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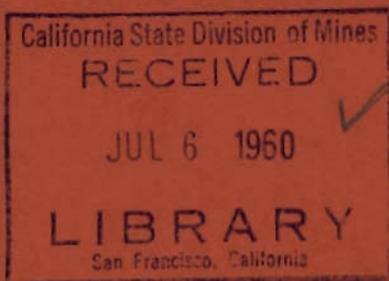
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OLIGOCENE FOSSILS FROM THE OLD BOLTON PHOSPHATE MINE NEAR CHARLESTON, SOUTH CAROLINA

BY

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INTRODUCTION

PHOSPHATE ROCK HAS BEEN KNOWN FROM SOUTH CAROLINA FOR MORE THAN A HUNDRED YEARS, AND NUMEROUS REPORTS HAVE BEEN WRITTEN ON THE SUBJECT, ESPECIALLY DURING THE YEARS OF MOST ACTIVE PRODUCTION IN THE LATTER PART OF THE NINETEENTH CENTURY.

VARIOUS OPINIONS HAVE BEEN GIVEN AS TO THE AGE OF THIS ROCK. COOKE (1936) BELIEVED THAT THE LOWER PART OF THE DEPOSIT BELONGED TO THE COOPER MARL OF EOCENE AGE, WHILE THE UPPER PART CONSTITUTED THE HAWTHORNE FORMATION OF MIOCENE AGE. THE FOSSILS FROM THE SPOIL BANKS FROM ABANDONED PHOSPHATE MINES WERE THUS REGARDED AS A MIXTURE OF EOCENE AND MIOCENE SPECIES. LATER, ON THE BASIS OF MORE PALEONTOLOGICAL DATA, THE COOPER MARL WAS REASSIGNED TO THE OLIGOCENE (COOKE AND MACNEIL, 1952).

VERY RECENTLY, MALDE (1959) MADE A SURVEY OF THE PHOSPHATE BEDS OF THE CHARLESTON AREA. FOLLOWING COOKE AND MACNEIL HE DATES THE COOPER MARL AS OLIGOCENE. HE REGARDS THE PHOSPHATE ROCK AS "PHOSPHATIZED COOPER MARL REWORKED INTO THE LOWER PART OF THE LADSON FORMATION", WHICH HE REGARDS AS OF PLEISTOCENE AGE. THE FAUNA OF THE LADSON FORMATION IS THUS A MIXTURE OF REWORKED OLIGOCENE FOSSILS PLUS SOME MARINE SPECIES OF DEFINITE PLEISTOCENE AGE.

DESCRIPTION OF LOCALITY

IN 1957 AND 1958, ONE OF US (HOPKINS) MADE EXTENSIVE COLLECTIONS OF FOSSILS FROM THE SPOIL BANKS OF THE OLD BOLTON MINE WHICH IS LOCATED 0.3 MILE SOUTH OF THE JOHNS ISLAND RAILROAD STATION, 9 MILES SOUTHWEST OF CHARLESTON, S. C., ON ROUTE 17.

THE LOCALITY WAS FIRST VISITED IN 1956 IN THE COMPANY OF COLONEL J. W. WATKINS, PROFESSOR OF GEOLOGY AT THE

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CITADEL IN CHARLESTON. HOWEVER, AT THAT TIME THE SPOIL BANKS WERE COMPLETELY OVERGROWN AND THE SECTION WAS OBSCURED AND LACKING IN PHOSPHATE NODULES.

