instead of the river.

The lack of camp cropmarks in the adjacent field does not appear to be due to changes in the potential for cropmarks between the fields. In fact, the adjacent field does contain cropmarks identified in aerial photographs as a fort (NN91NW20) but they are semi-circular in shape and could perhaps be originating from fluvial processes rather than anthropogenic activity. No field investigations of the cropmarks have been attempted. Also, a slightly lower elevation covered with thick vegetation exists at the southern perimeter of the encampment that extends to the present river channel. This small feature may be the most obvious remnant of the earlier channel course and if so, suggests that this encampment might have been constructed with access to the Earn river, as the other camps in the Earn valley seemed to have been situated prior to existence of Roman roads.

It is also possible that the spring site located north along the field boundary is draining into the low lying area and is the primary source for the drainage and/or land boundary evidence rather than the channel change possibility. Further investigation of the Innerpeffray site from sources other than aerial photography is in order.

The temporary Roman camp at Forteviot is located on the Earn river in close proximity to Garvock Burn and the Water of May. Figure 5.25 shows an aerial view of the landscape superimposed with the cropmarks that represent the encampment. St. Joseph has identified the camp as a member of an early third-century group based primarily on its rectangular shape (Maxwell, 1980, 28). The western margin of the camp has been breached by the modern river's

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~~PRINT ONLY~~	ROMAN TEMPORARY CAMP		
	©, and permission to reproduce from: J. DEWAR 7068/09		

Figure 5.25 Aerial photo by J. Dewar (1975) of temporary Roman camp at Forteviot (PT 6792, RCAHMS), Water of May in upper right

course (See Figure 5.21), but it is to other areas of the Forteviot landscape that the aerial photographs are most applicable.

In the far right background of the aerial photograph, the Water of May meanders out of the scene and into an extraordinarily rich archaeological complex of aerially photographed sites known as Forteviot. Forteviot and the lands surrounding the Water of May are believed to be a "major royal centre where Durst, son of Ferat, the last king of the Picts, was slain by the Scots and where his successor, Kenneth son of Alpin, first ruler of the combined kingdom, died in palacio" (Alcock, 1984, 29), in the royal hall or palace. No trace of the palace remains and there is "general agreement that the Haly Hill, and indeed the whole western scarp of the Forteviot terrace, was under active attack by the Water of May" (Alcock, 1982, 217) in the mid-1700's.

By 1832, Skene claimed that "the ground on which the palace stood... has been almost entirely swept away, along with the ruins themselves, by the encroachment of the May (Skene, 1857, 278)"(ibid.). It was probably the attempts to canalize the Water of May and thereby stop the destruction of the church at Forteviot which led to the discovery, a few years before 1832, of the carved stone arch which is thought to form the head of an opening to a chapel in the palace complex (ibid., 220).

Skene tells us that the arch "was discovered lying in the bed of the May, immediately under Haly Hill (ibid.). Other accounts by archaeologists similarly state that the ruins of the Forteviot palace complex "had been largely swept away by the river" (Alcock, 1982, 2). Where did the remains of such a substantial and important site go? Are we just to dismiss their absence with a brief statement about some fluvial process affecting their whereabouts? Or should we consider some non-traditional site survey techniques in an attempt to relocate them?

Aerial photography in the surrounding landscape substantiates the notion that the modern channel of the May is underfit and does not adequately reflect its previous stream potential. The tracts of land both east and west of the current water course show evidence of extensive floodplain reworking (Figure 5.26). Further investigation at this site utilizing non-traditional site survey methods to develop a better understanding of the fluvial processes at work in this landscape might help in resolving the matter of lost palace complexes.

With respect to settlement patterns in Forteviot, since 1975 aerial photographs have been used by archaeologists to unravel a shift in the settlement patterns of Pictish and Picto-Scottish kings. "Clearly the earliest focus, in the third and second millennia BC, was towards the southern edge of the level ground. By the later first millennium BC, or more probably into the Christian era, the activity revealed by air-photography had shifted some 400m north to the eastern fringes of the modern village. Subsequently, a further shift, westward to the Haly Hill, must have occurred" (Alcock, 1982, 233).

Alcock ends this paper wondering WHO were the inhabitants that were shifting their settlement locations and he comments that this could be determined if a date for the stone arch (and therefore the palace complex) could be determined. I, on the other hand, am wondering WHY were they moving and what kinds of information with respect to settlement patterns would be available from fluvial studies designed to reconstruct past hydrologic regimes in the basin. Would choices in site location for the earliest inhabitants of Forteviot have been affected by fluvial stability, especially given the dynamic and extreme nature of its activity in recent years?

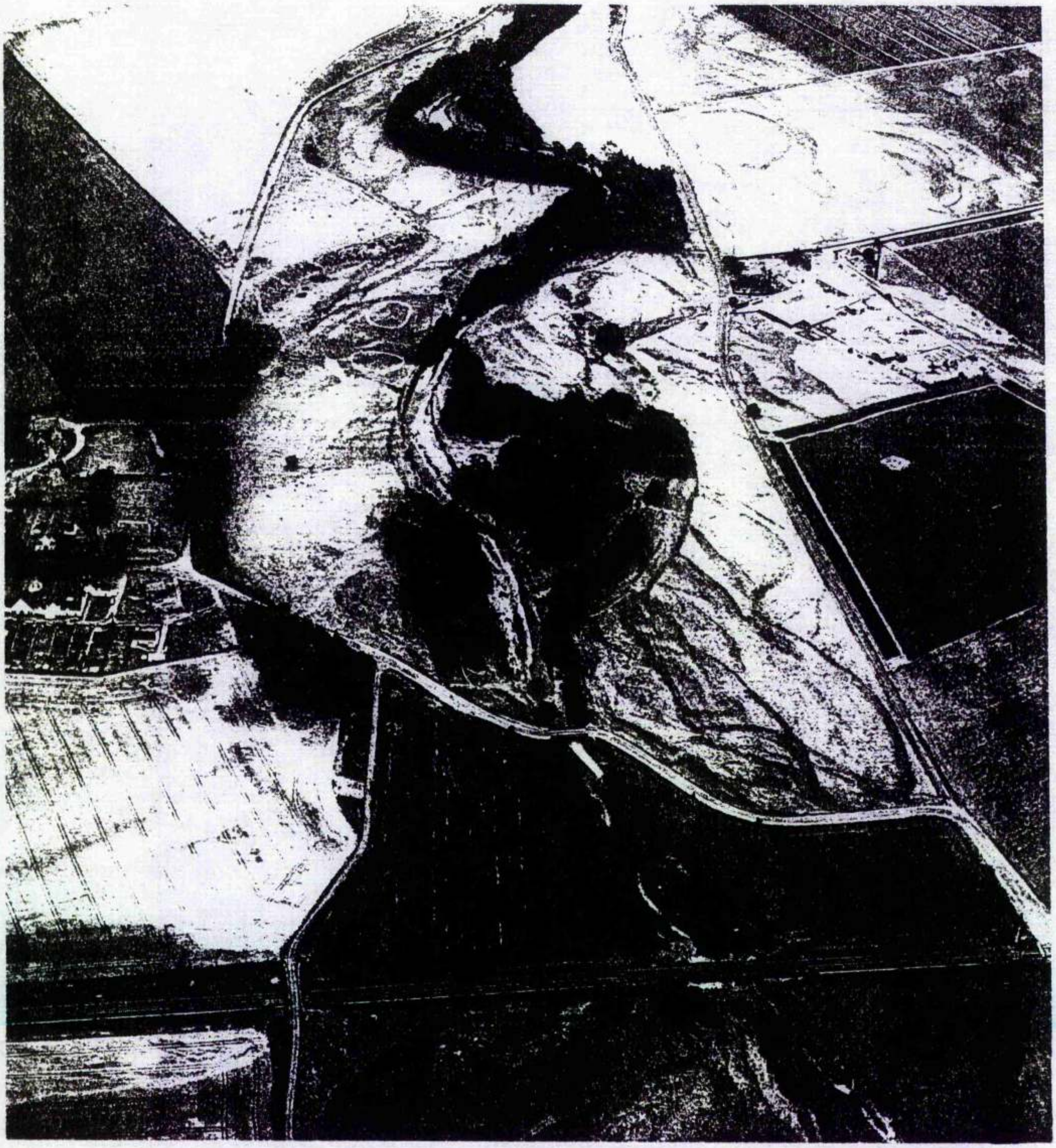

Figure 5.26 Aerial photo (A64524) of Forteviot general view looking south

It is my opinion that the archaeologists working at the Forteviot complex have fallen victim to what Bettis(1992, 120) identified as two conceptual problems in sampling the archaeological record: (1) the belief that the present landscape more or less reflects past landscapes, and (2) the failure to consider that the archaeological record has passed through an environmental filter (in this case, the river) in which burial, alteration and destruction has occurred.

Modern geomorphic studies - Modern geomorphic studies and data handling advantages from new technologies are the final sources of evidence that came to light during the course of this geoarchaeological investigation of the Earn river valley. Although not applied in this case study, there are geomorphologists using geographic information systems(GIS) to map channel change over time (See Gilvear and Harrison, 1991; Gilvear and Winterbottom, 1992). The outcome would be similar to the comparisons made between early and modern maps in this chapter except that the procedure includes scanning, digitizing and overlying all images onto one comparative image provided with a key. Large-scale data storage and retrieval with mainframe computers has made this technique possible. Problems of scale are more easily overcome with this high technology approach as well.

In addition, contemporary geomorphologists study recent flood events to determine the extent of overbank flooding and the location of drapes and breaches in channel embankments. This information can be useful when considering the effect of fluvial processes on modern landscapes containing archaeological resources. Dr. David Gilvear, a geomorphologist at the University of Sterling, has been studying the 1:10,000 vertical aerial photographs that were taken after the January 1993 floods on the River Tay. Our understanding of flood events on the River Tay throughout history can be illuminated by studying the effects of throughout history can be illuminated by studying the effects of modern floods upon the landscape.

Dr. Gilvear and his associates are also developing a technique whereby aerial photos can be used to map three-dimensional channel forms. This becomes possible because relative depths can be determined using image enhancing analysis on greyscale levels from black and white photos or more accurately from red/green absorption ratios from colour photos or multi-spectral imagery (Gilvear, pers. comm.). All of these techniques being used in contemporary fluvial geomorphology will enhance our ability to understand the processes at work in our fluvial landscapes and provide an additional source of evidence for geoarchaeologists in the future.

Summary

The geoarchaeological methodology presented in Chapter three and improved upon in the River Earn case study, has identified many new sources of evidence to consider when studying the geoarchaeology of the Earn river basin. The sources of evidence from early maps, aerial photos and geomorphic studies were used in conjunction with geological, pedological, archaeological and historical data that were available from other disciplines. Combined is this way, relationships between soils and archaeological sites known in the river basin begin to emerge. Upon closer consideration, biases in the archaeological record are apparent and are likely prospects for testing in field projects in the Earn valley designed to investigate those curious relationships.

The Earn case study has illustrated the flexibility of the methodology presented in chapter three through the numerous sources of evidence that have emerged from the research. It is hopeful that applications in other fluvial systems will yield equally interesting and varied forms of evidence besides those gleaned from the Florida and Scotland case studies. Chapter six will extend the application of the methodology to conclude with a review and comparison of the methodology's effectiveness in the landscapes of Scotland and Florida.

Chapter Six

METHODOLOGICAL REVIEW AND CONCLUSIONS: LEARNING FROM THE CASE STUDIES

Methodological Review

In the past five chapters of this thesis, I have attempted to construct an argument for the application of a methodology advocating the use of geoarchaeological techniques and multi-disciplinary teams to study river basin archaeology. The methodology involves integration of knowledge and information available from many other fields of science besides archaeology. Geological, pedological, historical, paleontological, fluvial and geomorphological information are combined in order to study the relationship of humans and their archaeological remains to fluvial systems.

In the course of this thesis, I have consistently referenced authors who have supported -- even stated themselves -- facts and feelings that lend support for the concepts presented in this discourse. I have not fabricated the concepts or principles referenced from these disciplines, but I may have combined them in unusual ways. Some might say, even in a controversial way!

Perhaps there will be those of you who will take issue with what is being said here because it rests too heavily on cultural ecology theory or generalizes certain aspects of one particular science or another. But if you review the references and consider the general position of the field of archaeology today, you will see that this multi-disciplinary methodology has an application to the future of archaeological studies in fluvial systems. If there is any doubt about this statement, reread Chapter Three's section, "The approach used in the Oklawaha and Earn river case studies," wherein the five step approach is presented in detail. Is there any room for disagreement over the utility of these basic concepts? The comparison of points of similarity and contrast in the methodological options practicable in these two rather extreme case studies from Scotland and Florida might then serve as a basis for assessing what approaches and procedures are likely or unlikely to be of practical value in these examples or in less radically different fluvial systems.

The Comparison and Study Area Selection Process

The geologic histories of the two river basins are tremendously different. Scotland with its relatively ancient landscape has been undergoing literally hundreds of millions more years of geologic activity than Florida. Their resulting solid geologies bear evidence to this fact. Their only broad geologic similarity -- sedimentary rock -- forms 75 per cent of all the earth's continental surfaces (Hamblin, 1985). However, other factors such as slope, latitude, morphology and the affects of glaciation have reworked the landscapes to such an extent that even this similarity is imperceptible.

The velocity of each river is comparably close. Although the St. Johns is longer -- almost twice as long -- and therefore probably draining a larger catchment, it has a similar average daily flow (Figure 6.1). Since the 1950's these flows have been somewhat artificially maintained in Scotland by hydroelectric schemes. In Florida, a series of locks constructed for the recently deauthorized Cross Florida Barge Canal project hydrologically controls the Okalawaha River. Forty three per cent (43%) of the water in the Tay river basin comes into contact with hydroelectric operations. The St. Johns is not so heavily affected since the canal only controls one tributary of the river, the Oklawaha. The Oklawaha River discharge into the St. Johns is only 33.98 cubic metres per second (1,200 cfs), approximately 21 per cent of the St. Johns' daily average flow.

COMPARISON OF RIVERS		
Vital Statistic	**TAY**	**ST. JOHNS**
Daily average flow	167 m3/s (5,896.77 cfs)	161.05 m3/s (5,687 cfs)
Maximum flow	1,746 m3/s (61,651 cfs)	1,699.2 m3/s (60,000 cfs)
Length	117 miles (187 km)	300 miles (482 km)
Catchment	5,031 km (2,000 m2)	-Karstic
Change in river elevation	625 meters (2,050 feet)	76.2 meters (250 feet)
Change in catchment elevation	1,000 meters (3,280 feet)	8.2 meters (27 feet)
Vital Statistic	**EARN**	**OKLAWAHA**
Daily average flow	31 m3/s (1,094.61 cfs)	40.4 m3/s (1,427 cfs)
Maximum flow	255 m3/s (9,004 cfs)	161.9 m3/s (5,720 cfs)
Length	43 miles (70 km)	70 miles (112 km)
Catchment	588 sq. miles	2,780 sq. miles
Change in catchment elevation	640 meters (2,099 feet)	48 meters (160 feet)
Annual precipitation	96.5 cm (38 inches)	132 cm (52 inches)
Study area size	38 miles (61 km)	19 miles (30 km)
ORS		9 miles (14.5 km)

Figure 6.1 Vital statistics for the Tay/Earn and St. Johns/Oklawaha river systems

Most significant in terms of fluvial geomorphology is the variation in river slope between the Tay (Figure 6.2) at 625 metres (2,050 feet) and St. Johns at a mere 8.2 metres (27 feet)! Needless to say catchment elevation comparison makes this point even more dramatically -- the Tay basin at 1,000 metres (3,280 feet) and the St. Johns at 76 metres (250 feet). Slope and its importance to the meandering nature of rivers were introduced in Chapter Two. Its affect upon human interaction in the Tay basin can be gleaned from examination of contemporary data concerning slope and land use changes (Figure 6.3). The River Earn enters the Tay basin 145 km

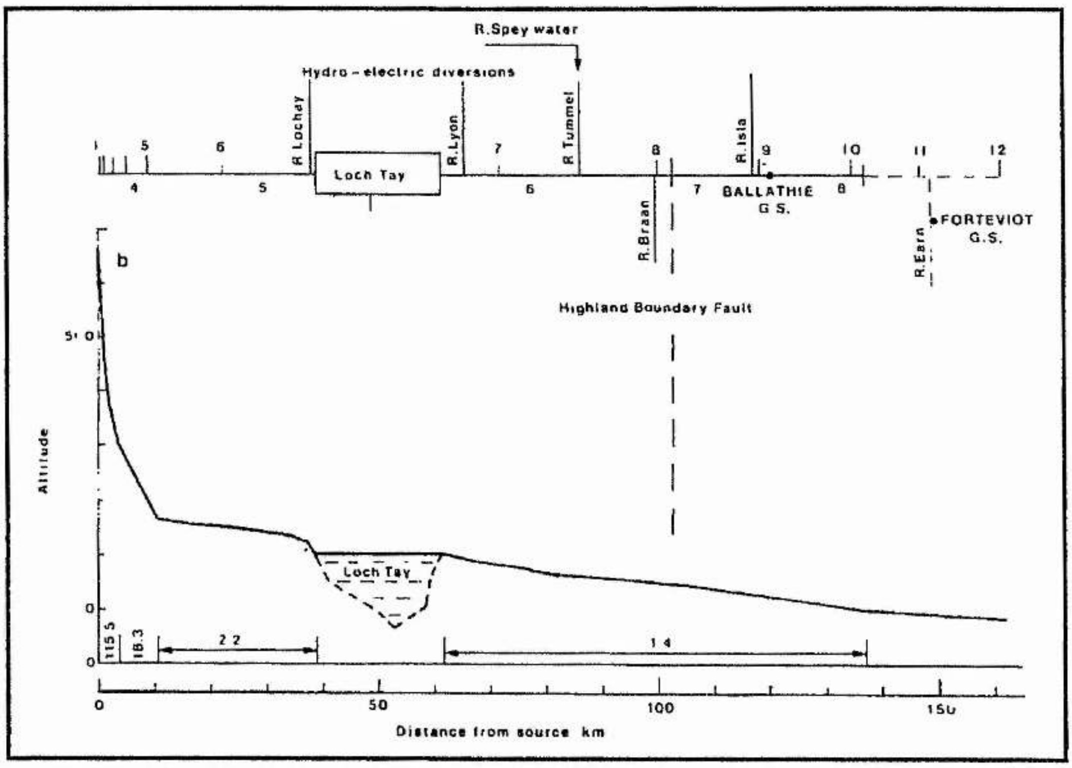

Figure 6.2 Longitudinal layout of the River Tay (from Maitland and Smith, 1987, 377).

from its source indicating that at this elevation, the Tay's landuse is approximately 2 per cent urban, 4 per cent water, 4 per cent forest, 23 per cent arable with the remaining 61 per cent rough grazing. This markedly differs from the upper reaches of the Tay, particularly above the Highland Boundary Fault where arable land declines and urbanization ceases.

Figure 6.4 partly illustrates the effects of slope on the bed material composition of the River Tay. Notice the change in the bed material's character 100 miles downstream where arable lands begin to increase. The amount of boulders and stones increase considerably, while sands and gravels decline. Equally interesting, within 20 miles of the River Earn confluence, the amount of silt rises from 0 to 45 per cent while sands, gravels, stones and boulders decline in various proportions. The Tay is

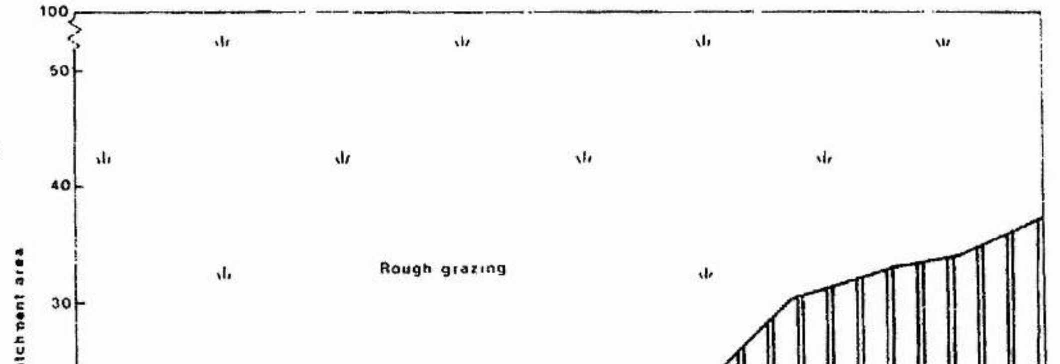

Figure 6.3 Land use changes along the River Tay: Solid black area represents the percentage of catchment occupied by urban development (from Maitland and Smith, 1987, 38●).

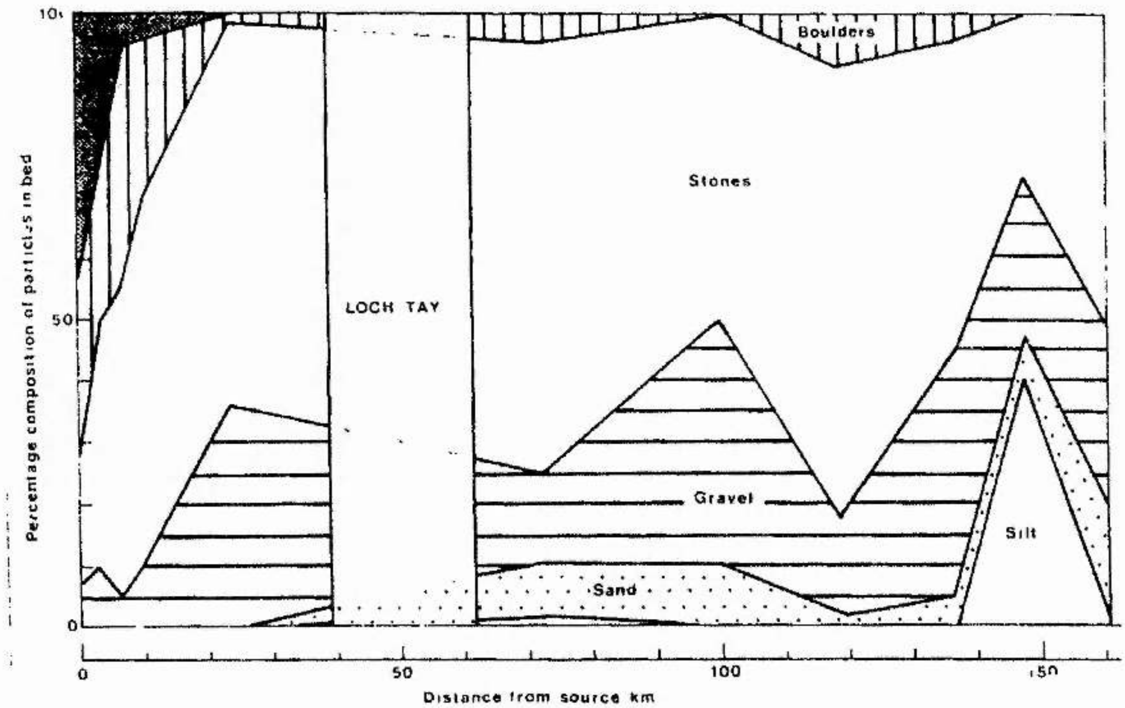

Figure 6.4 The change in bed material composition along the length of the River Tay: Closely stippled area represents the percentage of the river bed occupied by bedrock (from Maitland and Smith, 1987, 382).

expected to carry 93 to 95 per cent of its load in suspension like the River Earn and therefore its bed material characteristics are a useful indicator of the changing carrying capacity of the river along its course.

In Florida, however, as Figure 6.5 indicates, alterations in slope are negligible and therefore have no great effects on land use nor bed material composition within the basin.

There are some basic similarities in the Earn and Oklawaha river study areas (Figures 5.5 and 4.3 respectively). First, each suffers to some degree from hydrologic control, although the Oklawaha seems to bear the greatest impact from modification as a result of the Cross Florida Barge Canal. Second, the Oklawaha holds a similar inflow relationship with the St. Johns that the Earn has established with the Tay. The River Earn contributes 15 per cent of the total fresh water inflow to the Tay while the Oklawaha contributes 21 per cent to the St. Johns. Third, rainfall in each area is seasonal and its affect upon discharge similar, although the Earn has a much greater variation in its precipitation capability. Fourth, land use is comparable in that neither drainage system is suffering a great deal from urbanization and historically agriculture predominates their usages.

In contrast, the terrace formations which are an effect of sea level fluctuation and glacio-isostatic rebound in the Earn river valley are unmatched by any such activity in the Oklawaha. Similarly, Scottish attention to the Tay and Earn river's geomorphology, specifically the effects of sea level fluctuation and the formation of raised terraces that result, has a long research history unlike any such studies in Florida[1]. Argument for

[1] The first in-depth descriptive geological works in Scotland can be attributed to Jamieson (1865), Fleming (1821), Smith (1871) and Melville (1939). Most sea-level studies and coastal change were associated with the Institute of British Geographers founded

application of the geoarchaeological approach depends on geological research in order to interpret evidence of human interaction in the Scottish river environment.

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in 1933. In the next twenty years, J.B. Sissons published many papers on elevated shorelines in Scotland. By 1892, geomorphological and biological techniques were combined to resolve the problems of sea-level change in Scotland (Tooley, 1987). Further examination of the Tay's geomorphologic history was undertaken in the 1970's and 1980's by several researchers such as McManus (1971), Browne (1980), and Al-Ansari (unpublished thesis). In 1987, the Royal Society of Edinburgh devoted an entire issue to Tay estuarine studies. An associated researcher is R. A. Cullingford, whose papers on the raised beaches in the Tay area are unprecedented. His work (Cullingford and Smith, 1966; Cullingford et al, 1980; and Morrison et al, 1981) and that of his colleagues and predecessors establish the geological foundations on which this thesis rests.

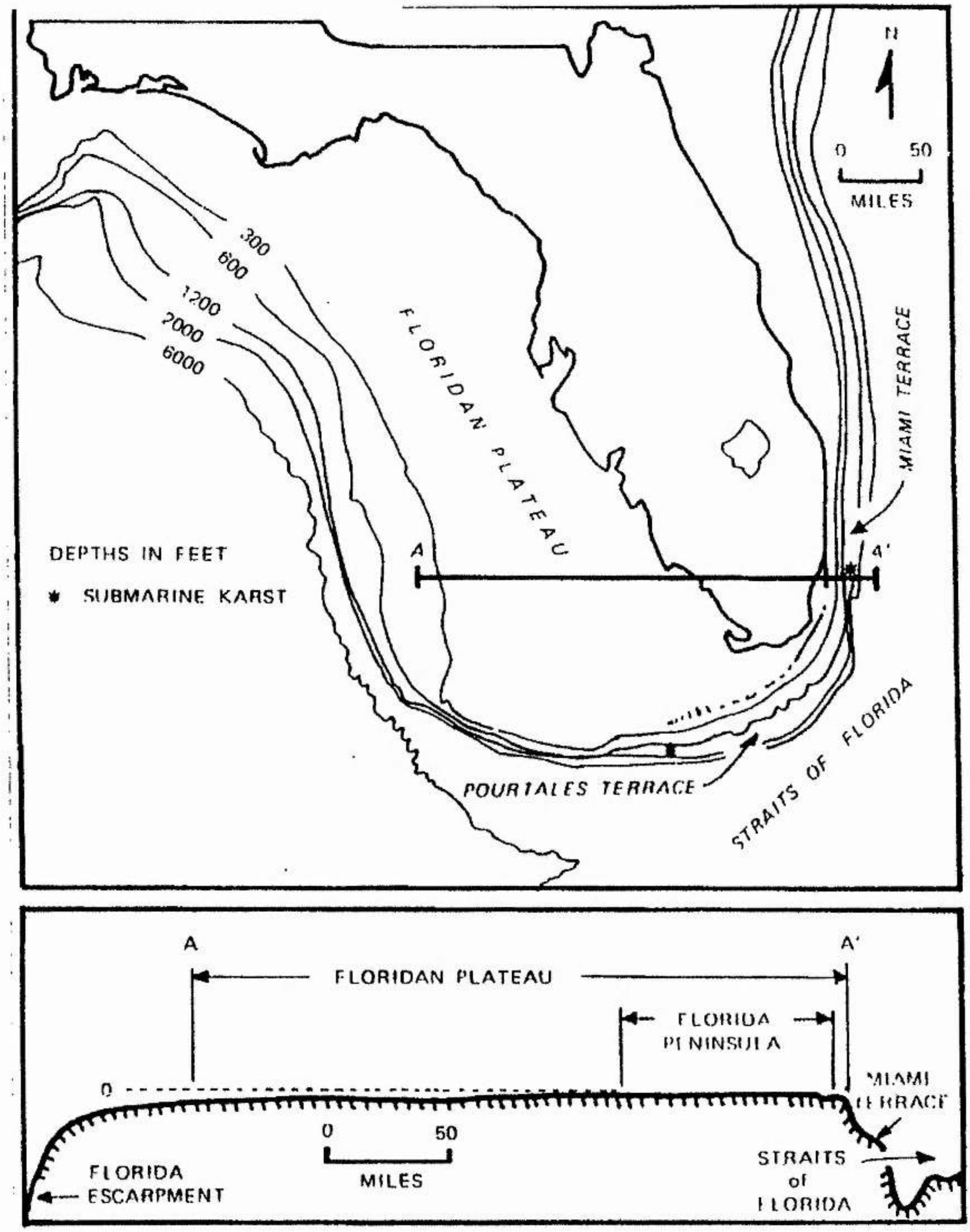

Figure 6.5 Florida Plateau with submarine karst features illustrating the negligible slope differential in Florida (from White, 1958)

Archaeological Comparison: The Reporting Agencies

The National Monuments Record (NMR)is a department within the Royal Commission of Ancient and Historic Monuments of Scotland and is responsible to the Secretary of State for Scotland. Similarly, the Master Site File (MSF) operates within the Bureau of Historic Preservation, Division of Historical Resources, Department of State for the State of Florida. Both maintain a similar archive consisting of locational maps augmented by older site files(MSF) or cards(NMR) and more recent computer-aided systems for maintaining the records. Both agencies have completed input of the old records into the new computer systems. Both are also quick to inform a researcher that thorough investigation of their data only *starts* with the computer search. In any serious study, it is essential visually to inspect the primary data collected and maintained by each agency for each site within each study area. Standarized geological and geomorphological data such as topography, soil type or landform are not included in either the NMR or MSF. Its omission from archaeological records is evidence of the discipline's attitude as a whole concerning the simple application of geological observation to archaeology. Soil information is entirely excluded. However, there are places on the MSF forms for topographic data although it lacks standard methodology and terminology that is available from the related disciplines. Given the varied and complex set of formation processes ongoing within river systems (See Chapter Two), it is hoped that future archaeological records will acknowledge the need to understand the natural and physical processes affecting the landscape before attempting to interpret cultural material or site distribution in that landscape. A good first step may be the inclusion of such data from standardized sources into the site records themselves.

There is a distinguishable difference in the way each agency obtains its site data. The Royal Commission systematically operates archaeological survey teams throughout Scotland. The surveys include ground and aerial reconnaissance. The majority of sites entered into the NMR come from these surveys and are therefore completed by professional archaeological teams employed in-house by the Royal Commission. The site information is transferred to the NMR where a record is created. Appendix One shows a typical computer file for each site. These files include the following:

(1) general site locational and classificational information,
(2) archive details including numbers for photo negatives and manuscripts,
(3) references to information related in "text page", and
(4) survey and excavation history.

These forms represent the computer database currently being maintained for sites entering the NMR in Scotland. There is no publication available to assist persons who may wish to make entry of a site into the record; most entries come from within the Royal Commission itself and therefore no such publication is needed.

Florida's Master Site File office maintains archaeological records collected from a variety of sources. The Division of Historical Resources includes a Bureau of Archaeological Research (BAR) that functions to a lesser degree like the Royal Commission's survey staff. In addition to active research (and thereby placement of sites into the MSF by in-house staff), the BAR also provides consultation to the Bureau of Historic Preservation's grant program.

One would think that with more than one million dollars per year dedicated to grant aid funding that it would provide an adequate impetus for undertaking archaeological work. Competition for those funds is fierce and invariably not all applicants are funded. Therefore, the project budgets they do manage to fund are reduced and cut to afford the most value for the least money. In the case of the Oklawaha River Survey, this cost cut meant the academic value of this project was lessoned to an unsatifactory level and can be cited as an example of tensions between archaeological ideals and operational realities in maintaining funding.

Grant applications include a category for "Survey and Registration" of sites. Funds are distributed by the Historic Preservation Advisory Council on advise from the Bureau of Archaeological Research to qualified applicants to undertake archaeological survey within the State of Florida. The MSF office has necessarily created a site form and accompanying manual to ensure proper form completion and to aid in standardization of the information being obtained from such a wide variety of informants, the grant recipients.

The BAR and MSF staff spend a large proportion of their time consulting with grant recipients throughout all phases of the survey projects. Appendix One offers some examples of MSF forms including (1) an underwater archaeological site form, (2) a terrestrial site form, and (3) an archaeological short form, utilized to record the appropriate site by members of the public, grant recipients and BAR staff alike.

Whereas the Royal Commission does not assist with externally funded survey projects, the Bureau of Archaeological Research does not coordinate the placement of archaeological sites onto government maps. In Britain, the government's Ordnance Survey produces maps of the country including significant archaeological sites. The equivalent American agency, the United States Geological Service, produces a quadrangle map without such information being made available. This factor might indicate a national difference in opinions about making archaeological information available to the public -- perhaps with good reason. There is a tremendous amount of looting activity on archaeological sites in the United States, a problem which seems less prevalent in Britain. The reasoning behind this difference could be attributed to my feeling that Americans do not consider the cultural heritage interred in American soil to be their own. The past associated with these archaeological sites is not *their* past -- it's not their culture or history, therefore looting for economic gain or destruction for the sake of the object is more easily justified.

Comparison of Inland Waterway Research

The BAR also includes a small underwater research division that is responsible for the submerged cultural heritage. Its objectives and their development and history have been affected by the extreme economic viability of shipwreck salvage around the coast of Florida -- a situation unique to only a few areas in the world. Aid in research and conservation of another invaluable source of Florida's history, inland waterways and its prehistoric archaeology, has been negatively affected by shipwreck salvage activity in the state.

