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LABORATORY OF ARCHAEOLOGY SERIES
REPORT NUMBER 49

GEOARCHAEOLOGY OF THE OCONEE RESERVOIR

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Athens
2011

GEOARCHEOLOGY OF THE OCONEE RESERVOIR

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WALLACE RESERVOIR PROJECT CONTRIBUTION NUMBER 15

Department of Anthropology

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1981

PREFACE

The geomorphological information upon which this report is based was derived largely in conjunction with the Ongoing Survey conducted within the Wallace Reservoir pool between July, 1977 and October 1, 1978. For this reason, the report should be considered as one part of the final report for the Ongoing Survey authorized in Appendix 1 of the Archaeological Salvage Agreement between the University of Georgia and the Georgia Power Company.

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Principal Investigator

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INTRODUCTION

The Oconee Reservoir extends 48 km along the Oconee River, 17 km along the Apalachee, 22 km along Richland Creek, and fingers into several smaller tributary valleys. The area was affected by orogenic movements in the southern Appalachian region in Middle Ordovician, and Late Mississippian to Early Pennsylvanian times. It is underlain by igneous and metamorphic rocks including granites, gneisses, schists, metaquartzites, and meta-volcanics. Foliation in metamorphic rocks is NE-SW. Discordant unmetamorphosed granite plutons of Permian age have pierced the older metamorphic rocks. One of these, the massive coarsely-porphyritic Siloam granite, forms the bedrock of the southern portion of the reservoir (Fig. 1).

At the end of the Appalachian orogeny the region remained land through the Jurassic and Lower Cretaceous with the formation of a Lower Cretaceous peneplain (King 1950). During the Upper Cretaceous the sea advanced on to this peneplain with deposition of the sedimentary Tuscaloosa Formation uncomformably on the bevelled crystalline rocks. After a phase of subaerial denudation during Paleocene and Early and Middle Eocene times the sea once more reached the Piedmont. The Late Eocene Barnwell Formation, which overlaps Tuscaloosa deposits, was laid down (La Moreaux 1946). In more recent times uplift of the Lower Cretaceous peneplain with respect to sea level has resulted in its fluvial dissection.

Stream downcutting was influenced by stillstands in sea level, and by the underlying geologic structure. Woodruff and Parizek (1956) have described the long profiles of streams on the Georgia Piedmont as a series of short curves developed above temporary, lithologically-controlled knick points, and note that at the knick points the valleys are narrow and youthful, while upstream of them stream meandering in less resistant rocks

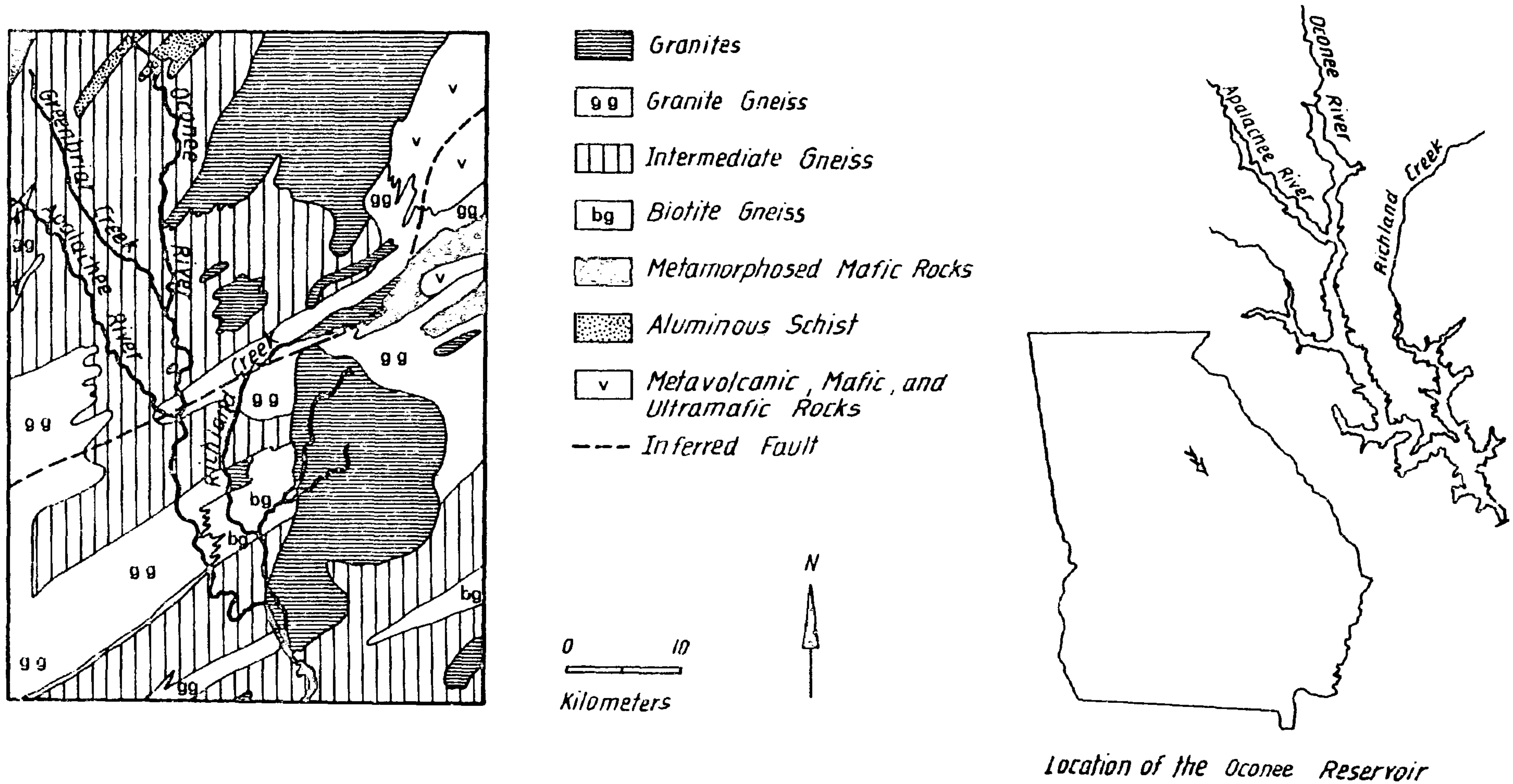

Fig. 1. Location and geology of the Oconee Reservoir area.

has produced broad, flat valleys. Many valleys, therefore, consist of a series of broad floodplains separated and pinched off from each other by shoals. Woodruff and Parizek have called these "boudin valleys." The Oconee Reservoir is situated in a boudin valley, the broad, flat floodplain of the northern portion of the reservoir site narrowing rapidly downstream at Long Shoals.

Geomorphic analysis of areas under archeological investigation frequently provides information on past environments, which is useful in the final interpretation of prehistoric man-land relationships. For this reason geomorphic studies of the Oconee Reservoir site were undertaken. The broad objective was to outline the geomorphic history of the site, since formation of the Lower Cretaceous peneplain, in a manner useful to archeologists. Emphasis was placed on the last 10,000 years, the approximate period of Indian occupation.

THE UPLAND SURFACE

The even skyline of the uplands in the Oconee reservoir region cuts across a variety of igneous and metamorphic rocks, and is not therefore structurally controlled. Instead the approximately accordant hill, ridge, and plateau crests are believed to be remnants of an uplifted and dissected Jurassic and Lower Cretaceous peneplain (King 1950). To learn more about the form of this peneplain, in a small study area centered upon the reservoir, summit elevation data have been subjected to altitude-frequency and polynomial trend surface analysis (Brook 1978).

Summit elevations and geographic coordinates were obtained from the 1:24,000 scale Buckhead, Greensboro, Harmony, and Liberty quadrangles; from the southern halves of the Greshamville and Penfield quadrangles;

and from the northern halves of the Meda and Rockville quadrangles (Fig. 2). Summit-frequency histograms for the Buckhead-Greshamville, Greensboro-Penfield, Harmony-Meda, and Liberty-Rockville areas show marked peaks at 570 and 450, 610, 570 and 430, and 550 and 510 ft (174 and 137, 186, 174 and 131, and 168 and 155 m) respectively, suggesting a single major summit bevel in the study area at 550-610 ft (168-186 m, Fig. 3).[1] Secondary peaks in the Buckhead-Greshamville, and Harmony-Meda areas at 450 and 430 ft (137 and 131 m) may point to a former base level of erosion in the Oconee valley at 430-450 ft (131-137 m). Summit data for the entire study area are normally distributed with a modal value of 570 ft (174 m) supporting the view of a single widespread summit bevel in the area.

Trend analysis was conducted on grid sample mean elevations. The area was divided into 600 (20 x 30) equal-sized units 0.74 km north to south and 0.68 km east to west. The mean elevation of summits within each grid unit was determined and assigned the geographic coordinates of the grid unit center. Robinson (1972) has shown that this smoothing procedure reduces the spatial clustering of information without significantly affecting trend surface form. Because averaging filters out local variations in the raw data, trend surfaces fitted to grid sample means appear more significant, in terms of the percentage RSS statistic, than surfaces generated from the raw data (Doornkamp 1972) but are less probable (Unwin 1973).

Linear, quadratic, and cubic trend surfaces fitted to grid sample mean elevations explain 10.2, 42.1, and 47.0% of the initial variance in the data respectively (Fig. 2). Standard errors are 53, 43, and 41 ft (16,

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[1] Absolute elevations are given in feet throughout, in deference to the available topographic maps.

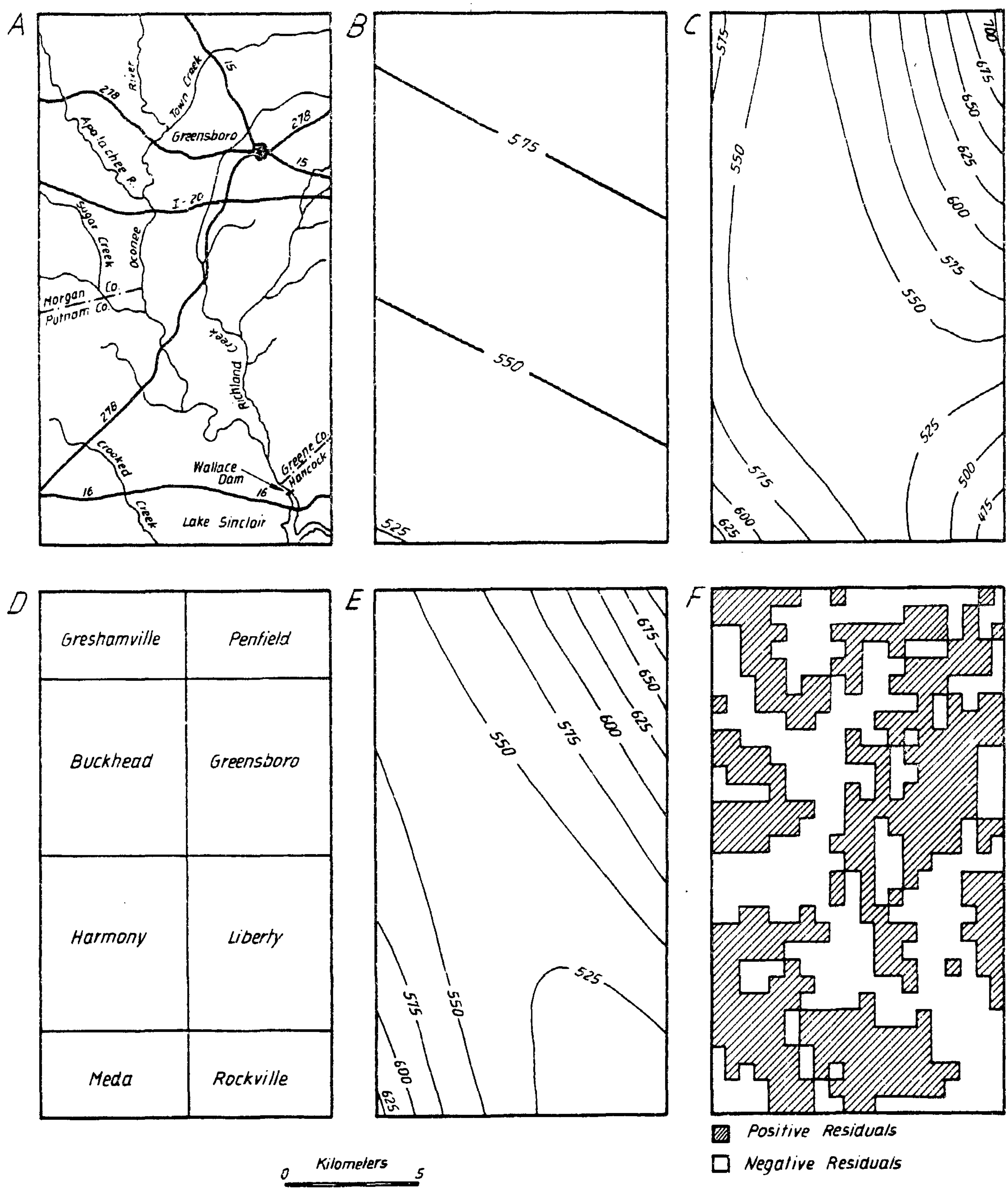

Fig. 2. Polynomial trend surfaces fitted to grid-sample mean summit data in the Oconee Reservoir area. (A) the study area, (B) linear trend surface, (C) quadratic trend surface, (D) 1:24,000 scale topographic maps from which summit data were obtained, (E) cubic trend surface, and (F) positive and negative residuals from the cubic surface. Contours are in feet above sea level.