THE FOLLOWING YEAR, WASHER CREEK, A TRIBUTARY OF STONO RIVER AND BORDERING THE BOLTON MINE LOADING STATION, WAS DREDGED. THROUGH THE KINDNESS OF MR. ALVIN HILTON, A NEARBY RESIDENT, A LETTER WAS RECEIVED TELLING OF THE DREDGING AND OF THE PRESENCE OF QUANTITIES OF FOSSIL SHARK TEETH, FISH BONES AND SHELLS ON THE SPOIL BANKS. ACCORDING TO INFORMATION RECEIVED FROM MR. L. W. BOYKIN 3RD, OF KINGS DREDGING COMPANY, "THE DIGGING WAS DONE ON THE MILL SIDE OF THE CREEK ABOUT 70 TO 75 FEET WIDE AND 300 FEET LONG. THE DEPTH WAS BETWEEN 3 AND 8 FEET BELOW THE EXISTING CREEK BOTTOM AT THE TIME OF EXCAVATION. THE LOOSE MATERIAL ABOVE THE ROCK WAS REMOVED. A VERY HEAVY DUTY BUCKET WAS USED, AND AT TIMES THE ROCK WAS PENETRATED ABOUT 2 FEET. THE BOTTOM LEVEL WAS VERY IRREGULAR AS WE FOUND IT." AT THE LOADING STATION THE BANK WAS ABOUT 12 FEET ABOVE WATER LEVEL IN THE CREEK AT LOW TIDE.

THE MATERIAL ON THE SPOIL BANKS WAS OF TWO KINDS: (1) PHOSPHATE NODULES (OF THE OVERLYING LADSON FORMATION) AND (2) AN ARENACEOUS LIMESTONE (THE UNDERLYING COOPER MARL). THE FOSSILS WERE COMPLETELY MIXED IN THE SPOIL BANKS. THE NODULES WERE JAGGED AND VERY IRREGULAR IN OUTLINE AND FREQUENTLY HONEYCOMBED WITH IRREGULAR SPACES. THEY VARIED IN COLOR FROM LIGHT TO DARK BROWN, BLUISH AND NEARLY WHITE TO NEARLY BLACK. THEY WERE CHARACTERIZED BY THE PRESENCE OF THE FOSSILS, MOSTLY IN THE FORM OF CASTS AND MOLDS, THE ORIGINAL SHELL MATERIAL HAVING BEEN DISSOLVED AWAY.

THE ARENACEOUS LIMESTONE (COOPER MARL) CONTAINED BOTH UNALTERED AND ALTERED SHELLS, SOME OF WHICH WERE THE SAME SPECIES AS THOSE IN THE PHOSPHATE NODULES. SOME OF THE UNALTERED SHELLS PROBABLY REPRESENT A SUPERFICIAL PLEISTOCENE LAYER CONTAINING SUCH SPECIES AS PECTEN GIBBUS L., TAGELUS GIBBUS SPENGLER, OSTREA VIRGINICA GMELIN, CHIONE CANCELLATA SAY AND NASSA OBSOLTEA SAY.

SCATTERED OVER THE SPOIL BANKS WERE VARIOUS VERTEBRATE FOSSILS INCLUDING SHARK TEETH, FISH VERTEBRAE, RAY DENTAL PLATES, AND MISCELLANEOUS BONE FRAGMENTS.

ACKNOWLEDGMENTS

SPECIMENS FOR COMPARISON WERE CONSULTED IN THE COLLECTIONS OF THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, THE UNITED STATES NATIONAL MUSEUM, AND THE CHARLESTON MUSEUM. THE ONLY COLLECTION EXAMINED WHICH CLOSELY RESEMBLED OUR FAUNA FROM THE LIMESTONE WAS THE MATERIAL IN THE CHARLESTON MUSEUM COLLECTED BY EARLE SLOAN AND LABELED "SALKEHATCHIE DOZE." THIS IS AN OBSOLETE NAME FOR CERTAIN OF THE SOUTH CAROLINA PHOSPHATE

DEPOSITS. THE NATIONAL MUSEUM HAD MATERIAL FROM THE OLD BOLTON MINE WITH SMALL PHOSPHATIC NODULES SIMILAR TO OURS CONTAINING ANTIGONA, NUCULANA (= LEDA), MARGINELLA AND A CORAL. WE HAVE ALSO HAD THE ADVANTAGE OF SOME COMMENTS BY DR. F. STEARNS MACNEIL, OF THE U. S. GEOLOGICAL SURVEY AT MENLO PARK, CALIFORNIA, WHO COMPARED SOME OF OUR SPECIMENS WITH MATERIAL COLLECTED BY MALDE. DR. DONALD SQUIRES, OF THE AMERICAN MUSEUM OF NATURAL HISTORY IN NEW YORK, EXAMINED OUR SPECIMENS OF CORALS. A SET OF THE SPECIMENS, INCLUDING ALL FIGURED MATERIAL, IS IN THE COLLECTION OF THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA.