It is my opinion that the Division of Historical Resource's position on underwater archaeology has suffered in the past from the political activity associated with shipwreck salvage in Florida to the detriment of inland waterway research. With the exception of the Aucilla River where BAR funding was withdrawn in 1991, and the 1991 Oklawaha River Survey (see Chapter Three), no other inland waterway surveys have been funded by the BHP or undertaken by BAR staff[1]. This is significant when compared with the numbers of terrestrial or wet site surveys funded by BHP or undertaken by other BAR divisions each year. Numerous wet site excavations have taken place in Florida and Britain yielding some of the most exciting environmental data and organic remains ever collected (See Purdy, 1992). However, wet site archaeologists also state concern that the value of their sites is not fully recognized nor supported (MacDonald and Purdy, 1982).

For the purpose of this thesis, the most important difference between the two reporting agencies is the lack in infrastructure or procedure within the Royal Commisssion for placement of underwater sites into the record. Because most, if not all, surveys in Scotland are completed by in-house staff and because no staff members are trained in underwater archaeological survey or excavation techniques, no records exist for such sites. In addition, there is no formal procedure within the Royal Commission that allows for external bodies to make application for funds to undertake surveys or research of an "unconventional" nature.

It is my opinion -- and that expressed by others as well -- that the Royal Commission does not fully acknowledge the value of underwater archaeological survey to archaeology in general, though there are signs that this attitude is changing[1]. Given the broad archaeological responsibilities with which the Royal Commission is charged, obviously there is strong competition for the limited finances among its departments too. But in order to prove the

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[1] In 1991 BHP approved a special category grant for an underwater investigation at Little Salt Springs, an inland site in south Florida.

[1] The Royal Commission in England has recently established a Marine Division to create and operate a database of maritime archaeological sites.

value of underwater survey to terrestrial archaeology, a mechanism by which the Royal Commission can undertake pilot surveys either in-house or externally should be developed.

If Scotland, like Florida, had "suffered" from having treasure shipwrecks along its coasts, perhaps the structure for an underwater record would exist and its inland waterway research would have proceeded from there. Instead, many crannogs or artificial islands located along Scotland's loch shores -- some fresh water and some sea lochs -- have been identified and included in the NMR, although their survey and excavation were not supported financially by the Royal Commission[4].

Conversely, the existence of the treasure fleets in Florida's territorial waters has aided in the distraction of archaeologists' interest in inland waterway sites despite their better preservation and yield of different classes of artefacts compared with similar terrestrial sites. Underwater archaeology, as a relatively new field within archaeology, has not been particularly successful in making its own case for the value of its research. Future underwater archaeologists must strive to make their research more applicable to the issues surrounding terrestrial archaeology and attempt to furnish data relevant to the questions at hand. Likewise, it is my intention to encourage terrestrial archaeologists to view their landscapes as if the water was not there, then to ask them to consider how the water that IS there has altered their landscapes and their ability to interpret human interaction within them.

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[4] Morrison (1985) and Dixon (1991) provide a comprehensive history of crannog excavation and survey in Scotland. There is a crannog located in Loch Tay at the head of the Tay River Valley and the reader is referred to Dixon(1982a),(1982b), and (1984) for a summary of work at Oakbank.

A maritime perspective applied first to inland waterways will be more easily grasped by and applicable to terrestrial archaeologists who then may be more readily led out to sea and its maritime sites. The successful application of underwater survey in inland waterways to archaeological questions of terrestrial concern will enhance the value of underwater archaeology to the larger discipline of archaeology as a whole.

Ultimately a unified body of terrestrial and underwater archaeologists will emerge which will undertake archaeological duties in such a way as to effectively erase the arbitrary land/water interface that exists at the margins of their contemporary landscapes. Only then will the archaeological discipline coherently record, protect and preserve all forms of cultural heritage both terrestrial and submerged in inland waterways or coastal and marine settings around the world. Moreover, and applicable to this thesis, the geoarchaeological approach applied to fluvial settings offers the best opportunity for beginning to accomplish this task.

Observations from the methodology's application in Florida and Scotland: A Comparison

It is apparent from the archaeological literature that Florida archaeology has more readily taken on board the application of a maritime approach to prehistory (DHR, 1991, 44). Likewise, application of the geoarchaeological approach is prevalent in a small portion of the American archaeological mainstream. However, neither archaeologists in Britain nor America, are applying these perspectives to the survey of sites located or actively being destroyed in floodplains. Underwater geoarchaeology has yet to come out of the archaeological closet and be recognized for its potential contributions.

There is a similarity between the mentality of the Royal Commission in Britain concerning sites identified through aerial photography and the desire for placement of sites by survey in Florida's Site File Office. Survey for the sake of locating sites, without subjecting them to techniques capable of extracting information about the past from them, is like collecting aerial photographs of sites and not testing them. The acquisition of quantities of sites without quality data is not much good in terms of understanding the past. Obviously, cultural resource management is served by such endeavors, but at some point, closer examination of known sites must take priority (DHR, 1991, 79).

Predicting locations for archaeological sites in Scotland can be inferred from other field research presented. Investigating point bars in the Tay and Earn rivers, for instance, could potentially yield evidence of human occupation comparable to the results of the Savannah river point bar sites reported by Brooks, et al. (1986), and DePratter and Amer (1988). The research at the Haw River (Larsen and Schldenrein, 1990) and the Middle Flint River (Worth, 1988) would suggest that the expanded floodplain just below the fall line (near Dunkeld) on the River Tay should be surveyed for archaeological sites. These geomorphic features in the South Atlantic region of North America were heavily utilized by prehistoric occupants. Perhaps the same is true in Scotland.

Geoarchaeology can also help identify the relationship between culture change and environmental factors. As an example, consider the application of the field of soil science (including the laboratory anaylsis) to archaeological sites during the Okalawaha River Survey (See Kuehl and Denson, in press). The concept of terrace formations composed of sand became of interest. Archaeological sites were predominantly situated on sand terraces close to the river's edge which had been formed either in-situ or from sheet wash off higher land infilling low-lying land or through channel migration and redeposition.

Similarly, in Britain 95 per cent of lower paleolithic sites are situated in river terraces made of gravel. This illustrates that past peoples living in Florida and Britain were making a similar choice to utilize the same landform -- terraces that differ only by their parent materials. Similarly, the terraces are being modified by the same geomorphic processes -- fluvial by nature. Individuals in Scotland and Florida chose similar site locations on terraces, or the sites were transported there at a later date by similar processes.

Either way, as geoarchaeologists studying human interaction in river environments, we are compelled to develop an understanding of fluvial processes that create terrace deposits and to investigate the sites being affected by them in the contemporary landscape before attempting to infer culture change from the affected archaeological record.

The primary goal of this thesis is to begin cultural resource managers and terrestrial archaeologists thinking of the land/water interface not as a permanent and unmoving barrier but as a significant component to understanding their research areas. We must effectively erase that arbitrary boundary in favour of a total landscape survey in order to gain a better understanding of its past, and the peoples associated with it. Terrestrial archaeologists must begin to look over and through the waterways within their regions while underwater archaeologists must press on with multidisciplinary research aimed towards accentuating the existing terrestrially-based models of the past. Only then can archaeology be contextual and relevant to understanding human interaction in river systems.

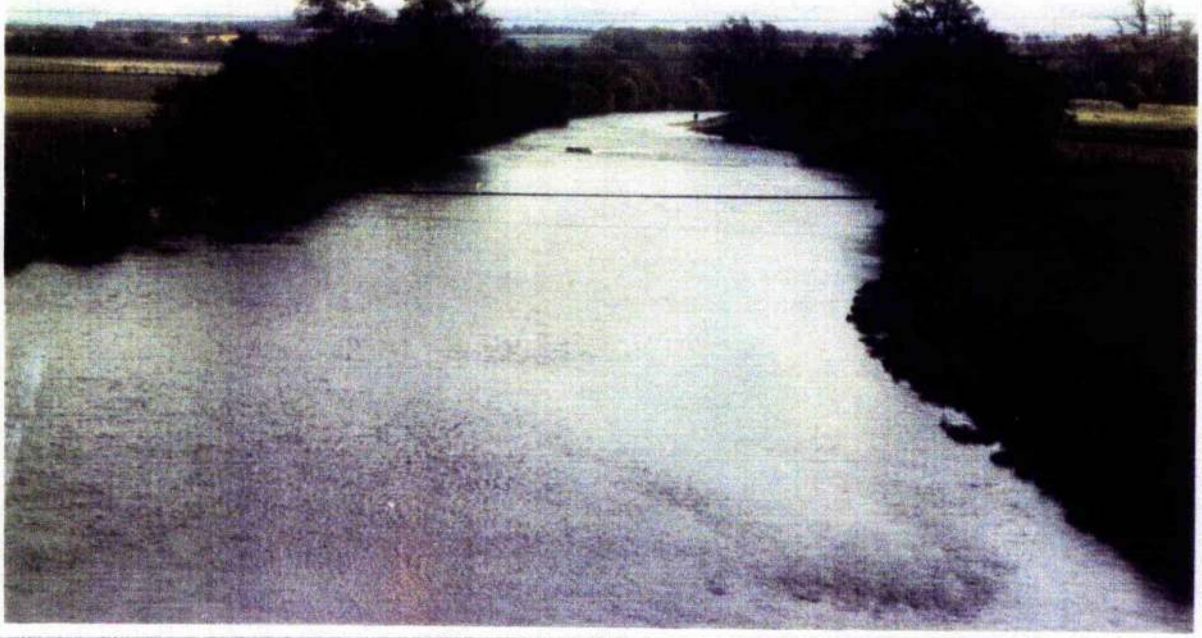

Figure 6.6 Earn river at Forteviot (R. Denson, photo)

Summary

The development of geoarchaeological theory is rooted in mainstream archaeology and the supporting theories of cultural ecology and a contextual approach. The hypothesis presented in Chapter One - that archaeologists must first understand the natural and physical processes affecting a landscape before attempting to interpret cultural material or site distribution within it -- is incontrovertible. Application of this approach to understanding human interaction in river environments is equally indisputable. Fluvial landscapes have long been a prime venue for human occupation, and these systems, by definition, are undergoing high rates of geomorphic change. In the contemporary landscape, geomorphic changes are affecting distributions of archaeological sites and their materials in quantifiable ways rarely studied before.

Underwater archaeology in floodplains can illuminate fluvial processes and help to develop a better understanding of their effects upon the archaeological landscape. Fluvial geomorphologists have established well-accepted models for bedload and suspended material transport and deposition in rivers.

If archaeologists assume that cultural material acts in a similar fashion, then by observing and recording sites that are actively being eroded, new models for fluvially derived archaeological material can be constructed and tested. In turn, terrestrial archaeologists working in alluvial sediments can apply the knowledge obtained from underwater archaeological research in modern floodplain environments to their fluvially affected terrestrial sites.

Similar to the Sahara Desert palaeo-river channels identified under a blanket of aeolian sand, underwater archaeology provides to archaeologists a newly recognized geomorphic context for sites. Understanding the dominant processes at work in this geomorphic context requires, first a new approach, and second, recognition of biases relevant to the geomorphic context. Site location preferences by people in the past were formulated with concepts (bias) of fluvial activity held in mind. Our own biases inherent in collection strategies and database management systems lacking inclusion of geomorphic data, also affect our perception of archaeological site distribution in the landscape[5].

Equally notable is differential preservation of site types associated with certain geomorphic features. Once these processes are understood and their biases accounted for, cultural material from river environments will no longer be considered as

[5] DHR (1991, 33/35) admits a sampling bias in Florida's survey strategy. Most sampling strategies target only land that is well to moderately-well drained.

insignificant stray finds, their context will be more fully understood and as a result their inclusion in archaeological databases more meaningful.

Geoarchaeology is the best approach for studying archaeological sites in fluvial settings. Future education and training in the archaeological discipline must emphasize the utility of a multidisciplinary approach rooted in a geoarchaeological methodology. There will be a greater need to train archaeologists to make observations and carry out geological procedures as geoarchaeologists rather than to rely entirely on the support of other disciplines.

In addition, archaeologists need to consider a maritime perspective of the landscape. Without it, a biased terrestrial-based interpretation of past cultural activity from the archaeological record can result. Land archaeologists must face the fact that underwater landscapes form a significant portion of their own research areas. To ignore them is to deny compilation of a complete archaeological record for any time period under investigation. Integration of the geoarchaeological approach to all archaeological field work is the ultimate goal. One futuristic day, archaeologists might view their landscapes from a non-distinquishing land/water site geoarchaeological perspective, and then the Willey and Phillips of that day will say

> "Archaeology is geoarchaeology, wet and dry, or it is nothing at all."

Greater contributions to other disciplines can be achieved with a contextual archaeological approach which includes geoarchaeology. Geomorphology, botany, zoology, ecology, pedology and sedimentology will benefit from a contextual approach applied to all archaeological sites. Application of a geoarchaeological approach to fluvial environments and inclusion of this data into existing databases will alter site distribution and density patterns within the landscape[6] .

Learning from the Case Studies

Scotland: The Future - The archival and documentary research in the Earn study area represents the last step taken in Scotland for application of the geoarchaeological approach. Step five, a field survey of the river channel and margins in the study area would serve several purposes. First, the actively eroding Roman sites could be re-surveyed to include their underwater portions. A quantified rate of erosion during the past 2,000 years would provide geomorphic data on fluvial processes at work in the Earn valley since that time.

Gathering the archaeological evidence affected by such processes and utilizing a systematic method of recording the archaeological scatter would provide information applicable to formation of alluvial sites in this and similar landscapes. It may be prudent to consider use of a backhoe in carse deposits and shallow terraces to determine the presence of buried land surfaces. This technique has proven useful in many geomorphic regions of North America (Goodyear, in press).

As in the Oklawaha River Survey research design, the Earn River Survey could target eroding river margins to identify and record archaeological sites being affected by channel migration. Where aerial photography has indicated anthropogenic activity near the Scottish river, the associated channel and margins would also be

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[6] Inclusion of the Oklawaha River Survey data increased the number of known archaeological sites in the study area by 40 per cent.

potentially useful for further inspection. It is likely that a river channel survey of the Earn study area would change site distribution and density patterns across the Earn river landscape.

How might that change affect archaeological research in the Earn river valley? Driscoll (1991, 86) notes that aerial photography has radically altered our perception of prehistoric and medieval settlement[7]. I propose that a similar radical change will result from the applications of both a geoarchaeological and maritime approach to the Earn river valley's socio-cultural model of landscape development.

In the Earn valley research presented by Driscoll, his first assumption is that power in medieval Scotland flowed from the land (ibid., 83). Then, does it not follow that reconstruction of the land itself should be included in archaeological research theorizing state formation within it? To this end, only one sentence in Driscoll's argument asserts the importance of considering the land:

> "The thanage typically stretched across several ecological zones, from riverside meadows to hilltop moorland, and included a fair proportion of good agricultural land" (ibid., 107).

On the other hand, he calls for more palaeobotanical work on sites of later prehistoric to medieval date (ibid., 98), acknowledging a lack of environmental data from the area.

[7] We have discussed the bias associated with the NMR and aerial photography sites in great detail in Chapter Six. Even Driscoll (1991, 86) admits "that a great deal of chronological uncertainty surrounds most unexcavated aerial photographic sites."

I would like to assume that political power in medieval Scotland flowed with the inland waterways and its hinterland. I propose a theory of thanage distribution in the landscape based on the most advantageous sites being determined by their fluvial settings. These locations and their occupants, in turn, rise to power based on an advantage achieved from greater natural resources available to them.

Obviously, there are social factors to include, but even these can be described from an ecological point of view. For instances, thanages upstream are at a disadvantage compared to a mid-stream thanage or downstream community that has greater access to other communities based on ease and distance of travel between thanages.

Driscoll states that Pictish tribes competed amongst themselves for overlordship (ibid., 108). Could it be possible then to understand the rise of Scone as the seat of royal power, since its location in Tayside is at the geographical optimum for trade, distribution and tranportation within, and without the surrounding area[8]?

The lesser thanages described by Driscoll (1990) at Dunning and Forteviot also can be approached from a geoarchaeological and maritime perspective -- an approach clearly lacking in current archaeological research there. **Its** usefulness is obvious -- even

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[8] Driscoll (1990, 108) states that "archaeological identification of a social institution *like a shire* presents a real challenge, but it is possible, if attention is focused on agricultural evidence and indications of the local circulation of high quality craft goods, such as might be produced under the lord's patronage <italics mine>". Could not local circulation of both high quality goods and regular goods, as well as extra-local circulation depend on riverine and coastal portages? Driscoll's comment (ibid., 93) "... shared terminology with the English only serves to underscore the close links extending along the north-east coast of Britain" serves to emphasize the point. Inland waterways provided a major tranportation link between cultural groups separated by fluvial barriers and terrestrial distance.

Driscoll makes reference to the river for locational purposes while he discusses the socio-political elements of his argument (ibid., 102).

Both thanages are located on tributaries of the Earn, the Dunning Burn and the Water of May, respectively. Looking along the Earn study area's course, there is a concentration of archaeological sites in each of the southern tributary systems. I would propose a thanage model based on the importance of access to the main water course (the Earn) first, followed by access to good agricultural land (the second terrace deposits) second, and grazing or moorland last. This model would then allow for cultural development and shifts of power between thanages to be explained relative to their natural systems and the resources they provided as well as their associated socio-political systems[9].

I disagree with Driscoll when I state that understanding the order behind random scatter of settlements within the thanage depends on "understanding the natural system first." Then, through archaeological evidence focusing on the local economic and social relations, we can provide a key to greater understanding of human interation in the Earn river environment. In addition, I argue that Driscoll's archaeological evidence is incomplete since aerial photography sites are mostly unexcavated and the river and its margins are entirely unsurveyed. This category of archaeological evidence and its maritime perspective has been overlooked.

[9] Driscoll's model of joint tenancy farms comes from Whittington (1973), an examination of Muthill thanage just west of the Earn study area. It is a concentric model, with the settlement located within or at the edge of the infield core, the intensively cultivated land. This is surrounded by outfield, portions of which were cultivated in rotation, and is in turn surrounded by permanent pasture and moorland (Driscoll, 1990, 95).

The point is, application of a geoarchaeological approach to problems of site density and distribution in fluvial landscapes is absolutely necessary. Human interaction in river environments is too consistent -- based on our biological need and the ecosystem's improved transportation, rich natural resources and agricultural potential (DHR, 1991, 32) -- to ignore its importance in the past or its affect on sites in the present. Fluvial processes do alter landscapes and therefore the sites within them. We must begin to look underwater (DHR, 1991, 45).

Oklawaha River Survey: Results and Future - In Florida, the results of the Oklawaha River Survey illustrate the affect of locating sites by river survey and including them in terrestrially-based archaeological databases. Forty per cent more sites were located in the Oklawaha study area as a result of the river survey. Evidence from another inland waterway survey of the Upper Damariscotta River in Maine located an additional 70 sites along a 23-mile stretch without any diving activity (Riess and Dean, 1989). Of those newly identified sites in the Oklawaha River Survey, 40 per cent were historic and 33 per cent were classified prehistoric.

It is hopeful that further archaeological investigations of prehistoric sites in Florida can lead to a better understanding of the chronological breakdown within the prehistoric cultural sequence. More controlled testing of sites (Coles, 1990) will be needed to accomplish this goal. Evidence collected during the Oklawaha River Survey suggests that archaeological material does not move any further than one meander length downstream from its original place of entrainment. As a model, this hypothesis provides a starting point for dismissing the concept that river finds have no context. Clearly, more quantified research on riverine sites will correct any past and/or present misunderstandings of context for river finds.

Sites in rivers also can provide stratified deposits along eroding margins if their presence is identified before their extent is destroyed. A state-wide river survey programme in Florida would identify such sites. DHR (1991, 45) recognizes the need to look in the water for archaeological sites. However, DHR then exhibits an uninformed terrestrial attitude by stating that sites underwater cannot be excavated in a controlled fashion. Use of sandbags and pumps (ibid., 45) are suggested so that excavation in the dry can achieve controlled excavation. Contrary to this misconception, underwater archaeology is capable of recovering provenance data in a controlled context.

Multidisciplinarian teams could quantify the affects of erosion on archaeological material while sampling stratified deposits for further examination by fluvial and pedological specialists. During the Oklawaha River Survey, soil analysis provided some interesting insights into geomorphic activities affecting the landscape -- sheet erosion, channel infilling and deposition, to name a few (Kuehl and Denson, in press). In addition, phosphate studies at the Durisoe site provide an opportunity for comparison with others in the future.

Ultimately, and with more money, a model of seasonal movement for prehistoric peoples in the Oklawaha river basin can be developed. Anderson and Hanson's (1988) annual round model provides one alternative. Closer to the study area, Russo's (1990) model of archaic populations proposes a more sedentary lifeway north of the Oklawaha in the coastal zone. Further contextual work in the river valley is needed to develop a working model for the populations living in the Oklawaha river basin.

Conclusions

That the geoarchaeological approach can be applied with good success to fluvial systems in regions as diverse as Florida and Scotland exemplifies its flexibility as a conceptual methodology. It allows different types of evidence to be used for predicting the locations of archaeological sites within fluvial landscapes as well as the processes that affect them. Initially, similar categories of evidence, for instance, the geology, archaeology and history are considered for each area. The information obtained in the initial steps is likely to exhibit regional variability that requires diversity and flexibility offered by the geoarchaeological approach. This approach is well suited for interpreting and relating all categories of evidence that are identified through the application of the methodology presented for studying the geoarchaeology of fluvial systems.

In Florida, the karstic nature of the topography and the predominance of sand size particles makes specific soil types and their corresponding vegetation useable as indicators of river shift (i.e. terra ceia muck) or of the potential presence of archaeological sites (i.e. well-drained soils in good proximity to water). This represents a form of evidence identified in Florida by application of geoarchaeology to the archaeology of its fluvial system. Additional and complementary forms of evidence come from examination of pre-existing archaeological information supplied from the State's Master Site File office on known sites in the study area. Biases can be identified and possibly linked to compliance-based archaeological surveys on federally owned lands, in this instance.

River diver information, a regionally specific form of evidence used for locating archaeological sites is characteristic of the Florida example. From this information source, actively eroding river margins were identified through a survey that was designed and successfully carried out to locate and record affected sites. The nature and rates of erosion affecting these archaeological sites in the Oklawaha River are now being identified and quantified. A working hypothesis on the effect of river erosion on archaeological sites has been developed and future investigations will continue to collect data on geomorphic processes affecting sites and to identify any new forms of evidence that arise from this methodology.

There are some drawbacks associated with the application of this methodology to studying the geoarchaeology of fluvial systems. First, because of its multidisciplinary nature, organizing and mounting an appropriate project crew can be both expensive and difficult. No single archaeologist can be expected to make multidisciplinary field observations as sufficiently as a selected team of professional researchers. Thus, this approach is heavily dependent on multidisciplinary teams. Likewise, another difficult part of any multidisciplinary project is establishing and maintaining communication and interaction between the different players throughout the planning, development and implementation stages. First, the archaeologist's goals and objectives must be communicated to the other researchers in a timely fashion so that an effective research design can be created and carried out with the utmost of financial efficiency and feedback. Input from all disciplines at the planning stage should improve the effectiveness of the project and the quality of the geoarchaeological data extracted during the field work.

In Scotland, the glaciated landscape and resulting isostatic uplift of the land and eustatic affects of the sea dictate that more geoaracheological work is needed in the Earn valley in order for field work to be productive. Future work in the Earn River Valley will be directed at quantifying the rate of erosion at the eroding

Roman sites using the full range of evidence available. Further correlation of geomorphic data including soils and terracing with the archaeological data should be addressed in the research design and evidenced in the multidisciplinary team created to undertake the project. It is anticipated that some underwater survey utilizing geophysical methods of investigation combined with visual survey techniques, similar to those carried out in the Oklawaha River, will be developed and implemented.

Extensive terracing and deposition of marine and estuarine sediments in the Earn valley during the Late Devensian and Flandrian demands that these processes and resulting landforms be identified and understood before attempting any interpretation of site distribution and density patterns in the Earn valley's archaeological record. The Florida example has proven that careful examination of a fluvial system and the archaeoloical sites they may contain can change our knowledge about its past and the human activity taking place within the fluvial landscape. Geoarchaeology is presented in this paper as a most effective methodology, although costly and not without drawbacks, for studying the archaeology of fluvial systems.

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Appendix 1

BLANK FORMS

__ original
__ update

ARCHAEOLOGICAL SITE FORM
FLORIDA MASTER SITE FILE

Version 1.1: 11/88

Site #8__________
Recorder #__________
Field Date__________

SITE NAME(S) __________
PROJECT NAME __________ DHR#__________
OWNERSHIP _private-profit _priv-nonprof _priv-indiv _priv-unsp _city _county _state _federal
USGS MAP NAME __________ CITY__________
UTM: ZONE 16 / 17 EASTING /_/_/_/_/_/0/ NORTHING /_/_/_/_/_/_/0/
COUNTY __________ TWP ___ RANGE ___ SECTION ___ ¼___ ¼-¼___ ¼-¼-¼___
(Optional) LATITUDE d ___ m ___ s ___ LONGITUDE d ___ m ___ s ___
ADDRESS/VICINITY OF/ROUTE TO __________

TYPE OF SITE (All that apply) _prehist unspecified _hist aboriginal _hist nonaboriginal _hist unspecified

SETTING	STRUCTURES OR FEATURES			FUNCTION	DENSITY
_land site	_aboriginal boat	_fort	_road segment	_none specified	_unknown
______	_agric/farm bldg	_midden	_shell midden	_campsite	_single artifact
_wetland fresh	_burial mound	_mill unspecified	_shell mound	_extractive site	_diffuse scatter
_wetland salt/tidal	_building remains	_mission	_shipwreck	_habitatn/homestead	_dense scatter>2/m²
______	_cemetery/grave	_mound unspecif	_subsurface features	_farmstead	_variable density
_underwater	_dump/refuse	_plantation	_well	_village/town	______
______	_earthworks	_platform mound	_wharf/dock	_quarry	______

OTHER__________

HISTORIC CONTEXTS (All that apply) _unknown culture _aboriginal unspecif _hist unspecified

ABORIGINAL:	_Early Archaic	_Glades IIb	_Manasota	_St. Johns unspecif	_Swift Creek
_Alachua	_Early Swft Creek	_Glades IIc	_Middle Archaic	_St. Johns I	_Transitional
_Archaic unspec.	_Englewood	_Glades III	_Mount Taylor	_St. Johns Ia	_Weeden Island
_Belle Glade	_Fort Walton	_Glades IIIa	_Norwood	_St. Johns Ib	_Weeden Island I
_Belle Glade I	_Glades unspecif	_Glades IIIb	_Orange	_St. Johns II	_Weeden Island II
_Belle Glade II	_Glades I	_Glades IIIc	_Paleo-Indian	_St. Johns IIa	______
_Belle Glade III	_Glades Ia	_Hickory Pond	_Pensacola	_St. Johns IIb	______
_Belle Glade IV	_Glades Ib	_Late Archaic	_Perico Island	_St. Johns IIc	______
_Cades Pond	_Glades II	_Late Swift Creek	_Safety Harbor	_Santa Rosa	_prehistc-aceramic
_Deptford	_Glades IIa	_Leon-Jefferson	_St. Augustine	_Seminole	_prehistc-ceramic
NONABORIGINAL:	_1st Spn 1700-63	_Amer Terr 1821-44	_Postrecn 1880-97	_Depress 1930-40	_American 1821-
_1st Spanish unsp	_Brit 1763-1783	_Statehood 1845-60	_SpWar 1898-1916	_WW II 1941-49	_American 1821-99
_1st Spn 1513-99	_2dSpn 1783-1821	_Civil War 1861-65	_WW I 1917-1920	_Modern 1950-	_American 1900-
_1st Spn 1600-99	______	_Reconstr 1866-79	_Boom 1921-1929	______	_Afro-American

OTHER__________

RECORDER'S EVALUATION OF SITE

Eligible for National Register?	_yes	_no	_likely, need information	_insufficient information
Significant as part of district?	_yes	_no	_likely, need information	_insufficient information
Significant at the local level?	_yes	_no	_likely, need information	_insufficient information

SIGNIFICANCE STATEMENT FOR COMPUTER FILES (Limit to 3 lines here; attach full justification)

____
____
____

DHR USE ONLY -- *DHR USE ONLY*

DATE LISTED ON NAT REG. ___/___/___

KEEPER DETERMINATION OF ELIGIBILITY: Yes _ No _ Date__________
SHPO EVALUATION OF ELIGIBILITY: Yes _ No _ Date__________
LOCAL DETERMINATION OF ELIGIBILITY: Yes _ No _ Date__________
Local Office__________

CFBC ARCHAEOLOGICAL SITES

Site Number: 8CI00058 Location: I
Site Name: BURTINE ISLAND A
Date Investigated: 7/21/65

Sitetype1: MDSH	Sitetype2:	Sitetype3:	Sitetype4:
Culture1: DEPT	Culture2:	Culture3:	Culture4:
Culture5:	Culture6:	Culture7:	Culture8: P

Ownership: STAT Public Tract:
Quadrangle: RED LEVEL
Quarter Sections: SE/SE/SW
Section: 13 Township: 17S Range: 15E
UTM Zone: 17 Easting: 330020 Northing: 3208190

Topography: COASTAL AND ISLAND
Physiographic Setting: 18 SALT MARSH
Soil Series: ROCK OUTCROP-HOMOSASSA/LACOOCHEE COMPLEX
Drainage Category: W
Site Site: 5000
Landuse: CANAL LAND
Site Integrity: LOW-MODERATE

Cultural Materials:
60 Pasco Plain, 72 sand temper Plain, and presence of St. Johns Plain and Check Stamped, Ruskin Dentate Stamped, Deptford Simple Stamp; Melongena and Busycon hammers, chert knife and lithic

Site Features:
Small shell midden of predominately Oyster with small portions of Crown Conch and Left-Handed Whelk.

Discussion:
Site surveyed and tested by Bullen (1966) who reported site partially covered by canal construction spoil. Buried context may be present beneath the spoil.

Significance: Pot. significant NRHP Listing Date:

Management:
Resurvey to locate and evaluate site condition.