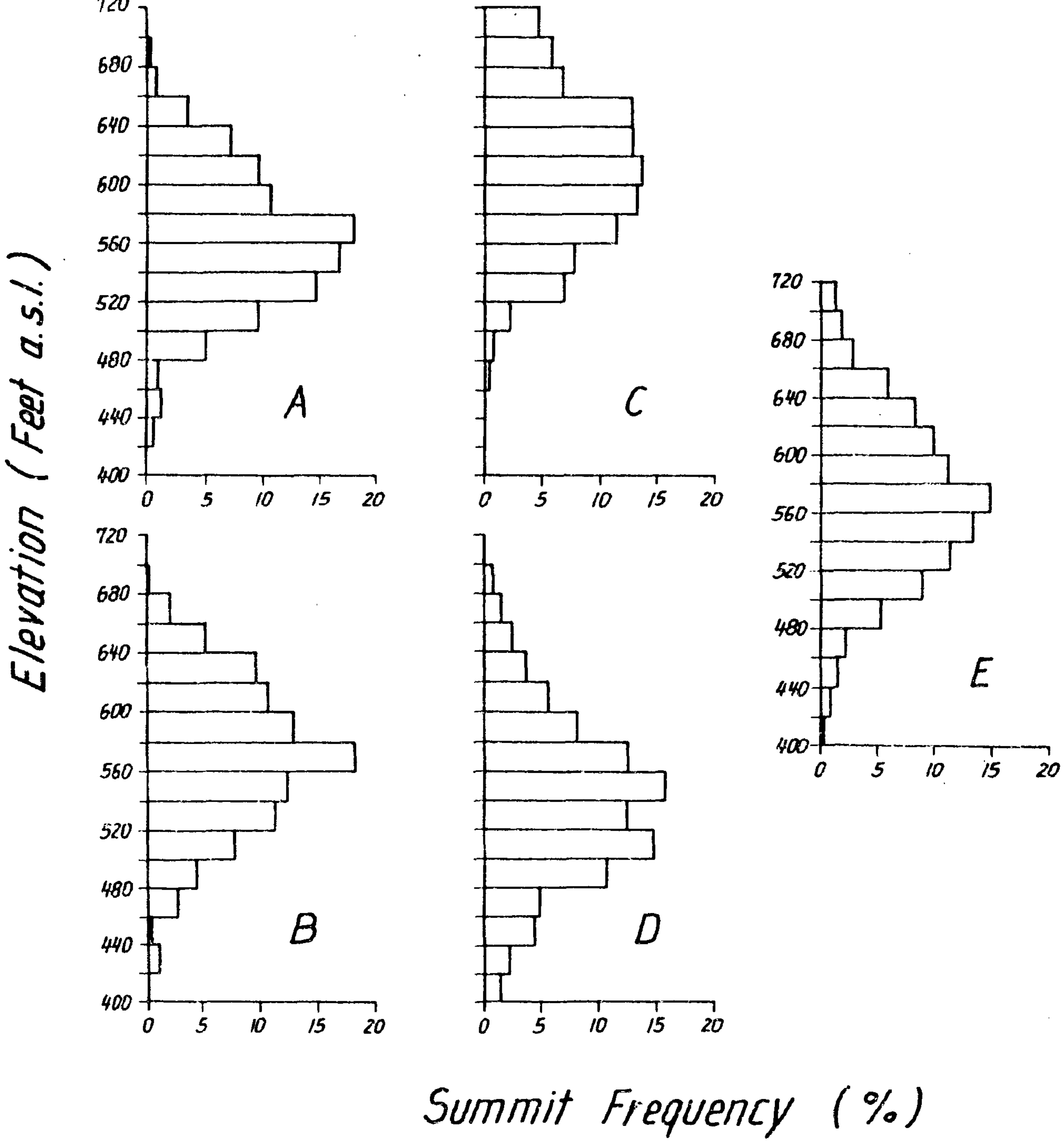

Fig. 3. Summit-frequency distributions in the Buckhead-Greshamville (A), Greensboro-Penfield (B), Harmony-Meda (C), and Liberty-Rockville (D) map areas; and in the entire Oconee Reservoir study area (E) shown in Fig. 2D.

13 and 12.5 m). All surfaces are significant at the 99.99% probability level (F-test). The model provided by the cubic trend surface shows a Late Cretaceous peneplain with 150 ft (46 m) of local relief; present elevations range from 550 to 700 ft (168 to 213 m). As might be expected, residuals from the cubic polynomial model are spatially autocorrelated, negative residuals occurring in the major stream valleys, positive residuals in interfluve areas.

The cubic model indicates that, since the Late Cretaceous, the Oconee River and its tributaries in the study area have cut approximately 120 ft (37 m) into the Lower Cretaceous peneplain as this was uplifted with respect to sea level.

RIVER TERRACES ALONG THE OCONEE RIVER VALLEY

Remnants of two ancient paired river terraces have been identified along the Oconee River valley above the Fall Line. The higher of these terraces parallels the downstream continuation of the Oconee and Apalachee river profiles above Barnett Shoals and immediately below High Shoals respectively. Between Barnett Shoals and Long Shoals the "Barnett Shoals terrace" lies 9-15 m above the Oconee River (Fig. 4). Evidence of the existence of the terrace is illustrated in cross-profiles of the Oconee valley (Fig. 5). Terrace remnants are most common where tributary streams enter the Oconee River.

At site 1, where State Route 15 crosses the Oconee north of the Ellison Creek junction and south of Scull Shoals, there is an extensive terrace at 480 ft (146 m) above sea level (a.s.l.). Fluvial sand 9-18 m deep lies beneath the terrace and is presently being exploited as a commercial deposit. Several kilometers downstream, where Greenbriar Creek

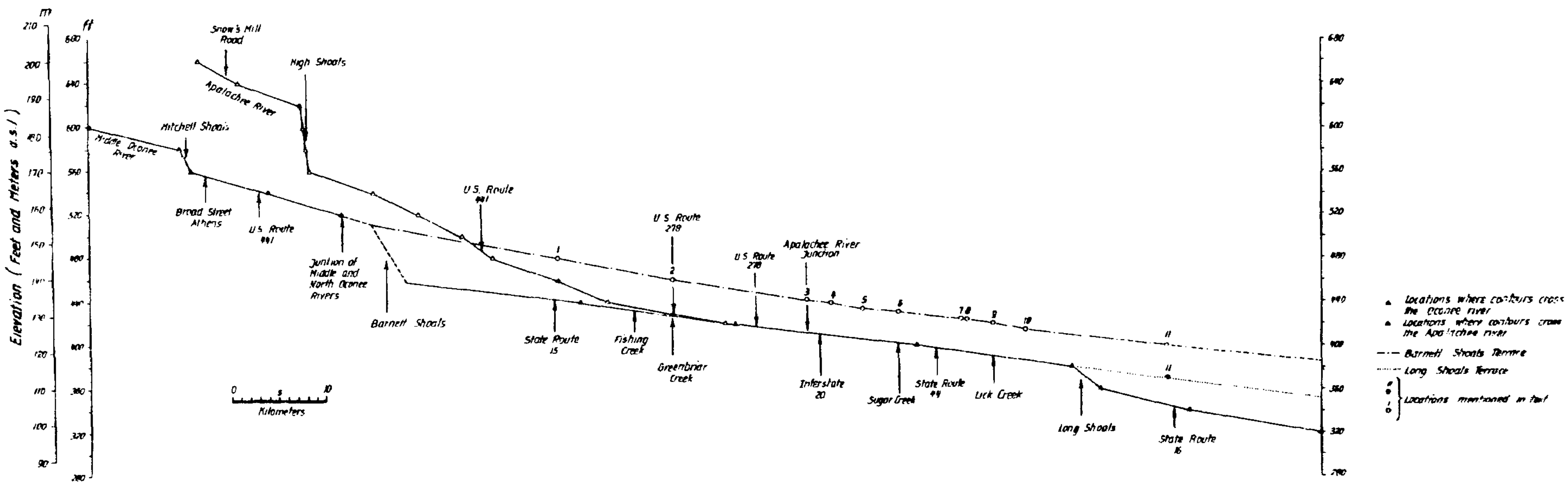

Fig. 4. Terraces along the Oconee and Apalachee Rivers in the Oconee Reservoir area.

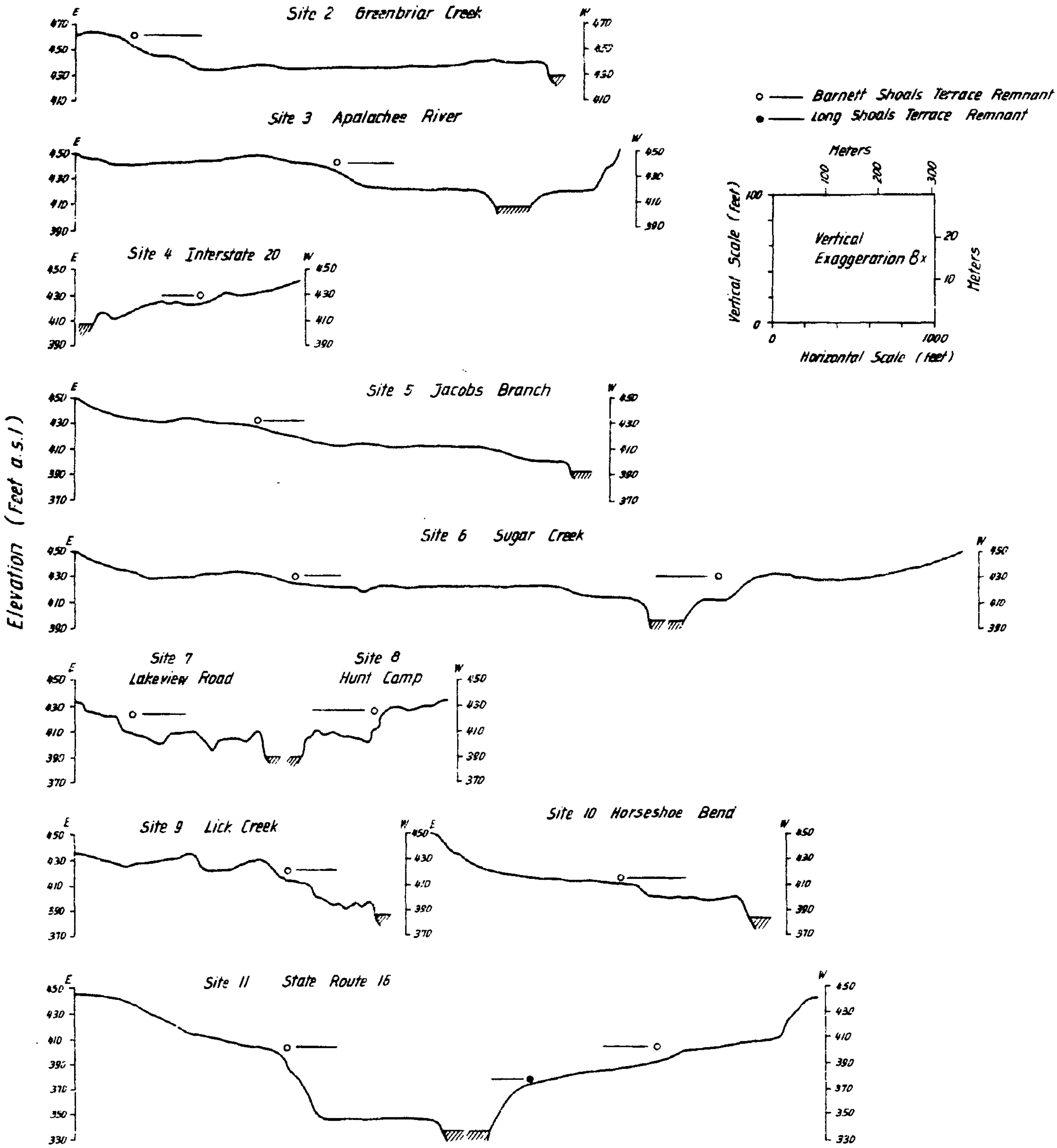

Fig. 5. Cross-profiles of the Oconee River valley showing Barnett and Long Shaols terrace remnants. Site locations are shown in Fig. 4.

enters the Oconee (site 2, Figs. 4 & 5), terrace remnants are evident as flat-topped spurs at elevations slightly above 460 ft (140 m). Extremely well preserved terrace remnants occur on either side of the Apalachee River where it joins the Oconee; these are at approximately 445 ft (136 m) a.s.l. (site 3, Figs. 4 & 5).

The lower of the two terraces, the "Long Shoals terrace," parallels the downstream continuation of the present Oconee River profile between Barnett and Long Shoals. Where State Route 16 crosses the Oconee the terrace is 8 m above the river (site 11, Figs. 4 & 5); downstream nearer the Fall Line it increases to 9.5 m.

Other workers have recognized ancient terraces along Piedmont valleys but there has been no comprehensive study. Woodruff and Parizek (1956, p. 132) have noted that "Recurrent along the mature valley walls are two erosional terraces that are probably unrelated to lithology, but may reflect fluctuations in marine shorelines, discharge, or headwater elevations." Dennis (1971, p. 127) reports three terraces in Piedmont valleys at 9-12 m, 18-24 m, and 30-46 m above the present floodplain.

The presence of paired terraces in the Oconee valley below Barnett Shoals and Long Shoals indicates that these knick points were produced by stream rejuvenations, and are not simply due to rock control as Woodruff and Parizek (1956) have suggested. The most likely explanation of the terraces is that they reflect the secular lowering of sea level at the Georgia Coast during Pliocene and Quaternary times. At the Fall Line the Barnett Shoals and Long Shoals terraces are 320-340 ft (97-104 m) and 290-310 ft (88-94 m) a.s.l. respectively. It is possible, therefore, that they correlate with the Okefenokee and Satilla river terraces of Veatch and Stephenson (1911). These workers report that at the Fall Line near

Milledgeville the Okefenokee terrace is 290 ft (88 m) a.s.l., some 23 m above the river, and at Macon it is 355 ft (108 m) a.s.l., 23 m above the river. Satilla sediments occur at 300 ft (91 m) a.s.l. at the Fall Line. Both river terraces merge with raised marine terraces on the Coastal Plain at 50-125 ft (15-38 m) and 10-20 ft (3-6 m) respectively. The Barnett Shoals and Long Shoals river terraces must be traced across the Coastal Plain before exact relationships to raised marine deposits can be determined.