PALEONTOLOGY

PHYLUM COELENTERATA

CLASS ANTHOZOA

BALANOPHYLLIA SP.

PHYLUM MOLLUSCA

CLASS PELECYPODA

OSTREA SPP.

PLATE 2, FIGURE 5,6

SEVERAL YOUNG SPECIMENS OF OYSTERS, NOT IDENTIFIABLE AS TO SPECIES. VERY COMMON IN THE LIMESTONE.

GRYPHAEDOSTREA PLICATELLA (MORTON)

PLATE 2, FIGURE 4

SEVERAL SPECIMENS FOUND IN THE LIMESTONE.

ANOMIA JUGOSA CONRAD

PLATE 2, FIGURE 2

SHELLS CLOSELY RESEMBLING THE TYPE OF A. JUGOSA CONRAD (ANSP) ARE FAIRLY COMMON LOOSE IN THE COOPER MARL. THIS SPECIES WAS DESCRIBED FROM THIS FORMATION AND IS NOT KNOWN ELSEWHERE.

ANOMIA SIMPLEX D'ORBIGNY

PLATE 2, FIGURE 1

A FEW SPECIMENS OF ANOMIA APPEAR CLOSER TO A. SIMPLEX THAN TO A. JUGOSA. A. SIMPLEX IS KNOWN FROM THE MIOCENE TO THE RECENT.

CHLAMYS CF. C. ACANIKOS GARDNER

PLATE 1, FIGURE 1
PLATE 2, FIGURE 8

SEVERAL SPECIMENS CLOSELY RESEMBLE C. ACANIKOS GARDNER FROM THE MIOCENE OF MARYLAND AND FLORIDA. THEY

ARE ALSO RELATED TO C. MADISONIUS (SAY), A COMMON MIOCENE FORM.

CHLAMYS SP. CF. C. CROCUS (COOKE) PLATE 2, FIGURE 7

OUR SPECIMENS PROBABLY BELONG TO A NEW SPECIES, BUT SINCE THE LOT CONSISTS OF ONLY ONE BROKEN SPECIMEN AND SEVERAL FRAGMENTS, IT DOES NOT SEEM WISE TO DESCRIBE IT AT THIS TIME. IT IS RELATED TO C. CROCUS (COOKE) FROM THE MIOCENE OF FLORIDA AND THE OLIGOCENE OF ANGUILLA. FOUND MAINLY IN THE LIMESTONE.

AMUSIUM CF. A. CERINUS (CONRAD) PLATE 1, FIGURE 7

OUR SPECIMENS CLOSELY RESEMBLE A. CERINUS (CONRAD) FROM THE CALVERT FORMATION (MIOCENE) OF MARYLAND.

CARDIUM SPP.

SEVERAL SPECIMENS, TOO POORLY PRESERVED FOR SPECIFIC IDENTIFICATION WERE FOUND IN THE LIMESTONE. ACCORDING TO MACNEIL (MALDE, 1959, P. 14), SPECIMENS OF CARDIUM FOUND IN THE COOPER MARL ARE RELATED TO FORMS FROM THE TAMPA LIMESTONE OF FLORIDA AND THE OLIGOCENE OF PUERTO RICO.

CARDITA CF. C. CASTRATA (GLENN) PLATE 2, FIGURE 12

OUR SPECIMENS ARE PROBABLY NEW, BUT ARE TOO POORLY PRESERVED FOR ADEQUATE DESCRIPTION. THEY RESEMBLE C. CASTRATA (GLENN) DESCRIBED FROM THE CALVERT FORMATION OF MARYLAND, BUT ARE LESS CURVED.

MERETRIX SP. (?) PLATE 1, FIGURE 3, 10

SEVERAL MOLDS OF VENERIDS ARE TENTATIVELY REFERRED TO THIS GENUS. FOUND ONLY IN THE LIMESTONE AND NOT COMMON.