NGR (e.g NS32SW) — NMRS nº — (Sub-numbers) — e.g Roman road, Wade road, linear ditc

Royal Commission On The Ancient and Historical Monuments Of Scotland

```
*-------------------------------------------------------------------------
: Mapno     ______ Site ________ __ __ ( 1 of __ ) Linear ________
: Name      ___________________________________________________________
: Period    _______________
: Class>>   ___________________________________________________________
*-------------------------------------------------------------------------
Gridref     ____ ____  NGRDesc>> (for more than one grid ref. when features are extensive)
Altname     alternative name.
Parish      ______________________________
County      __  ________________________
Region      __  ________________________
District    __  ________________________          Threatened building section
                              e.g building, industrial, destroyed
Smrref  Number allotted by other sites records. ______  Form ______ ( ______________ ) TB No _____ (1 of __
SAM No      ______ (1 of __ )     HB No  ____ ______ _   (1 of __ )
Othstat     other notes of interest.                     RCAHMS _  Date ____
Entrydate   06-MAY-92   Lastupdate  06-MAY-92   NumLink ________
                              Historic buildings       Number linking photographs to sites
*-------------------------------------------------------------------------
            Report Text Indicator _        Report last updated  ____ ______
*-------------------------------------------------------------------------

                              Page 1                   Count  99
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Scheduled ancient monument information

Page 1 of RCAHMS database.

General site locational, classificational information.

When details of a discovery are sent in, a record is created using the database, and it is plotted on the relevant map. Only outstanding sites, or those seen in the course of a systematic survey are checked by RCAHMS surveyors.

Many new sites are published by the Council for Scottish Archaeology in Discovery and Excavation, Scotland on a yearly basis and all are entered into the records.

Royal Commission On The Ancient And Historical Monuments Of Scotland

| Mapno ______ Site ___ ___ __ Linear _______
| Name ____
| Period ______________ Class ____________________________

FULL ARCHIVE

Number ___ ______ ______ (__________________) __
Description:-

Author ______________
Startdate ____ Stopdate ____ Ref ________________
Scale ______________ Med ______________________ Size ____________
Collection ____
Copyright RCAHMS____________

(Numlink _______)

: To view Archive List press PF14 :

Page 2 Count:-*0

Page 2.

Archive details – photograph negative numbers and details
– manuscript and typescript details

Royal Commission On The Ancient And Historical Monuments Of Scotland

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*-------------------------------------------------------------------------------*
:  mapro ______ Site ____ ___ __  Linear ________                               :
:    Name _____________________________________________________________________
: Period _______________  Class __________________________________________
*-------------------------------------------------------------------------------*
                              AUTHORITIES
Author>> ______________________________________ Initials>> _______ Bibno ______
 References _________________________________________________________________
  Illustrations _______________________________________ Refdate _________ ____
Author>> ______________________________________ Initials>> _______ Bibno ______
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 References _________________________________________________________________
  Illustrations _______________________________________ Refdate _________ ____
*-------------------------------------------------------------------------------*
:                 To view full bibliography press PF14                          :
*-------------------------------------------------------------------------------*
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                              Page 3                    Count: *0
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Page 3.

References to information related in "text page".
(Page numbers, figures etc)

Royal Commission on the Ancient and Historical Monuments of Scotland

Mapno ______	Site ____ ___ __	Linear ________
Name		
Period ____________	Class	

ARCHAEOLOGICAL HISTORY

Field survey

	Startdate	Stopdate		Surveyor	Sponsor
\/	____	____	____	____	____
\/	____	____	____	____	____
\/	____	____	____	____	____

Excavation

	Startdate	Stopdate		Director	Sponsor
\/	____	____	____	____	____
\/	____	____	____	____	____
\/	____	____	____	____	____

Site Elements\/ ____________

\/ ____________

C14 Dates>> ____________ Other Dates>> ____________

Museum \/ ____________ Acc Nos ______ Finds>> ____________

Page 4.

Survey history

Excavation history

ARCHAEOLOGICAL SITE FORM

Site #8________

Division of Historical Resources, Florida Department of State

METHODS FOR SITE DETECTION

_no field check _exposed ground _screened shovel
_literature search _posthole digger ____________
_informant report _auger--size:____ ____________
_remote sensing _unscreend shovel ____________

METHODS FOR SITE BOUNDARIES

_bounds unknown _remote sensing _unscreened shovel
_none by recorder _insp exposed ground _screened shovel
_literature search _posthole digger _block excavns
_informant report _auger--size:____ _guess

Other/Remarks (#, size, depth, pattern of units; screen size) ____________

COLLECTION STRATEGY

_unknown _unselective (all artifacts)
_selective (some artifacts)
_uncollected _general (not by subarea)
_controlled (by subarea)

ARTIFACT CATEGORIES

_unknown _daub _nonlocal-exotic _bone-unspec
_lithics _brick/bldg matl _metal _unworked shell
_ceramic-aborig _glass _bone-human _worked shell
_ceramic-nonabo _prec metal/coin _bone-animal _subsurf feats

Other (Strategy, Categories)____________

SITE EXTENT Size (m^2) _______ Depth/Stratigraphy of Cultural Deposit ____________

Perpendicular Dimensions ____m ____________ direction by ____m ____________ direction

SPACE COLLECTED Surface: #units___, total area ____m^2. Excavation: #units___, total vol ____m^3

TOTAL ARTIFACTS Count or Estimate? Surface #_______ Subsurface #_______.

DIAGNOSTICS (TYPE OR MODE & FREQUENCY)

1____________ N=___
2____________ N=___
3____________ N=___
4____________ N=___
5____________ N=___
6____________ N=___
7____________ N=___

Remarks____________

TEMPORAL INTERPRETATION Components: _single _prob single _prob multiple _multiple _uncertain

Describe each occupation spatially. For each, estimate begin, end dates BP; basis; if absolute dates, give method, lab, id, date, range, etc.

____

ENVIRONMENT Nearest Fresh Water ____________ Distance (m) ____________

Natural Community____________
Local Vegetation____________
Topographic Setting____________
Present Land Use____________
SCS Soil Series ____________ Soil Association____________

SITE INTEGRITY Overall Disturbance: _none seen _minor _substantial _major _redeposited

Nature of Disturbances/Threats____________

INFORMANT(S) Contact Information____________
REPOSITORY Field Notes, Artifacts____________
Photographs (negative nos)____________
MANUSCRIPTS OR PUBLICATIONS ON THE SITE____________

RECORDER(S): Name____________ Date of Form________
Affiliation/Address/Phone____________

RECOMMENDATIONS FOR SITE____________

NARRATIVE DESCRIPTION: Attach information on site discovery, history, current integrity, apparent threats, environment, and your temporal and functional interpretations.

DISCUSSION OF SIGNIFICANCE: Attach justification for recorder's evaluation (Page 1).

REQUIRED: USGS MAP OR COPY WITH SITE LOCATION MARKED

STATE OF FLORIDA
DEPARTMENT OF STATE
Division of Archives, History
and Records Management

☐ Original ☐ Update

Florida Master Site File / UNDERWATER ARCHAEOLOGICAL SITE FORM

SITE NUMBER__________ SITE NAME__________
USGS 7.5 MINUTE QUAD__________
NOTE: Please attach an 8.5" X 11" copy of the appropriate portion of the above map, with site location indicated.

TOWNSHIP/RANGE/SECTION:

Township	Range	Section

NOTE: The figure to the left represents a regular section (1 square mile); please indicate the location of your site by placing an X in the appropriate portion of the section.
If the section is irregular or part of a land grant, please check below and disregard above instructions.

☐ *Irregular section*
☐ *Land grant* __________ *(name)*

UTM COORDINATES: Zone / Easting / Northing
____ / ____ / ____

NOTE: If you are unfamiliar with calculating UTM measurements, leave blank.

LATITUDE: ____ ____ ____ LONGITUDE: ____ ____ ____

SITE SITUATION: (check one)
[] inland [] estuary [] offshore

UNDERWATER ENVIRONMENT: (check one)
[] high energy marine [] low energy marine
[] lake or ponds [] river, stream or creek
[] cavernous sink [] cavernous spring
[] intermittently flooded lands with a flowing water environment
[] intermittently flooded lands with a still water environment

SEDIMENT:
[] clay [] silt [] sand [] peat [] marine growth [] rock

LOCAL INFORMANT(inc. private collections)__________
ADDRESS__________
LOCAL INFORMANT(inc. private collections)__________
ADDRESS__________
SURVEY DATE__________ OTHER MASTER SITE FILE NUMBERS__________
RECORDER(S)(list principal investigator first)__________
____
ADDRESS__________
PROJECT NAME__________
TOPOGRAPHICAL SETTING__________

TYPE OF SITE(check one or more as appropriate):

[] indeterminate
[] unknown
[] single artifact
[] artifact scatter
[] lithic scatter
[] midden(s)
[] shell midden(s)
[] shell works
[] historic shipwreck
[] stone wall
[] __________

[] mound(s)
[] burial mound(s)
[] platform/temple mound(s)
[] canal
[] mission
[] prehistoric earthworks
[] wharves, docks, piers
[] shrine
[] __________

[] prehistoric cemetery
[] prehistoric vessel
[] prehistoric refuse
[] historic earthworks
[] shell ring
[] redeposited
[] inundated terrestrial
[] historic refuse
[] well
[] bridges (also covered bridges)
[] __________

THREATS TO SITE:

[] zoning [] transportation [] vandalism
[] development [] fill [] phosphate mining
[] deterioration [] dredge [] agriculture/plowing
[] borrowing [] logging [] ________

REMARKS:

[] preservation recommended [] recommended for further testing
[] severely disturbed/destroyed [] ________

REPOSITORY ________

BIBLIOGRAPHIC DATA ________

____

NOTE: Cite any reports referring <u>specifically</u> to this site. General background material need not be cited. Use <u>Florida Anthropologist</u> format.

CULTURAL CLASSIFICATION ________

CULTURAL PERIOD ________

CULTURAL MATERIAL(Check as many as apply):

[] aboriginal ceramics
[] nonaboriginal ceramics
[] lithics
[] worked bone
[] human bone/burial(s)
[] animal bone/ unidentified bone
[] shell food remains
[] worked shell
[] plant remains
[] wood
[] metal
[] precious metal/ coin(s)
[] glass
[] brick/bldg materials
[] other human remains (e.g., hair)
[] exotic items (mica, etc)
[] petroglyphs
[] textile(s)
[] misc/prehistoric
[] misc/historic
[] trade bead(s)
[] ballast
[] fossil
[] ________
[] ________

DIAGNOSTIC ARTIFACTS ________

____

SITE SIZE(approx acreage) ________
SITE SIZE(est in sq meters) ________
DEPTH OF CULTURAL DEPOSIT (if known) ________

ELEVATION

	<u>Meters</u>	<u>Feet</u>
Max	____	____
Min	____	____

DEGREE OF SITE DESTRUCTION

[] relatively undisturbed [] minor
[] moderate [] major

SITE DISTURBANCES

[] bioturbation
[] erosion
[] mining/borrow pit
[] agricultural
[] residential/ commercial
[] dredging/ditching
[] site looting
[] forest preparation or harvesting
[] fill
[] previous archaeological excavations
[] ________
[] ________
[] ________

COLLECTION STRATEGY

[] general [] selective [] controlled [] unknown [] ________

TYPE OF INVESTIGATION

[] surface collection
[] shovel test
[] extensive excavation
[] test excavation
[] water probe
[] auger test
[] coring
[] remote sensing
[] none
[] ________
[] unknown
[] prop wash deflectors
[] airlift
[] waterlift
[] ________

OPTIONAL NARRATIVE DESCRIPTION(If there is no published report, provide a short description of the site on a separate sheet)

OPTIONAL PHOTOGRAPHS OR SKETCHES OF DIAGNOSTIC OR UNIQUE ARTIFACTS (Please attach separate sheet(s))

FORM PREPARED BY ________

ADDRESS ________

DATE ________

Page 1
__ original
__ update

HISTORICAL STRUCTURE FORM
FLORIDA MASTER SITE FILE
Version 1.1: 3/89

Site 8__________
Recorder #______

SITE NAME ______________________
HISTORIC CONTEXTS ______________________
NAT. REGISTER CATEGORY ______________________
OTHER NAMES OR MSF NOS ______________________
COUNTY __________ OWNERSHIP TYPE __________
PROJECT NAME ______________________ DHR NO ______
LOCATION (Attach copy of USGS map, sketch-map of immediate area)
ADDRESS ______________________ CITY __________
VICINITY OF / ROUTE TO ______________________

SUBDIVISION __________ BLOCK NO ____ LOT NO ___
PLAT OR OTHER MAP ______________________
TOWNSHIP ____ RANGE ____ SECTION ___ 1/4 ___ 1/4-1/4 ____
IRREGULAR SEC? _ y _ n LAND GRANT __________
USGS 7.5' MAP ______________________
UTM: ZONE ____ EASTING __________ NORTHING __________
COORDINATES: LATITUDE ____D ___M ___S LONGITUDE _____D ___M ___S

HISTORY
ARCHITECT: F __________ M __________ L __________
BUILDER: F __________ M __________ L __________
CONST DATE ______ CIRCA__ RESTORATION DATE(S): __________
MODIFICATION DATE(S): ______________________
MOVE: DATE ______ ORIG LOCATION __________
ORIGINAL USE(S) ______________________
PRESENT USES(S) ______________________

DESCRIPTION
STYLE ______________________
PLAN: EXTERIOR ______________________
INTERIOR ______________________
NO.: STORIES ___ OUTBLDGS ___ PORCHES ___ DORMERS ___
STRUCTURAL SYSTEM(S) ______________________
EXTERIOR FABRIC(S) ______________________
FOUNDATION: TYPE __________ MATLS __________
INFILL ______________________
PORCHES ______________________
ROOF: TYPE __________ SURFACING __________
SECONDARY STRUCS. ______________________
CHIMNEY: NO__ MTLS __________ LOCNS __________
WINDOWS ______________________

EXTERIOR ORNAMENT ______________________
CONDITION __________ SURROUNDINGS __________
NARRATIVE (general, interior, landscape, context; 3 lines only)
____
____
____

ARCHAEOLOGICAL REMAINS AT THE SITE
FMSF ARCHAEOLOGICAL FORM COMPLETED? _ y _ n (IF Y, ATTACH)
ARTIFACTS OR OTHER REMAINS ______________________
____

RECORDER'S EVALUATION OF SITE

AREAS OF SIGNIFICANCE ______________________________

ELIGIBLE FOR NAT. REGISTER? _y _n _likely, need info _insf inf
SIGNIF. AS PART OF DISTRICT? _y _n _likely, need info _insf inf
SIGNIFICANT AT LOCAL LEVEL? _y _n _likely, need info _insf inf

SUMMARY ON SIGNIFICANCE (Limit to three lines provided; see page 3)

____

* * *DHR USE ONLY* DHR USE ONLY * *

DATE LISTED ON NR ______
KEEPER DETERMINATION OF ELIG.(DATE): -YES ______ -NO ______
SHPO EVALUATION OF ELIGIBILITY(DATE): -YES ______ -NO ______
LOCAL DETERMINATION OF ELIG.(DATE): -YES ______ -NO ______
OFFICE ______________________________

* * *DHR USE ONLY* DHR USE ONLY * *

RECORDER INFORMATION: NAME F______________ M_______ L______________
DATE: MO__ YR____ AFFILIATION ______________________________

PHOTOGRAPHS (Attach a labeled print bigger than contact size)
LOCATION OF NEGATIVES ______________________________
NEGATIVE NUMBERS ______________________________

P H O T O G R A P H	M A P Street/plat map, not USGS
Attach a B/W photographic print here with plastic clip. Label the print itself with at least: the FMSF site number (survey number or site name if not available), direction and date of photograph. Prints larger than contact size are preferable.	

REQUIRED: USGS MAP OR COPY WITH SITE LOCATION MARKED

ARCHAEOLOGICAL SHORT FORM
FLORIDA SITE FILE

___ original
___ update

Version 0.1: 09/91

Site #8__________
Date of Form__________

SITE NAME(S) ______________________________

OWNERSHIP
_private-individual
_county
_private-profit
_private-unspecified
_state
_private-nonprofit
_city
_federal

CITY ______________ COUNTY ______________
TOWNSHIP _______ N/S RANGE _______ E/W SECTION _______
USGS MAP NAME ______________________________
ADDRESS/VICINITY OF/ROUTE TO ______________________________

____

____

ENVIRONMENT Nearest Fresh Water ______________ Distance (m/ft) _____
Local Vegetation ______________________________
Current Land Use ______________________________

ARTIFACT CATEGORIES If available, attach photos or sketches of key artifacts.

___Stone tools
___Ceramics-Nat. American
___Ceramics-Other
___Brick/Building Material
___Glass
___Precious Metal/Coin
___Metal
___Bone-Human
___Bone-Animal
___Bone-Unspecified
___Shell
___Other

RECORDER Name ______________________________
Affiliation/Address/Phone ______________________________

____

____

FAS Chapter ______________________________

LOCATION Field Notes, Artifacts, Photographs ______________________________

____

CONTACT PERSON (Would landowner be agreeable to further contact? ___Y ___N)
Name ______________________________
Address/Phone ______________________________

____

NARRATIVE DESCRIPTION: Attach information on site discovery, list of artifacts collected, history, current integrity, apparent threats, environment, and other pertinent observations.

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REQUIRED: USGS MAP OR COPY WITH SITE MARKED

Appendix 2

EARN DBF

NMRR	REF	DESC	INFO	BIBLIOGRAPHY	SOIL	IND	ERO	SOILT	AP
005	27461700	COIN ROMAN HOUSE OF CAREY	PICKED UP ON THE BANKS OF THE RIVER TAY NEAR THE HOUSE OF CAREY IN 1867. SEE NO 1 NE 27	PSAS 52 1918 246	CG	T			
027	27491835	FONT STONE WESTER RHYND	WESTER RHYND	BALLINGAL J. 1905 THE RHYND AND LECROPT A PARISH HISTORY EDIN P.73-74	AL	F			
023	18061851	CHURCH RHYND	RHYND NOT USED SINCE 1842 ORIGINALLY A CELL OF THE PRIORY OF MAY 1ST MENTIONED IN REIGN OF KING DAVID (1124-53) EXISTING BLDG ERECTED IN 17TH CENTURY BUT ONE OR TWO RE-USED STONES SUGGEST AN OLDER STRUCTURE WAS ON THE SAME SITE	BALLINGAL J. 1905 THE RHYND AND LECROPT A PARISH HISTORY EDIN P.26-43	SG	F			
027	17401650	ROMAN TEMPORARY CAMP	COVERS 116 ACRES RHOMBOIDAL NO EARTHWORKS REMAIN DISCOVERED BY AP (RCAMSAP 83 MOST RECENT) N & S SIDES HAVE 2 GATES E & W HAVE SOLITARY CENTRAL GATE, S SIDE DITCH YIELDED FROM NEAR THE BOTTOM OF THE SILT THE SMALL GAULISH SAMIAN 2ND CENTURY	HANSON W.S. 1980 BAR INTERNAT 73 P 129. HANSON 1978 PSAS 109 (1977-78) P143-44. MAXWELL G.S. 1980 SCOTTISH ARCHAEOLOGICAL FORUM 12 (1980) 25-54 P28 29-37 & 39-40	CF	T		TQ	
037	16811766	FARMHOUSE CULTEARGIE	SEE ARCHITECTURE		SG	F			
012	16851742	BRIDGE CARGIE	SEE ARCHITECTURE		BR	T			
044	15471829	FARMHOUSE ELLIOTFIELD	SEE ARCHITECTURE		SG	T			
013	19501807	HOUSE FERRYFIELD AT CARPOW	SEE ARCHITECTURE		SG	F			
017	17191835	FARMHOUSE WESTER RHYND	SEE NO 11 NE 81 AND SEE ARCHITECTURE		AL	F			
062	19641816	RING DITCH	RCAMSAP 77 - P175677-9		SG	F			A
066	19611809	LINEAR CROPMARKS	EXTENDS FROM ABOVE REF. TO 19501790 PT7345 6 J. DELVAR 7 08/12-13 1975.		SG	F			A
069	16282832	ENCLOSURE	RCAMSAP 82 PT3855-7 AND 12122-5		AL	F			A
076	1959[illegible]	PIER CARNIE		GRAHAM A. 1969 PSAS 101 200-85 P226	BR	T			
077	1947[illegible]	QUAY FERRYFIELD AT CARPOW		GRAHAM A. PSAS 101 200-85 P243-1	BR	T			
079	18071801	CHURCH RHYND	TRADITIONALLY SAID TO HAVE STOOD NEARER TO THE JUNCTION OF THE TAY AND EARN THAN THE PRESENT CHURCH NO 11 NE 23. SOME FREE STONES THAT SEEM TO HAVE BEEN USED IN BUILDING HAVE BEEN PLOUGHED UP IN THE [illegible] FIELD ON EASTER RHYND FARM	STAT. ACC. IV (1792) 183.	SG	F			
080	18061803	LAIRDS HOUSE EASTER RHYND	NOW DESTROYED	BALLINGAL J. 1905 THE RHYND AND LECROPT A PARISH HISTORY EDIN 1905-91	SG	F			
081	17101837	HOUSE WESTER RHYND	LAIRDS HOUSE IN 17TH CENTURY	BALLINGAL J. 1905 THE RHYND AND LECROPT A PARISH HISTORY EDIN P71-74	AL	F			
011	10281933	HENGE CAIRN STONE CIRCLE	METAL WORKING SITE MONCREIFFE HOUSE, A CIRCLE OF ELEVEN STONES THREE OF WHICH ARE NOW BURIED.	STEWART MEC 1985 PSAS 115 125-50 CASE (DIST C) 1982 PALYNOLOGICAL EVIDENCE FOR EARLY CEREAL CULTIVATION IN STRATHEARN PSAS 112 39-47	PW	T			
012	10801838	WINDMILL DUNBARNEY	TOWER ABOUT 19 FEET HIGH WITH 3-4 FOOT WALLS 6 FEET DIAMETER. MASONRY MATCHES THAT OF THE DOVECOT NO 11 NW 17 WHICH BEARS THE DATE 1697. P	PSAS 79 (1945) 6-14	SH	F			
013	11221879	VILLAGE SITE DUNBARNEY	1586-1683 (SEE NO 11 NW 16) WHEN THE CHURCH STOOD ON THE PROP. A CONSIDERABLE VILLAGE HOUSING 50 FAMILIES STOOD CLOSE TO THE MANSION OF GEO CRAIGIE OF DUNBARNEY. NO POSITIVE TRACES OF VILLAGE REMAIN ALTHOUGH SEVERAL PIECES OF LIME MORTARED BLDG APPEAR		SH	T			
014	13261818	OLD BRIDGE OF EARN	EXISTING TRACES OF OLD BRIDGE CONSISTS OF 3 ARCHES. THERE WERE FORMERLY 5 OUT A 6TH WAS BUILT 1760 AS A NORTHWARD EXTENSION. THE GRANT OF STONE FOR THE CONSTRUCTION OF A BRIDGE IS MENTIONED IN A RECORD DATED 1329. THE BRIDGE IS MENTIONED IN 1614(1)	(1) NEW STAT. ACC. 1844 831 822	BR	T	T		
016	14331898	CHURCH CEMETARY DUNBARNEY	SITUATED ON AN ELEVATED SPOT ABOUT 1/3 OF A MILE FROM THE EARN THERE IS A BURYING GROUND ENCLOSED BY A 10 FOOT STONE WALL AND ON IT STOOD THE ANCIENT KIRK OF DUNBARNEY. THERE IS NO TRACE OR RECOLLECTION OF THE PARISH CHURCH WITHIN THE GRAVEYARD STILL USED	NEW STAT. ACC. 1844 1922-23 ORDINANCE NEW BOOK 23 (1859) P17	CI	[illegible]			
017	11011862	DOVECOT DUNBARNEY	DATED 1697 AND INITIALED [illegible] FOR JOHN CRAIGIE OF DUNBARNEY WHO WITNESSED DOCUMENTS IN 1661 1667 AND 1672	PSAS 79 (1944-5) P7 HIST. FAMILY OF MONCRIEFFE 1929	CX	T			
020	RIV EARN	CARVED STONE BALL	FOUND AT DEPTH OF 9 FEET AT BRIDGE OF EARN HOUSED AT ROYAL MUSEUM OF SCOTLAND (AS 109)	PSAS 45 (1910-11) 315; MARSHALL D.N. 1977. CARVED STONE BALLS PSAS 108 (1976-77) 40-72.	SC	T			
024	RIV EARN	GOTLAND HORSE HEAD BROOCH	FOUND AT BRIDGE OF EARN HOUSED AT PERTH MUSEUM ACC NO 2253	VIKING ANTIQUITIES IN GRT. BRITAIN AND IRELAND PT IV 1954 P218-9	AL	[illegible]			
022	RIV EARN	STONE AXE	FOUND NEAR BRIDGE OF EARN 4 2/3 LONG PERTH MUSEUM ACC NO 2249	TRANS PERTH SOC OF NAT SCI 8 (1930) P146	AL	[illegible]			
023	12551095	FORT CARNAC OR MORRIDUM	THOUGHT TO BE SITE OF BATTLE IN 728 BETWEEN PICTS ANGUS AND ALPIN ON MONCRIEFFE HILL	FEACHEM R.W. PREHIST. SCOTLAND 1963 P145 CHRISTISON D. PSAS 34 1899 P80 WAINWRIGHT F.T. PROBLEMS OF THE PICTS 1955 P 23 79-80	SH	[illegible]			
005	09951544	FORT CASTLE LAW	PICTISH?		SH	[illegible]		BS	
006	05031597	CROSS	EARLY CHRISTIAN SUPPOSED SITE OF THE BATTLE OF DUPPLIN BETWEEN MAR THE SCOTTISH REGENT AND BALLIOL OF ENGLAND IN 1332. 8% HIGH WITH SCULPTURES ON ALL SIDES	ALLEN J.R. AND J. ANDERSON 1903 THE EARLY CHRISTIAN MONUMENTS OF SCOTLAND EDIN. III P319-21	AL	[illegible]			
022	05651947	CASTLE DUPPLIN	EARLIEST RECORDED OWNER SIR WILLIAM OLIPHANT LIVED AT THE CLOSE OF THE 13TH C. IN 1461 CASTLE ATTACKED DESTROYED & REBUILT. IN 1688 IT WAS AGAIN REBUILT. A TOWER AND OTHER PARTS OF THE EARLIER BLDG BEING PRESERVED. DESTROYED BY FIRE IN 1827 & REBUILT	MILLAR A.H. 1890 HISTORIC CASTLES AND MANSIONS OF SCOTLAND P126-132	BF				