PREHISTORIC RIVER CHANNEL CHANGES AND INDIAN SETTLEMENT PATTERNS

The reconstruction and understanding of prehistoric settlement patterns in the Oconee reservoir site requires knowledge of the paleogeography of the floodplain. Stream terraces and old river channels in the northern section of the reservoir were, therefore, mapped from 1:24,000 scale color aerial photographs (Fig. 6). The photography was flown for the U.S. Forest Service on March 5, 1978, when forest clearance along the floodplain was well advanced.

As Figs. 6 and 7 show, there are clear relationships between the distribution of archeological sites and the locations of old river channels. An obvious example of this occurs where Greenbriar Creek joins the Oconee River. Greenbriar Creek was straightened in historic times; old meander loops lie north and south of the present man-made channel. For obvious reasons archeological sites have not been found near the present river but have been found on levees of the former channel.

Elsewhere in the northern part of the reservoir there are similar relationships between archeological sites and river channels abandoned naturally. Immediately south of the Greenbriar Creek-Oconee River junction, for example, sites Ge 811, 830, and 842 are located along an old channel.

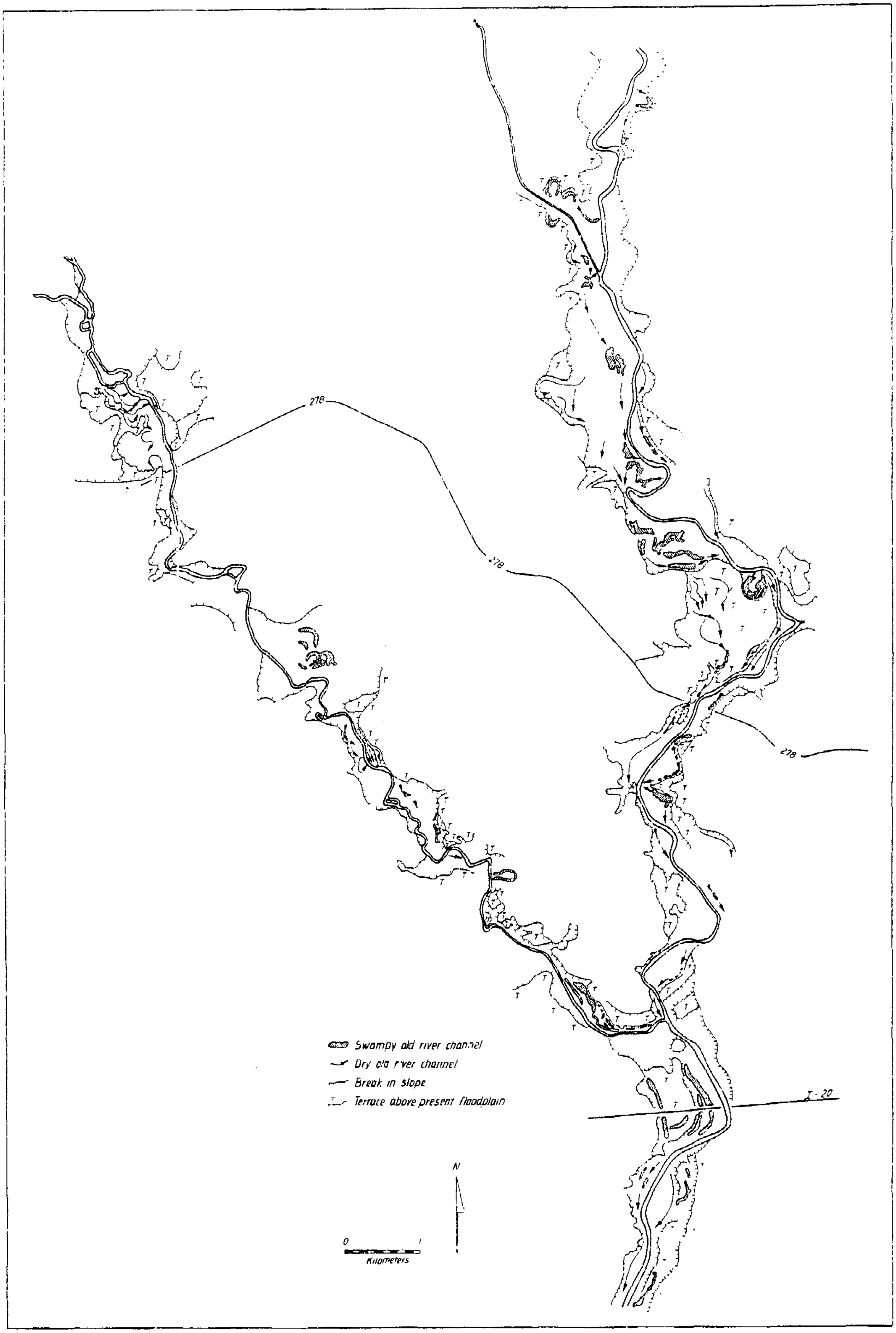

Fig. 6. Stream terraces and old river channels along the Oconee and Apalachee Rivers in the northern section of the Oconee Reservoir site.

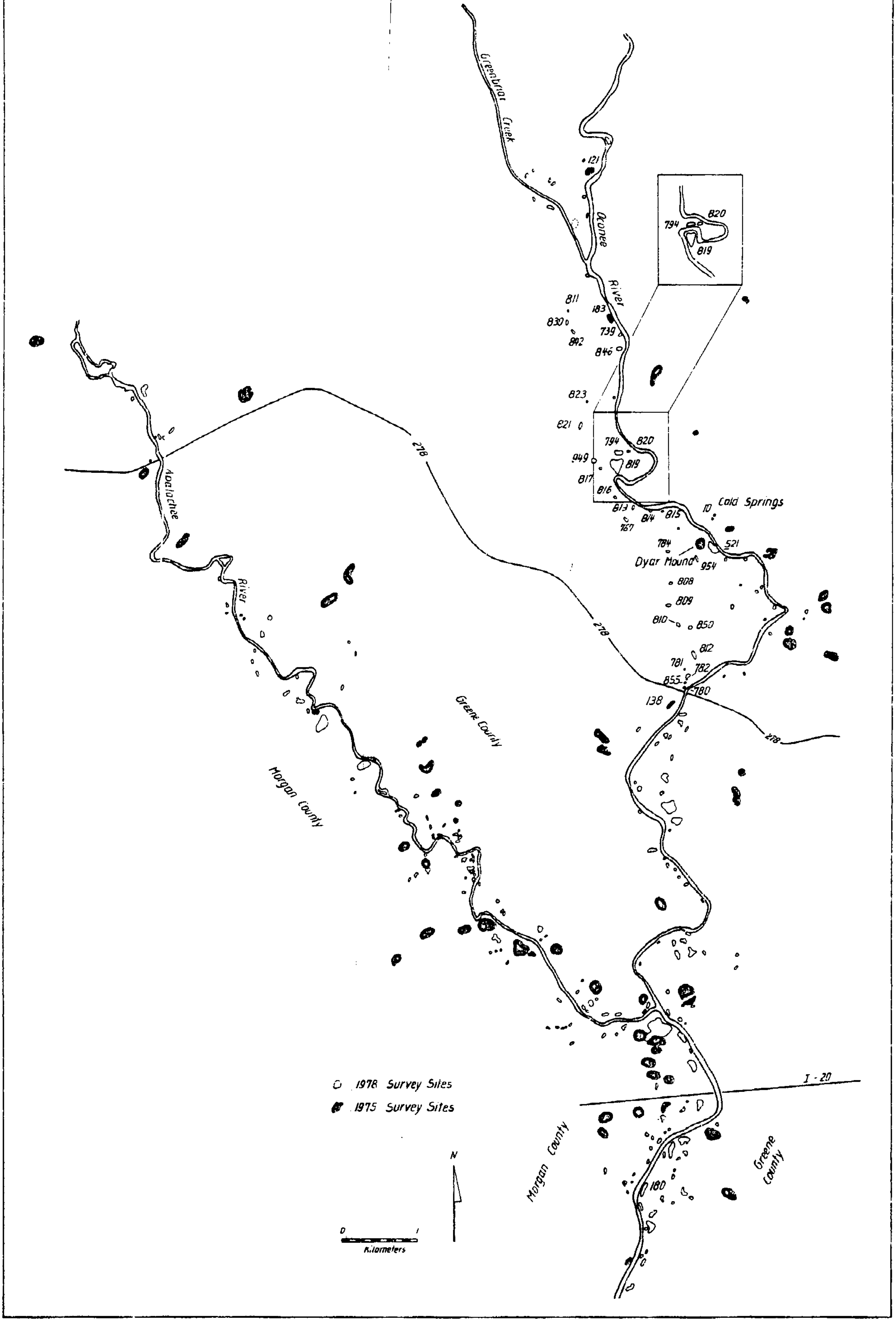

Fig. 7. Distribution of archeological sites along the Oconee and Apalachee Rivers in the northern part of the Oconee Reservoir site. The inset shows the prehistoric relationship between the Oconee River channel, and sites Ge 794, 819, and 820.

Site Ge 830 has Early Archaic artifacts, site Ge 842, Early and Middle Archaic, and Early and Late Mississippian artifacts. Adjacent to the present river, sites Ge 183, 739, and 846 have only artifacts of Lamar occupation. The implication is that in Early and Middle Archaic times (8,000-3,000 years B.C.), the Oconee River occupied a position west of its present position, and that Indian groups lived on its banks.

Further south, sites Ge 817, 821, 823, and 949 are also located along an old stream channel. No diagnostic artifacts were discovered at Ge 823 but Early and Late Archaic, and Lamar artifacts were found at Ge 821, Early and Middle Archaic and Early Woodland at Ge 949, and Late Woodland at Ge 817. Again it appears that the Oconee River occupied a position west of its present location in Archaic and Woodland times. When the river changed its course the sites became less suitable explaining why evidence of more recent occupation is limited.

Sites Ge 794, 819, and 820 also parallel a former channel of the Oconee. Occupation at Ge 794 dates to Middle and Late Archaic times, and to Lamar; at Ge 819 to Late Archaic, Early Woodland, and Early and Late Mississippian; and at Ge 820 to Lamar. There is no obvious indication from artifacts found at these sites when the river occupied the position shown in the inset of Fig. 7. It is clear, however, that site Ge 819 was originally located on a developing point bar on the east bank of the Oconee; it is presently on the west bank.

There are several abandoned channels west of Dyar Mound (Ge 5). Relationships are complex and it is difficult to discern the course of the river at any given time. However it is clear that the river migrated eastwards. On the west bank of the Oconee sites Ge 813-816 were occupied in Early and Late Mississippian times. Ge 5, approximately 150 m from the west bank of the river, is an older site. Occupation began in Late Woodland times and continued through Lamar. An abandoned channel west of the site raises the possiblity that in Woodland times the site may have been on the east bank of the Oconee. Further from the river are three older sites Ge 767, 784, and 954. Artifacts from Ge 767 are of Middle and Late Archaic age, those from Ge 784 of Late Archaic age. There is no evidence of recent occupation. It appears that these Archaic sites were originally on the banks of the Oconee River. As the channel migrated eastwards the old sites were abandoned and new ones occupied. This might explain why sites away from the river are older than sites near to it in this area.

Artifacts from Ge 521, southeast of Dyar Mound, indicate that this site was occupied almost continuously from Middle Archaic times (Middle Archaic, Middle Woodland, Early and Late Mississippian artifacts have been found). There are no abandoned channels near the site; the long occupation can be explained by postulating that the Oconee River has remained near the site for the last 10,000 years.

Southwest of Dyar Mound are a string of sites, some more than 1.0 km from the present river. These sites, which include Ge 780-782, 808-810, 850, and 855, parallel an ancient stream channel of the Oconee. Artifacts discovered at these sites date to the Middle and Late Archaic; Lamar; Early Woodland; Late Archaic; Late Archaic and Early Woodland; Lamar; Early and Middle Archaic, and Lamar; Middle Archaic; and Middle Archaic respectively. Seven of the nine sites were occupied in Archaic times suggesting that all were originally located along the banks of the Oconee River. Again an eastwards migration of the river is indicated.

Many archeologists feel that abandoned river channels were attractive locations for Indian settlement because they provided a varied environment for food collection. This is not a satisfactory explanation of the juxtaposition of old river channels and archeological sites in the northern part of the Oconee reservoir. The age distribution of sites near old channels suggests that many were initially located on the banks of active stream channels and that subsequently these channels were abandoned. When this occurred most settlements were relocated adjacent to the new river channel.

HISTORIC SEDIMENTATION ALONG THE OCONEE RIVER VALLEY AND TRIBUTARIES

The southern Piedmont has been described by Trimble (1974) as one of the most seriously eroded agricultural areas in the United States. The period of greatest erosive land use along the Oconee River, in the cotton plantation era, was between 1860 and 1920. Prior to European settlement erosion may have been minimal. In early colonial times streams were generally described as clear, indicating that Indian floodplain agriculture was causing little soil erosion. Trimble has argued that soil eroded in the period 1860-1920 has filled stream channels and valleys to varying degrees. Ground water levels have been raised causing many bottomlands to become swampy, and floods have deposited brown and red sediments on previously dark bottomland soils. During the 20th century soil erosion was greatly reduced because of a decline in agricultural land use, the transition of former cropland to forest and pasture, and the widespread implementation of soil conservation practices. Trimble believes that streams are now dissecting the sediments deposited in their valley floors.

Evidence from Dyar Mound and Cold Springs supports the arguments of Trimble. At the Dyar site, occupied from A.D. 1,000-1,550, a blanket of alluvium 65 cm thick covers an early plow-disturbed soil stratum 15 cm thick. An English button, recovered from the base of this plow zone, has been approximately dated to the first half of the 19th century by comparison with buttons recovered from Brownsville Town (1800-1830) and Fort Fisher (1837-1865). The button was discovered during excavations in the the area lying between the present river channel and a large prehistoric earthwork. The implication of this find is that 65 cm of floodplain alluvium has been deposited in the area since about the time of the Civil War. By comparison the soil stratum representing approximately 500 years of Indian occupation at the site is only 65-90 cm. It is clear that sedimentation has been occurring at this site since A.D. 1,000 but the rate greatly increased following European settlement in the area (Marvin Smith, personal communication).