023	06421943	CHURCH CEMETARY DUPPLIN	FEW REMAINS? FIRST REFERENCE TO CHURCH WAS IN 1296. PARISH UNITED WITH ABERDALGIE IN 1618	NEW STAT. ACC 16 1845 855 880	CX	F		GA	
052	05851907	CASTLE DUPPLIN	SOUTH LODGE GATE PIERS SEE ARCHITECTURE		CX	F		M	
053	05501957	WALLED GARDEN DUPPLIN	SEE ARCHITECTURE		DI	F			
037	06901731	ENCLOSURE PIT-GROUP	RCAMSAP 83 PT 15071-3		CX	F			A
013	06721769	STEADING KILDINNY	SEE ARCHITECTURE		SH	F			
014	07051556	BRIDGE WATER OF MAY	SEE ARCHITECTURE		BR	T			
025	07531838	ENCLOSURE CROPMARK	NEWTON OF CONDIE CUCAP ACN 81 PT 19974 P0		CX	F			A
019	07621809	COTTAGE NEWTON OF CONDIE	SEE ARCHITECTURE		GA	F			
056	07331803	RING DITCH CROPMARK	NEWTON OF CONDIE RCAMSAP 79 P16290-1		CX	F			A
052	07571818	TOWER HOUSE NEWTON OF CONDIE	DATES TO THE THIRD QUARTER OF THE 16TH C. SEVERAL ALTERATIONS SINCE THAT TIME		KV	T			
061	0744[illegible]775	RING DITCH NEWTON OF CONDIE	RCAMSAP 84 164225-6 CS		PI	F			A
017	17141695	CAIRN	45 FT. DIAMETER AND 5.5 FEET HIGH OCCUPIES THE POSITION OF THE TRIANGULATION POINT IN JACKSCAIRN WOOD	ARCH SCOT 4 1857 [illegible] P277 (SKENE)	SH	T			
020	[illegible]	HILL-FORT	LITTLE REMAINS	PSAS 24 1900 126	BI	F			
012	05081744	CHURCH FORTEVIOT	REPUTED TO HAVE BEEN FOUNDED C. 1700 A STONE ARCH CARVED WITH CROSS AND THE AGNUS DEI WAS FOUND BEFORE 1831 IN THE BED OF THE RIVER MAY IMMEDIATELY BELOW THE PREV. SITE (SEE NO 01 NW 16)	(1) PSAS 26 1892 134-9 (2) STUART J. SCULPTURED STONES OF SCOTLAND 2 1856 58-60	GL	T			
013	0630[illegible]758	SHORT CISTS	FOUND 1912 CONTAINED A SKULL, FLEXED, TEETH AND A NUMBER OF PEBBLES SOME ROUNDED SOME ANGULAR WENT TO PERTH MUSEUM	PSAS 52 1918 [illegible]	GI	T			
015	0520[illegible]758	WHORL SANDSTONE	1 3/4 DIAM. AND FLATTER THAN USUAL FOUND IN THE SCHOOL HOUSE GARDENS PERTH MUSEUM ACC NO 2125	TRANS PERTH SOC OF NAT SCI 7 1923 P147	GI	F			
021	05601750	ENCAMPMENT MILLERS ACRE	BALIOL'S ARMY ENCAMPED HERE IN 1332. THAT HE LAY ON THE SOUTH SIDE OF THE EARN IS GENERALLY ACCEPTED BY MOD HIS. NAME IS MENTIONED IN THE CHRONICLE OF ANDREW OF WYNTOUN AS THE MYLNARS AKYRE	LANG A. 1929 HISTORY OF SCOTLAND 1 244; THE HISTORIANS OF SCOTLAND VOL 3 1872 P356 - SITE OF WYNTOUN CRONYKIL OF SCOTLANDE	AL	T		SG	
028	05801690	SUBCIRCULAR ENCLOS. FORTEVIOT	A GROUP OF ARCHITECTURES NOT NECESSARILY CLOSELY RELATED HAS BEEN REVEALED BY AP SOUTH OF FORTEVIOT. THE SITE OCCUPIES GROUND WHICH GENTLE SLOPE NORTHWARD BOUNDED ON THE WEST BY A PROMINENT SCARP FALLING TO THE WATER OF MAY. SEE SMR DOC FOR FURTHER INFO	ST. JOSEPH J.K. 1976. AIR RECONNAISSANCE RECENT RESULTS 40, ANTIQUITY 50 55-7, ANTIQUITY 52 47-50,	GE	T	T		A
029	05491740	ENCLOSURE BARROW CROPMARK	CEMETARY LISTED UNDER PRE-HISTORIC RITUAL AND FUNERARY RCAMSAP 81 A29222-5 PART OF OR NEAR TO FORTEVIOT RITUAL COMPLEX		GE	F			A
030			PART OF FORTEVIOT RITUAL COMPLEX SEE ST. JOSEPHS ARTICLE LISTED IN NO 01 NE 028		GE	F			A
036	05281734	ENCLOSURE	RCAMSAP 86 A29754 A29756-9 PART OR NEAR FORTEVIOT RITUAL COMPLEX		GE	F			A
058	05061664	PIT ALIGNMENT	RCAMSAP 86 A29750-5 A29757-9		GE	F			A
063	05061662	CROPMARKS	HENHILL GEOLOGICAL RCAMSAP 84 A29283-5		CX	F			A
004	03901750	TEMPORARY ROMAN CAMP FORTEVIOT	DISCOVERED FROM AP IN 1951 NO TRACE OF THIS CAMP IS SEEN ON THE GROUND. WESTERN MARGIN IS BISECTED BY THE R. EARN. RCAMSAP 85 A41108-285, RCAMSAP 84 A29209-12 A29214-15 A64239-1105	PSAS 84 1949-50 217. ST. JOSEPH J.K. JOURNAL OF ROMAN STUDIES VOLS 45(1955) P105-6 W PLAN; 55 (1965) P81, & 59 P116. MAXWELL G.S. 1980 AGRICOLAS CAMPAIGNS: THE EVIDENCE OF THE TEMPORARY CAMPS SCOTTISH ARCH. FORUM 12 P25-54 W SPEC REFS	CX	T	F	AI	A
032	03061800	CARVED STONE BALL	IN IN ROYAL MUSEUM OF SCOTLAND (AS 179) CAST AS 167	PSAS 44 (1909-10) 157. MARSHALL D.N. 1977 CARVED STONE BALLS PSAS 108 40-72.	RI	F			
007	02401508	TEMPORARY ROMAN CAMP DUNNING	MAY BE SITE OF BATTLE OF MONS GRAUPIUS DESCRIBED BY TACITUS. ONLY REMAINS ARE THOSE OF KINCLADIE WOOD OTHER THAN AP LOCATED ON THE EAST SIDE OF DUNNING BURN 200 YDS. NO EROSION	HANSON W.S. 1978. ROMAN CAMPAIGNS NORTH OF THE FORTH-CLYDE ISTHMUS: THE EVIDENCE OF THE TEMPORARY CAMPS PSAS 109 (1977-78) 140-50 W SPECIFIC REF TO THIS SITE ON 143-44.	PL	T			
008	10401780	CARVED STONE BALL	FOUND NEAR BRIDGE OF DALREOCH BY T. ROSS AND DONATED TO THE NAT MUSEUM OF ANTIQUITIES	PSAS 64 (1930) 9. DONATIONS TO MUSEUMS	RI	T			
001	10951562	CISTS	SITE LIES ON EDGE OF A NATURAL SCARP ABOVE AN OLD MILL LADE. CISTS MAY HAVE BEEN FOUND DUE TO EROSION OF BANK. SOME LARGE STONES LIE ALONG THE BOTTOM OF AN OLD FENCE C. 10 M NORTH OF FIND SPOT ONLY ONE OF THEM COULD BE A CIST STONE.	ORDINANCE NEW BOOK PERTH 25 1859 33.	AI	T	T		
010	01271346	CISTS IN ARIHERRY	URNS AND STONE COFFINS WERE FOUND IN 1844. WHEN EXCAVATED THE URNS WHICH WERE BROKEN CONTAINED HUMAN ASHES. SITE LIES IN A RELATIVELY FLAT FIELD THERE ARE NO INDICATIONS OF A MOUND	ORDINANCE NEW BOOK PERTH 25 (DUNNING) 1859 P03	CX	F		AI	
015	09151781	DALREOCH BRIDGE	SCHEDULED AND BUILT IN 1766	LAMS (SCOT) 1962 36 (NP 33)	BR	T			
016	04901750	PALACE FORTEVIOT	SUPPOSED SITE OF RESIDENCE OF SEVERAL PICTISH AND SCOTTISH KINGS REF (1) MENTIONS PALACE IN 858. (2) QUOTES CHARTER FROM 1165-1211 REFERRING TO RESIDENCE TRAD. SITE RECORDED AS HALY HILL AT THE WEST END OF FORTEVIOT WHERE A HEAP OF RUBBISH REMAINED C 1772	(1) ANDERSON A.O. 1922 EARLY SOURCES OF SCOTTISH HISTORY 2 270 288 291. (2) CHADWICK H.M. 1949 EARLY SCOTLAND P 3-4 129. (3) STUART J. 1867 SCULPTURED STONES OF SCOT. 2 58-59	AI	T	T	CX	
017	03601920	ENCLOSURE UPPER CAIRNIE	TYPE TWO RECTILINEAR POSSIBLY ROMAN OR MEDIEVAL RCAMSAP 83 PT 15074-7 PT 15088	ST. JOSEPH J.K. 1965 AIR RECONNAISSANCE IN BRITAIN 1961-64 JOURNAL OF ROMAN STUDIES LV (1965) 74-89. SPECIFIC SITE REF #82	PL	T			A
018	01113901	RING DITCH THE FOUR ACRE	RCAMSAP 83 PT 15078-80		PI	F			A
019	02641598	ENCLOSURE INVERDUNNING HOUSE	RCAMSAP 83 PT 15081-2		GE	F			A
020	02401440	ENCLOSURE INVERDUNNING HOUSE	PT15081-2		GE	F			A
021	02101645	ENCLOSURE LEADKETTY	TYPE ONE RCAMSAP 84 A64075-8 [illegible] A29165 A29166 129167 A29168		CX	F		PI	A
022	02171621	ENCLOSURE LEADKETTY	TYPE TWO RCAMSAP 84 A64075-8		CX	F			A
035	01811700	HOUSE HENSHILL	FARMHOUSE STEADING SEE ARCHITECTURE		CX	F			
031	03451628	RING DITCH DRUM OF GARVOCK	RCAMSAP 73 P15705-7 [illegible] A29848 THROUGH A29855 VERY NEAR GARVOCK BURN		AI	F			A

NUMBER	REF	DESC	NOTE	BIBLIOGRAPHY	SOIL	IND	PERIO	SOILT	AP
013	02131334	RING DITCH 2 LEADKETTY	RCAMSAP 86 A29152 A29154 THROUGH A29465		CX	F		M	A
016	01921347	RING DITCH LEADKETTY	BARROWS POSSIBLE RCAMSAP 86 A29447 THROUGH A29456		CX	F		BL	A
017	02591641	RING DITCH INVERDUNNING HOUSE	RCAMSAP 82 PT 1041659		CE				A
018	01101736	RING DITCHES ENCLOS CROPMARKS	MASTERFIELD RCAMSAP 79 PT 6272-4		CX	F		Y	A
039	02101480	PITS LEADKETTY	J DEWAR 776681 DS-68 JULY 1975 P 6789-90		CX	F			A
040	02001350	PIT ALIGNMENT LEADKETTY	EXTENDS TO 020 150 POSSIBLE PIT ENCLOSURE RCAMSAP 86 A29147 THROUGH A29463		CX	F		M	A
042	01361526	ENCLOSURE 3 LEADKETTY	RCAMSAP 86 A29145 THROUGH A29436 AND A29597 THROUGH A29605		CX	F		M	A
044	01301560	LINEAR CROPMARKS AUCHTERHEAD	EXTENDS TO 030 1530 CUCAP SKE 17 C26 JULY 1970 PT 1098 TO		GE	F			A
045	01801564	ENCLOSURE 4 (POSS)	LEADKETTY CUCAP HBD 47 11 JULY 1978 PT 1681-90		CX	F			A
047	00801730	PITS CROPMARKS MASTERFIELD	RCAMSAP 84 A29216-18		CX	F			A
048	04201810	CULTIVATION REMAINS	POLCASTLE BRIDGE RCAMSAP 84 A29213-14		AL	F	Y		A
051	01401530	SETTLEMENT SOCKETS	UNENCLOSED DUNCRUB RCAMSAP 84 A64599 THROUGH A64605		CX	F			A
052	02901735	BRIDGE FORTEVIOT			BR	F			
053	00831781	BRIDGE DALREOCH	OLD BRIDGE		BR	F			
055	01921580	FOSTER LEADKETTY	RCAMSAP 86 A29447 THROUGH A29457		CX	F		M	
056	02121613	ENCLOSURE (POSS) LEADKETTY	RCAMSAP 86 A29464 THROUGH A29467		CX	F			A
058	01801558	ENCLOSURE PITS	NONE GIVEN		AI	F		CX	A
002	95801889	WATCH TOWER ROMAN ROUNDLAW	EXCAVATED IN 1972 12 X 14 M DITCH ENCLOSED AREA ABOUT 48' IN DIAMETER SINGLE ENTRANCE CAUSEWAY ACROSS EXISTING ROAD ON THE S 1ST CENTURY POTTERY IN EVIDENCE NO DATABLE FINDS NOTHING VISIBLE ON THE GROUND AP 87 A55125 THROUGH A55128	D & E 1972 33 ROBERTSON A S 1974 ROMAN SIGNAL STATIONS ON THE GASK RIDGE TRANS PERTH SOC OF NAT SCI SPEC ISSUE 14-29 W SEE THE REFERENCE TO THIS SITE P17 24-27	BI	F			
003	99031919	ROMAN SIGNAL STATION GASK	80' DIAMETER EXCAVATED IN 1900 SURROUNDED BY DITCH 4' DEEP EXCAVATIONS IN 1965 FOUND 4 POST HOLES IN CENTRE AND SINGLE FLAVIAN (LATE 1ST CENTURY) POTSHERD. SCHEDULED	PSAS 35 1900-01 P26-7; D & E 1965 P31; BREEZE D J 1979 ROMAN SCOTLAND A GUIDE TO THE VISIBLE REMAINS NEWCASTLE UPON TYNE ROBERTSON 1974 TRANS PERTH SOC NAT SCI SPEC ISSUE P15-16 18-21 29	BI	F			
004	96761853	ROMAN WATCHTOWER KIRKHILL	EXCAVATED IN 1900 112' DIAMETER DITCH OF 4' DEPTH AND EXTERIOR BANK TO 2' HEIGHT CENTRE HAD 4 POSTHOLES FORMING A SQUARE OF 9.5' FLAVIAN DATE STILL VISIBLE IN 1967. SCHEDULED IN 1961	PSAS 35 1900-10 P28; ARCH J 121 1964 197 SEE BREEZE P 42 AND ROBERTSON P15-16 FROM BIB LIST IN NN 91 NE 003	MR	F		AD	
005	98211897	ROMAN WATCHTOWER MUIR O'FAULD	57' DIAMETER DITCHES 11' WIDE ON WEST SIDE CAUSEWAY 18.5' WIDE AND 9' LONG FLAVIAN SCHEDULED IN 1961 VISIBLE IN 1967	PSAS 35 P27; ROBERTSON P15-16 BREEZE P42 FROM BIB LISTED IN NN 91 NE 003	MR	F			
006	99761953	ROMAN SIGNAL STAT WITCH KNOWE	HUMAN SKELETON FOUND 1837 EXCAVATED 1930 TRADITIONALLY WITCHES WERE BURNED HERE AND COAL CINDERS COULD BE SEEN	PSAS 35 P25 W PLAN; BREEZE P42; SEE NN 91 NE 003	BI	F			
007	96001500	CIST (BEAKER) BAILIELANDS	A SANDSTONE CIST CONTAINING A CONTRACTED SKELETON AND A AC BEAKER WAS FOUND C1890 ON THE FARM OF BAILIELANDS AUCHTERARDER NATIONAL MUSEUM OF ANTIQUITIES (1958) ACC 283 EG 40	PSAS 32 314; B A POTTERY 1 1912 90 P61280; PSAS 33 1898-9 ?	CX	F		BU	
008	96311812	SPRING TRINITY WELL	RENOWNED BEFORE THE REFORMATION FOR MIRACULOUS CURES ELF JOHNSTON IN 1967 STATES WELL IS NOW DRY AND ALL THAT REMAINS IS AN OVERGROWN HOLLOW A MARKET CROSS NEARBY SUGGESTS THAT THE SPRING IS NOW PIPED	NEW ORDNANCE SURVEY 10 1845 P335	BI	I			
009	97161910	ROMAN TEMPORARY CAMP			BI	F			
010	95091500	BRONZE SWORD BAILIELANDS	LBA SWORD OF NATIVE BRITISH (EWART PARK) TYPE 2 WAS FOUND IN FEB 1898 ON THE FARM OF AUCHTERARDER ABOUT 200 YDS FROM CIST (NN 91 NE 007) NATIONAL MUSEUM OF ANTIQUITIES ACC NO DL 25	PSAS 32 P215; COLES 1959-60 PSAS 93 P85	CX	F		PU	
011	97341510	CHAPEL FORMER PARISH CHURCH	15-16TH CENTURY REMAINS ST KATTAN'S CHAPEL		CX	F		M	
012	97711641	STANDING STONE ENCLOSURE	STONE STANDS ABOUT 6' AND IS SURROUNDED BY A POSS ENCLOSURE DEFINED BY FAINT CROPMARKS (20-22M) IN DIAMETER AND 1-2.5 M IN WIDTH STONE IS IN THE SOUTH SECTOR OF THE ENCLOSURE JUST INSIDE THE LINE OF THE DITCH WHICH IS APPARENTLY INTERRUPTED LENGTH	HARDING A F AND G E LEE 1987 HENGE MONUMENTS AND RELATED SITES OF GREAT BRITAIN AIR PHOTO EVIDENCE AND CATALOGUE BAR SERIES 175 OXFORD RCAMSAP 84 A64623-7	CX	F			F
013	97661599	BARROW CISTS BELLIE	A NUMBER OF STONE COFFINS WERE REMOVED FROM THIS TUMULUS IN 1839 IN THE LEVELING PROCESS. NOW MOUND IS 4 DIAMETER AP SHOW CROPMARK OF A LARGE CIRCULAR DARK MARK SURROUNDED BY SWIRL OF PARCHED PLANTS AT THE SIDE	HARDING AND LEE 1987 P405 (SEE NN 91 NE 012)	CX	F			F
014	98621743	CASTLE RUIN GASCON HALL	ALL THAT REMAINS IS A ROUGH COLUMN OF MORTARED MASONRY APPROX 2 M SQUARE AND 2.5 M HIGH THE REAL GASCON HALL IS SAID TO HAVE STOOD ABOUT A MILE AND HALF TO THE NE OF THIS RUIN PERHAPS GASK HOUSE NN 91 NE 037)		AI	F			
017	99501580	GASK HOUSE	1ST MENTION OF ANY DWELLING IS 1304 RECORDING A VISIT OF THE ENGLISH KING EDWARD I AND QUEEN. PURCHASED BY OLIPHANT IN 1625. RUIN PULLED DOWN IN 1800 PRESENT HOUSE BUILT 1801 RESTORED IN 1935-15	HUNTER 1892 ILLUSTRATED GUIDE TO PERTH P71-72 NEW ORDNANCE SURVEY 10 1845 P337	BH	F			
018	97741610	HENGE CROPMARK BEAKER	PENNANULAR ENCLOSURE C35M IN DIAMETER WIN A DITCH C1-2M IN WIDTH ENTRANCE C2M WIDE IN ESE DITCH APPEARS TO THIN IN THE SW SECTOR TOWARDS THE NE TERMINAL NO TRACE OF A BANK A NUMBER OF LINEAR AND PIT-LIKE MARKS AND 2 SIGNS OF POSS PIT CIRCLES TOO	HARDING AND LEE 1987 405 NO301 (NN 91 NE 012) BAR 175 RALSTON I 1958A DES 28; RALSTON I 1958B SHELLIE FARM PERTH AND KINROSS DISTRICT UNIV OF EDIN 34TH ANN UAI REPORT P29 NO 9.12	CX	F			
020	98051626	MILL DREM TOGLE	SEE ARCHITECTURE		AI	F			
021	97751677	RING DITCH BELLIE	CROPMARKS REVEAL A PENANNULAR RING DITCH C 8M IN DIAMETER WIN A DITCH C 2M WIDE DITCH IS BROKEN IN NW BUT THIS MAY NOT BE ORIGINAL COULD BE A MINI-HENGE RCAMSAP 84 A64623-7	HARDING AND LEE 1987 404 NO.302 (BAR 175)	CX	F			A
022	98801610	RING DITCHES SOUTH STRATHY	PT 6783 J DEWAR 776680 11 JULY 1975		AL	F		CT	A
023	99301580	ENCLOSURES CROPMARKS	BROADSLAP RCAMSAP 84 A64621-2 A64611-13 A64256-60 CS		CX	F			A
025	99301720	ENCLOSURE (POSS)	RCAMSAP 85 A45189-97		AI	F			A
027	97921657	HOMESTEAD PALISADED BELLIE	RCAMSAP 84 A64623-7 A64367-9 CS		CX	F			A
028	99361579	ENCLOSURES (POSS) MAILINGKNOWE	RCAMSAP 84 A64606 AND A64608		CE	F			A
029	99281530	CROPMARKS WESTBURN	RCAMSAP 84 A64607-10		CT	F			A
030	98901779	RING DITCHES CROPMARKS	FIELDS ON GASK TWO RING DITCHES ARE CLEARLY VISIBLE IN THIS FIELD BUT THERE ARE FURTHER CROPMARKS LESS WELL DEFINED BETWEEN THEM THESE INCLUDE A POSSIBLE PALISADED ENCLOSURE	RCAMSAP 84 A64614-16	LA	F		CX	A
031	98651742	ENCLOSURE GASCON HALL	RCAMSAP 84 A64617-20		AL	F			A
033	98401780	CROPMARKS HAUGH OF ABERUTHVEN	RCAMSAP 84 A65565-66		AL	F			A
034	93901814	WINDPUMP LAWHILL			BI	F			
037	97721605	ENCLOSED CREMATION CEMETARY	BELLIE AP SHOW TRACES OF SEGMENTED RING DITCH C 8-9 M IN DIAMETER WIN A DITCH C 1-1.5 M IN WIDTH SEVERELY DAMAGED EXTERNAL PITS ONE OF WHICH PRODUCED URN SHERDS	SEE NN 91 NE 018 RALSTON REFERENCES	CX	F			F
038	97501670	RING DITCHES CROPMARKS UNITLES	BELLIE AP SHOW RING DITCH IN NW PART OF SAME FIELD AND 170M WNW OF NN 91 NE 018 IT MEASURES C 10 M IN DIAMETER AND WIN A DITCH C 1-2 M WIDE	SEE NN 91 NE 018 FOR REFERENCES	CX	I			F
039	97701610	NATURAL FEATURES	EXCAVATIONS SHOWED THAT POSSIBLE BARROW IN THE SAME FIELD AS NN 91 NE 018 AND 037 WAS NATURAL AS WAS A SUBSTANTIAL SLAB SE OF NN 91 NE 037 (AT NN 977160)	RALSTON I 1980 DES 22	CX	I	I	M	
043	98401623	ENCLOSURE (POSS) CROPMARK	NO CARD		CX	F			A
001	90261580	FORT VITRIFIED CHAPEL	LOCATED ON A LOW RIDGE ABOVE THE MACHANY WATER STONE BUILT CONSTRUCTION SCHEDULED	PSAS 87 1942-3 58 CHILDE AND GRAHAM	BU	T		AG	
002	93191852	ROMAN WATCH TOWER RAITH	LOCATED 300 FEET ABOVE SEA LEVEL ON HIGHEST GROUND FOR 5 MILE RADIUS NOTHING VISIBLE ON THE GROUND PT 15505-5 CS PT 1598?9	SEE ROBERTSON 1974 AND BREEZE 1982 FROM BIB IN NN 91 NE 003	BI	F			
003	94691876	ROMAN WATCH TOWER ARDUNIE	FLAVIAN DATE SUGGESTED DILAPIDATED CONDITION IN 1967 DITCH ONLY 4 M DEEP WITH NO TRACE OF A BANK CAUSEWAY INDISTINCT	SEE ABOVE	MR	F		BL	
005	90351780	INNERPEFFRAY CASTLE 17TH C	BUILT ABOUT 1610 GOOD EXAMPLE OF A PLAIN SCOTTISH HOUSE	TRANTER 1962-70 THE FORTIFIED HOUSE OF SCOTLAND EDINBURGH AND LONDON VOL 5 P210	AI	I		CX	
006	91671816	ROMAN SIGNAL STATION PARKNEUK	EXCAVATION CARRIED OUT REVEALED 12' BY 10' WOODEN TOWER ENCLOSED WITHIN A 9' WIDE CLAY RAMPART AND A 12' WIDE OUTER DITCH ASSOCIATED WITH GASK HOUSE SIGNAL STATION (NN 91 NE 003)	DES 1968 P28-9	LX	F			
007	90201523	INNERPEFFRAY CHAPEL	EARLIEST REF. TO CHAPEL AT SITE IS 1365 AND 1483 EXISTING BUILDING IS 16TH C MAP SHOWS SITE CLOSE ALONGSIDE RIVER ON HIGH POSSIBLY ERODING SCARP	EASSON D E 1957 MED. REL. HOUSES SCOTLAND P181	AI	T	T	CX	
008	93801621	ST BEANS CHURCH KINKELL	PROBABLY BUILT AT END OF 16TH C AND REPAIRED IN 1680		AL	F		BN	
011	93951501	CIST	CONTAINED CHARRED HUMAN BONES FOUND BY PLOWING SEE LIES ON NORTH SLOPE OF A LARGE NATURAL MOUND IN ARABLE FIELD	ONB C1860 36	BL	F			
012	92851580	EARTHWORK ENCLOSURE	50M ACROSS DOUBLE DITCHES GREATER PART LIES ON A PLATEAU AREA ABOVE THE MACHANY WATER BUT THE DEFENSES INCLUDE PART OF THE LOW GROUND ON THE BANK OF THE WATER SMALL TRENCHING DONE IN 1987	BARCLAY G J 1987 DES(1987) 58-9	AL	T	T	BL	
013	91941718	EARTHWORK CRAIGSHOT	NO TRACE OF DOUBLE BANK AND DITCH FORMING THE SEGMENT CIRCLE WITH THE CHORD RESTING ON THE PRECIPITOUS DROP TO THE RIVER EARN OBSERVED BY E JOHNSTON IN 1967 RCAMSAP 82 PT 1068-6	IN DRISCOLL'S THESIS	CX	T	T	M	P
014	91601620	ROMAN TEMP CAMP INNERPEFFRAY	EXTREMELY WELL DOCUMENTED THRU AP		BI	F		RU	A
015	90202861	CROPMARK ENCLOSURE	NOTHING VISIBLE ON GROUND		RU	T			A
016	92531751	CAIRN CIST	FOUND IN 1841 CIST W/ COAL, ASHES AND BURNT BONES MIXED WITH THE STONES OF THE CAIRN	NSA 10 1845 338; ONB C 1860 14	BU	F			
017	92621691	BARROW CUP-MARKED STONE CAIRN	NORTH MAINS SITE BET CONFLUENCE OF EARN AND MACHANY WATER CAIRN OVERLYING OLD LAND SURFACE WITH TIMBER ENCLOSURES EXCAVATED IN 1978-79 RC DATES SUGGEST MOUND WAS BUILT AROUND 2ND MILLENIUM BC	DES 1978 33; 1979 44 NO. 257; BARCLAY G J 1983 SITES OF THE 3RD MILLENIUM BC TO THE 1ST MILLENIUM BC IN STRATHALLAN PERTHSHIRE PSAS 113 (1983) 122-281 HEDGES & SHERIFFS 1983 14A OF A RC DATED CORE FROM NORTH MAINS PSAS 113 (1983) 305-153	CX	T			
018	92951625	HENGE SITE NORTH MAINS	EXCAVATED IN 1979 TWO RINGS OF PITS INNER RING PRECEDED OUTER RING WHICH IN TURN WAS COMPLETED BEFORE THE QUARRYING OF THE DITCH ALSO INCLUDED 31 CREMATION DEPOSITS AND INHUMATIONS IN LONG GRAVES AND PITS ONE BEAKER FOOD VESSEL & 13 LONG GRAVES (CHR)	BARCLAY REF IN NN 91 NW 017 AND HUTAG? BOTH FINAL REPORTS AVAILABLE FROM CLU MS/294 31	RU	F		CX	
019	93501630	RING DITCHES PROB. BARROWS	EXCAVATED IN 1979 TWO RING DITCHES 1ST CONTAINED BURNT STONES IN THE EAST HALF THE 2ND SMALLER DITCH CONTAINED A SM QUANTITY OF CREMATED BONE. ANY TRACE OF BARROWS WHICH MIGHT HAVE BEEN DUG FROM THE SHALLOW RING DITCHES HAD BEEN DESTROYED BY PLOUGH	DES 1979 44 NO. 259 IN DRISCOLL'S THESIS	RU	F		CX	

REF	DESC	INFO	BIBLIOGRAPHY	SOIL	INT	PRO	SOILI	AP
90701599	LARI	ONLY KNOWN FROM RCAMSAP PLATE 83 PT 15117-22 ALONG EARN	DRISCOLL'S THESIS	CX				A
90261856	INNERPEFFRAY SCHOOL	SEE ARCHITECTURE		CX	I		M	
90101800	ENCLOSURE REMAINS OF STRAGEATH	RCAMSAP 83 PT 14885-6 PT 15985-6 ALONG SIDE EARN	DRISCOLL'S THESIS	AI		I		A
90701820	ROMAN TEMP CAMP INNERPEFFRAY	WELL FLOWN	ST JOSEPH 1958 P96-101	CX	I		RU	A
93101618	WATERMILL BRIDGE	SEE ARCHITECTURE		BR	I			
91471510	WALLED GARDEN	STRATHALLAN CASTLE SEE ARCHITECTURE		BI				
92701563	STRATHALLAN CASTLE BRIDGE	SEE ARCHITECTURE		BR	I			
91521604	FARMHOUSE	STRATHALLAN CASTLE HOME FARM SEE ARCHITECTURE		CX			A	
90131563	FARMHOUSE STEADING DRUMNESS	SEE ARCHITECTURE		BI				
90301590	PITS CROPMARKS SOUTH MAINS	INNERPEFFRAY RCAMSAP 82 PT 12380-2 ALONG EARN	DRISCOLL'S THESIS	AI	I		CX	A
92101760	LINEAR CROPMARKS GREY BURN	RCAMSAP 82 PT 11057		BI			RU	A
92401680	LINEAR CROPMARKS MILLS OF EARN	RCAMSAP 82 PT 12120-1		CX	I		RU	A
90901790	ENCLOSURE SOUTH MAINS	INNERPEFFRAY RCAMSAP 82 PT 11077-9		RU	I	I	M	A
93771545	RING DITCH WALLFAULD	RCAMSAP 83 PT 8616-18		DV	I			A
93501550	ENCLOSURE WALLFAULD	RCAMSAP 81 PT 8619-21 MAP SHOWS ENCLOSURE GOING INTO PINNEY BURN		AI	I		DV	A
91701630	RING-DITCHES WHITEHILL	RCAMSAP 77 PT 5735-7		CX	I		RU	A
93401550	ENCLOSURE CALLEWARD	RCAMSAP 81 PT 8558-61 8615-15 NEAR PINNEY BURN		CX	I		RU	A
90101770	RING-DITCH CROPMARKS PARKHEAD	RCAMSAP 77 PT 5605-8	DRISCOLL'S THESIS	CX	I			A
90701550	LINEAR CROPMARKS MAGIANNY	CUCAP BGT 56 PT 1100 PO		AI	I		RU	A
91151800	LINEAR CROPMARKS PARKNECK	RCAMSAP 82 PT 11078 11073-6		RU	I			A
92001860	PITS SHEARERTON	RCAMSAP 85 A31178-81		KV				A
93011702	MILLEARNE HOUSE	SEE ARCHITECTURE		CX				
93901630	WALKMILL ENCLOSURE	RCAMSAP 84 A64643-4	DRISCOLL'S THESIS	RU	I		RU	A
93621756	SOUTHERN LOWBANK	RCAMSAP 84 A64653-5		RU			RU	A
93671694	WINDYEDGE ALLANS			BI				
92501630	NORTH MAINS CROPMARKS			AI	I		CX	A
87571901	ROMAN CAMP DORNOCK	DISCOVERED BY AP IN 1962 WITHIN A LOOP OF THE RIVER SW SIDE DESTROYED BY EROSION IN 1967 NO SURFACE TRACES APPARENT SURVEYED FROM AP AND GROUND CONTROL AT 1:2500. RCAMSAP 86 A28562-72	JOURNAL OF REMOTE SENSING VOL 55 SUMMER 39 /70 & 114	CX	I			P
87601980	CAMP FINDAL	OLD ACCOUNT IN GLENTURRET PARISH LIB WHICH PROBABLY REFERS TO CAMP AT DORNOCK (NN 81 NE 01) IF ALLOWANCE IS MADE FOR THE FREQUENT CHANGES OF COURSE OF THE RIVER EARN AND THE FACT THAT THE REF IN OLD TIMES COULD BE REFERRING TO THE ROMAN CAMP AT DORNOCK		CX	I			
87581975	STONE AXE	FOUND BY MR JACK IN 1966 IS NOW IN POSSESSION OF MR J SHAW A BUILDER COMMISSIONER ST CRIEFF (1967). MR CAMERON LECK WAS WATER BAILIFF 88 KING ST CRIEFF		AI	T			
89401880	ENCLOSURES AND TIMBER HALL	POSSIBLY AN OLD MEANDER OF THE RIVER (?) RCAMSAP 86 A28782-85 ALSO SMALL ENCLOSURE IS PROB. TIMBER HALL	(1) [illegible] 1949 57 (1975 OK WATFORD)	AI	I	F		A
87511557	BISHOPS BRIDGE	SEE ARCHITECTURE		BR	I			
89091565	KNAPPYLANDS BRIDGE	SEE ARCHITECTURE		BR	I			
89301800	ROMAN FORT STRAGEATH	SCHEDULED IN 1961 DISCOVERED BY AP IN 1957 14 YEAR EXCAVATION ON SITE MUCH DETAIL IF NEEDED	HANSON W S 1980 THE FIRST ROMAN OCCUPATION PERIOD IN SCOTLAND BAR INTERNATIONAL SERIES 71 OXFORD P 32-43 W SPECIFIC REF TO THIS SITE ON P 24 AND 32	CX	F			
88241839	CHAPEL CEMETARY STRAGEATH	PARISH CHURCH OF STRAGEATH CONTAINS GRAVESTONE DATED 1692 AND GRAVEYARD WAS REPORTED AS STILL IN USE IN 1860 (1) IN 1967 A FIELD INSPECTOR COULD NOT FIND THE 17TH C GRAVESTONE BUT FOUND THE N S & E WALLS OF CHAPEL BUILDING	(1) ONB 1860 (2) R DICKSON 5 25 67	AI	F			
89001800	II ROMAN CAMP STRAGEATH	REVEALED BY AP IN 1979 ELONGATED PLAN 33 ACRES IN AREA RCAMSAP 86 A29807-08 A28772-77	MAXWELL G S 1980 AGRICOLAS CAMPAIGNS THE EVIDENCE OF THE TEMPORARY CAMPS SCOTTISH ARCHAEOLOGICAL FORUM 12 (1980) 25-54	AI	F		CX	A
89231965	ENCLOSURE CULTHERS	RCAMSAP 86 A28776-779 A29106-108		KV				A
88501790	LINEAR CROPMARKS CULTHERS	RCAMSAP 78 PT 6097-9 RCAMSAP 86 A25771-5		DV			CX	A
88601810	ENCLOSURE DALPATRICK	ENCLOSURE NORTHERN EDGE GETS INTO RIVER COURSE RCAMSAP 83 PT 15129-31 RCAMSAP 77 PT 5615-19		AI	T	F	CX	A
89001850	ENCLOSURE CROPMARKS DALPATRICK	RCAMSAP 82 PT 10997-001		CX				A
88101950	RING DITCH ENCLOSURE DORNOCK	RCAMSAP 77 PT 5594-6 AND 5591		CX	F			A
88011920	RING DITCH ENCLOSURE DORNOCK	RCAMSAP 77 PT 5594-6 5591		AI	F			A
87701880	RING-DITCHES DORNOCK	RCAMSAP 78 PT 6160-1 W IN ROMAN CAMP AT DORNOCK NN 81 NE 014		AI			CX	A
88201847	FARMHOUSE STRAGEATH MILL	SEE ARCHITECTURE		AI				
88981557	COTTAGE DARGILL COTTAGE	SEE ARCHITECTURE		AI				
89501790	FIELD SYSTEM STRAGEATH	RCAMSAP 86 A29103-04 A28774		KV				
89201816	LINEAR CROPMARKS STRAGEATH	RCAMSAP 83 PT 14973-9		CX	F			A
89301770	ENCLOSURE STRAGEATH	RCAMSAP 83 PT 14973-6 14979-81		KV	F		CX	A
89101776	LINEAR CROPMARK CULTHERS	RCAMSAP 81 PT 8609-12		KV	F			A
86301980	PIT-ALIGN PIT ENCLOS BENNYBEG	RCAMSAP 86 A28786-92		TO	F		DV	A
86611910	PIT CIRCLE BENNYBEG	RCAMSAP 86 A28786-92	HARDING AF AND LEE GE 1987. HENGE MONUMENTS AND RELATED SITES OF GREAT BRITAIN. AP EVIDENCE AND CATALOGUE. BAR SERIES 175 OXFORD P 409 NO 309	DN	F			A
88001900	ENCLOSURE DORNOCK	RCAMSAP 77 PT 5592		CX	F			A
89001770	CULTIVATION REMAINS STRAGEATH	RCAMSAP 85 A36256-8 A36260-62		KV	F		CX	A
89401840	SOILMARKS STRAGEATH MAINS	RCAMSAP 85 A46871-4 NORTHERN PERIMETER ABUTTS RIVER MARGIN		AI		I		A
88101950	PIT-ALIGNMENT DORNOCK	RCAMSAP 77 PT 5594-6		CX	F			A
88061953	SOUTERRAIN(POSS) DORNOCK	RCAMSAP 86 A28679-81		CX	F			A
89001840	PITS CROPMARKS STRAGEATH MAINS	RCAMSAP 86 A28099-100		CX	F			A
86751914	ENCLOSURE FINDAL COTTAGES	RCAMSAP 86 A28786-92		DN	F			A
86211884	RING DITCH BENNYBEG CRAIG	RCAMSAP 86 A28793-95		HO	F			A
88111895	ENCLOSURE (POSS) DORNOCK 2	RCAMSAP 86 A28868-74 SOUTHERN PERIMETER ABUTTS 30 M CONTOUR - SCARP FACE ALONG RIVER MARGIN		CX	I	I	M	A
88801980	RING-DITCH REDHILLS	POSSIBLY PARTLY COMPOSED OF PITS CUCAP 1984 A82918-23 PO		CX	F			A
88601970	ENCLOSURE REDHILLS	CUCAP 1984 A82918-23 PO		CX	F			A
88601970	RING-DITCH REDHILLS	CUCAP 1984 A82918-23 PO		CX	F			A
89001960	ENCLOSURE PITS POWSIDE	CUCAP 1984 A82918-23 PO		CX	F		C	A
89001990	PIT-ALIGNMENT (POSS) MILLHILLS	CUCAP 1984 A82918-23 PO		CX	F			A
88651880	ENCLOSURE(POSS) LINEAR CROPMK	DORNOCK COTTAGE CUCAP 1980 A82856 PO		AI	F			A
87051850	ENCLOSURE (POSS) TEMPLEMILL	CUCAP 1980 A82577-81 PO		AI	I			A
88801800	PITS BET CULTHERS & STRAGEATH	CUCAP 1980 A82855 PO		CX	F			A
85922004	STANDING STONE DARGILL ISLAND	REMAINS OF STONE CIRCLE OTHER STONES REMOVED IN 1989. ONE REMAINS A SQUARISH BLOCK OF SCHIST. RCAMSAP 81 PT 8605-5 POSSIBLE RING DITCH		AI	T			A
85622682	WORKS SOUTH BRIDGEND	STRATHEARN PRESERVE WORKS SEE ARCHITECTURE		AI	F			
87602050	ENCLOSURE	RCAMSAP 76 PT 1698-99		RU	T		CX	A
85902050	PIT-ALIGN ENCLOS(POSS) DARGILL	RCAMSAP 81 PT 8603-5 ALONG RIVER EARN'S SOUTHERN EDGE FIELD WITHIN NN 82 SE 22		AI	F	I		A
86702030	ENCLOSURE BROICH	RCAMSAP 82 PT 11894-6 NEAR WHAT LOOKS TO BE LINE PREVIOUS RIVER COURSE		CX	I	I	M	A
86602022	LINEAR CROPMARKS BROICH	RCAMSAP 82 PT 11094-6 SEE NN 82 SE 068		CX	I	I	M	A

Appendix 3

OKLAWAHA DBF

SITENUMBE	SITENAME	LOC	DATEINVES	STYP1	STYP2	CULT1	CULT2	CULT3	CULT4	CULT5	CULT8	OWNER	PUBLICTRA	QUADRANGLE	QUARTERSE	SECTION
8MR00013	SUNDAY BLUFF	I	02 04 57	MDSH		DEPT	SJ2	ORAN	WE		P	STAT		FORT MCCOY	NE NE/NW	27.0000
8MR00014	OLD SITE EATON CREEK	I	02 04 57	MDSH		ORAN	SJ2				P	STAT		FORT MCCOY	NW SW/NE	27.0000
8MR00015	EATON CREEK	O	02 04 57	MIDD		ORAN	SJ				P	STAT		FORT MCCOY	SW NE NE	34.0000
8MR00016	EATON CREEK MIDDEN	I	02 04 57	MIDD		DEPT	SJ	ORAN			P	STAT		FORT MCCOY	NW SE NE	34.0000
8MR00017	EATON CREEK	I	02 04 57	MDDN		INDE					UN	STAT		FORT MCCOY	SE NW NE	3.0000
8MR00019	SHINER POND MOUND 2	O	15 07 75	MOUN		SJ1					P	STAT		FORT MCCOY	SW NW SE	8.0000
8MR00020	SHINER POND MOUND 3	O	15 07 75	MOUN		INDE					UN	STAT		FORT MCCOY	NW SW SE	8.0000
8MR00021	SHINER POND MOUND 1	O	15 07 75	MOUN		INDE					UN	STAT		FORT MCCOY	SW NW SE	8.0000
8MR00022	SHINER POND MOUND 4	O	15 07 75	MOUN	SCAR	INDE					UN	STAT		FORT MCCOY	SW NW SE	8.0000
8MR00023	PALMETTO LANDING MOUND 5	O	15 07 75	MOUN		INDE					UN	STAT		FORT MCCOY	SE NW SE	8.0000
8MR00024	PALMETTO LANDING MOUND 6	O	15 07 75	MOUN		ORAN	SJ	SJ1			P	STAT		FORT MCCOY	SW NW SW	9.0000
8MR00025	PALMETTO LANDING 7	O	15 07 75	MOUN		INDE					UN	STAT		FORT MCCOY	SE NE SE	9.0000
8MR00030	GORES LANDING MIDDEN	I	02 04 57	MIDD		INDE					UN	STAT		FORT MCCOY	SW NE SE	5.0000
8MR00031	GORES LANDING MOUND	I	02 04 57	MOUN		INDE					UN	STAT		FORT MCCOY	NW SW SE	5.0000
8MR00032	DELKS LANDING MOUND	I	02 04 57	MOUN		INDE					UN	STAT		LYNNE	NW NW SW	2.0000
8MR00044	NN	I		MDSH		SJ2	ALAC				PA	STAT		FORT MCCOY	NE NW SW	18.0000
8MR00080	GORES LANDING BORROW PIT	I	09 08 64	SCLI		ARC		–			P	STAT		FORT MCCOY	NE SE NE	7.0000
8MR00097	FLA BARGE CANAL 29	I	23 07 65	SCLI		INDE					UN	STAT		LYNNE	SW SW SW	25.0000
8MR00141	COFFEE POT MOUND	I	15 08 75	MOUN		SJ					P	FEDE	OCALA NATIONAL FOREST	FORT MCCOY	NW SE/NW	34.0000
8MR00143	UPCHURCH LUMBER CO CAMP	O	15 08 75	INDU	REFU	AMER	SPAW				H	UNKN		FORT MCCOY	NW NW NW	22.0000
8MR00145	BUCK MACDONALD MOUND	O	15 08 75	MOUN		PREH					P	UNKN		FORT MCCOY	SW NW NE	17.0000
8MR00146	PETERSON'S MOUND	O	15 08 75	MOUN		PREH					P	UNKN		FORT MCCOY	NW NE NE	27.0000
8MR00147	PLUM TREE HOUSE	O	15 08 75	HOUS	REFU	AMER	POSR	RECO	SPAW		H	PRIV		FORT MCCOY	NE NW NW	27.0000
8MR00148	DOUBLE BRIDGE MOUND A	I	15 08 75	MOUN		DEPT	ORAN	SJ	SJ1	SJ2	P	STAT		FORT MCCOY	NW NW NE	3.0000
8MR00149	DOUBLE BRIDGE MOUND B	I	15 08 75	MDSH		PREC					P	STAT		FORT MCCOY	SW SW SE	34.0000
8MR00224	OKLAWAHA RIVER SHELL MOUND II	I	01 01 81	MDSH		ORAN	SJ1				P	FEDE	OCALA NATIONAL FOREST	FORT MCCOY	NE/SE NW	4.0000
8MR00230	AMY'S DREAM	I	15 09 81	HABI		ARC	SJ2	ORAN			P	COPR		FORT MCCOY	NE NE NE	18.0000
8MR00232	NN	I	15 09 81	SCLI		ARC					P	FEDE	OCALA NATIONAL FOREST	FORT MCCOY	SE SW SW	8.0000
8MR00242	USFS 81-51	O	15 10 81	SCLI		ARC					P	FEDE	OCALA NATIONAL FOREST	FORT MCCOY	SW SW SW	17.0000
8MR00243	USFS 81-52	O	15 10 81	SCLI		ARC					P	FEDE	OCALA NATIONAL FOREST	FORT MCCOY	SW NW NW	17.0000
8MR00244	USFS 81-53	O	15 10 81	SCLI		ARC					P	FEDE	OCALA NATIONAL FOREST	FORT MCCOY	SW SE/NW	17.0000
8MR00245	USFS 81-54	O	15 10 81	SCLI		ARCL	MTTA				P	FEDE	OCALA NATIONAL FOREST	FORT MCCOY	NW NE SW	17.0000
8MR00247	USFS 81-60	I	15 10 81	SCLI	MDSH	SJ	SJ1	TRAN			P	FEDE	OCALA NATIONAL FOREST	FORT MCCOY	SE/SE SW	22.0000
8MR00248	USFS 81-57	O	15 10 81	SCAR		ORAN					P	FEDE	OCALA NATIONAL FOREST	LAKE KERR	SE NE SE	15.0000
8MR00254	USFS 81-35	I	01 02 81	SCLI		PREH					P	FEDE	OCALA NATIONAL FOREST	FORT MCCOY	SW NE SW	15.0000
8MR00255	IT'S MIDDEN (PINEY ISLAND MIDDEN)	I	01 02 81	MDSH		MTTA	SJ2				P	FEDE	OCALA NATIONAL FOREST	FORT MCCOY	SW SE SW	15.0000
8MR00262	USFS 81-61	I	01 05 81	MDSH		SJ1	TRAN				P	FEDE	OCALA NATIONAL FOREST	FORT MCCOY	NW NW SE	27.0000
8MR00263	USFS 81-63	O	01 05 81	SCLI		ARC					P	UNKN		FORT MCCOY	NE NE/SW	8.0000
8MR00519	FORE LAKE WEST	O	20 07 83	SCLI		PREA					P	FEDE	OCALA NATIONAL FOREST	FORT MCCOY	SE/SE NW	17.0000
8MR00819	LAKE CHARLES UNIT 5, NO 1	O	15 02 86	SCAR		SJ2	TRAN				P	FEDE	OCALA NATIONAL FOREST	FORT MCCOY	SW/NE SE	16.0000
8MR00820	LAKE CHARLES UNIT 5, NO 3	O	15 02 86	SCAR		SJ2					P	FEDE	OCALA NATIONAL FOREST	FORT MCCOY	SW/SW SW	15.0000
8MR00825	CEDAR CREEK STILL	I	15 05 86	STIL		20TH	AMER				H	FEDE	OCALA NATIONAL FOREST	FORT MCCOY	NE/SW SW	8.0000
8MR00831	LAKE CHARLES UNIT 5 NO 2	O	15 06 86	SCAR		SJ1	SJ2				P	FEDE	OCALA NATIONAL FOREST	FORT MCCOY	NW SW/SW	15.0000
8MR00848	PINEY ISLAND	I	15 06 86	BURP	MIDD	ARCI					P	STAT		FORT MCCOY	SE SW SW	15.0000
8MR00850	USFS OCA 87-2/SHARPES FERRY 52 SAWMILL	O	15 10 86	MILL		AMER					H	FEDE	OCALA NATIONAL FOREST	LYNNE	SW SW SW	1.0000
8MR00851	USFS OCA 87-3/SHARPES FERRY 52 SCATTER	O	15 10 86	SCLI		PREA					P	FEDE	OCALA NATIONAL FOREST	LYNNE	NE NW NW	12.0000
8MR01867	315 RIDGE	I	15 02 88	SCNO		PREA					P	COPR		LYNNE	SW NE SW	26.0000
8MR01869	BUTTERBUTT LANDING	I	15 04 88	SCNO		UNSP					UN	COPR		LYNNE	NE/SW SW	25.0000
8MR01874	EATON CREEK	I	15 04 88	HABI	REFU	DEPT	SJ1	AMER	WWII		M	COPR		FORT MCCOY	NE/SW NE	15.0000
8MR01876	314-A	O	15 04 88	SCAR	INDE	PREC	UNSP				P	COPR		FORT MCCOY	SE SW NW	15.0000
8MR01916	USS #89-2 OCALA	O	12 12 88	SCAR		PREA					P	FEDE	OCALA NATIONAL FOREST	FORT MCCOY	SW SW/SE	17.0000
8MR01969	USFS OCA 90-14	O	29 05 90	HABI	SCAR	SJ1	SJ2				P	FEDE	OCALA NATIONAL FOREST	FORT MCCOY	SE/SE NW	22.0000
8MR01970	USFS OCA 90-15	O	29 05 90	HOME		HIST					H	FEDE	OCALA NATIONAL FOREST	FORT MCCOY	SE/SE NW	22.0000
8MR00057	COLBY LANDING	I	01 03 68	MDSH	HABI	DEPT	ORAN	SJ			P	STAT	FLA. ANT 23.2	LYNNE	SE SE SW	2.0000

REG	EASTING	NORTHING	TOPOGRAPHY	PHYSIOGRAPHY	SOILSERIE	DRAIN	SITESIZE	LANDUSE	SITEINTEG	CULTURAL	SITEFEATU	DISCUSSION	SIGNIFICAN	MANAGEMENT
24L	412100.0000	3215650.0000	FLOODPLAIN	3 SAND PINE SCRUB	ASTATULA SAND DARK SURFACE 8-17%	E	0.0000	CANAL LAND	LOW-MODERATE	Orange Plain and Incised Deptford Simple Stamp and Pasco Plain and St. Johns Plain Linear and Simple Stamp ceramics, unidentified projectile points and worked chert lithic fragments	Sand shell midden	The Sunday Bluff Site was excavated by Bullen in 1969 and represents an important transitional period habitation site	Pot. significant	Re-evaluation of site data and resurvey to evaluate integrity
24L	412100.0000	3215130.0000	FLOODPLAIN	21 SWAMP HARDWOODS	TERRA CEIA MUCK-ASTATULA SAND DARK SURFACE 8-17%	VP	0.0000	CANAL LAND	LOW	15 St. Johns Plain and 5 Check Stamp (grit temper) 7 Orange Incised and 2 Plain (grit temper), large hammerstone human bone (from within the midden)	Shell midden.	Site was visited by Alvarez et al (1935) and Goggin in 1952. The presence of human bone within midden context suggests variability in site function and potential for recoverable contexts.	Unknown	Reevaluation of site data and resurvey to evaluate integrity.
24L	411520.0000	3243820.0000	FLOODPLAIN	3 SAND PINE SCRUB	ASTATULA SAND 0-8%-ASTATULA SAND DARK SURFACE 8-17	E	0.0000	CANAL LAND	UNKNOWN	Not described	Midden	Insufficient information on site form	Unknown	Site outside of canal zone. Avoid pending reevaluation.
24L	412570.0000	3243450.0000	FLOODPLAIN	21 SWAMP HARDWOODS	TERRA CEIA MUCK	P	0.0000		UNKNOWN	5 St. John's Plain 2 St. John's Incised and 2 with indeterminate markings 11 Orange Incised and 3 Plain 1 Check Stamped Grit Temp. (Deptford?) and 3 Plain Grit Temp. Glades-like ceramics	Midden	Insufficient information on site form	Unknown	Resurvey to locate and evaluate site condition.
24L	411600.0000	3232180.0000	FLOODPLAIN	25 FRESHWATER MARSH AND PONDS	SELLERS SAND	VP	0.0000		UNKNOWN	Not described	Midden(?)	Insufficient information on site form	Unknown	Resurvey to locate and evaluate site condition
24L	411160.0000	3239700.0000	UPLAND LACUSTRINE	6-3 S. FLA. FLATWOODS-SAND PINE SC	DELKS SAND-POMELLO SAND	SP	0.0000		UNKNOWN	Not collected	Remains of a mound	One of seven reportedly related mounds near Palmetto Landing which Goggin (1952) Johnson and Reitz (1975) have characterized as having been demolished by Moore (1895). Moore found no burials.	Unknown	Site outside of canal zone. Avoid pending reevaluation
24L	411160.0000	3239620.0000	UPLAND LACUSTRINE	3 SAND PINE SCRUB	POMELLO SAND	MW	0.0000		UNKNOWN	Not collected	Doughnut shaped remains of an excavated mound	Site excavated by Moore (1895). Moore did not find burials or human remains. Johnson and Reitz (1975) survey report no artifacts on the surface.	Unknown	Site outside of canal zone. Avoid pending reevaluation
24L	411180.0000	3239740.0000	UPLAND LACUSTRINE	6 S. FLA. FLATWOODS	DELKS SAND	SP	0.0000		UNKNOWN	Not collected	Disturbed sand mound.	Reportedly related to 8 Mr 19-21 this site was tested by Moore in 1895. Insufficient information on site form.	Unknown	Site outside of canal zone. Avoid pending reevaluation
24L	411220.0000	3239780.0000	UPLAND LACUSTRINE	6 S. FLA. FLATWOODS	DELKS SAND	SP	0.0000		UNKNOWN	Not collected	Disturbed sand mound	Reportedly related to 8 Mr 19-21 the site's center has been extensively potted. Moore (1895) may have tested this site.	Unknown	Site outside of canal zone. Avoid pending reevaluation
24L	411250.0000	3239770.0000	UPLAND LACUSTRINE	6 S. FLA. FLATWOODS	DELKS SAND	SP	0.0000		UNKNOWN	Not collected	Disturbed sand mound.	Results of the Peebles Thomson and Stephens (1981) survey suggest the site was extensively potted. Moore (1895) may have tested this site.	Unknown	Site outside of canal zone. Avoid pending reevaluation
24L	410930.0000	3240935.0000	UPLAND LACUSTRINE	6 S. FLA. FLATWOODS	DELKS SAND	SP	0.0000		UNKNOWN	Undefined amounts of prehistoric ceramics characterized as 2-3 Orange series and 1-3 St. Johns.	Sand mound with shell concentration.	Site was resurveyed by Johnson and Reitz (1975) and found to have been extensively potted. Site may be the renumbered 8 Mr 89.	Unknown	Site outside of canal zone. Avoid pending reevaluation
24L	413420.0000	3239750.0000	UPLAND LACUSTRINE	3 SAND PINE SCRUB	POMELLO SAND	MW	0.0000		UNKNOWN	Not described	Sand mound	Site form reports Moore (1895) destroyed the mound	Unknown	Site outside of canal zone. Avoid pending reevaluation
24L	411180.0000	3211350.0000	FLOODPLAIN	21 SWAMP HARDWOODS	TERRA CEIA MUCK	P	0.0000		UNKNOWN	Not described	Midden with possible associated mound (100' upriver)	Insufficient information on the site form.	Unknown	Resurvey to locate and evaluate site condition.
24L	411050.0000	3211130.0000	FLOODPLAIN	21 SWAMP HARDWOODS	TERRA CEIA MUCK	P	0.0000		UNKNOWN	Not described	Mound.	Site is the mound reportedly related to 8Mr 30 located 300' down river. Site form indicates that the site was not visited	Unknown	Resurvey to locate and evaluate site condition.
24L	408180.0000	3201510.0000	FLOODPLAIN	21 SWAMP HARDWOODS	TERRA CEIA-IBERIA CLAY	VP	0.0000		UNKNOWN	Not described	No features reported	Insufficient information on the site form	Unknown	Resurvey to locate and evaluate site condition.
24L	408880.0000	3278190.0000	FLOODPLAIN	21 SWAMP HARDWOODS	TERRA CEIA MUCK	P	0.0000		UNKNOWN	2 St. John's Plain and 2 Check Stamped [illegible] Marked 12 Plain Grit Temp. ceramics and undefined amounts of alligator turkey turtle and deer bone	Shell midden.	Insufficient information on the site form	Unknown	Resurvey to locate and evaluate site condition.
24L	410110.0000	3240350.0000	FLOODPLAIN	22-21 WET HARDWOOD HAM-SWAMP HARDW	HOLOPAW SAND-ANCLOTE SAND	P	0.0000		UNKNOWN	Undefined amount of lithic debris	Excavated borrow pit.	Insufficient information on the site form. Form suggests the site was destroyed by soil borrowing activities	Not significant	No further work recommended
23L	406050.0000	3334610.0000	FLOODPLAIN	6 S. FLA. FLATWOODS	DELKS SAND	SP	0.0000		UNKNOWN	Undefined amount of lithic debris	No features reported	Site is characterized as a chipping area on the site form	Unknown	Resurvey to locate and evaluate site condition
24L	413900.0000	3243550.0000	MARGIN	3 SAND PINE SCRUB	POMELLO SAND	MW	25.0000	NATIONAL FOREST	LOW	Undefined amounts of St. Johns Plain Fiber Temp. sherds, Shell, turtle, drum fish and alligator bones	Sand mound with shell.	This site was evaluated at the survey level in 1975 by Johnson and Reitz and found to have little significance	Not significant	No further work recommended
24L	413560.0000	3237630.0000	UPLAND LACUSTRINE	3 SAND PINE SCRUB	POMELLO SAND	MW	0.0000		UNKNOWN	Undefined amounts of historic debris including steel glass railroad ties and pine machinery (?)	Roadbed.	Insufficient information on the site form.	Unknown	Site outside of canal zone. Avoid pending reevaluation
24L	411130.0000	3238930.0000	UPLAND LACUSTRINE	3 SAND PINE SCRUB	PAOLA SAND MED DEEP WTR 0-8%	E	0.0000		UNKNOWN	Not described	Mound.	Insufficient information on the site form	Unknown	Site outside of canal zone. Avoid pending reevaluation
24L	414320.0000	3215960.0000	UPLAND LACUSTRINE	3 SAND PINE SCRUB	ASTATULA SAND DARK SURFACE 0-8%	E	0.0000		UNKNOWN	Not described	Mound.	Insufficient information on the site form	Unknown	Site outside of canal zone. Avoid pending reevaluation.
24L	413900.0000	3235930.0000	UPLAND LACUSTRINE	3 SAND PINE SCRUB	ASTATULA SAND DARK SURFACE 0-8%	E	0.0000		UNKNOWN	Not described	House remains with associated cemetery	Insufficient information on the site form.	Unknown	Site outside of canal zone. Avoid pending reevaluation
24L	414270.0000	3242150.0000	FLOODPLAIN	25 FRESHWATER MARSH AND PONDS	SELLERS SAND	VP	300.0000		LOW-MODERATE	Undefined amounts of St. John's Plain and Check Stamped Deptford Check Stamped and Orange Plain and Incised ceramics; lithic debris; shell charcoal and deer rodent and soft-shelled turtle bone	Mound.	Insufficient information on the site form.	Unknown	Resurvey to locate and evaluate site condition
24L	414270.0000	3242510.0000	FLOODPLAIN	25 FRESHWATER MARSH AND PONDS	SELLERS SAND	VP	250.0000		LOW-MODERATE	Undefined amounts of unidentified sand temp. and plain prehistoric ceramics; lithic debris and deer turtle and catfish bones	Midden with mound	Insufficient information on the site form	Unknown	Resurvey to locate and evaluate site condition
24L	0.0000	0.0000	UPLAND LACUSTRINE	3 SAND PINE SCRUB	POMELLO SAND	MW	100.0000	NATIONAL FOREST	LOW	4 St. John's Incised 1 unidentified sherd 2 Fiber Temp. sherds 8 Sand Temp. Plain sherds 1 non-decortication and 1 decortication flakes; 20 unidentified bone fragments	Remains of shell mound.	Site form indicates site significance and integrity may have been lost owing to excessive vandalism and shell mining (Dorian 1981).	Unknown	Resurvey to locate and evaluate site condition.
24L	410530.0000	3239260.0000	UPLAND LACUSTRINE	6 S. FLA. FLATWOODS	DELKS SAND-TERRA CEIA MUCK	SP	500.0000		HIGH	16 Fiber Temp. sherds 10 St. John's and 16 Sand Temp. Plain sherds, 14 flakes 1 Culbreath point and 1 probable reworked Culbreath point 1 biface frag. 1 unifacial drill 1 scraper/graver/other flakes	No features reported	Site form information indicates site is large multicomponent with specialized activity as functional area such as shell fishing. Good research potential	Pot. significant	Resurvey with testing to verify location integrity and significance.
24L	410410.0000	3239200.0000	UPLAND LACUSTRINE	6 S. FLA. FLATWOODS	DELKS SAND	SP	6250.0000	NATIONAL FOREST	MODERATE	12 decortication flakes 34 non-decortication flakes 1 distal end of a bifacial tool lithic shatter	No features reported	Insufficient information on the site form	Pot. significant	Resurvey to locate and evaluate site condition
24L	410260.0000	3237680.0000	UPLAND LACUSTRINE	6-3 S. FLA. FLATWOODS-SAND PINE SC	DELKS SAND-POMELLO SAND	XW-SP	0.0000	NATIONAL FOREST	UNKNOWN	Undefined amounts of lithic debris	No features reported.	Site form indicates site was disturbed by pipeline (gas?) construction	Not significant	Site outside of canal zone.
24L	410520.0000	3238600.0000	UPLAND LACUSTRINE	6 S. FLA. FLATWOODS	DELKS SAND	SP	0.0000	NATIONAL FOREST	UNKNOWN	Undefined amounts of lithic debris	No features reported	Insufficient information on the site form. Form suggests site is not significant.	Not significant	Site outside of canal zone.
24L	410600.0000	3236640.0000	UPLAND LACUSTRINE	3 SAND PINE SCRUB	POMELLO SAND	MW	0.0000	NATIONAL FOREST	UNKNOWN	Undefined amounts of lithic debris	No features reported	Insufficient information on the site form. Form suggests site is not significant.	Not significant	Site outside of canal zone.
24L	410740.0000	3238200.0000	UPLAND LACUSTRINE	3 SAND PINE SCRUB	POMELLO SAND	MW	0.0000	NATIONAL FOREST	MODERATE	Undefined amounts of lithic debris and 1 unidentified Archaic point	No features reported	Insufficient information on the site form. Form suggests site is not significant.	Not significant	Site outside of canal zone.
24L	411110.0000	3243890.0000	UPLAND DRY	3-21 SAND PINE SCRUB-SWAMP HARDWOOD	ASTATULA SAND DARK SURFACE 8-17%	E	0.0000	NATIONAL FOREST	LOW	Undefined amounts of St. John's Sand Temp. Plain and Sand and Fiber Temp. ceramics, lithic scatter 2 heat treated biface fragments primary and secondary decort. flakes, miscellaneous lengths (?)	Freshwater shell midden.	Site form indicates site has lost integrity owing to prior sand mining (Dorian 1981).	Not significant	No further work recommended.
24L	413400.0000	3236260.0000	UPLAND DRY	3 SAND PINE SCRUB	ASTATULA SAND 0-8%	E	0.0000	NATIONAL FOREST	UNKNOWN	Undefined amounts of Orange-Ocoee sherds and lithic debris	No features reported	Site form indicates site is not significant (Dorian 1981).	Not significant	Site outside of canal zone.
24L	0.0000	0.0000	FLOODPLAIN	21 SWAMP HARDWOODS	TERRA CEIA MUCK	P	100.0000	NATIONAL FOREST	MODERATE	2 non-decortication flakes 2 decortication flakes 13 non-decortication microliths	No features reported.	Site form indicates site is not significant (Dorian 1981).	Not significant	No further work recommended.
24L	0.0000	0.0000	FLOODPLAIN	21 SWAMP HARDWOODS	TERRA CEIA MUCK	P	100.0000	NATIONAL FOREST	HIGH	16 St. John's Plain 1 Dunn Creek Red 3 Fiber Temp. 3 Sand Temp. base with tetrapod and 3 Fiber Temp. body sherds; 2 decortication and 7 non-decortication flakes 32 fragments of [illegible]	No features reported	Site form indicates site has diversity of materials and integrity of location - undisturbed. Research potential suggested.	Pot. significant	Resurvey to locate and evaluate site condition.

Appendix 4

OKLAWAHA RIVER SURVEY, MASTER SITE FILE FORMS

STATE OF FLORIDA
DEPARTMENT OF STATE
Division of Archives, History
and Records Management

[ ] Original [X] Update

Florida Master Site File / UNDERWATER ARCHAEOLOGICAL SITE FORM

SITE NUMBER 8 MR 57 SITE NAME Colby Landing
USGS 7.5 MINUTE QUAD Lynne
NOTE: Please attach an 8.5" X 11" copy of the appropriate portion of the above map, with site location indicated.

TOWNSHIP/RANGE/SECTION:

Township	Range	Section
15S	23E	2

X			

NOTE: The figure to the left represents a regular section (1 square mile); please indicate the location of your site by placing an X in the appropriate portion of the section.
If the section is irregular or part of a land grant, please check below and disregard above instructions.

[ ] *Irregular section*
[ ] *Land grant* ______ *(name)*

UTM COORDINATES: Zone / Easting / Northing
____ / ____ / ____
NOTE: If you are unfamiliar with calculating UTM measurements, leave blank.
LATITUDE: ____ ____ ____ LONGITUDE: ____ ____ ____
SITE SITUATION: (check one)
[x] inland [] estuary [] offshore
UNDERWATER ENVIRONMENT: (check one)
[] high energy marine [] low energy marine
[] lake or ponds [X] river, stream or creek
[] cavernous sink [] cavernous spring
[] intermittently flooded lands with a flowing water environment
[] intermittently flooded lands with a still water environment
SEDIMENT:
[] clay [] silt [x] sand [] peat [] marine growth [] rock
LOCAL INFORMANT(inc. private collections)
ADDRESS
LOCAL INFORMANT(inc. private collections)
ADDRESS
SURVEY DATE 7/30/91 OTHER MASTER SITE FILE NUMBERS
RECORDER(S)(list principal investigator first) RL Denson
FMNH, Dept. of Anthropology, Univ. of Florida
ADDRESS Museum Road
PROJECT NAME Oklawaha River Survey
TOPOGRAPHICAL SETTING bottomland hardwood

TYPE OF SITE(check one or more as appropriate):

[] indeterminate	[] mound(s)	[] prehistoric cemetery
[] unknown	[] burial mound(s)	[] prehistoric vessel
[] single artifact	[] platform/temple mound(s)	[] prehistoric refuse
[] artifact scatter		[] historic earthworks
[x] lithic scatter	[] canal	[] shell ring
[] midden(s)	[] mission	[] redeposited
[] shell midden(s)	[] prehistoric earthworks	[] inundated terrestrial
[] shell works		[] historic refuse
[] historic shipwreck	[] wharves, docks, piers	[] well
		[] bridges (also covered bridges)
[] stone wall	[] shrine	
[] ______	[] ______	[] ______

THREATS TO SITE:

- [] zoning
- [] development
- [] deterioration
- [] borrowing
- [] transportation
- [] fill
- [] dredge
- [] logging
- [] vandalism
- [] phosphate mining
- [] agriculture/plowing
- [] ________________

REMARKS:

- [] preservation recommended
- [] recommended for further testing
- [] severely disturbed/destroyed
- [] ________________

REPOSITORY ________________

BIBLIOGRAPHIC DATA ________________

NOTE: Cite any reports referring <u>specifically</u> to this site. General background material need not be cited. Use <u>Florida Anthropologist</u> format.

CULTURAL CLASSIFICATION ________________

CULTURAL PERIOD ________________

CULTURAL MATERIAL(Check as many as apply):

- [] aboriginal ceramics
- [] nonaboriginal ceramics
- [] lithics
- [] worked bone
- [] human bone/burial(s)
- [] animal bone/ unidentified bone
- [] shell food remains
- [] worked shell
- [] plant remains
- [] wood
- [] metal
- [] precious metal/ coin(s)
- [] glass
- [] brick/bldg materials
- [] other human remains (e.g., hair)
- [] exotic items (mica, etc)
- [] petroglyphs
- [] textile(s)
- [] misc/prehistoric
- [] misc/historic
- [] trade bead(s)
- [] ballast
- [] fossil
- [] ________
- [] ________

DIAGNOSTIC ARTIFACTS ________________

SITE SIZE(approx acreage) ________

SITE SIZE(est in sq meters) ________

DEPTH OF CULTURAL DEPOSIT (if known) ________

ELEVATION	Meters	Feet
Max	_____	_____
Min	_____	_____