Recent valley alluviation is also suggested by the elevation of the present water table at the Dyar site. In the eastern area of the village the water table was above the lower limit of recent alluvium. Near the center of the site a burned structure (STR 4) was located by a backhoe excavation in the spring. Excavation had to be delayed until August wher following a summer drought the water table became low enough to allow excavation. Even in this dry spell low areas of the floor filled with ground water. Areas north of this structure were even lower, preventing detailed assessment of the soil strata. It is clear that the aboriginal ground surface was below the present water table since numerous artifacts were "dredged up" with the backhoe machine (Marvin Smith, personal communication).

Similar observations were made at Cold Spring's near Dyar Mound on the opposite side of the Oconee River. Datable artifacts indicate that occupation of the site began in the Archaic although no features of this period have been positively identified. Features have been dated from the Cartersville (A.D. 0), Swift Creek (A.D. 290, 400, and 445), Etowah (A.D. 905) and Lamar periods. The river presently floods the area to the west of the two mounds during times of high water. The present water table is above the bases of structures from both the Swift Creek and Etowah periods, and also fills Cartersville and Lamar pits. None of these features would have been functional under damp conditions. The floors of Swift Creek and Etowah structures were excavated into the soil to 60-75 cm depth. Water stood in these structures during much of the summer of 1978, the water coming from the ground water rather than from rain. Even under dry conditions the bases of these structures were saturated (Suzanne Fish, personal communication). The indication is that at both Dyar and Cold Springs there has been extensive alluviation of the valley floor in recent times and a raising of the river level and associated water table.

Rates of sedimentation on natural levees in the northern portion of the reservoir have been determined by examining the characteristics of subsurface sites discovered during the 1975 archeological survey of the area (De Pratter 1976). Sites Ge 145 and Ge 148 are in presently active levees. Ge 145 is located between the Oconee River and Harris Creek; the levee rises 3.5 m above the river. Occupation occurred during the Late Archaic Stallings Ceramic Phase (3,000-1,000 years B.C.). Since then 70-100 cm of alluvium has accumulated. Ge 184 lies on a natural levee of the Oconee River north of the man-made channel of Greenbriar Creek. Here there has been 80-90 cm of alluviation since Lamar times (A.D. 1,300-1,600).

Sedimentation has also been estimated on levees which are no longer adjacent to the river channel. Excavations at Ge 121, 400 m north of the old channel of Greenbriar Creek, have shown that there has been 25-30 cm of alluviation in the sand ridges of a developing point bar since Lamar times. Ge 138 is located on the west side of the Oconee River south of highway 278. It occurs in an old levee 60 m from the river; the levee rises approximately 1.0 m above the surrounding floodplain. At this site a Lamar occupation phase is buried beneath 30-40 cm of alluvium.

Site Ge 180 on the east bank of the Oconee 1.1 km downstream of Interstate 20 is on a natural levee rising 8-9 m above normal river level. Between it and the river is a smaller ridge 4-6 m high. Since Lamar occupation there has been 50 cm of alluviation at this site; undated artifacts at 125 cm indicate that sediment was accumulating prior to the Lamar phase. On the west bank of the Oconee 1.2 km upriver from Parks Mill there are two parallel levees; they rise 2 m, and 3-4 m above the floodplain. Site Mg 90 is located on the larger inner levee. An Early Archaic occupation has been identified at 120-150 cm and a brief later occupation (possibly Lamar) at 80 cm. The upper 35 cm of the profile consists of red and brown sands and clay loams and may date to the historic period.

Analysis of buried sites in the northern portion of the reservoir, uncovered by the 1975 survey (De Pratter 1976), has shown that since the Lamar period (since A.D. 1600) maximum sedimentation rates on natural levees adjacent to the river or at some distance from it have varied from 79-237 cm/1,000 years. These high sedimentation rates are probably a further indication that there has been accelerated sedimentation in the Oconee River valley since European settlement was complete.

Wahl and Lawson (1970) have compared climatic data for the continental United States for the 1850's and 1860's with climatic normals derived from 1931-1960 statistics. Results show that Piedmont Georgia had a mean annual temperature 2°F lower in the period 1850-1869 and 10% more rainfall. The greatest increases in precipitation were in summer (July through August) and in late fall (November through December). An earlier analysis by Wahl (1968) found generally lower temperatures and increased precipitation in the eastern United States for the period 1830-1849. Wahl and Lawson (1970) suggest that the cooler and wetter conditions of the early and mid 1800's came to an end during the 1880's.

Increased agricultural activity and to a lesser extent increased precipitation in the early and mid-1800's were together responsible for accelerated erosion and sedimentation, and a higher water table in the Piedmont. Flood analysis of the Oconee River suggests that at the height of the cotton era (1860-1920) floods were more severe because of increased surface runoff. The data used to construct the flood profiles in Figure 8 were obtained from Bunch and Lopez (1954), Bunch (1964) and from measurements made at Parks Mill. The highest floods on record occurred in 1884, 1887 and 1908. At Parks Mill water reached 435.3, 434.7, and 431.3 ft (132.7, 132.5, and 131.5 m) above sea level respectively. Between 1940 and 1961 there were only two severe floods. In November 1948 water reached an elevation of 428.6 ft (130.6 m) at Parks Mill and in March 1952 it reached 419.8 ft (127.9 m).

Bunch (1964) regards the 1887 flood as a 100-year event. Under present land use conditions his estimate is probably high. Flood levels in 1884, 1887, and 1908, and possibly also in 1929 and 1936, were probably higher than they would be today under similar weather conditions. The transition of

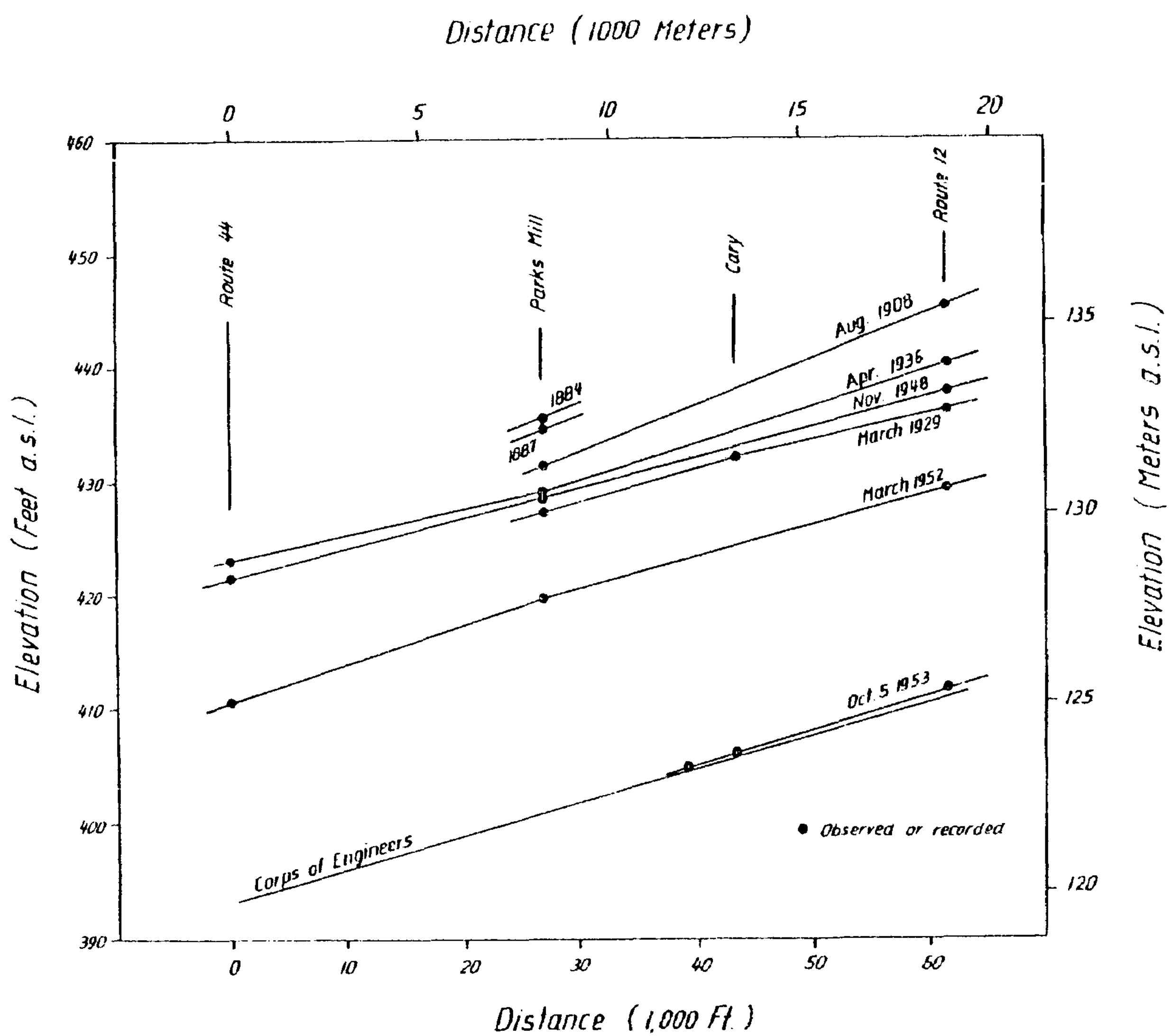

Fig. 8. Flood profiles for the Oconee River between Routes 12 and 44 (partly after Bunch, 1964).

former cropland to forest and pasture, and widespread use of soil conservation practices have greatly reduced the volume of surface runoff.

THE FLOODPLAIN ENVIRONMENT: AN 1804-1978 COMPARISON

Before the end of the American Revolution the General Assembly of Georgia passed two acts relating to the granting of land. The Act of February 17, 1783, allowed a man to take 200 acres of land upon his own "headright" and 50 acres for each member of his family up to a maximum of 1,000 acres. The land was surveyed by the county surveyor who kept a copy of the plat and filed one with the Surveyor General. The "headright" system led to an unsystemmatic distribution of land. Holdings varied considerably in size and boundaries were arbitrarily chosen by the surveyor.

In response to the pine barren speculations and the Yazoo controversy in Georgia, on May 11, 1803, the State Legislature approved an act establishing a land lottery to distribute land acquired in the 1802 Creek cession. The Act of 1803 directed that the new territory be divided into counties and each county subdivided into districts of approximately equal size. District surveyors appointed by the Legislature subdivided the districts into square lots or tracts. They were instructed to mark trees or stakes on the surveyed lines and to note in field notebooks water courses, the type of tree or stake marked, and distances run between stations. The district surveyor was also instructed to produce a map of his district showing all surveys within the district. In addition a "detailed plat" of each lot within the district was to be deposited in the Surveyor General's office.

Land in the Oconee Reservoir site east of the Apalachee and east of the Oconee south of the Apalachee junction was "headright" land. All other land was systematically surveyed in 1804 according to the Act of 1803. The area is covered by district maps 2-5 of what in 1804 was Baldwin County. The land in Baldwin County was surveyed into tracts 45 chains square (905 m square), each containing 202.5 acres.

Trimble (1974) has described the effects of accelerated sedimentation on river environments in the southern Piedmont between 1700 and 1970. His arguments suggest that the present landscape of the Oconee valley is different from that of early historic times. An attempt has been made to determine if this was the case by comparing the 1804 valley landscape shown on land lottery plats, held in the Georgia Surveyor General Department in Atlanta, with the present landscape. Environmental reconstructions using headright plats have not been attempted because of the difficulties involved in determining the exact locations of land shown on headright plats.

Some of the land lot boundaries in the area west of the Apalachee and west of the Oconee downstream of the Apalachee junction are still clearly visible in low altitude black and white aerial photographs. Many of the present land boundaries and secondary roads parallel the 1804 survey lines. This made it possible to produce a reasonably accurate map of the original land lottery boundaries from the aerial photographs. This information was then transferred on to the U.S. Geological Survey 1:24,000 scale topographic quadrangles of the area. Detail of the Oconee and Apalachee Rivers shown on the plats was then added and a plat mosaic prepared. Examples of the plats used to construct the plat mosaic of the Oconee Reservoir region are shown in Fig. 9.