DEGREE OF SITE DESTRUCTION

- [X] relatively undisturbed
- [] moderate
- [] minor
- [] major

SITE DISTURBANCES

- [] bioturbation
- [] erosion
- [] mining/borrow pit
- [] agricultural
- [] residential/ commercial
- [] dredging/ditching
- [] site looting
- [] forest preparation or harvesting
- [] fill
- [] previous archaeological excavations
- [] ________
- [] ________
- [] ________

COLLECTION STRATEGY

[X] general [] selective [] controlled [] unknown [] ________

TYPE OF INVESTIGATION

- [X] surface collection
- [] shovel test
- [] extensive excavation
- [] test excavation
- [] water probe
- [] auger test
- [] coring
- [] remote sensing
- [] none
- [] ________
- [] unknown
- [] prop wash deflectors
- [] airlift
- [] waterlift
- [] ________

OPTIONAL NARRATIVE DESCRIPTION(If there is no published report, provide a short description of the site on a separate sheet)

OPTIONAL PHOTOGRAPHS OR SKETCHES OF DIAGNOSTIC OR UNIQUE ARTIFACTS (Please attach separate sheet(s))

FORM PREPARED BY RL Denson

ADDRESS FMNH

DATE 9-30-91

STATE OF FLORIDA
DEPARTMENT OF STATE
Division of Archives, History
and Records Management

[X] Original [ ] Update

Florida Master Site File / UNDERWATER ARCHAEOLOGICAL SITE FORM

SITE NUMBER 8MR 2061 SITE NAME Carter
USGS 7.5 MINUTE QUAD Lynne
NOTE: Please attach an 8.5" X 11" copy of the appropriate portion of the above map, with site location indicated.

TOWNSHIP/RANGE/SECTION:

Township	Range	Section
15S	23E	35

	X		

NOTE: The figure to the left represents a regular section (1 square mile); please indicate the location of your site by placing an X in the appropriate portion of the section. If the section is irregular or part of a land grant, please check below and disregard above instructions.

[ ] *Irregular section*
[ ] *Land grant* ______ *(name)*

UTM COORDINATES: Zone / Easting / Northing
17 / 404840 / 3233750
NOTE: If you are unfamiliar with calculating UTM measurements, leave blank.
LATITUDE: ___ ___ ___ LONGITUDE: ___ ___ ___
SITE SITUATION: (check one)
[X] inland [ ] estuary [ ] offshore
UNDERWATER ENVIRONMENT: (check one)
[ ] high energy marine [ ] low energy marine
[ ] lake or ponds [X] river, stream or creek
[ ] cavernous sink [ ] cavernous spring
[ ] intermittently flooded lands with a flowing water environment
[ ] intermittently flooded lands with a still water environment
SEDIMENT:
[ ] clay [ ] silt [X] sand [X] peat [ ] marine growth [ ] rock
LOCAL INFORMANT(inc. private collections)______
ADDRESS______
LOCAL INFORMANT(inc. private collections)______
ADDRESS______
SURVEY DATE 8-1-91 OTHER MASTER SITE FILE NUMBERS______
RECORDER(S)(list principal investigator first) R.L. Denson
Dept. of Anthropology, FMNH, University of Florida, Gainesville
ADDRESS Florida 32611
PROJECT NAME Oklawaha River Survey
TOPOGRAPHICAL SETTING floodplain
TYPE OF SITE(check one or more as appropriate):
[ ] indeterminate [ ] mound(s) [ ] prehistoric cemetery
[ ] unknown [ ] burial mound(s) [ ] prehistoric vessel
[ ] single artifact [ ] platform/temple mound(s) [ ] prehistoric refuse
[X] artifact scatter [ ] historic earthworks
[ ] lithic scatter [ ] canal [ ] shell ring
[ ] midden(s) [ ] mission [ ] redeposited
[ ] shell midden(s) [ ] prehistoric earthworks [ ] inundated terrestrial
[ ] shell works [ ] historic refuse
[ ] historic shipwreck [ ] wharves, docks, piers [ ] well
[ ] bridges (also covered bridges)
[ ] stone wall [ ] shrine
[ ] ______ [ ] ______ [ ] ______

THREATS TO SITE:
[ ] zoning [ ] transportation [ ] vandalism
[ ] development [ ] fill [ ] phosphate mining
[ ] deterioration [ ] dredge [ ] agriculture/plowing
[ ] borrowing [ ] logging [x] erosion

REMARKS:
[ ] preservation recommended [x] recommended for further testing
[ ] severely disturbed/destroyed [ ] ______

REPOSITORY FMNH accession number 91-75

BIBLIOGRAPHIC DATA Denson, RL Oklawaha River Survey Final Report

NOTE: Cite any reports referring specifically to this site. General background material need not be cited. Use Florida Anthropologist format.

CULTURAL CLASSIFICATION ______

CULTURAL PERIOD Early Archaic

CULTURAL MATERIAL (Check as many as apply):
[ ] aboriginal ceramics [ ] wood [ ] exotic items (mica, etc)
[ ] nonaboriginal ceramics [ ] metal [ ] petroglyphs
[x] lithics [ ] precious metal/coin(s) [ ] textile(s)
[x] worked bone [ ] misc/prehistoric
[ ] human bone/burial(s) [ ] glass [ ] misc/historic
[x] animal bone/ ~~unworked worked~~ [ ] brick/bldg materials [ ] trade bead(s)
[ ] ballast
[ ] shell food remains [ ] other human remains (e.g., hair) [ ] fossil
[ ] worked shell [ ] ______
[ ] plant remains [ ] ______

DIAGNOSTIC ARTIFACTS Edgefield Scraper, Pleistocene megafauna

SITE SIZE (approx acreage) ______ ELEVATION
SITE SIZE (est in sq meters) ? Meters Feet
DEPTH OF CULTURAL DEPOSIT (if known) ______ Max 10 Max ______
Min 8 Min ______

DEGREE OF SITE DESTRUCTION
[ ] relatively undisturbed [ ] minor
[x] moderate [ ] major

SITE DISTURBANCES
[ ] bioturbation [ ] dredging/ditching [ ] previous archaeological excavations
[x] erosion [ ] site looting
[ ] mining/borrow pit [ ] forest preparation or harvesting
[ ] agricultural [ ] ______
[ ] residential/commercial [ ] fill [ ] ______
[ ] ______

COLLECTION STRATEGY
[ ] general [ ] selective [x] controlled [ ] unknown [ ] ______

TYPE OF INVESTIGATION
[x] surface collection [ ] auger test [ ] unknown
[ ] shovel test [ ] coring [ ] prop wash deflectors
[ ] extensive excavation [ ] remote sensing [ ] airlift
[ ] test excavation [ ] none [ ] waterlift
[ ] water probe [ ] ______ [ ] ______

OPTIONAL NARRATIVE DESCRIPTION (If there is no published report, provide a short description of the site on a separate sheet)

OPTIONAL PHOTOGRAPHS OR SKETCHES OF DIAGNOSTIC OR UNIQUE ARTIFACTS (Please attach separate sheet(s))

FORM PREPARED BY RL Denson

ADDRESS FMNH

DATE 9-30-91

STATE OF FLORIDA
DEPARTMENT OF STATE
Division of Archives, History
and Records Management

[X] Original [ ] Update

Florida Master Site File / UNDERWATER ARCHAEOLOGICAL SITE FORM

SITE NUMBER 8 MR 2060 SITE NAME DiCarlo
USGS 7.5 MINUTE QUAD Lynne
NOTE: Please attach an 8.5" X 11" copy of the appropriate portion of the above map, with site location indicated.

TOWNSHIP/RANGE/SECTION:

Township	Range	Section
14S	23E	35

		X	

NOTE: The figure to the left represents a regular section (1 square mile); please indicate the location of your site by placing an X in the appropriate portion of the section.
If the section is irregular or part of a land grant, please check below and disregard above instructions.

[ ] *Irregular section*
[ ] *Land grant* ______________ *(name)*

UTM COORDINATES: Zone / Easting / Northing
17 / 405380 / 3233760
NOTE: If you are unfamiliar with calculating UTM measurements, leave blank.
LATITUDE: ____ ____ ____ LONGITUDE: ____ ____ ____
SITE SITUATION: (check one)
[X] inland [ ] estuary [ ] offshore
UNDERWATER ENVIRONMENT: (check one)
[ ] high energy marine [ ] low energy marine
[ ] lake or ponds [X] river, stream or creek
[ ] cavernous sink [ ] cavernous spring
[ ] intermittently flooded lands with a flowing water environment
[ ] intermittently flooded lands with a still water environment
SEDIMENT:
[ ] clay [ ] silt [X] sand [ ] peat [ ] marine growth [ ] rock
LOCAL INFORMANT(inc. private collections) Al Cone
ADDRESS owner of property
LOCAL INFORMANT(inc. private collections) ______
ADDRESS ______
SURVEY DATE 8-4-91 OTHER MASTER SITE FILE NUMBERS ______
RECORDER(S)(list principal investigator first) RL Denson
FMNH, Univ. of Florida, Dept. of Anthropology
ADDRESS Museum Road, Gainesville, FL 32634
PROJECT NAME Oklawaha River Survey
TOPOGRAPHICAL SETTING bottomlands hardwood

TYPE OF SITE(check one or more as appropriate):

[ ] indeterminate
[ ] unknown
[ ] single artifact
[ ] artifact scatter
[X] lithic scatter
[ ] midden(s)
[ ] shell midden(s)
[ ] shell works
[ ] historic shipwreck
[ ] stone wall
[ ] ______
[ ] mound(s)
[ ] burial mound(s)
[ ] platform/temple mound(s)
[ ] canal
[ ] mission
[ ] prehistoric earthworks
[ ] wharves, docks, piers
[ ] shrine
[ ] ______
[ ] prehistoric cemetery
[ ] prehistoric vessel
[ ] prehistoric refuse
[ ] historic earthworks
[ ] shell ring
[ ] redeposited
[ ] inundated terrestrial
[ ] historic refuse
[ ] well
[ ] bridges (also covered bridges)
[ ] ______

THREATS TO SITE:

[] zoning
[] development
[] deterioration
[] borrowing
[] transportation
[] fill
[] dredge
[] logging
[] vandalism
[] phosphate mining
[] agriculture/plowing
[X] erosion

REMARKS:

[] preservation recommended
[] recommended for further testing
[] severely disturbed/destroyed
[X] monitor

REPOSITORY FMNH accession number 91-74

BIBLIOGRAPHIC DATA Bray, S.B., 1985 Marion County Remembers Salty Crackers #3, Cracker Publication

NOTE: Cite any reports referring specifically to this site. General background material need not be cited. Use Florida Anthropologist format.

CULTURAL CLASSIFICATION ______

CULTURAL PERIOD Early Archaic

CULTURAL MATERIAL (Check as many as apply):

[] aboriginal ceramics
[X] nonaboriginal ceramics
[X] lithics
[] worked bone
[] human bone/burial(s)
[] animal bone/ unidentified bone
[] shell food remains
[] worked shell
[] plant remains
[] wood
[] metal
[] precious metal/ coin(s)
[] glass
[] brick/bldg materials
[] other human remains (e.g., hair)
[] exotic items (mica, etc)
[] petroglyphs
[] textile(s)
[] misc/prehistoric
[] misc/historic
[] trade bead(s)
[] ballast
[] fossil
[] ______
[] ______

DIAGNOSTIC ARTIFACTS Cobb-like perform (Powell, 1990, 18)

SITE SIZE (approx acreage) ______

SITE SIZE (est in sq meters) 10 sq m

DEPTH OF CULTURAL DEPOSIT (if known) ______

ELEVATION

	Meters	Feet
Max	18	
Min	8	

DEGREE OF SITE DESTRUCTION

[] relatively undisturbed
[X] moderate
[] minor
[] major

SITE DISTURBANCES

[] bioturbation
[X] erosion
[] mining/borrow pit
[] agricultural
[] residential/ commercial
[] dredging/ditching
[] site looting
[] forest preparation or harvesting
[] fill
[] previous archaeological excavations
[] ______
[] ______
[] ______

COLLECTION STRATEGY

[] general [] selective [X] controlled [] unknown [] ______

TYPE OF INVESTIGATION

[X] surface collection
[] shovel test
[] extensive excavation
[] test excavation
[] water probe
[] auger test
[] coring
[] remote sensing
[] none
[] ______
[] unknown
[] prop wash deflectors
[] airlift
[] waterlift
[] ______

OPTIONAL NARRATIVE DESCRIPTION (If there is no published report, provide a short description of the site on a separate sheet)

OPTIONAL PHOTOGRAPHS OR SKETCHES OF DIAGNOSTIC OR UNIQUE ARTIFACTS (Please attach separate sheet(s))

FORM PREPARED BY RL Denson

ADDRESS FMNH

DATE 9-30-91

STATE OF FLORIDA
DEPARTMENT OF STATE
Division of Archives, History
and Records Management

[X] Original [ ] Update

Florida Master Site File / UNDERWATER ARCHAEOLOGICAL SITE FORM

SITE NUMBER 8 MR 2067 SITE NAME Olsen
USGS 7.5 MINUTE QUAD Lynne
NOTE: Please attach an 8.5" X 11" copy of the appropriate portion of the above map, with site location indicated.

TOWNSHIP/RANGE/SECTION:

Township	Range	Section
14S	23E	35

			X

NOTE: The figure to the left represents a regular section (1 square mile); please indicate the location of your site by placing an X in the appropriate portion of the section.
If the section is irregular or part of a land grant, please check below and disregard above instructions.

[ ] *Irregular section*
[ ] *Land grant* ____________ *(name)*

UTM COORDINATES: Zone / Easting / Northing
17 / 405340 / 3233900
NOTE: If you are unfamiliar with calculating UTM measurements, leave blank.
LATITUDE: 29° 12' 97" LONGITUDE: 81 59' 47"
SITE SITUATION: (check one)
[X] inland [ ] estuary [ ] offshore
UNDERWATER ENVIRONMENT: (check one)
[ ] high energy marine [ ] low energy marine
[ ] lake or ponds [X] river, stream or creek
[ ] cavernous sink [ ] cavernous spring
[ ] intermittently flooded lands with a flowing water environment
[ ] intermittently flooded lands with a still water environment
SEDIMENT:
[ ] clay [ ] silt [X] sand [ ] peat [ ] marine growth [ ] rock
LOCAL INFORMANT(inc. private collections) Richard Olsen,
ADDRESS 713 SE Broadway, Ocala, FL 32670
LOCAL INFORMANT(inc. private collections) ____________
ADDRESS ____________
SURVEY DATE 8-4-91 OTHER MASTER SITE FILE NUMBERS ____________
RECORDER(S)(list principal investigator first) RL Denson
Univ. of Florida, FMNH, Dept. of Anthropology,
ADDRESS Museum Road, Gainesville, FL 32611
PROJECT NAME Oklawaha River Survey
TOPOGRAPHICAL SETTING floodplain

TYPE OF SITE(check one or more as appropriate):

[ ] indeterminate	[ ] mound(s)	[ ] prehistoric cemetery
[ ] unknown	[ ] burial mound(s)	[ ] prehistoric vessel
[ ] single artifact	[ ] platform/temple mound(s)	[ ] prehistoric refuse
[ ] artifact scatter		[ ] historic earthworks
[ ] lithic scatter	[ ] canal	[ ] shell ring
[ ] midden(s)	[ ] mission	[ ] redeposited
[ ] shell midden(s)	[ ] prehistoric earthworks	[ ] inundated terrestrial
[ ] shell works		[ ] historic refuse
[X] historic shipwreck	[ ] wharves, docks, piers	[ ] well
		[ ] bridges (also covered bridges)
[ ] stone wall	[ ] shrine	
[ ] ________	[ ] ________	[ ] ________

THREATS TO SITE:

[] zoning [] transportation [] vandalism
[] development [] fill [] phosphate mining
[] deterioration [] dredge [] agriculture/plowing
[] borrowing [] logging [] ____________

REMARKS:

[] preservation recommended [] recommended for further testing
[X] severely disturbed/destroyed [] ____________

REPOSITORY FMNH

BIBLIOGRAPHIC DATA Denson, RL, 1991. Oklawaha River Survey Final Report

NOTE: Cite any reports referring specifically to this site. General background material need not be cited. Use *Florida Anthropologist* format.

CULTURAL CLASSIFICATION ____________

CULTURAL PERIOD historic

CULTURAL MATERIAL(Check as many as apply):

[] aboriginal ceramics [] wood [] exotic items (mica, etc)
[] nonaboriginal ceramics [] metal [] petroglyphs
[] lithics [] precious metal/ coin(s) [] textile(s)
[] worked bone [] misc/prehistoric
[] human bone/burial(s) [] glass [] misc/historic
[] animal bone/ unidentified bone [] brick/bldg materials [] trade bead(s)
[] ballast
[] shell food remains [] other human remains (e.g., hair) [] fossil
[] worked shell [X] bòiler
[] plant remains []

DIAGNOSTIC ARTIFACTS ____________

SITE SIZE(approx acreage) ____________

SITE SIZE(est in sq meters) 20 sq m

DEPTH OF CULTURAL DEPOSIT (if known) ____________

ELEVATION	Meters	Feet
Max	10	
Min	8	

DEGREE OF SITE DESTRUCTION

[] relatively undisturbed [] minor
[] moderate [X] major

SITE DISTURBANCES

[] bioturbation [] dredging/ditching [] previous archaeological excavations
[X] erosion [] site looting
[] mining/borrow pit [] forest preparation or harvesting
[] agricultural []
[] residential/ commercial [] fill []
[]

COLLECTION STRATEGY

[] general [] selective [] controlled [] unknown [X] none

TYPE OF INVESTIGATION

[] surface collection [] auger test [] unknown
[] shovel test [] coring [] prop wash deflectors
[] extensive excavation [] remote sensing [] airlift
[] test excavation [] none [] waterlift
[] water probe [X] probe [X] record structure

OPTIONAL NARRATIVE DESCRIPTION(If there is no published report, provide a short description of the site on a separate sheet)

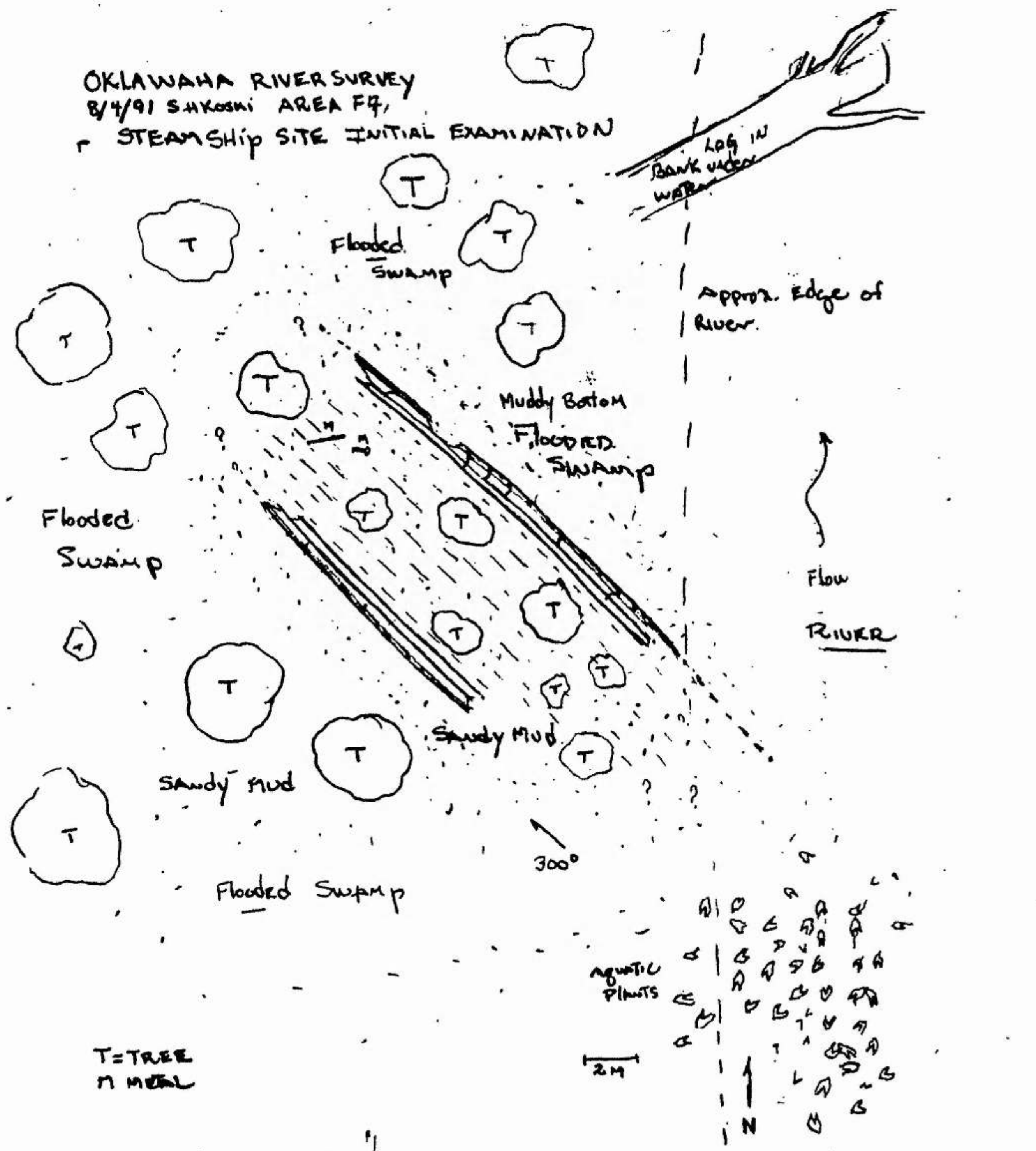
OPTIONAL PHOTOGRAPHS OR SKETCHES OF DIAGNOSTIC OR UNIQUE ARTIFACTS (Please attach separate sheet(s))

FORM PREPARED BY RL Denson

ADDRESS FMNH

DATE 9-30-91

OKLAWAHA RIVER SURVEY
8/4/91 S. HKOSKI AREA F7,
STEAMSHIP SITE INITIAL EXAMINATION

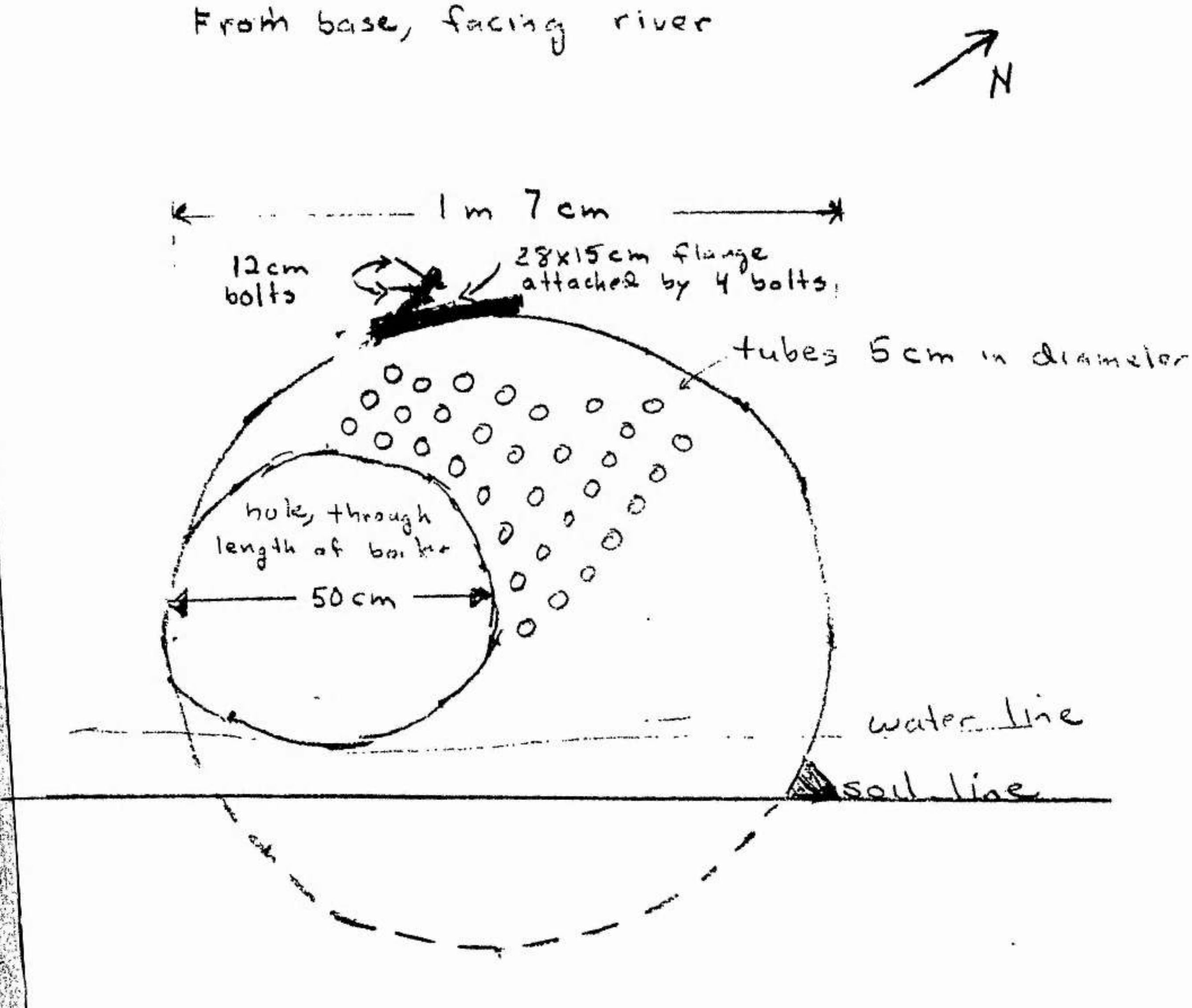


Two Sides of Hull Exposed
PORTION OF PORT + STARBOARD
L DECKING probed To flat surface under sand
but no planking exposed

SEE ATTACHED SHEET FOR MEASUREMENTS

Scale view of boiler from F-4 site

From base, facing river

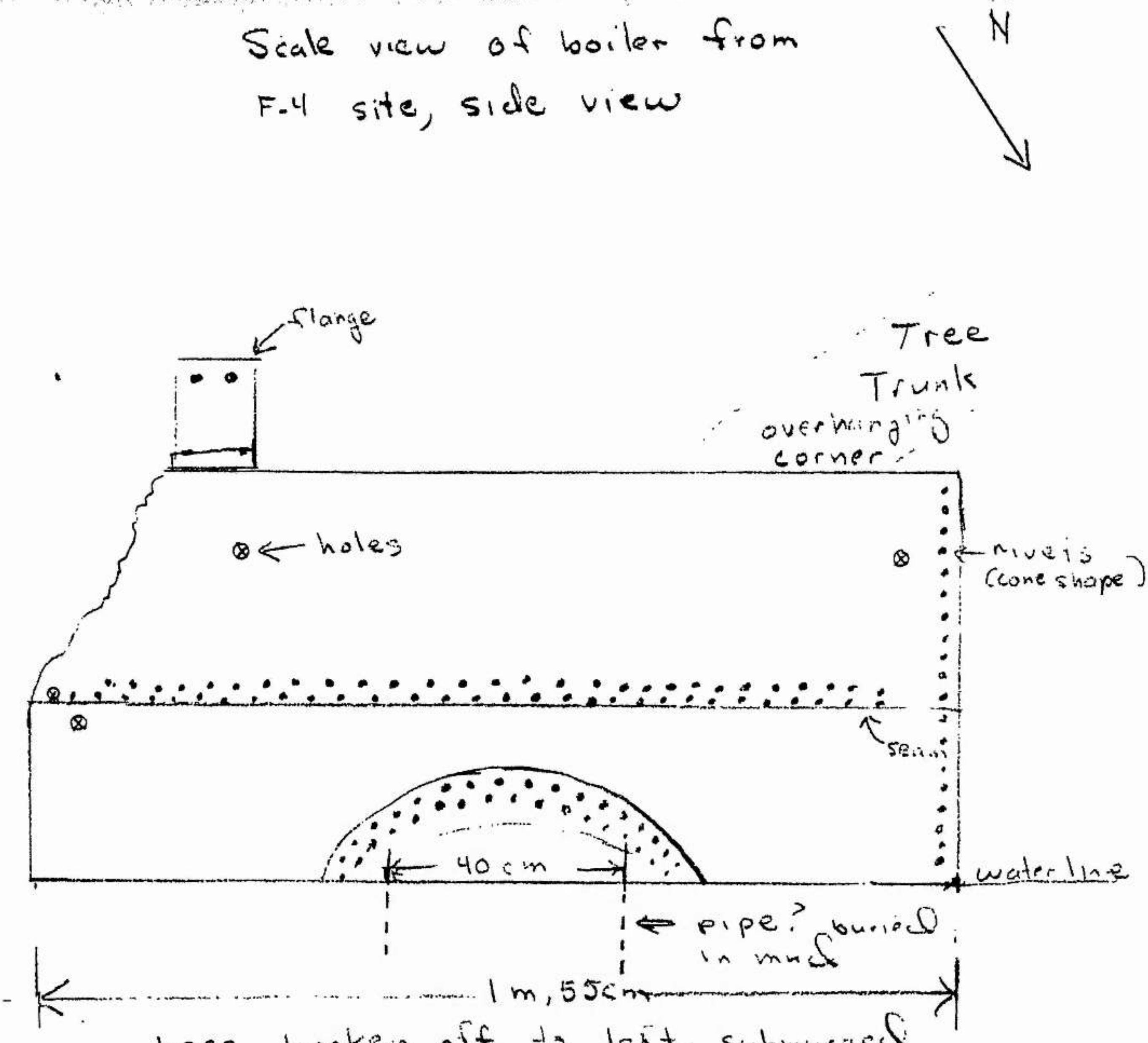


Scale 1cm = 10cm 1:10

F-4 8-4-91

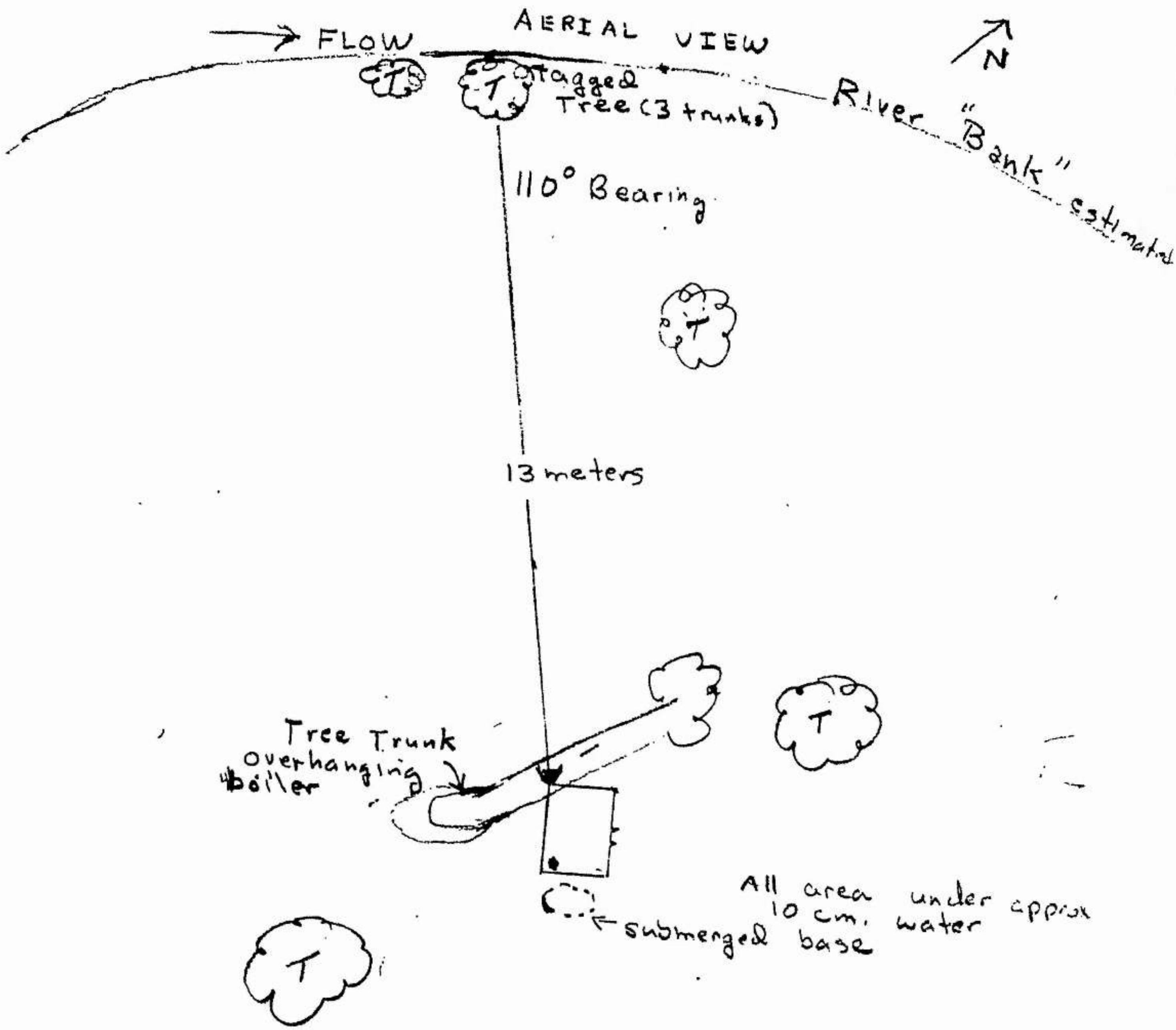
Mike Kellogg

Scale view of boiler from F-4 site, side view



base broken off to left, submurged except for small portion approx. 20 cm long

Scale 1cm = 10 cm 1:10
F-4 8-4-91
mike Kellogg



Scale 1 cm = 100 cm 1:100
F-4. 8-4-91
Mike Kellogg

STATE OF FLORIDA
DEPARTMENT OF STATE
Division of Archives, History
and Records Management

[X] Original [ ] Update

Florida Master Site File / UNDERWATER ARCHAEOLOGICAL SITE FORM

SITE NUMBER 8MR 2062 SITE NAME Backcurrent
USGS 7.5 MINUTE QUAD Lynne
NOTE: Please attach an 8.5" X 11" copy of the appropriate portion of the above map, with site location indicated.

TOWNSHIP/RANGE/SECTION:

Township	Range	Section
14S	23E	35

			X

NOTE: The figure to the left represents a regular section (1 square mile); please indicate the location of your site by placing an X in the appropriate portion of the section.
If the section is irregular or part of a land grant, please check below and disregard above instructions.

[ ] *Irregular section*
[ ] *Land grant* ______________ *(name)*

UTM COORDINATES: Zone / Easting / Northing
17 / 405580 / 3234000
NOTE: If you are unfamiliar with calculating UTM measurements, leave blank.
LATITUDE: ____ ____ ____ LONGITUDE: ____ ____ ____
SITE SITUATION: (check one)
[X] inland [ ] estuary [ ] offshore
UNDERWATER ENVIRONMENT: (check one)
[ ] high energy marine [ ] low energy marine
[ ] lake or ponds [X] river, stream or creek
[ ] cavernous sink [ ] cavernous spring
[ ] intermittently flooded lands with a flowing water environment
[ ] intermittently flooded lands with a still water environment
SEDIMENT:
[ ] clay [ ] silt [X] sand [X] peat [ ] marine growth [ ] rock
LOCAL INFORMANT(inc. private collections) ME Stallings, Rt 4, Box 890
ADDRESS Palatka, FL 32077
LOCAL INFORMANT(inc. private collections) Tony DiCarlo, Post Office
ADDRESS Box 248, Ft. McCoy, FL 32134
SURVEY DATE 7-30-91 OTHER MASTER SITE FILE NUMBERS ________
RECORDER(S)(list principal investigator first) RL Denson
FMNH, Univ. of Florida, Dept. of Anthropology
ADDRESS Museum Road, Gainesville, FL 32611
PROJECT NAME Oklawaha River Survey
TOPOGRAPHICAL SETTING bottomland hardwood
TYPE OF SITE(check one or more as appropriate):
[ ] indeterminate
[ ] unknown
[ ] single artifact
[ ] artifact scatter
[X] lithic scatter
[ ] midden(s)
[ ] shell midden(s)
[ ] shell works
[ ] historic shipwreck
[ ] stone wall
[ ] ________
[ ] mound(s)
[ ] burial mound(s)
[ ] platform/temple mound(s)
[ ] canal
[ ] mission
[ ] prehistoric earthworks
[ ] wharves, docks, piers
[ ] shrine
[ ] ________
[ ] prehistoric cemetery
[ ] prehistoric vessel
[ ] prehistoric refuse
[ ] historic earthworks
[ ] shell ring
[ ] redeposited
[ ] inundated terrestrial
[ ] historic refuse
[ ] well
[ ] bridges (also covered bridges)
[ ] ________

THREATS TO SITE:

[] zoning [] transportation [] vandalism
[] development [] fill [] phosphate mining
[] deterioration [] dredge [] agriculture/plowing
[] borrowing [] logging [X] erosion

REMARKS:

[] preservation recommended [] recommended for further testing
[] severely disturbed/destroyed [X] monitor

REPOSITORY FMNH accession number 91-76

BIBLIOGRAPHIC DATA Denson, RL, 1991. Oklawaha River Survey Final Report

NOTE: Cite any reports referring specifically to this site. General background material need not be cited. Use Florida Anthropologist format.

CULTURAL CLASSIFICATION

CULTURAL PERIOD bolen/greenbriar

CULTURAL MATERIAL(Check as many as apply):

[] aboriginal ceramics
[X] nonaboriginal ceramics
[X] lithics
[] worked bone
[] human bone/burial(s)
[] animal bone/ unidentified bone
[] shell food remains
[] worked shell
[] plant remains
[] wood
[] metal
[] precious metal/ coin(s)
[] glass
[] brick/bldg materials
[] other human remains (e.g., hair)
[] exotic items (mica, etc)
[] petroglyphs
[] textile(s)
[] misc/prehistoric
[] misc/historic
[] trade bead(s)
[] ballast
[] fossil
[] ________
[] ________

DIAGNOSTIC ARTIFACTS 1 turtleback scraper, 1 hammerstone, glazed european-made pottery

SITE SIZE(approx acreage)

SITE SIZE(est in sq meters) ?

DEPTH OF CULTURAL DEPOSIT (if known) -

ELEVATION

	Meters	Feet
Max	15	
Min	8	

DEGREE OF SITE DESTRUCTION

[] relatively undisturbed [] minor
[X] moderate [] major

SITE DISTURBANCES

[] bioturbation
[X] erosion
[] mining/borrow pit
[] agricultural
[] residential/ commercial
[] dredging/ditching
[] site looting
[] forest preparation or harvesting
[] fill
[] previous archaeological excavations
[] ________
[] ________
[] ________

COLLECTION STRATEGY

[] general [] selective [x] controlled [] unknown [] ________

TYPE OF INVESTIGATION

[X] surface collection
[] shovel test
[] extensive excavation
[] test excavation
[] water probe
[] auger test
[] coring
[] remote sensing
[] none
[] ________
[] unknown
[] prop wash deflectors
[] airlift
[] waterlift
[] ________

OPTIONAL NARRATIVE DESCRIPTION(If there is no published report, provide a short description of the site on a separate sheet)

OPTIONAL PHOTOGRAPHS OR SKETCHES OF DIAGNOSTIC OR UNIQUE ARTIFACTS (Please attach separate sheet(s))

FORM PREPARED BY RL Denson

ADDRESS FMNH

DATE 9-30-91

STATE OF FLORIDA
DEPARTMENT OF STATE
Division of Archives, History
and Records Management

[X] Original [ ] Update

Florida Master Site File / UNDERWATER ARCHAEOLOGICAL SITE FORM

SITE NUMBER 8MR 2063 SITE NAME Turkey Landing
USGS 7.5 MINUTE QUAD Lynne
NOTE: Please attach an 8.5" X 11" copy of the appropriate portion of the above map, with site location indicated.

TOWNSHIP/RANGE/SECTION:

Township	Range	Section
14S	23E	35

			X

NOTE: The figure to the left represents a regular section (1 square mile); please indicate the location of your site by placing an X in the appropriate portion of the section.
If the section is irregular or part of a land grant, please check below and disregard above instructions.

[ ] *Irregular section*
[ ] *Land grant* ______ *(name)*

UTM COORDINATES: Zone / Easting / Northing
17 /405650 /3234325
NOTE: If you are unfamiliar with calculating UTM measurements, leave blank.
LATITUDE: ___ ___ ___ LONGITUDE: ___ ___ ___
SITE SITUATION: (check one)
[X] inland [ ] estuary [ ] offshore
UNDERWATER ENVIRONMENT: (check one)
[ ] high energy marine [ ] low energy marine
[ ] lake or ponds [X] river, stream or creek
[ ] cavernous sink [ ] cavernous spring
[ ] intermittently flooded lands with a flowing water environment
[ ] intermittently flooded lands with a still water environment
SEDIMENT:
[ ] clay [ ] silt [X] sand [ ] peat [ ] marine growth [ ] rock
LOCAL INFORMANT(inc. private collections) ME Stallings, Rt 4, Box
ADDRESS 890, Palatka, Fl
LOCAL INFORMANT(inc. private collections) Tony Dicarlo,
ADDRESS Post Office Box 248, Ft. McCoy, FL 32134
SURVEY DATE 7-25-91 OTHER MASTER SITE FILE NUMBERS ______
RECORDER(S)(list principal investigator first) RL Denson
Univ. of Florida, FMNH, Dept. of Anthropology,
ADDRESS Museum Road, Gainesville, FL 32611
PROJECT NAME Oklawaha River Survey
TOPOGRAPHICAL SETTING bottomland hardwoods
TYPE OF SITE(check one or more as appropriate):

[ ] indeterminate	[ ] mound(s)	[ ] prehistoric cemetery
[ ] unknown	[ ] burial mound(s)	[ ] prehistoric vessel
[ ] single artifact	[ ] platform/temple mound(s)	[ ] prehistoric refuse
[X] artifact scatter		[ ] historic earthworks
[X] lithic scatter	[ ] canal	[ ] shell ring
[ ] midden(s)	[ ] mission	[ ] redeposited
[ ] shell midden(s)	[ ] prehistoric earthworks	[ ] inundated terrestrial
[ ] shell works		[ ] historic refuse
[ ] historic shipwreck	[ ] wharves, docks, piers	[ ] well
		[ ] bridges (also covered bridges)
[ ] stone wall	[ ] shrine	
[ ] ______	[ ] ______	[ ] ______

THREATS TO SITE:

[] zoning [] transportation [X] vandalism
[] development [] fill [] phosphate mining
[] deterioration [] dredge [] agriculture/plowing
[] borrowing [] logging [] ____________

REMARKS:

[] preservation recommended [] recommended for further testing
[] severely disturbed/destroyed [X] monitor

REPOSITORY FMNH accession number 91-77

BIBLIOGRAPHIC DATA Denson, RL, 1991. Oklawaha River Survey Final Report

NOTE: Cite any reports referring specifically to this site. General background material need not be cited. Use Florida Anthropologist format.

CULTURAL CLASSIFICATION ____________

CULTURAL PERIOD St. Johns

CULTURAL MATERIAL (Check as many as apply):

[X] aboriginal ceramics [] wood [] exotic items (mica, etc)
[] nonaboriginal ceramics [] metal [] petroglyphs
[X] lithics [] precious metal/coin(s) [] textile(s)
[X] worked bone [] misc/prehistoric
[] human bone/burial(s) [] glass [] misc/historic
[X] animal bone/unidentified bone [] brick/bldg materials [] trade bead(s)
[] ballast
[] shell food remains [] other human remains (e.g., hair) [] fossil
[] worked shell [] ____________
[] plant remains [] ____________

DIAGNOSTIC ARTIFACTS Dunns Creek Red

SITE SIZE (approx acreage) 1 acre

SITE SIZE (est in sq meters) ____________

DEPTH OF CULTURAL DEPOSIT (if known) ____________

ELEVATION

	Meters	Feet
Max	10	
Min	8	

DEGREE OF SITE DESTRUCTION

[] relatively undisturbed [] minor
[] moderate [X] major

SITE DISTURBANCES

[] bioturbation [] dredging/ditching [] previous archaeological excavations
[X] erosion [X] site looting
[] mining/borrow pit [] forest preparation or harvesting
[] agricultural [] ____________
[] residential/commercial [] fill [] ____________
[] ____________

COLLECTION STRATEGY

[] general [] selective [X] controlled [] unknown [] ____________

TYPE OF INVESTIGATION

[X] surface collection [] auger test [] unknown
[] shovel test [] coring [] prop wash deflectors
[] extensive excavation [] remote sensing [] airlift
[] test excavation [] none [] waterlift
[] water probe [] ____________ [] ____________

OPTIONAL NARRATIVE DESCRIPTION (If there is no published report, provide a short description of the site on a separate sheet)

OPTIONAL PHOTOGRAPHS OR SKETCHES OF DIAGNOSTIC OR UNIQUE ARTIFACTS (Please attach separate sheet(s))

FORM PREPARED BY RL Denson

ADDRESS FMNH

DATE 9-30-91

STATE OF FLORIDA
DEPARTMENT OF STATE
Division of Archives, History
and Records Management

[ ] Original [X] Update

Florida Master Site File / UNDERWATER ARCHAEOLOGICAL SITE FORM

SITE NUMBER 8 MR 1869 SITE NAME ____________
USGS 7.5 MINUTE QUAD Lynne
NOTE: Please attach an 8.5" X 11" copy of the appropriate portion of the above map, with site location indicated.

TOWNSHIP/RANGE/SECTION:

Township	Range	Section
14S	23E	25

NOTE: The figure to the left represents a regular section (1 square mile); please indicate the location of your site by placing an X in the appropriate portion of the section.
If the section is irregular or part of a land grant, please check below and disregard above instructions.

[X] *Irregular section*
[ ] *Land grant* ____________ *(name)*

UTM COORDINATES: Zone / Easting / Northing
____ / ____ / ____
NOTE: If you are unfamiliar with calculating UTM measurements, leave blank.
LATITUDE: ____ ____ ____ LONGITUDE: ____ ____ ____
SITE SITUATION: (check one)
[X] inland [ ] estuary [ ] offshore
UNDERWATER ENVIRONMENT: (check one)
[ ] high energy marine [ ] low energy marine
[ ] lake or ponds [X] river, stream or creek
[ ] cavernous sink [ ] cavernous spring
[ ] intermittently flooded lands with a flowing water environment
[ ] intermittently flooded lands with a still water environment
SEDIMENT:
[ ] clay [ ] silt [X] sand [ ] peat [ ] marine growth [ ] rock
LOCAL INFORMANT(inc. private collections) ____________
ADDRESS ____________
LOCAL INFORMANT(inc. private collections) ____________
ADDRESS ____________
SURVEY DATE 8-4-91 OTHER MASTER SITE FILE NUMBERS ____________
RECORDER(S)(list principal investigator first) RL DEnson
FMNH, Dept. of Anthropology,
ADDRESS Museum Road, Univ. of FLorida, Gainesville, FL
PROJECT NAME Oklawaha River Survey
TOPOGRAPHICAL SETTING ____________

TYPE OF SITE(check one or more as appropriate):
[ ] indeterminate [ ] mound(s) [ ] prehistoric cemetery
[ ] unknown [ ] burial mound(s) [ ] prehistoric vessel
[ ] single artifact [ ] platform/temple mound(s) [ ] prehistoric refuse
[ ] artifact scatter [ ] historic earthworks
[X] lithic scatter [ ] canal [ ] shell ring
[ ] midden(s) [ ] mission [ ] redeposited
[ ] shell midden(s) [ ] prehistoric earthworks [ ] inundated terrestrial
[ ] shell works [ ] historic refuse
[ ] historic shipwreck [ ] wharves, docks, piers [ ] well
[ ] bridges (also covered bridges)
[ ] stone wall [ ] shrine
[ ] ____________ [ ] ____________ [ ] ____________

THREATS TO SITE:

[] zoning [] transportation [] vandalism
[] development [] fill [] phosphate mining
[] deterioration [] dredge [] agriculture/plowing
[] borrowing [] logging [] none

REMARKS:

[] preservation recommended [] recommended for further testing
[] severely disturbed/destroyed [] ______

REPOSITORY ______

BIBLIOGRAPHIC DATA ______

NOTE: Cite any reports referring specifically to this site. General background material need not be cited. Use *Florida Anthropologist* format.

CULTURAL CLASSIFICATION ______

CULTURAL PERIOD ______

CULTURAL MATERIAL(Check as many as apply):

[] aboriginal ceramics
[] nonaboriginal ceramics
[] lithics
[] worked bone
[] human bone/burial(s)
[] animal bone/ unidentified bone
[] shell food remains
[] worked shell
[] plant remains
[] wood
[] metal
[] precious metal/ coin(s)
[] glass
[] brick/bldg materials
[] other human remains (e.g., hair)
[] exotic items (mica, etc)
[] petroglyphs
[] textile(s)
[] misc/prehistoric
[] misc/historic
[] trade bead(s)
[] ballast
[] fossil
[] ______
[] ______

DIAGNOSTIC ARTIFACTS ______

SITE SIZE(approx acreage) ______

SITE SIZE(est in sq meters) ______

DEPTH OF CULTURAL DEPOSIT (if known) ______

ELEVATION

	Meters	Feet
Max	______	______
Min	______	______

DEGREE OF SITE DESTRUCTION

[X] relatively undisturbed [] minor
[] moderate [] major

SITE DISTURBANCES

[] bioturbation
[] erosion
[] mining/borrow pit
[] agricultural
[] residential/ commercial
[] dredging/ditching
[] site looting
[] forest preparation or harvesting
[] fill
[] previous archaeological excavations
[] ______
[] ______
[] ______

COLLECTION STRATEGY

[X] general [] selective [] controlled [] unknown [] ______

TYPE OF INVESTIGATION

[X] surface collection
[] shovel test
[] extensive excavation
[] test excavation
[] water probe
[] auger test
[] coring
[] remote sensing
[] none
[] ______
[] unknown
[] prop wash deflectors
[] airlift
[] waterlift
[] ______

OPTIONAL NARRATIVE DESCRIPTION(If there is no published report, provide a short description of the site on a separate sheet)

OPTIONAL PHOTOGRAPHS OR SKETCHES OF DIAGNOSTIC OR UNIQUE ARTIFACTS (Please attach separate sheet(s))

FORM PREPARED BY RL Denson

ADDRESS FMNH

DATE 9-30-91

STATE OF FLORIDA
DEPARTMENT OF STATE
Division of Archives, History
and Records Management

[X] Original [ ] Update

Florida Master Site File / UNDERWATER ARCHAEOLOGICAL SITE FORM

SITE NUMBER 8MR2064 SITE NAME Conner Landing
USGS 7.5 MINUTE QUAD Lynne
NOTE: Please attach an 8.5" X 11" copy of the appropriate portion of the above map, with site location indicated.

TOWNSHIP/RANGE/SECTION:

Township	Range	Section
14S	23E	36

NOTE: The figure to the left represents a regular section (1 square mile): please indicate the location of your site by placing an X in the appropriate portion of the section.
If the section is irregular or part of a land grant, please check below and disregard above instructions.

X *Irregular section*
[ ] *Land grant* ______ *(name)*

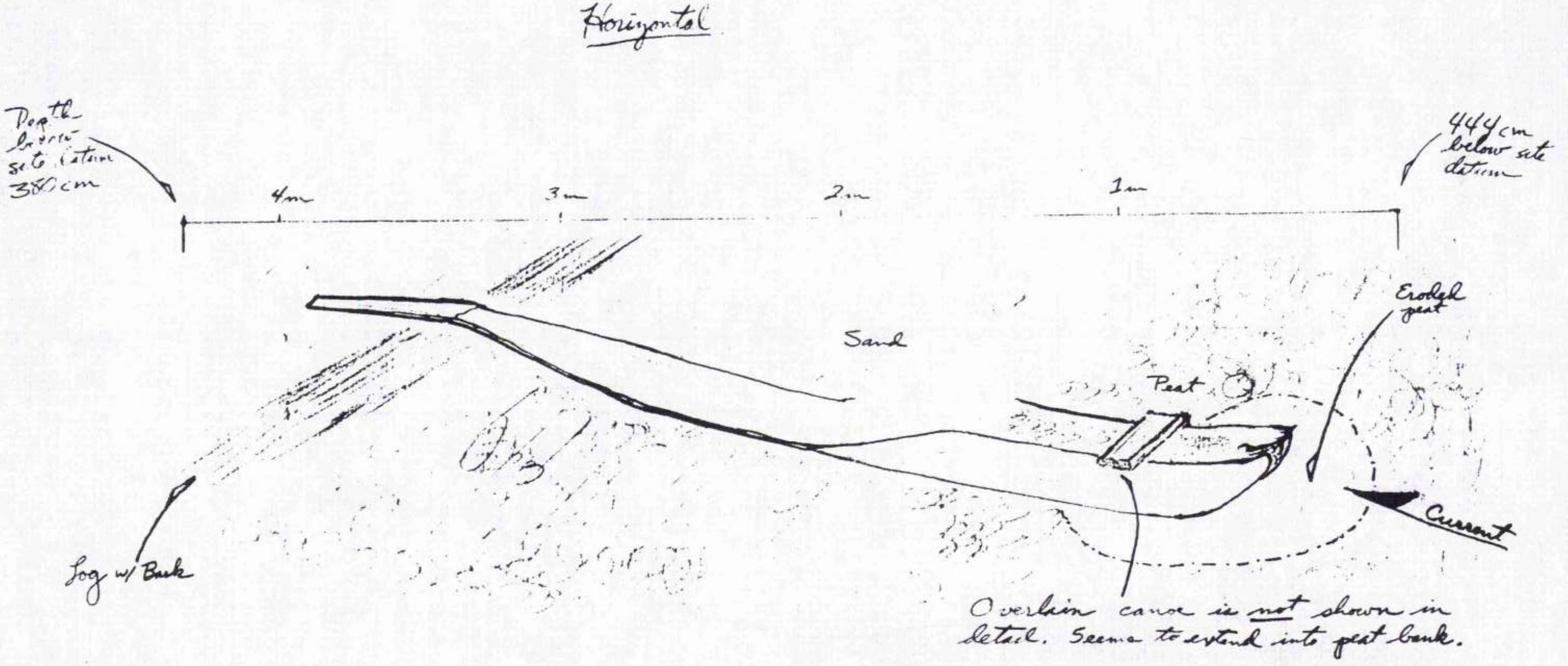
UTM COORDINATES: Zone / Easting / Northing
17 / 405950 / 3234600
NOTE: If you are unfamiliar with calculating UTM measurements, leave blank.
LATITUDE: ____ ____ ____ LONGITUDE: ____ ____ ____
SITE SITUATION: (check one)
[x] inland [ ] estuary [ ] offshore
UNDERWATER ENVIRONMENT: (check one)
[ ] high energy marine [ ] low energy marine
[ ] lake or ponds [x] river, stream or creek
[ ] cavernous sink [ ] cavernous spring
[ ] intermittently flooded lands with a flowing water environment
[ ] intermittently flooded lands with a still water environment
SEDIMENT:
[ ] clay [ ] silt [x] sand [x] peat [ ] marine growth [ ] rock
LOCAL INFORMANT(inc. private collections) Ben Waller , 5725
ADDRESS Abshier Blvd., Belleview, FL
LOCAL INFORMANT(inc. private collections) ______
ADDRESS ______
SURVEY DATE 8/2 & 3/91 OTHER MASTER SITE FILE NUMBERS 8 MR 97
RECORDER(S)(list principal investigator first) RL Denson
Dept. of Anthrolopogy
ADDRESS FMNH , Museum Road, Univ. of Florida, Gainesville, FL 32611
PROJECT NAME Olawaha River Survey
TOPOGRAPHICAL SETTING bottomland hardwoods

TYPE OF SITE(check one or more as appropriate):

[ ] indeterminate
[ ] unknown
[ ] single artifact
[ ] artifact scatter
[ ] lithic scatter
[ ] midden(s)
[ ] shell midden(s)
[ ] shell works
[ ] historic shipwreck
[ ] stone wall
[ ] ______

[ ] mound(s)
[ ] burial mound(s)
[ ] platform/temple mound(s)
[ ] canal
[x] mission (?)
[ ] prehistoric earthworks
[ ] wharves, docks, piers
[ ] shrine
[x] steamboat landing

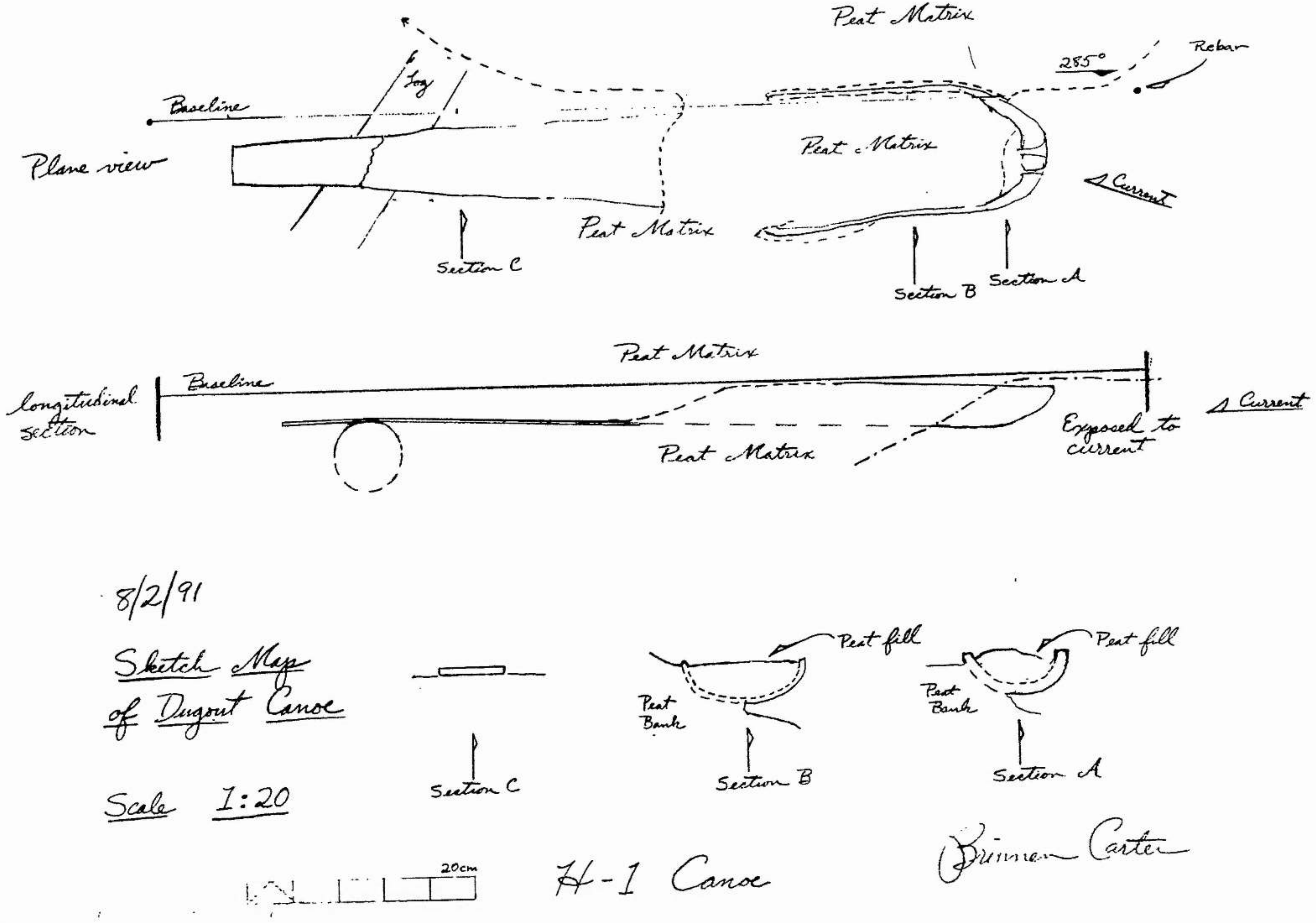
[ ] prehistoric cemetery
[ ] prehistoric vessel
[ ] prehistoric refuse
[ ] historic earthworks
[ ] shell ring
[ ] redeposited
[ ] inundated terrestrial
[x] historic refuse
[ ] well
[ ] bridges (also covered bridges)
[x] pre-historic canoe



3-D Plot of Canoe points Adjusted to reflect true gradient

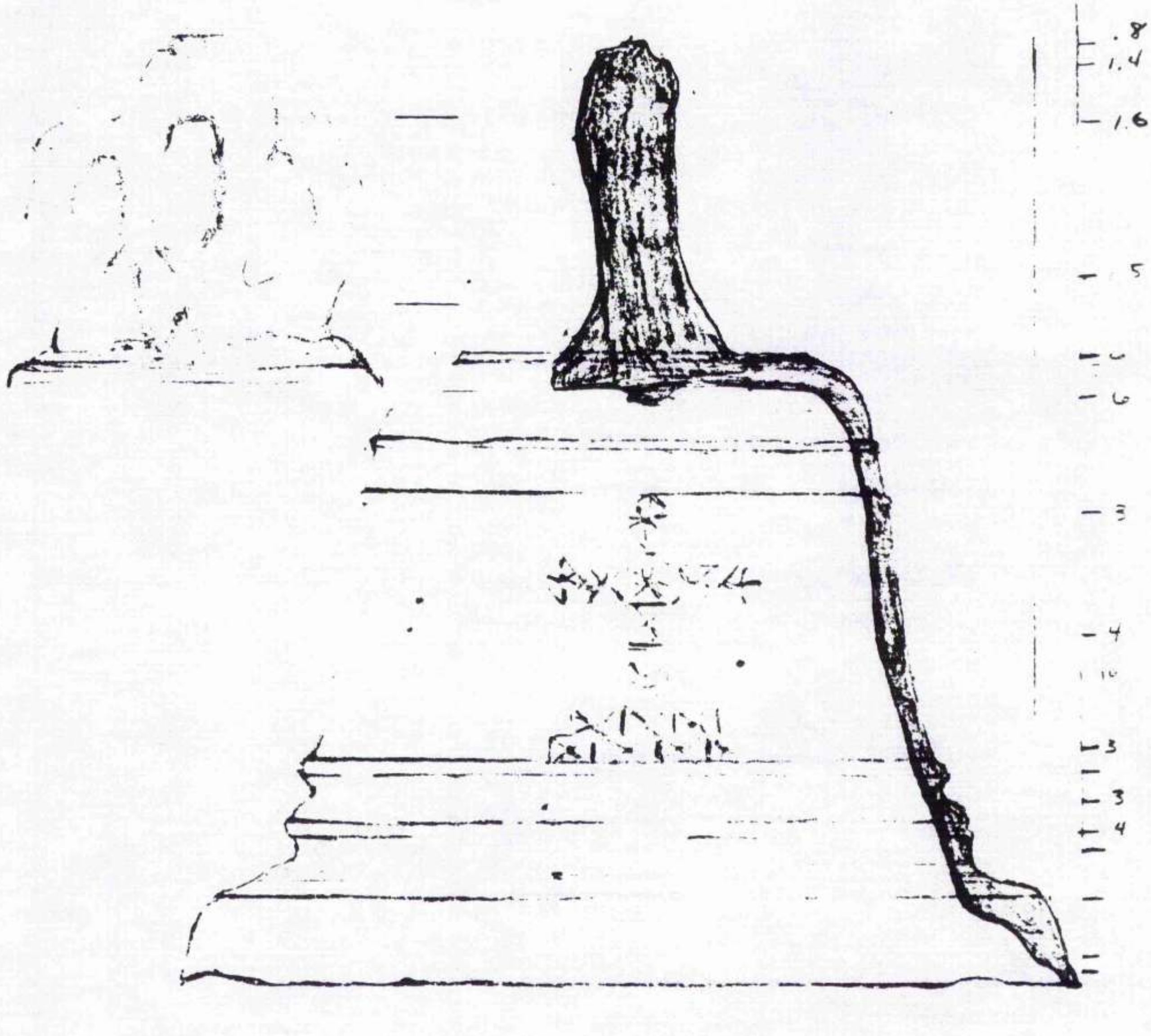
8/3/91

Brunner Carter



Peat Matrix
Rebar
285°
Log
Baseline
Plane view
Peat Matrix
Current
Peat Matrix
Section C
Section B
Section A
Peat Matrix
Baseline
longitudinal section
Current
Exposed to current
Peat Matrix
8/2/91
Sketch Map of Dugout Canoe
Scale 1:20
Peat fill
Peat fill
Peat Bank
Peat Bank
Section C
Section B
Section A
20cm
H-1 Canoe
Brinnen Carter

diameter 28.2 cm
length oa 30.2 cm
weight 13.64 Kg (30 lbs)



Bell Profile - Spanish Mission Bell (BIS) from H_1
9/2/91

Scale 1:2

BenRhD ... Spanish Mission Bell from H_1
9/2/91

scale 1:2

STATE OF FLORIDA
DEPARTMENT OF STATE
Division of Archives, History
and Records Management

[X] Original [ ] Update

Florida Master Site File / UNDERWATER ARCHAEOLOGICAL SITE FORM

SITE NUMBER 8MR2077 SITE NAME Strouds Creek
USGS 7.5 MINUTE QUAD Fort McCoy
NOTE: Please attach an 8.5" X 11" copy of the appropriate portion of the above map, with site location indicated.

TOWNSHIP/RANGE/SECTION:

Township	Range	Section
14S	23E	24

NOTE: The figure to the left represents a regular section (1 square mile); please indicate the location of your site by placing an X in the appropriate portion of the section.
If the section is irregular or part of a land grant, please check below and disregard above instructions.

X *Irregular section*
_ *Land grant* ________ (name)

UTM COORDINATES: Zone 17 / Easting 407280 / Northing 3237300

NOTE: If you are unfamiliar with calculating UTM measurements, leave blank.

LATITUDE: ___ ___ ___ LONGITUDE: ___ ___ ___

SITE SITUATION: (check one)
[X] inland [ ] estuary [ ] offshore

UNDERWATER ENVIRONMENT: (check one)
[ ] high energy marine [ ] low energy marine
[ ] lake or ponds [X] river, stream or creek
[ ] cavernous sink [ ] cavernous spring
[ ] intermittently flooded lands with a flowing water environment
[ ] intermittently flooded lands with a still water environment

SEDIMENT:
[ ] clay [ ] silt [X] sand [ ] peat [ ] marine growth [ ] rock

LOCAL INFORMANT(inc. private collections) M E Stallings, Rt 4,
ADDRESS Box 890, Palatka, FL 32077
LOCAL INFORMANT(inc. private collections) Tony Dicarlo, Post
ADDRESS Office Box 248, Fort McCoy, Fl 32134
SURVEY DATE 8-11-91 OTHER MASTER SITE FILE NUMBERS 8 MR 2068
RECORDER(S)(list principal investigator first) RL Denson
Dept. ofAnthropology, FMNH, Univ. of Florida
ADDRESS Museum Road, Gainesville, FL 32611
PROJECT NAME Oklawaha River Survey
TOPOGRAPHICAL SETTING Floodplain

TYPE OF SITE(check one or more as appropriate):

[ ] indeterminate [ ] mound(s) [ ] prehistoric cemetery
[ ] unknown [ ] burial mound(s) [ ] prehistoric vessel
[ ] single artifact [ ] platform/temple mound(s) [ ] prehistoric refuse
[ ] artifact scatter [ ] historic earthworks
[ ] lithic scatter [ ] canal [ ] shell ring
[ ] midden(s) [ ] mission [ ] redeposited
[X] shell midden(s) [ ] prehistoric earthworks [ ] inundated terrestrial
[ ] shell works [ ] historic refuse
[ ] historic shipwreck [ ] wharves, docks, piers [ ] well
[ ] bridges (also covered bridges)
[ ] stone wall [ ] shrine
[ ] ____ [ ] ____ [ ] ____

THREATS TO SITE:

[ ] zoning
[ ] development
[ ] deterioration
[ ] borrowing
[ ] transportation
[ ] fill
[ ] dredge
[ ] logging
[ ] vandalism
[ ] phosphate mining
[ ] agriculture/plowing
[X] erosion

REMARKS:

[ ] preservation recommended [ ] recommended for further testing
[ ] severely disturbed/destroyed [X] monitor

REPOSITORY FMNH accession number 91-85

BIBLIOGRAPHIC DATA Denson, RL, 1991. Oklawaha River Survey Final Report

NOTE: Cite any reports referring specifically to this site. General background material need not be cited. Use *Florida Anthropologist* format.

CULTURAL CLASSIFICATION

CULTURAL PERIOD St Johns

CULTURAL MATERIAL(Check as many as apply):

[X] aboriginal ceramics
[ ] nonaboriginal ceramics
[X] lithics
[ ] worked bone
[ ] human bone/burial(s)
[ ] animal bone/ unidentified bone
[ ] shell food remains
[ ] worked shell
[ ] plant remains
[ ] wood
[ ] metal
[ ] precious metal/ coin(s)
[ ] glass
[ ] brick/bldg materials
[ ] other human remains (e.g., hair)
[ ] exotic items (mica, etc)
[ ] petroglyphs
[ ] textile(s)
[ ] misc/prehistoric
[ ] misc/historic
[ ] trade bead(s)
[ ] ballast
[ ] fossil
[ ]
[ ]

DIAGNOSTIC ARTIFACTS St Johns Plain, sand tempered plain

SITE SIZE(approx acreage)

SITE SIZE(est in sq meters) 12 m

DEPTH OF CULTURAL DEPOSIT (if known) less than 2 m

ELEVATION

	Meters	Feet
Max	10	
Min	8	

DEGREE OF SITE DESTRUCTION

[ ] relatively undisturbed
[ ] moderate
[ ] minor
[X] major

SITE DISTURBANCES

[ ] bioturbation
[X] erosion
[ ] mining/borrow pit
[ ] agricultural
[ ] residential/ commercial
[ ] dredging/ditching
[ ] site looting
[ ] forest preparation or harvesting
[ ] fill
[ ] previous archaeological excavations
[ ]
[ ]
[ ]

COLLECTION STRATEGY

[X] general [ ] selective [ ] controlled [ ] unknown [ ]

TYPE OF INVESTIGATION

[X] surface collection
[ ] shovel test
[ ] extensive excavation
[ ] test excavation
[ ] water probe
[ ] auger test
[ ] coring
[ ] remote sensing
[ ] none
[ ]
[ ] unknown
[ ] prop wash deflectors
[ ] airlift
[ ] waterlift
[ ]

OPTIONAL NARRATIVE DESCRIPTION(If there is no published report, provide a short description of the site on a separate sheet)

OPTIONAL PHOTOGRAPHS OR SKETCHES OF DIAGNOSTIC OR UNIQUE ARTIFACTS (Please attach separate sheet(s))

FORM PREPARED BY RL Denson

ADDRESS FMNH

DATE 9-30-91

STATE OF FLORIDA
DEPARTMENT OF STATE
Division of Archives, History
and Records Management

[X] Original [ ] Update

Florida Master Site File / UNDERWATER ARCHAEOLOGICAL SITE FORM

SITE NUMBER 8MR 2065 SITE NAME Stallings
USGS 7.5 MINUTE QUAD Fort McCoy
NOTE: Please attach an 8.5" X 11" copy of the appropriate portion of the above map, with site location indicated.

TOWNSHIP/RANGE/SECTION:

Township	Range	Section
14S	23E	24

NOTE: The figure to the left represents a regular section (1 square mile); please indicate the location of your site by placing an X in the appropriate portion of the section.
If the section is irregular or part of a land grant, please check below and disregard above instructions.

[ ] *Irregular section*
[ ] *Land grant* ______ *(name)*

UTM COORDINATES: Zone / Easting / Northing
17 / 407500 / 3237400
NOTE: If you are unfamiliar with calculating UTM measurements, leave blank.
LATITUDE: ____ ____ ____ LONGITUDE: ____ ____ ____
SITE SITUATION: (check one)
[X] inland [ ] estuary [ ] offshore
UNDERWATER ENVIRONMENT: (check one)
[ ] high energy marine [ ] low energy marine
[ ] lake or ponds [X] river, stream or creek
[ ] cavernous sink [ ] cavernous spring
[ ] intermittently flooded lands with a flowing water environment
[ ] intermittently flooded lands with a still water environment
SEDIMENT:
[ ] clay [ ] silt [X] sand [ ] peat [ ] marine growth [ ] rock
LOCAL INFORMANT(inc. private collections) ME Stallings,
ADDRESS Rt 4, Box 890, Palatka, FL 32077
LOCAL INFORMANT(inc. private collections) Tony DiCarlo
ADDRESS Post Office Box 248, Ft. McCoy, FL 32134
SURVEY DATE 8-6-91 OTHER MASTER SITE FILE NUMBERS 8-MR 2068
RECORDER(S)(list principal investigator first) RL Denson
Univ. of Florida, FMNH, Dept. of Anthropology,
ADDRESS Museum Road, Gainesville, FL 32611
PROJECT NAME Oklawaha River Survey
TOPOGRAPHICAL SETTING floodplain hardwoods

TYPE OF SITE(check one or more as appropriate):

[ ] indeterminate
[ ] unknown
[ ] single artifact
[ ] artifact scatter
[X] lithic scatter
[ ] midden(s)
[ ] shell midden(s)
[ ] shell works
[ ] historic shipwreck
[ ] stone wall
[ ] ______
[ ] mound(s)
[ ] burial mound(s)
[ ] platform/temple mound(s)
[ ] canal
[ ] mission
[ ] prehistoric earthworks
[ ] wharves, docks, piers
[ ] shrine
[ ] ______
[ ] prehistoric cemetery
[ ] prehistoric vessel
[ ] prehistoric refuse
[ ] historic earthworks
[ ] shell ring
[ ] redeposited
[ ] inundated terrestrial
[ ] historic refuse
[ ] well
[ ] bridges (also covered bridges)
[ ] ______

THREATS TO SITE:

[ ] zoning [ ] transportation [ ] vandalism
[ ] development [ ] fill [ ] phosphate mining
[ ] deterioration [ ] dredge [ ] agriculture/plowing
[ ] borrowing [ ] logging [X] erosion

REMARKS:

[ ] preservation recommended [ ] recommended for further testing
[ ] severely disturbed/destroyed [X] monitor

REPOSITORY FMNH accession number 91-80

BIBLIOGRAPHIC DATA Denson, RL, 1991. Oklawaha River Survey Final Report

NOTE: Cite any reports referring specifically to this site. General background material need not be cited. Use Florida Anthropologist format.

CULTURAL CLASSIFICATION

CULTURAL PERIOD bolen/greenbriar

CULTURAL MATERIAL(Check as many as apply):

[ ] aboriginal ceramics [ ] wood [ ] exotic items (mica, etc)
[ ] nonaboriginal ceramics [ ] metal [ ] petroglyphs
[X] lithics [ ] precious metal/ coin(s) [ ] textile(s)
[ ] worked bone [ ] misc/prehistoric
[ ] human bone/burial(s) [ ] glass [ ] misc/historic
[X] animal bone/ ~~xxxxxxxxxxxxxxxxxxx~~ [ ] brick/bldg materials [ ] trade bead(s)
[ ] ballast
[ ] shell food remains [ ] other human remains (e.g., hair) [ ] fossil
[ ] worked shell [X] amulet
[ ] plant remains [X] ivory

DIAGNOSTIC ARTIFACTS unifacial tools

SITE SIZE(approx acreage)

SITE SIZE(est in sq meters) 20 sq m

DEPTH OF CULTURAL DEPOSIT (if known)

ELEVATION

	Meters	Feet
Max	10	
Min	8	

DEGREE OF SITE DESTRUCTION

[ ] relatively undisturbed [ ] minor
[X] moderate [ ] major

SITE DISTURBANCES

[ ] bioturbation [ ] dredging/ditching [ ] previous archaeological excavations
[X] erosion [ ] site looting
[ ] mining/borrow pit [ ] forest preparation or harvesting
[ ] agricultural [ ]
[ ] residential/ commercial [ ] fill [ ]
[ ]

COLLECTION STRATEGY

[ ] general [ ] selective [X] controlled [ ] unknown [ ]

TYPE OF INVESTIGATION

[X] surface collection [ ] auger test [ ] unknown
[ ] shovel test [ ] coring [ ] prop wash deflectors
[ ] extensive excavation [ ] remote sensing [ ] airlift
[ ] test excavation [ ] none [ ] waterlift
[ ] water probe [ ] [ ]

OPTIONAL NARRATIVE DESCRIPTION(If there is no published report, provide a short description of the site on a separate sheet)

OPTIONAL PHOTOGRAPHS OR SKETCHES OF DIAGNOSTIC OR UNIQUE ARTIFACTS (Please attach separate sheet(s))

FORM PREPARED BY RL Denson

ADDRESS FMNH

DATE 9-30-91

STATE OF FLORIDA
DEPARTMENT OF STATE
Division of Archives, History
and Records Management

[X] Original [ ] Update

Florida Master Site File / UNDERWATER ARCHAEOLOGICAL SITE FORM

SITE NUMBER 8 MR 2068 SITE NAME Durisoe
USGS 7.5 MINUTE QUAD Fort McCoy
NOTE: Please attach an 8.5" X 11" copy of the appropriate portion of the above map, with site location indicated.

TOWNSHIP/RANGE/SECTION:

Township	Range	Section
14S	23E	24

NOTE: The figure to the left represents a regular section (1 square mile); please indicate the location of your site by placing an X in the appropriate portion of the section.
If the section is irregular or part of a land grant, please check below and disregard above instructions.

[X] *Irregular section*
[ ] *Land grant* ____________ *(name)*

UTM COORDINATES: Zone 17 / Easting 407540 / Northing 3237420
NOTE: If you are unfamiliar with calculating UTM measurements, leave blank.
LATITUDE: ____ ____ ____ LONGITUDE: ____ ____ ____
SITE SITUATION: (check one)
[X] inland [ ] estuary [ ] offshore
UNDERWATER ENVIRONMENT: (check one)
[ ] high energy marine [ ] low energy marine
[ ] lake or ponds [X] river, stream or creek
[ ] cavernous sink [ ] cavernous spring
[ ] intermittently flooded lands with a flowing water environment
[ ] intermittently flooded lands with a still water environment
SEDIMENT:
[ ] clay [ ] silt [X] sand [ ] peat [ ] marine growth [ ] rock
LOCAL INFORMANT(inc. private collections) ME Stallings,
ADDRESS Rt 4, Box 890, Palatka, FL 32077
LOCAL INFORMANT(inc. private collections) Tony DiCarlo,
ADDRESS Post Office Box 248, Ft. McCoy, FL 32134
SURVEY DATE 8-6-91 OTHER MASTER SITE FILE NUMBERS 8 MR 2065 & 8 MR 2077
RECORDER(S)(list principal investigator first) RL Denson
FMNH, Univ. of Florida, Dept. of Anthropology,
ADDRESS Museum Road, Gainesville, FL 32611
PROJECT NAME Oklawaha River Survey
TOPOGRAPHICAL SETTING floodplain hardwoods

TYPE OF SITE(check one or more as appropriate):

[ ] indeterminate	[ ] mound(s)	[ ] prehistoric cemetery
[ ] unknown	[ ] burial mound(s)	[ ] prehistoric vessel
[ ] single artifact	[ ] platform/temple mound(s)	[ ] prehistoric refuse
[ ] artifact scatter		[ ] historic earthworks
[X] lithic scatter	[ ] canal	[ ] shell ring
[ ] midden(s)	[ ] mission	[ ] redeposited
[X] shell midden(s)	[ ] prehistoric earthworks	[ ] inundated terrestrial
[ ] shell works		[ ] historic refuse
[ ] historic shipwreck	[ ] wharves, docks, piers	[ ] well
		[ ] bridges (also covered bridges)
[ ] stone wall	[ ] shrine	
[ ] ____	[ ] ____	[ ] ____

THREATS TO SITE:

[ ] zoning [ ] transportation [ ] vandalism
[ ] development [ ] fill [ ] phosphate mining
[ ] deterioration [ ] dredge [ ] agriculture/plowing
[ ] borrowing [ ] logging [X] erosion

REMARKS:

[ ] preservation recommended [ ] recommended for further testing
[ ] severely disturbed/destroyed [X] monitor

REPOSITORY FMNH accession number 91-81

BIBLIOGRAPHIC DATA Denson, RL 1991. Oklawaha River Survey Final Report

NOTE: Cite any reports referring specifically to this site. General background material need not be cited. Use Florida Anthropologist format.

CULTURAL CLASSIFICATION