The 1804 plat mosaic is compared in Figs. 10 & 11 with a 1978 map of the Oconee River and tributaries prepared from aerial photographs. Numerous differences are apparent; these will be briefly outlined. The acreages of

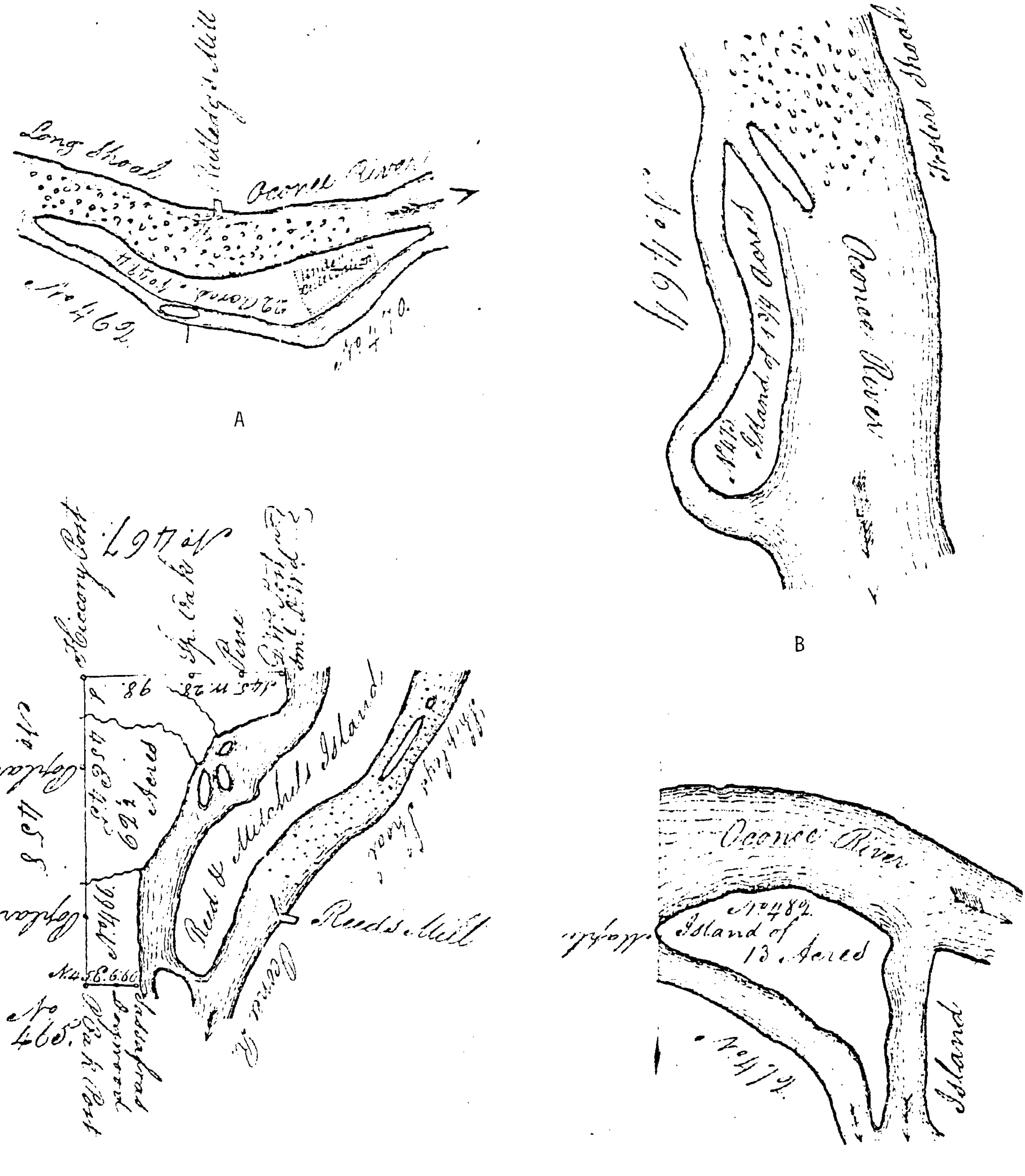

Fig. 9. Examples of plats used to construct an 1804 plat mosaic of the Oconee Reservoir area. The plats are 484(A), 475(B), 486(C) and 482(D).

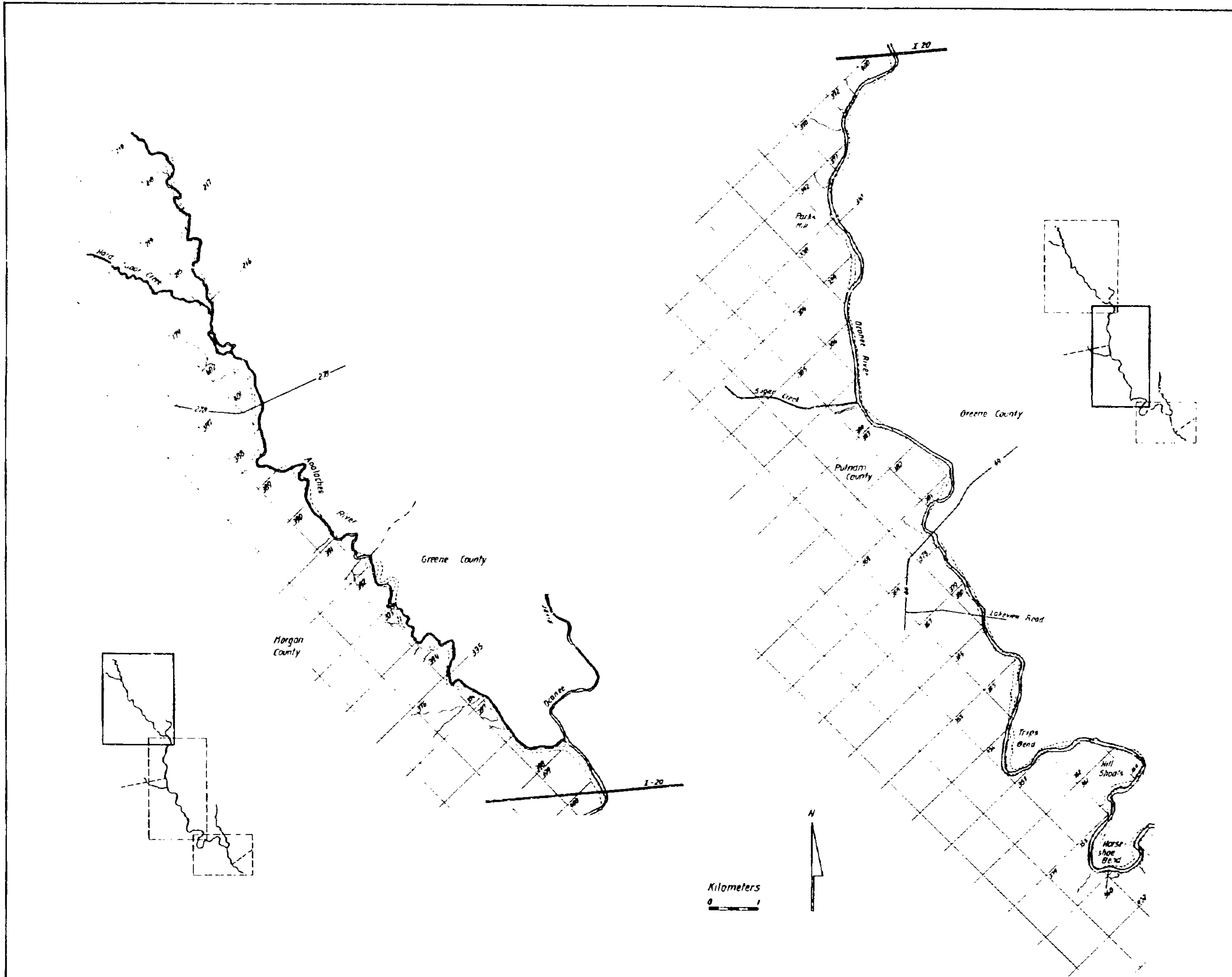

Fig. 10. Comparison of the 1804 and 1978 floodplains in the northern and central parts of the Oconee Reservoir region.

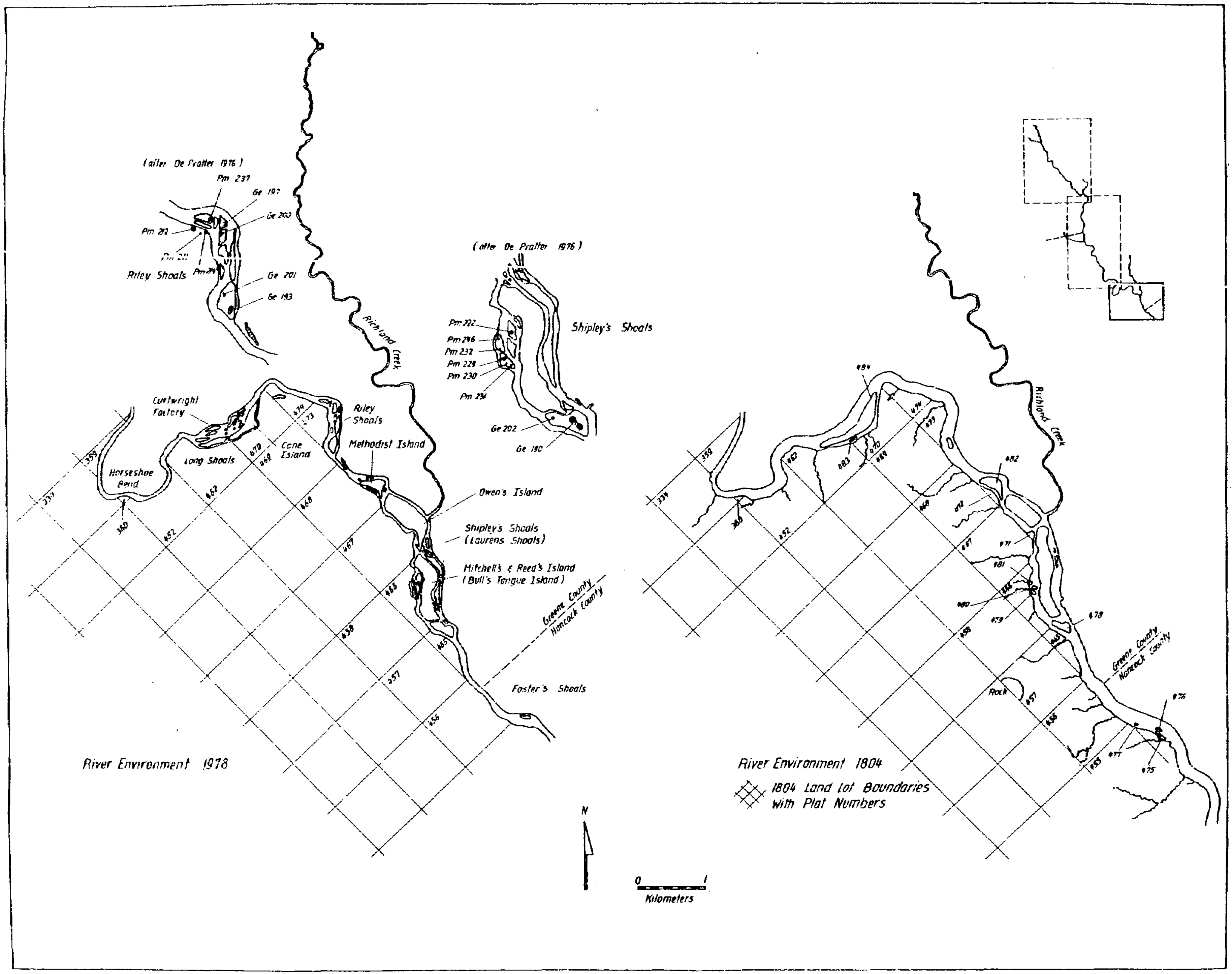

Fig. 11. Comparison of the 1804 and 1978 floodplains in the southern part of the Oconee Reservoir region.

16 riverside lots along the west banks of the Oconee and Apalachee rivers appear to have been reduced by an average 7.9 acres (σ = 8.3 acres) since 1804, and the acreages of 45 lots increased by 12.3 acres (σ = 12 acres). The Oconee and Apalachee rivers appear more sinuous today than in 1804. The increase is from 1.06 to 1.10 in the case of the Oconee downstream of the Apalachee junction, and from 1.04 to 1.21 in the case of the Apalachee.

At Horseshoe Bend (plat 359) migration of the Oconee River channel to the northwest is suggested and can not be ruled out by the presence of intact archeological sites between the present and postulated 1804 river channels. In the northern part of lot 359, however, the east bank of the Oconee is a steep bluff, here the river could not have been east of its present position in 1804. In the southern portion of the lot the west bank is a low floodplain so that the channel could have migrated westwards in historic times.

Figure 10 suggests that at Trips Bend there has been erosion at the outside of the river bend with slight migration westwards of the river channel. Site Ge 503 is located between the 1804 and present channel positions and would have been destroyed had the river migrated by bank erosion. If the channel position changed abruptly, however, Ge 503 would have been left intact. Upstream of Trips Bend (plat 365) sites Pm 198 and Pm 199 lie between the present and postulated 1804 positions of the river channel. Again if the channel position had switched abruptly to a backswamp area these sites would have been left intact.

Between route 44 and the junction with Sugar Creek (plats 381, 382, 383) there may have been east or northeast migration of the Oconee River. Immediately downstream of Sugar Creek in the vicinity of lot 383 several Indian sites have been discovered on the west bank of the Oconee or slightly back from it (Pm 567-568, Pm 579, and Pm 581). If the river had occupied the position indicated on the 1804 mosaic no sites should have been discovered. In this area, at least, the channel has probably not changed position in historic times. However the presence of an old channel west and northwest of the present channel in the vicinity of lots 381 and 382 is evidence that the river could have occupied a more westerly position in 1804.

South of Parks Mill in the region of lots 338-339, and 341 the river may have occupied a more westerly position in 1804. The presence of sites Mg 96 and Mg 148 between the two river positions indicates that if any change did take place it was abrupt. It is possible that at the time of Indian occupation Mg 96 and Mg 148 were on the east bank of the Oconee and not, as they are now, on the west bank.

There is good correspondence between the 1804 and present positions of the Apalachee River immediately upstream of the Oconee-Apalachee junction. Near lots 389-394, and 396 however, the channel appears to have been more sinuous in 1804. No Indian sites have been discovered that would preclude these apparent changes in channel position.

Floodplain geomorphology near lot 389 suggests that the river was accurately depicted on plat 389. The district surveyor mapped the meander cutoff in the north of the surveyed lot and was clearly not aware of the meander loop further to the north. To the southwest there is a flooded old river channel on a small point bar. It appears that in 1804 the river occupied this channel and has since shifted northeastwards. On plat 391, however, there can be no doubt that the district surveyor simplified the configuration of the river channel. Here the Apalachee is shown to cross a high-level, flat-topped spur on the southwest bank of the river. This terrace is approximately 10 m above the river. The river could not have been in this position in 1804.

Plats 391 and 392 show a pond near the southwest bank of the Apalachee. This pond exists today confirming that here the river channel has remained essentially stable since 1804. An old river channel south of the present river in the region of lot 394 however, suggests that the configuration of the Apalachee shown on the 1804 plat was correct and that the present stream channel is more sinuous. Differences in channel position near lots 388 and 401-402 may reflect mapping errors. The configuration of the channel is the same at both periods but the 1804 channel is displaced slightly. No changes in river position in this area are therefore postulated. Plats 214 and 217-218 show a much less sinuous Apalachee River. Furthermore there is no indication from the distribution of Indian sites that the river was not indeed much less sinuous in 1804.