CULTURAL PERIOD Orange - Archaic

CULTURAL MATERIAL (Check as many as apply):

[X] aboriginal ceramics [ ] wood [ ] exotic items (mica, etc)
[ ] nonaboriginal ceramics [ ] metal [ ] petroglyphs
[ ] lithics [ ] precious metal/ coin(s) [ ] textile(s)
[X] worked bone [ ] misc/prehistoric
[ ] human bone/burial(s) [ ] glass [ ] misc/historic
[X] animal bone/ unidentified bone [ ] brick/bldg materials [ ] trade bead(s)
[ ] ballast
[ ] shell food remains [ ] other human remains (e.g., hair) [ ] fossil
[ ] worked shell [ ] ______
[ ] plant remains [ ] ______

DIAGNOSTIC ARTIFACTS 1 archaic stemmed point, orange plain, St Johns Plain, Sand Tempered Plain

SITE SIZE (approx acreage) ______

SITE SIZE (est in sq meters) 30 sq m

DEPTH OF CULTURAL DEPOSIT (if known) less than 2 m

ELEVATION

	Meters	Feet
Max	10	
Min	8	

DEGREE OF SITE DESTRUCTION

[ ] relatively undisturbed [ ] minor
[ ] moderate [X] major

SITE DISTURBANCES

[ ] bioturbation [ ] dredging/ditching [ ] previous archaeological excavations
[X] erosion [ ] site looting
[ ] mining/borrow pit [ ] forest preparation or harvesting
[ ] agricultural [ ] ______
[ ] residential/ commercial [ ] fill [ ] ______
[ ] ______

COLLECTION STRATEGY

[ ] general [ ] selective [X] controlled [ ] unknown [ ] ______

TYPE OF INVESTIGATION

[X] surface collection [ ] auger test [ ] unknown
[ ] shovel test [ ] coring [ ] prop wash deflectors
[ ] extensive excavation [ ] remote sensing [ ] airlift
[ ] test excavation [ ] none [ ] waterlift
[ ] water probe [ ] ______ [ ] ______

OPTIONAL NARRATIVE DESCRIPTION (If there is no published report, provide a short description of the site on a separate sheet)

OPTIONAL PHOTOGRAPHS OR SKETCHES OF DIAGNOSTIC OR UNIQUE ARTIFACTS (Please attach separate sheet(s))

FORM PREPARED BY RL Denson

ADDRESS FMNH

DATE 9-30-91

STATE OF FLORIDA
DEPARTMENT OF STATE
Division of Archives, History
and Records Management

[X] Original [ ] Update

Florida Master Site File / UNDERWATER ARCHAEOLOGICAL SITE FORM

SITE NUMBER 8MR 2076 SITE NAME Osceola
USGS 7.5 MINUTE QUAD Fort McCoy
NOTE: Please attach an 8.5" X 11" copy of the appropriate portion of the above map, with site location indicated.

TOWNSHIP/RANGE/SECTION:

Township	Range	Section
14S	23E	24

NOTE: *The figure to the left represents a regular section (1 square mile): please indicate the location of your site by placing an X in the appropriate portion of the section.*
If the section is irregular or part of a land grant, please check below and disregard above instructions.
X *Irregular section*
[ ] *Land grant* ______ *(name)*

UTM COORDINATES: Zone / Easting / Northing
17 / 408420 / 3237625
NOTE: If you are unfamiliar with calculating UTM measurements, leave blank.
LATITUDE: ___ ___ ___ LONGITUDE: ___ ___ ___
SITE SITUATION: (check one)
[X] inland [ ] estuary [ ] offshore
UNDERWATER ENVIRONMENT: (check one)
[ ] high energy marine [ ] low energy marine
[ ] lake or ponds [X] river, stream or creek
[ ] cavernous sink [ ] cavernous spring
[ ] intermittently flooded lands with a flowing water environment
[ ] intermittently flooded lands with a still water environment
SEDIMENT:
[ ] clay [ ] silt [X] sand [ ] peat [ ] marine growth [ ] rock
LOCAL INFORMANT(inc. private collections) M.E. Stallings
ADDRESS Rt 4, Box 890, Palatka, FL 32077
LOCAL INFORMANT(inc. private collections) Tony Dicarlo
ADDRESS Post Office Box 248, Ft. McCoy, Fl 32134
SURVEY DATE 8/7/91 OTHER MASTER SITE FILE NUMBERS ______
RECORDER(S)(list principal investigator first) RLDenson
Department of Anthropology, FMNH, University of Florida
ADDRESS Museum Road, Gainesville, FL 32611
PROJECT NAME Oklawaha River Survey
TOPOGRAPHICAL SETTING bottomlands hardwood

TYPE OF SITE(check one or more as appropriate):
[ ] indeterminate [ ] mound(s) [ ] prehistoric cemetery
[ ] unknown [ ] burial mound(s) [ ] prehistoric vessel
[ ] single artifact [ ] platform/temple mound(s) [ ] prehistoric refuse
[X] artifact scatter [ ] historic earthworks
[X] lithic scatter [ ] canal [ ] shell ring
[ ] midden(s) [ ] mission [X] redeposited
[ ] shell midden(s) [ ] prehistoric earthworks [ ] inundated terrestrial
[ ] shell works [ ] historic refuse
[ ] historic shipwreck [ ] wharves, docks, piers [ ] well
[ ] bridges (also covered bridges)
[ ] stone wall [ ] shrine
[ ] ______ [ ] ______ [ ] ______

THREATS TO SITE:

[ ] zoning [ ] transportation [ ] vandalism
[ ] development [ ] fill [ ] phosphate mining
[ ] deterioration [ ] dredge [ ] agriculture/plowing
[ ] borrowing [ ] logging [X] sheet erosion

REMARKS:

[ ] preservation recommended [ ] recommended for further testing
[X] severely disturbed/destroyed [X] ____________

REPOSITORY FMNH accession number 91-82

BIBLIOGRAPHIC DATA Denson, RL 1991. Oklawaha River Survey Final Report See attached list

NOTE: Cite any reports referring specifically to this site. General background material need not be cited. Use Florida Anthropologist format.

CULTURAL CLASSIFICATION ____________

CULTURAL PERIOD ____________

CULTURAL MATERIAL (Check as many as apply):

[X] aboriginal ceramics [ ] wood [ ] exotic items (mica, etc)
[X] nonaboriginal ceramics [ ] metal [ ] petroglyphs
[X] lithics [ ] precious metal/coin(s) [ ] textile(s)
[ ] worked bone [ ] misc/prehistoric
[ ] human bone burial(s) [ ] glass [ ] misc/historic
[ ] animal bone/unidentified bone [ ] brick/bldg materials [ ] trade bead(s)
[ ] ballast
[ ] shell food remains [ ] other human remains (e.g., hair) [ ] fossil
[ ] worked shell [ ] ____________
[ ] plant remains [ ] ____________

DIAGNOSTIC ARTIFACTS St Johns plain, Sand Tempered Plain Chatahoochee, Whiteware

SITE SIZE (approx acreage) ____________

SITE SIZE (est in sq meters) 100 sq m

ELEVATION

	Meters	Feet
Max	18	
Min	8	

DEPTH OF CULTURAL DEPOSIT (if known) ____________

DEGREE OF SITE DESTRUCTION

[ ] relatively undisturbed [ ] minor
[ ] moderate [ ] major

SITE DISTURBANCES

[ ] bioturbation [ ] dredging/ditching [ ] previous archaeological excavations
[X] erosion, sheet & lateral [ ] site looting
[ ] mining/borrow pit [ ] forest preparation or harvesting
[ ] agricultural [ ] ____________
[ ] residential/commercial [ ] fill [ ] ____________
[ ] ____________

COLLECTION STRATEGY

[ ] general [X] selective [ ] controlled [ ] unknown [ ] ____________

TYPE OF INVESTIGATION

[X] surface collection [ ] auger test [ ] unknown
[ ] shovel test [ ] coring [ ] prop wash deflectors
[ ] extensive excavation [ ] remote sensing [ ] airlift
[ ] test excavation [ ] none [ ] waterlift
[ ] water probe [ ] ____________ [ ] ____________

OPTIONAL NARRATIVE DESCRIPTION (If there is no published report, provide a short description of the site on a separate sheet)

OPTIONAL PHOTOGRAPHS OR SKETCHES OF DIAGNOSTIC OR UNIQUE ARTIFACTS (Please attach separate sheet(s))

FORM PREPARED BY RL Denson

ADDRESS FMNH

DATE 9-30-91

STATE OF FLORIDA
DEPARTMENT OF STATE
Division of Archives, History and Records Management

[ ] Original [X] Update

Florida Master Site File / UNDERWATER ARCHAEOLOGICAL SITE FORM

SITE NUMBER 8 MR 44 SITE NAME ______

USGS 7.5 MINUTE QUAD Ft. McCoy

NOTE: Please attach an 8.5" X 11" copy of the appropriate portion of the above map, with site location indicated.

TOWNSHIP/RANGE/SECTION:

Township	Range	Section
14S	23E	18

X			

NOTE: The figure to the left represents a regular section (1 square mile); please indicate the location of your site by placing an X in the appropriate portion of the section.
If the section is irregular or part of a land grant, please check below and disregard above instructions.

[ ] *Irregular section*
[ ] *Land grant* ______ *(name)*

UTM COORDINATES: Zone / Easting / Northing
____ / ____ / ____

NOTE: If you are unfamiliar with calculating UTM measurements, leave blank.

LATITUDE: ____ ____ ____ LONGITUDE: ____ ____ ____

SITE SITUATION: (check one)
[x] inland [ ] estuary [ ] offshore

UNDERWATER ENVIRONMENT: (check one)
[ ] high energy marine [ ] low energy marine
[ ] lake or ponds [X] river, stream or creek
[ ] cavernous sink [ ] cavernous spring
[ ] intermittently flooded lands with a flowing water environment
[ ] intermittently flooded lands with a still water environment

SEDIMENT:
[ ] clay [ ] silt [X] sand [ ] peat [ ] marine growth [ ] rock

LOCAL INFORMANT(inc. private collections) ______
ADDRESS ______
LOCAL INFORMANT(inc. private collections) ______
ADDRESS ______
SURVEY DATE 8-9-91 OTHER MASTER SITE FILE NUMBERS ______
RECORDER(S)(list principal investigator first) RL Denson
Dept. of Anthropology, FMNH, Univ. of Florida
ADDRESS Museum Road, Gainesville, FL
PROJECT NAME Oklawaha River Survey
TOPOGRAPHICAL SETTING floodplain

TYPE OF SITE(check one or more as appropriate):
[ ] indeterminate [ ] mound(s) [ ] prehistoric cemetery
[ ] unknown [ ] burial mound(s) [ ] prehistoric vessel
[ ] single artifact [ ] platform/temple mound(s) [ ] prehistoric refuse
[ ] artifact scatter [ ] historic earthworks
[ ] lithic scatter [ ] canal [ ] shell ring
[ ] midden(s) [ ] mission [ ] redeposited
[X] shell midden(s) [ ] prehistoric earthworks [ ] inundated terrestrial
[ ] shell works [ ] historic refuse
[ ] historic shipwreck [ ] wharves, docks, piers [ ] well
[ ] bridges (also covered bridges)
[ ] stone wall [ ] shrine
[ ] ______ [ ] ______ [ ] ______

THREATS TO SITE:

[ ] zoning [ ] transportation [ ] vandalism
[ ] development [ ] fill [ ] phosphate mining
[ ] deterioration [ ] dredge [ ] agriculture/plowing
[ ] borrowing [ ] logging [ ] ______

REMARKS:

[ ] preservation recommended [ ] recommended for further testing
[ ] severely disturbed/destroyed [ ] ______

REPOSITORY ______

BIBLIOGRAPHIC DATA ______

NOTE: Cite any reports referring specifically to this site. General background material need not be cited. Use *Florida Anthropologist* format.

CULTURAL CLASSIFICATION ______

CULTURAL PERIOD ______

CULTURAL MATERIAL(Check as many as apply):

[ ] aboriginal ceramics [ ] wood [ ] exotic items (mica, etc)
[ ] nonaboriginal ceramics [ ] metal [ ] petroglyphs
[ ] lithics [ ] precious metal/ coin(s) [ ] textile(s)
[ ] worked bone [ ] misc/prehistoric
[ ] human bone/burial(s) [ ] glass [ ] misc/historic
[ ] animal bone/ unidentified bone [ ] brick/bldg materials [ ] trade bead(s)
[ ] ballast
[ ] shell food remains [ ] other human remains (e.g., hair) [ ] fossil
[ ] worked shell [ ] ______
[ ] plant remains [ ] ______

DIAGNOSTIC ARTIFACTS ______

SITE SIZE(approx acreage) ______
SITE SIZE(est in sq meters) ______
DEPTH OF CULTURAL DEPOSIT (if known) ______

ELEVATION
Meters: Max ______ Min ______
Feet: Max ______ Min ______

DEGREE OF SITE DESTRUCTION unknown, site may be well off the river in the swamp or totalling gone

[ ] relatively undisturbed [ ] minor
[ ] moderate [ ] major

SITE DISTURBANCES

[ ] bioturbation [ ] dredging/ditching [ ] previous archaeological excavations
[ ] erosion [ ] site looting
[ ] mining/borrow pit [ ] forest preparation or harvesting
[ ] agricultural [ ] ______
[ ] residential/ commercial [ ] fill [ ] ______
[ ] ______

COLLECTION STRATEGY

[X] general [ ] selective [ ] controlled [ ] unknown [ ] ______

TYPE OF INVESTIGATION

[X] surface collection [ ] auger test [ ] unknown
[ ] shovel test [ ] coring [ ] prop wash deflectors
[ ] extensive excavation [ ] remote sensing [ ] airlift
[ ] test excavation [ ] none [ ] waterlift
[ ] water probe [ ] ______ [ ] ______

OPTIONAL NARRATIVE DESCRIPTION(If there is no published report, provide a short description of the site on a separate sheet)

OPTIONAL PHOTOGRAPHS OR SKETCHES OF DIAGNOSTIC OR UNIQUE ARTIFACTS (Please attach separate sheet(s))

FORM PREPARED BY RL Denson

ADDRESS FMNH

DATE 9-30-91

STATE OF FLORIDA
DEPARTMENT OF STATE
Division of Archives, History
and Records Management

[X] Original [ ] Update

Florida Master Site File / UNDERWATER ARCHAEOLOGICAL SITE FORM

SITE NUMBER 8MR2066 SITE NAME Gore's Landing
USGS 7.5 MINUTE QUAD Fort McCoy
NOTE: Please attach an 8.5" X 11" copy of the appropriate portion of the above map, with site location indicated.

TOWNSHIP/RANGE/SECTION:

Township	Range	Section
14S	24E	7

		X	

NOTE: The figure to the left represents a regular section (1 square mile): please indicate the location of your site by placing an X in the appropriate portion of the section.
If the section is irregular or part of a land grant, please check below and disregard above instructions.

[ ] *Irregular section*
[ ] *Land grant* ____________ *(name)*

UTM COORDINATES: Zone / Easting / Northing
17 / 410000 / 3240195
NOTE: If you are unfamiliar with calculating UTM measurements, leave blank.
LATITUDE: ___ ___ ___ LONGITUDE: ___ ___ ___
SITE SITUATION: (check one)
[x] inland [ ] estuary [ ] offshore
UNDERWATER ENVIRONMENT: (check one)
[ ] high energy marine [ ] low energy marine
[ ] lake or ponds [x] river, stream or creek
[ ] cavernous sink [ ] cavernous spring
[ ] intermittently flooded lands with a flowing water environment
[ ] intermittently flooded lands with a still water environment
SEDIMENT:
[ ] clay [ ] silt [x] sand [ ] peat [ ] marine growth [ ] rock
LOCAL INFORMANT(inc. private collections) ME Stallings, Rt4, Box 890,
ADDRESS Palatka, FL 32077
LOCAL INFORMANT(inc. private collections) Tony DiCarlo
ADDRESS P.O. Box 248, Ft. McCoy, FL 32134
SURVEY DATE 8/11/91 OTHER MASTER SITE FILE NUMBERS ______
RECORDER(S)(list principal investigator first) RL Denson
Dept. of Anthropology
ADDRESS FMNH, Museum Road, Univ. of Florida, Gainesville, FL
PROJECT NAME Oklawaha River Survey
TOPOGRAPHICAL SETTING Bottomland hardwoods

TYPE OF SITE(check one or more as appropriate):

[ ] indeterminate	[ ] mound(s)	[ ] prehistoric cemetery
[ ] unknown	[ ] burial mound(s)	[ ] prehistoric vessel
[ ] single artifact	[ ] platform/temple mound(s)	[ ] prehistoric refuse
[x] artifact scatter		[ ] historic earthworks
[ ] lithic scatter	[ ] canal	[ ] shell ring
[ ] midden(s)	[ ] mission	[ ] redeposited
[ ] shell midden(s)	[ ] prehistoric earthworks	[ ] inundated terrestrial
[ ] shell works		[ ] historic refuse
[x] historic shipwreck - barge	[ ] wharves, docks, piers	[ ] well
		[ ] bridges (also covered bridges)
[ ] stone wall	[ ] shrine	
[ ] ______	[ ] ______	[x] logging center

THREATS TO SITE:

[] zoning [] transportation [] vandalism
[] development [] fill [] phosphate mining
[] deterioration [] dredge [] agriculture/plowing
[] borrowing [] logging [X] erosion

REMARKS:

[] preservation recommended [] recommended for further testing
[] severely disturbed/destroyed [x] monitor

REPOSITORY FMNH accesssion number 91-79

BIBLIOGRAPHIC DATA Denson, 1991 Oklawaha River Survey Final Report

NOTE: Cite any reports referring specifically to this site. General background material need not be cited. Use *Florida Anthropologist* format.

CULTURAL CLASSIFICATION

CULTURAL PERIOD St. Johns - historic

CULTURAL MATERIAL(Check as many as apply):

[x] aboriginal ceramics [] wood [] exotic items (mica, etc)
[] nonaboriginal ceramics [x] metal [] petroglyphs
[x] lithics [] precious metal/ coin(s) [] textile(s)
[] worked bone [] glass [] misc prehistoric
[] human bone/burial(s) [] brick/bldg materials [] misc historic
[x] animal bone/ unidentified bone [] other human remains (e.g., hair) [x] trade bead(s)
[] shell food remains [] ballast
[] worked shell [] fossil
[] plant remains [x] logging eqmt.
[]

DIAGNOSTIC ARTIFACTS St Johns Plain

SITE SIZE(approx acreage)

SITE SIZE(est in sq meters) 100 sq m

ELEVATION

	Meters	Feet
Max	10	
Min	8	

DEPTH OF CULTURAL DEPOSIT (if known)

DEGREE OF SITE DESTRUCTION

[] relatively undisturbed [] minor
[] moderate [x] major

SITE DISTURBANCES

[] bioturbation [] dredging/ditching [] previous archaeological excavations
[x] erosion [] site looting
[] mining/borrow pit [] forest preparation or harvesting
[] agricultural [x] recreation
[] residential/ commercial [] fill []
[]

COLLECTION STRATEGY

[x] general [] selective [] controlled [] unknown []

TYPE OF INVESTIGATION

[x] surface collection [] auger test [] unknown
[] shovel test [] coring [] prop wash deflectors
[] extensive excavation [] remote sensing [] airlift
[] test excavation [] none [] waterlift
[] water probe [] []

OPTIONAL NARRATIVE DESCRIPTION(If there is no published report, provide a short description of the site on a separate sheet)

OPTIONAL PHOTOGRAPHS OR SKETCHES OF DIAGNOSTIC OR UNIQUE ARTIFACTS (Please attach separate sheet(s))

FORM PREPARED BY RL Denson

ADDRESS FMNH, Dept. of Anthropology, Univ. of Florida

DATE 9/30/91

Appendix 5

ORS SOIL ANALYSIS DATA

Oklawaha River Survey Soil Data

TRANSECT	DESCRIPTION	DEPTH (CM & IN)	ORGANICS/DESC	ORGANICS (% AS SAND)	pH IN H2O	pH IN CaCl	pH IN KCl	ORGANIC CARBON	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	% SAND	% SILT	% CLAY	Al TOTAL	Fe TOTAL	[illegible]	[illegible]	[illegible]
O-1	A	0-14CM	TWIGS	3	5.93 6.2	5.82	6.51	3.21	1.11	10.95	30.01	25.18	4.60	71.26	11.19	17.53	0.121	0.143	0.0656	0.361	0.309
--	2C	14-40CM	GRAVEL	.25	5.71	4.11	4.60	1.82	1.75	1.14	29.14	29.88	5.47	67.38	18.27	14.4	0.432	0.131	0.081	0.336	0.339
--	2C2	42-123CM	GRAVEL	.14	6.95 5.90	5.48	5.60	1.55	1.3	8.84	25.53	28.28	3.08	58.97	13.99	27.04	0.390	0.310	0.018	0.301	0.310
--	2A	123-198CM	LIMEROCK	.05	7.21	5.92	6.39	5.61	0.92	7.27	22.12	23.95	5.55	61.1	14.26	25.64	0.365	0.398	0.092	0.298	0.322
O-2	A	0-21CM	ORGANIC	.01				4.81	1.25	9.35	28.9	28.92	9.22	77.64	11	11.36	0.372	0.372	0.138	0.326	0.326
--	Bt	17-80CM	QUARTZ	.22	1.48 4.69	4.22	4.11	1.58	0.82	3.69	15.39	16.71	5.85	43.14	16.56	40.6	0.354	0.481	0.132	0.251	0.256
--	2Ck	80-105CM	LIMEROCK	4.15	7.11 7.27	6.28	6.49	1.26	1.08	1.51	2.18	4.85	5.25	15.27	26.52	37.2	0.195	0.298	0.122	0.050	0.077
O-3	AB	0-50CM	GRAVEL	.52	4.85	4.50	4.32	1.68	7.60	5.14	15.92	17.15	6.80	15.51	15.84	48.63	0.327	0.376	0.149	0.257	0.279
--	C1	50-110CM	LIMEROCK	10.97	7.22	7.02	6.46	0.65	1.0	2.3	4.1	4.8	7.8	16.0	64.6	20.0					
--	C2	110-145CM			7.13	6.94	6.56	0.37	0.3	7.3	25.2	16.6	3.2	55.1	14.1	30.8					
--	C3	145-201CM	LIMEROCK	4.80	7.57	6.9 7.3	6.8	0.22	0.8	6.91	32.16 27.57	2.42	70.16	14.61	15.2	0.558	0.394	0.087	0.379	0.426	
--	C4	201-240CM	QUARTZ	1.9	6.82	6.24	6.83	0.20	1.81	8.56	31.22	35.72	3.13	81.84	9.36	8.8	0.407	0.336	0.126	0.365	0.391
O-4	A	0-29CM	ORGANIC	.41				1.59	2.94	30.11	30.28	34.94	3.95	82.24	9.15	8.59	0.468	0.272	0.233	0.331	0.382
--	Bt	29-121CM	ORGANIC	.21	7.28	6.76	7.02	1.07	9.41	12.39	36.73	23.12	5.30	70.25	15.24	7.56	0.463	0.291	0.073	0.358	0.231
O-5	C	0-122CM	ORGANIC	.08	6.79	5.74	5.56	4.40	1.5	11.6	40.9	27.8	8.2	90.0	4.8	5.2					
O-6	A	0-5CM	CHARCOAL	2.06	6.12	5.98	5.54	1.16	2.00	17.09	31.05	28.54	9.42	84.10	9.45	6.45	0.469	0.339	0.113	0.332	0.303
--	2Bt	5-82CM			4.57	3.95	3.50	3.52	0.58	5.23	16.72	19.60	2.84	50.06	17.334	32.1	0.332	0.373	0.176	0.247	0.276
--	3C2	82-140CM			7.33	5.80	6.11	0.82	1.0	3.9	25.8	8.9	4.1	28.0	27.2	41.8					
--	C1	140-250CM	LIMEROCK	5.56	7.42	5.80	6.11	5.21	2.93	11.91	32.97	30.00	2.65	87.86	9.35	8.8	0.401	0.367	0.075	0.360	0.329
--	C2	250-320CM	LIMEROCK	2.0	7.12	6.72	6.50	5.21	1.05	4.94	15.03	20.71	1.97	77.19	9.38	13.6	0.338	0.658	0.625	0.213	0.586
--	C3	327-340CM	LIMEROCK	54.02	7.31	6.36	5.83	3.21	7.86	13.63	70.85	23.71	2.53	78.00	9.71	12.9	0.262	0.425	0.032	0.239	0.380
O-7	Bt	0-90CM	ORGANIC	.01	1.8 4.2	4.29	4.19	3.48	0.78	8.2	24.78	15.71	2.95	39.92	17.28	42.8	0.436	0.312	0.050	0.321	0.254
--	Bt2	90-95CM	LIMEROCK	.88	7.12	6.10	6.25	2.46	0.48	8.79	27.83	23.35	1.52	63.96	12.84	23.2	0.435	0.362	0.155	0.362	0.304
--	C1	95-143CM			6.69	6.50	6.57	2.18	2.93	13.8	37.18	22.08	2.36	52.35	9.25	8.4	0.428	0.359	0.025	0.340	0.350
--	C2	143-245CM			5.89	6.12	6.39	0.69	0.2	1.62	10.35	60.30	2.05	24.68	11.72	13.6	0.179	0.808	0.027	0.128	0.698
--	C4	245-295CM			6.38	6.93	6.49	0.23	2.02	7.6	24.07	42.36	2.45	78.4	9.6	12	0.318	0.340	0.031	0.283	0.481
O-8	A	0-5CM	CHARCOAL	4.31	4.93 4.90	4.59	5.21	2.58	5.99	37.25	50.80	36.63	4.93	87.63	8.59	3.76	0.351	0.218	1.056	0.232	0.180
--	B	5-62CM	QUARTZ	18	4.86 4.88	4.51	4.62	0.31	4.4	11.9	31.3	35.1	3.1	92.1	2.0	5.5					
--	2Bt	62-122CM	QUARTZ	.29	5.21	5.26	5.51	0.30	1.11	14.43	21.1	25.84	7.6	73.08	36.12	10.8	0.429	0.388	0.383	0.210	0.312
H-1, 50'SE	A	0-6IN	QUARTZ	.59				1.43	1.6	9.1	28.4	30.9	20.0	90.3	2.9	6.8					
--	C	6-18IN	GRAVEL	.12	5.01	4.67	3.53	0.11	0.97	13.67	39.55	24.76	3.53	86.9	9.5	4.5	0.455	0.242	0.091	0.110	0.256
H-1, 175'SE	A	0-8IN	ORGANIC	.01	3.95	3.33	-	0.54	0.11	3.24	11.25	29.09	21.40	68.09	8.43	23.48	0.308	0.127	0.111	0.185	0.390
--	B	8-40IN			4.26	3.42	3.56	0.41	0	2.0	7.7	16.6	39.5	65.8	10.2	21.0					
--	C	40-56IN			4.06	3.51	3.65	2.22	0.23	4.43	15.13	35.24	27.89	83.82	6.08	10.5	0.482	0.124	0.145	0.160	0.392
H-1, 250'SE	A	0-16IN	GRAVEL	.25	4.75	3.72	3.78	2.61	0.23	4.26	25.57	26.26	14.01	86.34	8.33	15.32	0.281	0.171	0.181	0.251	0.428
--	AC	16-34IN			3.93	3.52	3.50	6.40	0.61	10.96	35.55	23.1	7.61	77.83	12.17	10	0.456	0.296	0.197	0.395	0.256
H-1, 290'SE	A	0-6IN	IRON NODULE	2.47				0.87	0.42	9.06	30.73	20.56	6.18	85.21	9.11	5.680 .266	0.346	0.075	0.421	0.313	
--	E	6-10IN						0.29	0.2	2.3	36.4	24.0	41.6	82.5	1.6	15.6					
--	Btg	10-40IN	PACKED PEDONS	2.12	4.39 4.01	3.65	3.12	0.25	0	1.42	26.73	15.62	3.96	79.72	23.48	36.8	0.421	0.303	0.099	0.264	0.242
H-1, 20'E	A	0-4IN	ORGANIC	.06				1.58	0.33	10.33	31.11	28.19	10.53	83.92	10.12	6.04	0.406	0.335	0.129	0.363	0.303
--	Btg1	4-36	QUARTZ	.13	4.41 4.02	3.50	3.65	5.54	0.37	6.04	27.7	14.22	3.97	49.9	20.5	29.6	0.454	0.281	0.117	0.322	0.201
--	Btg2	36-46			3.88	3.51	3.56	2.36	0.32	7.53	25.45	15.86	6.68	55.66	16.14	28	0.453	0.283	0.159	0.333	0.277
H-1, 30'DOWNSTREAM	Cg1	60-70IN	ORGANIC	.12	4.57	4.35	3.81	1.45	0.7	10.6	30.5	24.0	11.9	82.8	1.6	15.6					
--	Cg2	70-80IN			4.13	3.91	4.50	2.26	0.54	6.52	28.23	24.07	9.63	60.01	17.29	13.6	0.409	0.345	0.139	0.326	0.278
H-1, IN RIVER		0-10IN	PACKED PEDONS	1.9	5.49 5.26 5.95	5.37	5.27	0.56	0.2	8.5	34.3	25.3	11.2	83.0	5.8	11.2					
--		36-70IN			5.60 5.81	5.72	5.57	0.52	2.91	14.65	26.12	23.1	5.61	71.59	22.41	6	0.501	0.312	0.011	0.282	0.258
M-1-26, SHELL MOUND					6.95	6.90	6.83	6.58	2.91	11.65	26.12	22.3	5.61	71.59	22.21	7.2	2.362	0.311	.078	0.251	0.236
--					6.98	7.31	7.15	0.17	4.7	17.2	25.3	20.4	6.7	73.8	1.8	14.4					
M-1-27, UPSTREAM, SAME LEVEL AS M-1-26					7.56	7.40	7.26	0.13	0.8	1.73	21.77	51.09	7.92	90.35	6.77	2.88	0.274	0.597	0.088	0.255	0.306
M-1-28, DOWNSTREAM, SAME LEVEL AS M-1-26					7.33	7.25	7.28	0.13	0.9	8.9	36.6	41.2	6.7	97.3	0.1	2.4					
M-1-29, BELOW 25 [illegible] CALCITE					7.20	7.37	7.25	0.10	0.45	6.65	29.35	32.84	6.2	72.62	13.5	13.88	0.362	0.452	0.085	0.111	0.391
M-1-30, BELOW 29 IN SAND					7.57 7.98 8.06	7.73 7.43	7.16	0.02	5	7.9	32.15	39.29	5.55	91.21	3.13	5.84	0.339	0.437	0.061	0.351	0.327
I-1-1	BOTTOM, HARD	25CM			6.78	6.60	6.80	2.15	0.25	2.17	1.92	6.14	6.01	18.92	43.96	37.21	0.207	0.450	0.317	0.052	0.180
I-1-2	SOFT W/SHELL	18CM			7.14	7.24	7.28	0.12	1.94	12.25	25.3	51	7.45	75.94	12.34	11.72	0.306	0.408	0.088	0.263	0.354
I-1-3	V. HARD	22CM			7.19	7.10	7.35	0.26	0.51	2.75	1.44	5.45	2.37	17.	17.6	65.4	0.261	0.312	0.253	0.081	0.090
I-1-4	SHELL HASH	12CM			7.46 7.38	7.38	7.36	0.18	1.09	9.33	18.08	20.69	11.46	60.64	23.25	16.12	0.298	0.311	0.189	0.215	0.264
I-1-5	TOP	35CM			7.33	7.17	7.32	0.91	0.90	1.6	6.17	6.55	2.42	22.95	12.97	24.08	0.268	0.297	0.192	0.310	0.127

TOTAL PHOSPHORUS	
SAMPLE NUMBER	P-PPM
47	6290
48	6710
49	688
50	578
51	2593
52	1007