Figure 11 suggests that upstream of the Oconee Reservoir dam there have been considerable changes in the number and morphologies of river islands. Plats 483 and 484 show that in 1804 there were two river islands in the Long Shoals area, they also show Rutledg's Mill on the north bank of the river. The larger of the two islands (lot 484) was surveyed at 22 acres and at the eastern end of the island a large area was mapped as being "under cultivation" (Fig. 9A). Whether this was Indian or European agriculture is not clear but a buried plow zone has been discovered in archeological excavations (Dean Wood personal communication). At the present time island lot 484 is two separate islands separated by a narrow channel. The easternmost of these two islands--Cane Island--is approximately 22 acres in area. Island lot 483 estimated in 1804 to be 0.75 acres no longer exists. Numerous islands are present at Long Shoals today, none of these is sketched on the 1804 plats. Sites Pm 208-Pm 210 have been discovered on Cane Island increasing the possibility of Indian agriculture at the eastern end of the island.

Changes also appear to have taken place near Riley Shoals although the evidence of Indian occupation in this area conflicts with the 1804 map. Only one island is shown on plat 473. There are numerous alluvial islands in this region at the present time. The evidence for changes at Riley Shoals is ambiguous. Indian occupation sites suggest that several of the present islands were in existence in 1804 although only one of these is depicted on the 1804 plats. Posthole tests at Ge 197 have revealed water-worn artifacts and at Ge 200 both water-worn and non-transported artifacts have been discovered (De Pratter 1976). At site Pm 237 an intact, buried Lamar occupation site has been discovered (Figure 11). The 1804 plats indicate that the island southwest of Pm 237 was part of the west bank of the river at that time; the island of site Pm 237 may also have been part of the west bank. Southeast of site Ge 193 is an old channel of the Oconee (inset Riley Shoals, Fig. 11). No sites have been discovered in the area separating it from the present river indicating that this may be a recent deposit. The east bank of the Oconee shown in the 1804 plats appears to follow the line of the old channel.

Between Riley Shoals and the Richland Creek confluence the 1804 mosaic shows two river islands. The most northerly of these, Methodist Island, was lot 482 and was estimated to have an area of 13 acres (Fig. 9D). Four small islands circle Methodist Island today, none of these appear on the 1804 plats. Today the island is nearer 11 acres suggesting that there may have been erosion of its banks since 1804. A Swift Creek site discovered on the southwestern shoreline of the island shows evidence of erosion implying that one or more of the nearby smaller islands may have been connected to the main island in 1804.

Owen's Island has a rock core; it was sketched on plat 467 but was not surveyed in 1804. Several Indian sites have been discovered (Ge 156-160, Ge 966-167). The 1804 plats indicate that at this time the island did not extend beyond the Richland Creek confluence. Today it extends well south of this confluence indicating that there may have been deposition of river alluvium at the southern end of the island in historic times.

Plats 466 and 467 include a sketch of Reed's and Mitchel's Island at Shipley's Shoals and show the locations of Mitchel's and Reed's Mills on the east bank of the Oconee opposite the northern and southern ends of the island respectively. The island is shown to extend northwards to a point just south of the Richland Creek confluence. It appears from recent maps and aerial photographs that river channel development in the northern alluvial portion of Reed's and Mitchel's Island has reduced it to a series of smaller islands. The remainder of the island, now called Weston-Reeves or Bull's Tongue Island, has changed little since 1804.

Plat 466 shows two small islands between Reed's and Mitchel's Island and the east bank of the Oconee and three island lots (479-481) of 2.25, 1.75, and 0.25 acres respectively between it and the west bank of the river (Fig. 9C). Today there are two large and several small alluvial islands in what is now called Lawrence's Shoals (Laurens Shoals) east of Bull's Tongue Island. The 1804 plats suggest that these are of recent origin as does the fact that no Indian artifacts have been discovered on them. Changes also seem to have taken place west of Bull's Tongue Island. In 1975 island lots 479 and 481 were still separate. Indian artifacts at sites Pm 246 and Pm 229-232 indicate they had been in existence for some considerable time. In 1978, however, the two islands were connected, presumably as a result of recent alluviation. A Lamar occupation site (Pm 222) on an alluvial island northeast of island lot 480 proves that this island was in existence in 1804 but was not included on any surveyed plat.

Plat 465 shows that the present unnamed island south of Bull's Tongue Island was in existence in 1804; it became island lot 478 and had an area of 9.75 acres. Indian occupation is indicated by posthole tests at sites Ge 190 and Ge 202. The 1804 plats suggest that alluviation at the southeast end of Reed's and Mitchel's Island may have added to its area and may have created a new island between it and island lot 478.

There were three islands (lots 475-477) at Foster's Shoals (the site of the Oconee Reservoir dam) in 1804 (Fig. 9B). These had areas of 1.75, 0.75, and 0.25 acres respectively. There is only one island at Foster's Shoals today; it is near the east bank and does not appear to correspond with any of the islands depicted on plat 464. It appears that sedimentation on the inside of the river bend has connected islands 475-477 with the west bank of the Oconee and that the present island was formed by erosion of the east bank.

Comparison between the 1804 plat mosaic, a recent map of the Oconee reservoir-site, and the distribution of archeological sites has revealed simplifications and omissions in the mosaic. These are not unexpected. The district surveyors were surveying boundary lines, they were not trying to produce accurate maps of the river and floodplain. In spite of minor difficulties it is clear that the 1804 plats contain a great deal of accurate information on the Apalachee and Oconee Valley environments in 1804. This evidence indicates that there have been changes in the positions of the main river channels (with a slight increase in sinuousity) and in the number and form of river islands downstream of Long Shoals.

According to Schumm (1963) the channel sinuosity (P), which is the ratio of the channel length to the valley length, is related to the percentage of silt and clay (M) in the perimeter of the channel where,

$$P = 0.94\ M^{0.25}$$

Schumm therefore suggests that as the wash load of a stream (the fine sediment in suspension) increases, channel sinuosity should increase. Trimble (1974) has shown that a tremendous amount of soil was washed into the Oconee River during the cotton plantation age (from about A.D. 1800 to 1920). He estimates that the depth of soil lost on the Georgia Piedmont was approximately 19 cm during this period. The concentration of fine sediment in the Oconee River must therefore have increased markedly during the cotton era and following Schumm (1963), this should have resulted in a narrower, deeper, and more sinuous channel.

In 1804 the sinuosity of the portion of the Apalachee River shown in Fig. 10 was 1.04 and the sinuosity of the Oconee River in Figs.10 & 11 downstream of the Apalachee was 1.06 giving a mean sinuosity for these two channel stretches of 1.05 in 1804. In 1978 the same two stretches of channel had a sinuosity of 1.15 indicating an increase in the intervening 174 years. This result suggests that the sinuosities of the Apalachee and Oconee Rivers may have increased because of increased soil erosion during the cotton plantation age.

Although there are no data on channel form in the Oconee Reservoir region at the height of the cotton plantation period such data are available for the Oconee River downstream of Milledgeville to its junction with the Altamaha River. This stretch was surveyed in the early 1800's as a part of the land lottery scheme and also by the Corps of Engineers in 1910. A study was conducted on the stretch of the Oconee River channel included on the 1:24,000 scale Gumm Pond Quadrangle (approximately 8 miles southeast of Milledgeville) to determine temporal variations in channel sinuosity. Maps for the years 1805 (prepared from land lottery plats), 1910, and 1973 (prepared from aerial photographs) were compared. In 1805 the sinuosity of this stretch of the Oconee was 1.23, in 1910 it was 2.10 and in 1973 it was 1.96.

Channel sinuosities are compared in Fig. 12 with the intensity of erosive land use (ELU) in the southern Georgia Piedmont 1700-1967. Within this time span Trimble (1974) recognizes a period of increasing intensity of ELU lasting from 1700-1850, a period of greatest ELU from 1850 to 1920 and a period of decreasing ELU lasting from 1920 to the present. Variations in the sinuosity of the Oconee River in the study area southeast of Milledgeville closely parallel variations in the intensity of ELU. Sinuosity was greatest in 1910 during the period of greatest ELU on the southern Georgia Piedmont. The sinuosity was much lower in 1805 at the beginning of the period of increasing ELU and slightly lower in 1973 at the end of the period of decreasing ELU.

The implication of this study of the Oconee River southeast of Milledgeville is that the stream channels in the Oconee Reservoir region were more sinuous in the period 1850-1920 than they are today or were in 1804. This fact must be taken into consideration when interpreting the locations and stratigraphic characteristics of archeological sites.

DEPOSITIONAL AND THERMAL REMANENT MAGNETISM STUDIES AT THE OCONEE RESERVOIR SITE

When work on the geomorphology of the Oconee reservoir began during the summer of 1978 one of the prime objectives was to develop an absolute chronology for the land forms of the area. It was hoped to obtain carbon

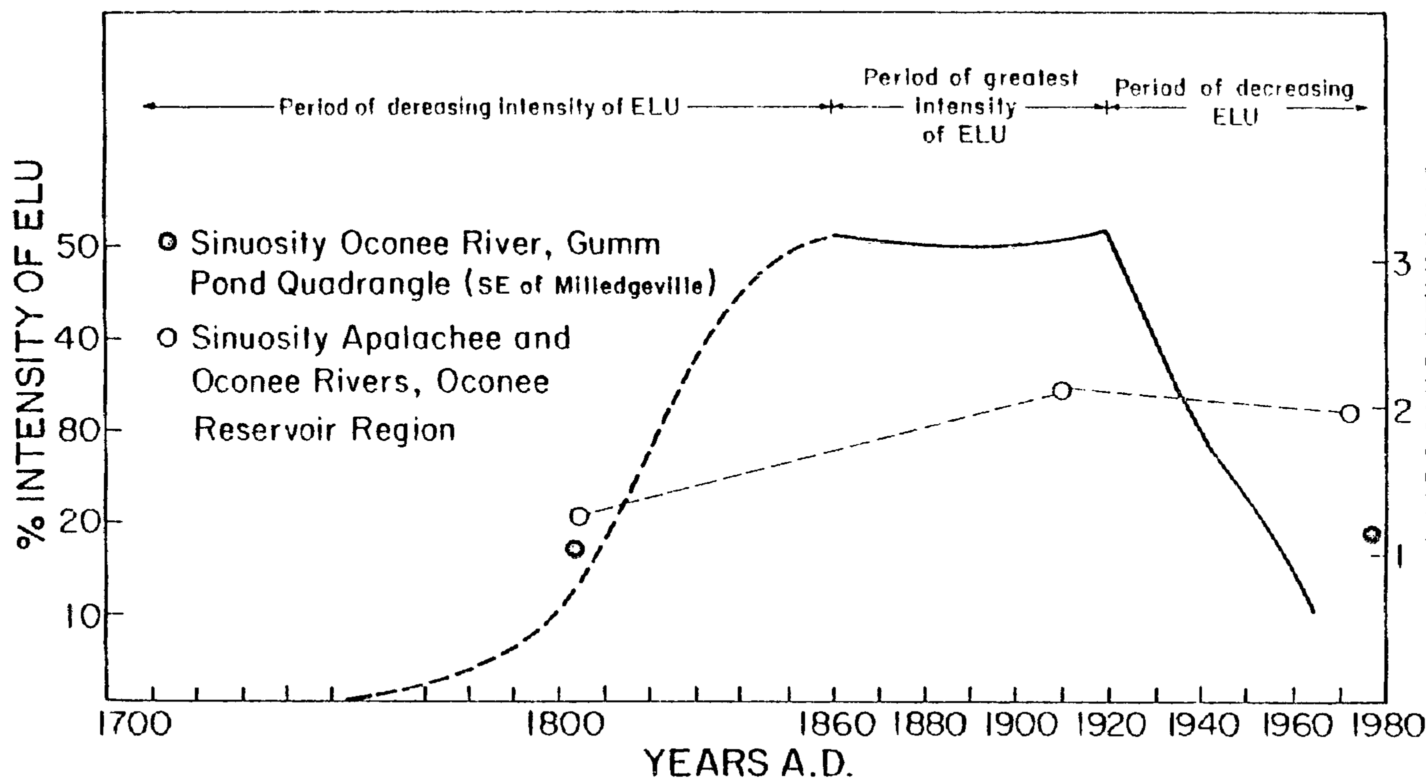

Fig. 12. Intensity of Erosive Land Use in the southern Georgia Piedmont, 1700-1967 and channel sinuosity in the Oconee Reservoir region and along the Oconee River in the Gumm Pond Quadrangle southeast of Milledgeville (partly after Trimble, 1974).

14 ages for wood co-deposited with fluviatile sands and silts, and to determine a glacial or interglacial origin for the sediments from the pollen assemblage. Both approaches had to be abandoned. Old levee, terrace, and backswamp sediments contained neither wood nor preserved pollen. In view of these difficulties an attempt was made to establish the potential of geomagnetic analysis of sediments and archaeological materials as a dating technique.

In recent years studies of depositional remanent magnetism (DRM) in sediments and thermoremanent magnetism (TRM) in archeological materials has proved useful in absolute dating (e.g. Ellwood 1971; Creer and Kopper 1974). The reversal time scale of the earth's magnetic field has been used to date sediments older than about 0.7 million years, and secular variations, persistent over distances of up to 3,000 km, to date more recent materials.

In-situ, fire-baked clay samples for TRM studies were taken from hearths and burned floors at Dyar (Ge 9) and Cold Springs (Ge 10), and sediment samples for DRM studies from active and relict levees, terraces, and backswamps at Hill Shoals and Dyar. Samples were collected in cubic plastic boxes of 8 cm^3 that were pressed or gently hammered into cleaned vertical sediment faces in archeological excavations or in stream-cut gullies. An aluminum angle strip was placed against the plastic boxes and used as a compass extension platform. The declination and inclination of each box were measured with a Brunton compass and then the boxes were removed. In thick sediments samples were taken at different depths so that changes in remanent magnetism over time could be determined. Multiple samples or multiple sets of samples were taken at each sample location to test the validity of results.

Remanent magnetism was measured using a 5 herz spinner magnetometer. Samples were then treated in alternating magnetic fields. A peak alternating magnetic field of 50 oersteds was applied to minimize unstable components, and the magnetic direction and intensity were re-measured.[2]

Measured remanent magnetism in multiple samples from fire-baked clay was very variable. In four samples taken from a clay hearth (Feature 29) at Dyar, declination varied from 248° to 12°, and inclination from 41° to 63°. In duplicate samples from two older burned floors beneath feature 29 declinations were 356° and 8° in the one case and 341° and 353° in the other; respective inclinations were 40° and 41°, and 50° and 51°. Because of such inconsistency, TRM measurements could not be used to construct curves of secular variation in declination and inclination necessary for the archeomagnetic dating or prehistoric sites.

The geomagnetic records obtained from duplicate sets of samples taken from floodplain sediments also lacked consistency. This is illustrated by results from two sample locations 3.0 m apart in the wall of a drainage ditch 2 km northwest of Dyar Mound (Fig. 13). Samples were collected from light brown floodplain loams 150 cm thick between a surface plow zone 20-30 cm thick and a basal sand at 180 cm. Although there are some similarities in the magnetic histories at the two locations, particularly in the magnetic inclination record below 100 cm, at any given depth declination and inclination are highly variable.

TRM and DRM studies indicate that fire-baked clay and floodplain sediments along the Oconee River record the locations of the earth's magnetic poles but not accurately enough for measurements to be used with published

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[2]Measurements were carried out in the Department of Geology, University of Georgia, under the supervision of Dr. Brooks B. Ellwood.

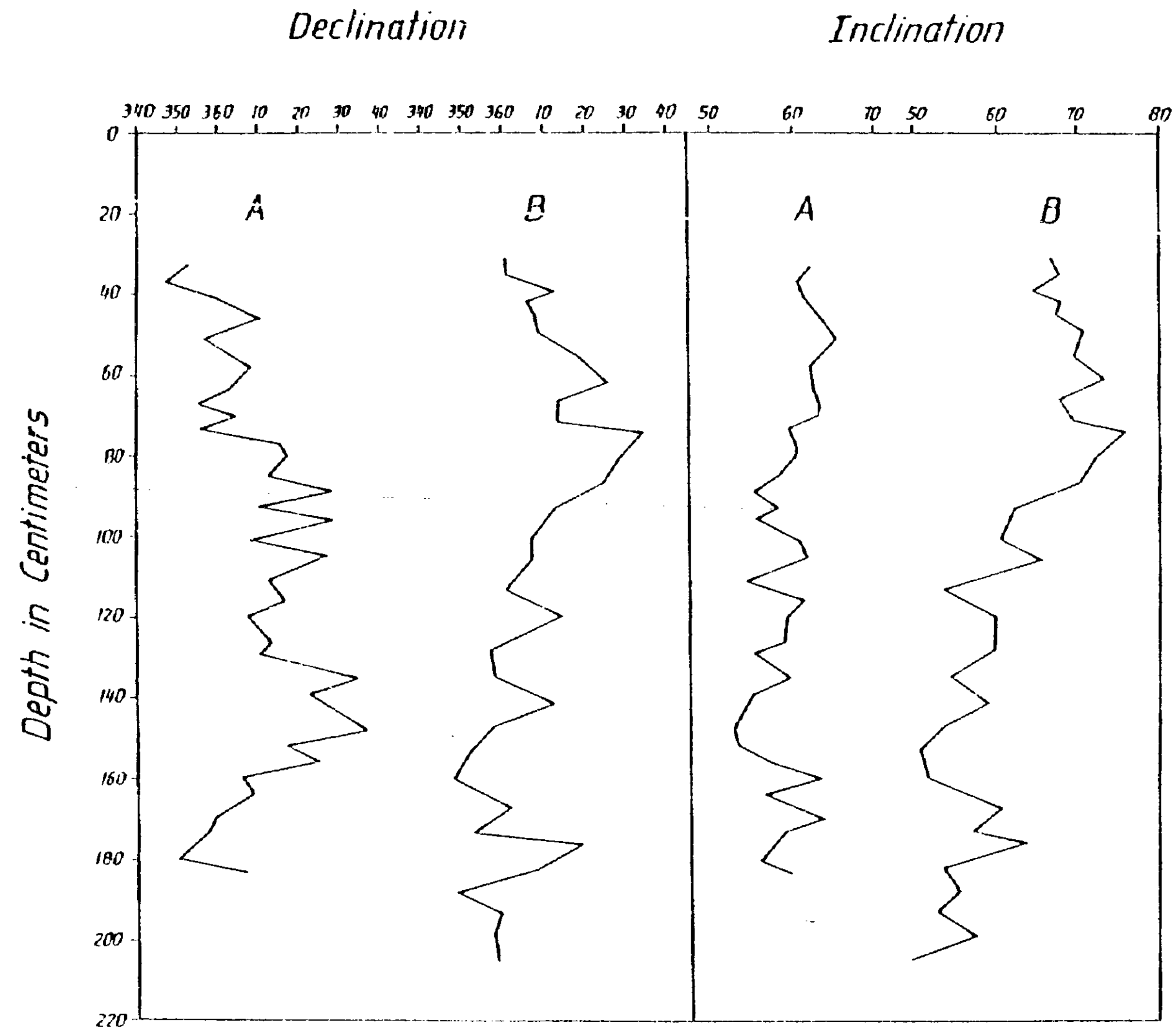

Fig. 13. Variations in the declination and inclination of depositional remanent magnetism (D.R.M.) in duplicate sample sets from floodplain sediments north of Dyar Mound.

curves of secular variations in the geomagnetic field to obtain absolute dates. These results suggest that sediments older than 0.7 million years might record reversals in the earth's magnetic field. Samples from a series of terraces above the present river in the Hill Shoals area showed no evidence of a magnetic reversal leading to the tentative conclusion that terraces in the Oconee reservoir area are younger than 700,000 years B.P.

Inconsistent DRM results may be due to post-depositional weathering of magnetite to hematite which gives the soils of the area a red-brown color. Studies in colder climates, where oxidation is less rapid, might be more successful. Poor TRM results could reflect difficulties in sampling hard fire-baked clay by the method employed. An improved sampling technique may be to first impregnate sediments with resin before drilling sample cores for analysis.

PALEOCLIMATE AND PALEOHYDROLOGY OF THE OCONEE RESERVOIR REGION 40,000 YR B.P. TO THE PRESENT

Paleoenvironmental conditions along the Oconee and Apalachee Rivers in the Oconee Reservoir area have been extremely difficult to deduce. In large part this is due to the extremely poor preservation of pollen in the fluvial sediments and also to the general lack of datable material (excluding archeological artifacts). Fortunately data from other sites in Georgia and elsewhere in the southeast can shed some light on conditions in this area during glacial and post-glacial times.

Pollen studies at Anderson Pond, north-central Tennessee, a sinkhole in dolomitic limestone, has provided important paleoclimatic data for the last 25,000 years. At Anderson Pond the pollen assemblage for the Farmdalian Interstadial (Plum Point Interstadial) dated at 25,000 $\pm$ 3,000 yr B.P. reflects cool but not severely cold climatic conditions. At this time there was sufficient soil moisture available to sustain growth of both temperate deciduous trees and northern pines, spruce, and fir (Delcourt, 1979). The plant fossil assemblage from 19,000-16,300 yr B.P. indicates that during the full Wisconsin glacial both the mean annual temperature and mean annual precipitation may have been substantially lower than today allowing "boreal" conifers to compete successfully with temperate deciduous trees. At Anderson Pond the climatic conditions during the full glacial may have been characterized by cool, long winters and a short growing season with periods of summer warmth. Pollen spectra from about 16,000-13,000 yr B.P. indicate a gradual warming trend. Late glacial warming began at about 16,500 yr B.P. (Fig. 14).

During the late glacial the pond filled rapidly with sediment especially at the time of transition from coniferous to deciduous forest at about 12,500 yr B.P. High influxes of inorganic sedimentary components between 12,750 and 12,500 yr B.P. support the interpretation of an interval of rapid and major ecosystem change and landscape instability at the Pleistocene-Holocene boundary. The period 12,000-10,000 yr B.P. was one of a cool, mesic climate. From 9,500 yr B.P. to the present, as far as is possible to detect from pollen analysis, the arboreal flora of the eastern Highland Rim and adjacent Cumberland Plateau of Tennessee has changed little. Warm-temperate taxa characterize the mid- and late-Holocene vegetation. A mid-Holocene warming and drying trend is inferred for middle Tennessee from 8,000-5,000 yr B.P. By 2,000 yr B.P. the pollen spectra are similar to those of 200 yr B.P. reflecting increased precipitation during the late Holocene. After land clearance and cultivation, beginning about 1790 A.D., increased soil erosion resulted in much-increased influxes of all sediment constituents into the Anderson Pond basin (Delcourt 1979).

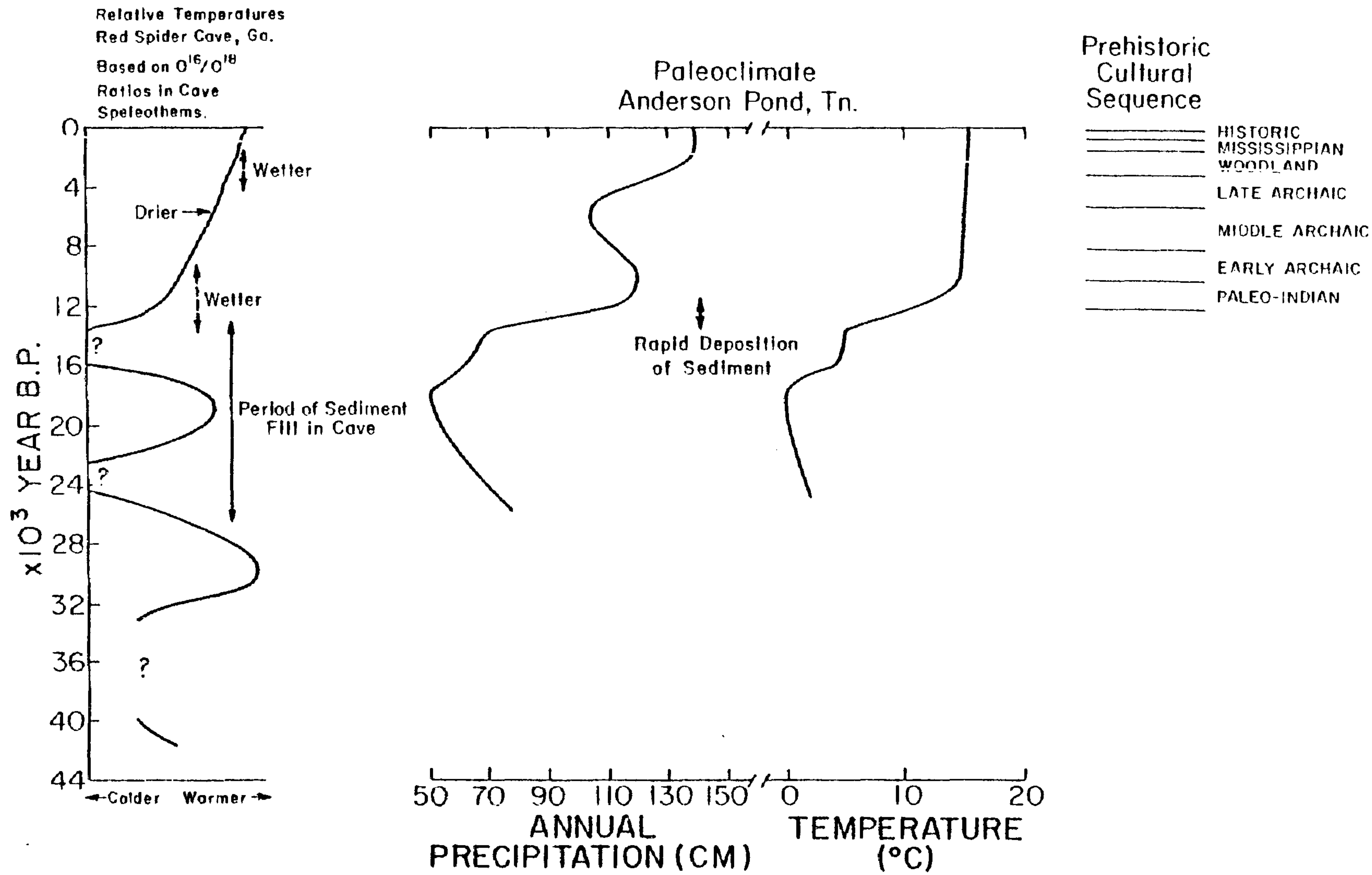

Fig. 14. Paleoclimates of northwest Georgia and northcentral Tennessee from evidence at Red Spider Cave and Anderson Pond (after Brook et al. (in preparation) and Delcourt (1979)).

Watts (1971) has also noted that the period 8,500-5,000 yr B.P. was drier on the Georgia coastal plain. At this time the vegetation was a mosaic of sclerophyllus oak woodland and small patches of prairie. From 5,000 yr B.P. the present pine forest came to predominate as the climate became wetter. Paleobotanical evidence from Little Salt Spring, Florida, also suggests a period of wetness around 9,000-8,000 yr B.P. and again during the past 4,500 years (Claussen et al., 1979). From 8,500-8,000 yr B.P. the water level in Little Salt Spring began to drop (the spring is a pond doline). By 6,800 yr B.P. the dropping local ground water level and at the same time the reduced availability of surface water made the spring an attractive location for human settlement.

Work at Red Spider Cave, near Trenton northwest Georgia, has also revealed marked changes in climate in this region during the past 4,000 years (Brook et al. in preparation). Radiometric dates have been obtained for 10 speleothems (stalactites and stalagmites) and oxygen isotopic (O^{18}/O^{16}) measurements have been made. These data were used to prepare the relative temperature curve for northwest Georgia shown in Fig. 14. Few speleothems were deposited in the cave during cold and perhaps dry climatic phases at 37,000, 24,000, 15,000 and 6,000 yr B.P. There was, on the other hand, abundant speleothem deposition during warmer and wetter phases at 41,000 32,000, 27,000, 18,000, 13,000-10,000, and 4,000-2,000 yr B.P. In the lengthy cold phase from 26,000-13,000 yr B.P. sediment accumulated in the cave suggesting a sparse vegetation cover on the upland plateau surface above the cave and, therefore, an ample supply of fine and coarse sediment. The uplands are believed to have supported a tundra vegetation at this time with deciduous and boreal conifers in the valleys.

Paleoclimatic data for Red Spider Cave in northwest Georgia and Anderson Pond in northcentral Tennessee, which are shown in Fig. 14, are in general agreement for late glacial and Holocene time. It is likely that the Georgia Piedmont experienced similar trends in both mean annual temperature and precipitation during the last 16,000 years. Paleotemperature and paleoprecipitation data for Anderson Pond (Delcourt, 1979, p. 270 and Fig. 14) have been used to estimate stream runoff and sediment yield in northcentral Tennessee and northeast Georgia using data in Schumm (1965). Apart from Schumm's data, consideration was also given to the suggestion of Knox (1972) that in some areas climate change can be so abrupt that it will trigger a response that, although short, may be the opposite of that suggested by the sediment yield curves. Knox (1976) concludes that a sharp and permanent increase in precipitation, as a result of a changed circulation pattern, will cause higher slope and channel erosion until the vegetation cover can improve. The result is a very short period of very high sediment yields followed by a decrease. Data from Anderson Pond show that a marked increase in precipitation occurred at 13,000-12,000 yr B.P. It has been assumed in constructing runoff and sediment yield curves that this period was one of unusually high runoff and sediment yield (Fig. 15).

Estimates for the last 14,000 years, shown in Fig. 15, are highly speculative but seem to agree with observations on sediment deposition and erosion in these areas. Although the calculations are for the mountains of Tennessee and Georgia, it is likely that changes in stream runoff and sediment yield on the Georgia Piedmont were of the same direction, if of slightly different magnitude. These estimates show that in northcentral Tennessee stream runoff was approximately 10" during full glacial times ca. 14,000 yr B.P., lay somewhere between 15 and 20" ca. 12,500 yr B.P., was

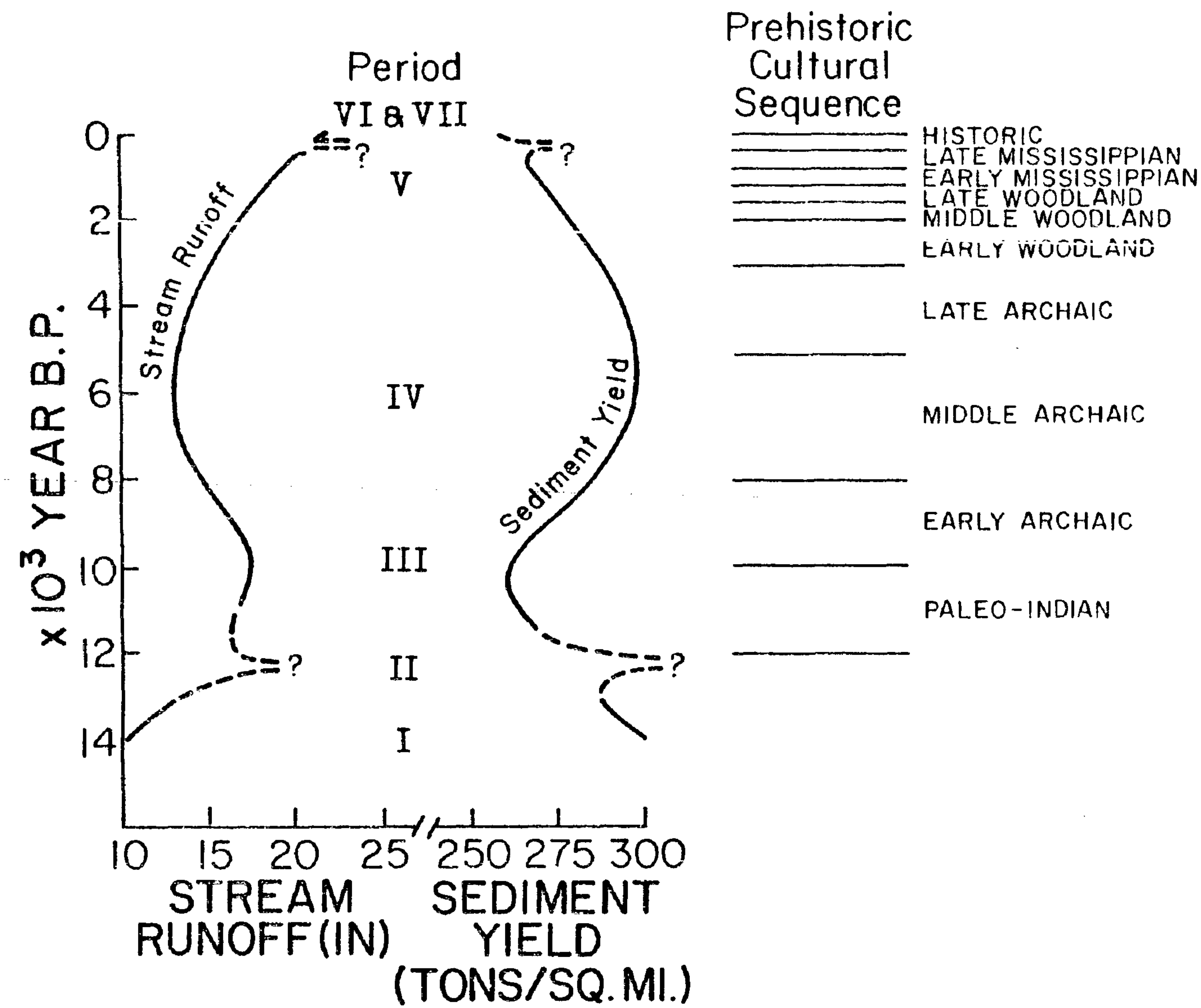

Fig. 15. Estimated Runoff and Sediment Yield Curves for northwest Georgia and northcentral Tennessee.

18" at 10,000 yr B.P., 13" at 6,000 yr B.P., and is presently about 22". During the same time period sediment yield may have varied from about 300 tons/square mile at 14,000, 12,500, and 6,000 yr B.P., and 260 tons/square mile at 10,000 and 0 yr B.P.; sediment yield during the historic period (A.D. 1700-1920) may have been up to 275 tons/square mile. Similar trends in runoff and sediment yield are envisaged for the Oconee Reservoir region.

An interpretation of the changing river conditions in the Oconee Reservoir region 14,000 yr B.P.-present is given in Table 1; it was developed from the data contained in Figs. 14 and 15. Seven distinct periods are recognized.

Low runoff and high sediment yields in full glacial times (Period I) probably resulted in alluviation along the Oconee and Apalachee Rivers in Piedmont Georgia. The river channels were probably narrow, deep and of low sinuosity as the channel increased its gradient to carry the high sediment load. Many of the islands in the southern half of the reservoir region were either more extensive or joined to what is now the riverbank. Alluviation at this time is in agreement with the findings at Red Spider Cave where sediment supply under full glacial conditions far exceeded the capacities of streams to remove it. As temperatures ameliorated and precipitation began to increase in late glacial times runoff probably increased slightly while sediment yields may have decreased slightly. However, if Delcourt (1979) and Brook _et al._ (in preparation) are correct in arguing that the period 13,000-12,000 yr B.P. saw a rapid increase in both temperature and precipitation, then it is likely that both runoff and sediment yield in Piedmont Georgia increased significantly before the vegetation had time to adjust to the new warmer and wetter conditions. At Anderson Pond, Tennessee,

TABLE 1 Changing River Conditions in the Oconee Reservoir Region 14,000 yr B.P.-Present*

PERIOD	STREAM RUNOFF	SEDIMENT YIELD	EROSION OR ALLUVIATION	POSTULATED CHANNEL CHARACTERISTICS
I FULL GLACIAL (15,000-13,000 yr B.P.)	Low	High	Slow alluviation	Narrow, deep, low sinuosity channels. Changes in channel position relatively common.
II LATE GLACIAL (13,000-12,000 yr B.P.)	Very High	Very High	Very rapid alluviation	Narrow, deep channels of increased sinuosity. Many changes in channel position during floods.
III LATE GLACIAL to EARLY HOLOCENE (11,000-9,000 yr B.P.)	High	Low	Erosion	Wider, shallower and moderately sinuous channels (more sinuous than in Period I) Channel trenching alluvium of Periods I and II.
IV MID HOLOCENE (8,000-4,000 yr B.P.)	Low	High	Long period of slow alluviation	Narrow, deep, low-sinuosity channels. Changes in channel position common.
V LATE HOLOCENE (2,000-300 yr B.P.)	High	Low	Slight erosion	Wider, shallower, more sinuous channels. Slight trenching of Period IV alluvial deposits.
VI HISTORIC (A.D. 1700-1920)	Very High	Very High	Very rapid alluviation	Slight increase in channel depth and sinuosity, slight reduction in channel width.
VII HISTORIC (A.D. 1920-Present)	High	Low	Erosion	Slightly reduced sinuosity (sinuosity comparable to Period III) streams becoming wider and shallower. Trenching of Period VI alluvium.

*Stream runoff, sediment yield, erosion, alluviation and stream channel characteristics are described in relative rather than absolute terms.

Delcourt (1979) found the period 12,750-12,500 to be one of high sediment yields at a time of changing ecosystems. At Red Spider Cave a period of sediment removal has similarly been dated to Period II in Table I. Period II, therefore, characterized by high runoff and high sediment yields was probably a time of rapid sedimentation and more severe flooding in the Oconee Reservoir region. By ca. 12,000 yr B.P. the vegetation had adjusted to the increased temperature and precipitation causing a rapid reduction in stream runoff and in sediment yields.

In late glacial to early Holocene time (11,000-9,000 yr B.P.) an increase in stream runoff and low sediment yields combined to cause erosion and trenching of alluvial terraces built up during Periods I and II. These terraces now stand 1-2 m above the present floodplain. Channels became wider and shallower, and more sinuous than in the previous two periods mid-channel islands were partly eroded. Early Archaic peoples lived on the levees bordering these channels at a time of low floodplain water table levels.

The mid-Holocene period from about 8,000-4,000 yr B.P. was characterized by reduced runoff and higher sediment yields. It was undoubtedly a period of slow alluviation with narrower and deeper river channels of low sinuosity, higher floodplain water table levels, numerous changes in channel position and accretion on river islands. Archaic artifacts are common in levee sands bordering a number of relict channels in the broad floodplain of the Oconee River in the northern part of the reservoir. At many sites there appears to have been a break in occupation in Middle or Late Archaic times suggesting that many of the relict channels were abandoned late in Period IV--the Indians moving to the levees of the newly established channel.

In the late Holocene during Period V (ca. 2,000-300 yr B.P.) increased stream runoff and reduced sediment yields caused erosion and slight trenching of deposits laid down in Period IV. Wider, shallower and slightly more sinuous channels evolved, the water table across the floodplain dropped slightly and there was erosion of river islands. This was the situation until Period VI, the cotton plantation age (A.D. 1700-1920), when clearing of forest and poor agricultural practices led to increased stream runoff and greatly increased sediment yields. The result was rapid alluviation, a slight increase in channel depth and sinuosity, a reduction in channel width and an increase in the elevation of the floodplain water table. Phase VII begins at the end of the cotton plantation age (A.D. 1920-present). Reforestation and improved agricultural methods have led to a marked reduction in sediment yields and trenching of sediments deposited in Period VI. Despite this trenching, water tables beneath floodplains are still higher today than they were in Period V as evidenced by structures at Cold Springs dated to Period V which are presently below the water table.

CONCLUSIONS

Geoarcheological research at the Oconee Reservoir site has demonstrated that the uplards surrounding the reservoir are the remnants of an uplifted and dissected lower Cretaceous peneplain that cut across both igneous and metamorphic rocks. Models of the surface indicate that there was approximately 150 ft (46 m) of relative relief and that present elevations range from 550-700 ft (168-213 m) in the reservoir region.

Dissection of the peneplain probably began in the Late Tertiary and continued throughout Quaternary times; in the reservoir region incision was approximately 120 ft (37 m). Paired terraces along the Oconee River valley indicate that downcutting was affected by several stillstands in a gradually falling sea level. Because sediments in ancient floodplains and levee deposits of the Barnett Shoals and Long Shoals terraces show no evidence of reversed remanent magnetism, they are probably younger than 700,000 years B.P. Early Archaic sites in the lowest floodplain and levee deposits in the reservoir site indicate that these sediments are older than about 10,000 years B.P. Although only a tentative estimate, this places the ages of the Barnett Shoals and lower terraces somewhere between 700,000 and 10,000 years B.P.

Where the Oconee River crosses the Siloam granite, in the southern part of the reservoir, there is evidence that stream incision was preceded by a period (Lower Cretaceous?) of differential deep chemical weathering. Weathering progressed to greater depths in areas of more intense jointing so that a highly irregular basal surface of weathering resulted. Regolith profiles contained fresh granite corestones up to 10 m in diameter "floating" in saprolite. Stream downcutting and subsequent valley side retreat exposed many of these corestones as tors. Large rounded examples near the river provided natural shelters for some Indian groups.

When Indians first moved into the area prior to 10,000 yr B.P. they settled along the river banks at a time when the streams were trenching sediments deposited in glacial and late glacial times. Major changes in the location of the channel occurred in many areas from ca. 8,000-4,000 yr B.P. The old levee sites were abandoned and new settlements were established on the banks of the new channel. The distribution of archeological sites is, therefore, intimately related to the paleogeography and paleohydrology of the river and its floodplain.

A period of increasing runoff and reduced sediment yields after ca. 3,000-2,000 yr B.P., with erosion and trenching of previously deposited sediments, was interrupted by the very high runoff and high sediment yields which characterized the cotton plantation age. Even today the extensive alluviation of this period has left its mark on the riverine landscape with higher water tables and more sinuous river channels than discharge-sediment characteristics should dictate.

Geomorphic studies of the Oconee Valley have provided important paleo-environmental data for this region. The work emphasizes the need for a multidisciplinary approach to archeological and anthropological research in the southeastern U.S.A. and elsewhere.

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