PHACOIDES CONTRACTUS (SAY) PLATE 1, FIGURE 4

THE SQUEEZES OF SEVERAL SPECIMENS CLOSELY RESEMBLE THIS SPECIES, KNOWN FROM THE MIOCENE OF MARYLAND. KNOWN FROM BOTH THE LIMESTONE AND PHOSPHATE ROCK, BUT MORE COMMON IN THE LIMESTONE. THIS SPECIES WAS ALSO REPORTED BY MACNEIL.

"LUCINA" SPP. PLATE 1, FIGURE 5,8,11

INTERNAL MOLDS OF LUCINOIDS ARE COMMON. THEY PROBABLY REPRESENT SEVERAL SPECIES. SINCE THE HINGE TEETH ARE NOT VISIBLE, IT IS POSSIBLE THAT SOME OF THE SPECIMENS BELONG TO DIPLODONTA OR OTHER GENERA. KNOWN FROM BOTH LAYERS.

ASTARTE cf. A. VICINA SAY

PLATE 1, FIGURE 2, 6

VARIOUS SPECIMENS OF AN ASTARTE, RELATED TO A. VICINA FROM THE CALVERT FORMATION (MIOCENE) OF MARYLAND HAVE BEEN FOUND IN BOTH THE COOPER MARL AND THE PHOSPHATE ROCK. HOWEVER, SINCE OUR MATERIAL CONSISTS ENTIRELY OF INTERNAL MOLDS, IT DOES NOT SEEM WISE TO REFER THEM POSITIVELY TO THIS SPECIES. MACNEIL REFERS MATERIAL FROM LOCALITIES IN THIS VICINITY TO "ASTARTE N. SP.? AFF. A. THOMASI CONRAD AND A. VICINA, SAY." OUR SPECIMENS APPEAR CLOSER TO A. VICINA.

ANTIGONA (ARTENA) UNDULATA (CONRAD) PLATE 2, FIGURE 3, 9,
10, 11

THIS IS ONE OF THE MOST COMMON SPECIES OF THE PHOSPHATE ROCK. THIS SPECIES WAS DESCRIBED BY CONRAD (1870, P. 76, 77) FROM PHOSPHATE DEPOSITS OF SOUTH CAROLINA. ALTHOUGH THE TYPE HAS APPARENTLY BEEN LOST, OUR SPECIMENS MATCH SPECIMENS IN THE U. S. NATIONAL MUSEUM REFERRED TO A. UNDULATA. THEY ARE RELATED TO A. LAMELLACEA KELLUM OF THE TRENT FORMATION OF NORTH CAROLINA; BUT, AS STATED BY MACNEIL, THE SOUTH CAROLINA SPECIES "DIFFERS FROM THAT IN THE TRENT BY THE PRESENCE OF CONSPICUOUS VENTRALLY UNDERCUT SHELVES ON THE CENTRAL DISC."

PANOPE SP.

PLATE 1, FIGURE 9

SEVERAL SPECIMENS PRESERVED AS INTERNAL MOLDS WERE OBTAINED FROM THE LIMESTONE. ONE SUGGESTS P. OBLONGATA CONRAD FROM THE GULF COAST EOCENE.

CLASS GASTROPODA

XENOPHORA CONCHYLIOPHORA BORN

PLATE 2, FIGURE 18

THIS COMMON AND RATHER WIDE-RANGING SPECIES IS REPRESENTED BY RATHER POORLY PRESERVED MOLDS FROM THE LIMESTONE. THEY RESEMBLE MATERIAL OBTAINED FROM THE CASTLE HAYNE FORMATION OF NORTH CAROLINA.

EPITONIUM CHARLESTONIANA (JOHNSON)

PLATE 2, FIGURE 16

SEVERAL SPECIMENS OF UNALTERED SHELLS FROM THE LIMESTONE. ORIGINALLY DESCRIBED FROM THE COOPER MARL NEAR CHARLESTON, S. C. (JOHNSON, 1931).

CONUS SP.

PLATE 2, FIGURE 15

POORLY PRESERVED AND UNIDENTIFIABLE AS TO SPECIES. RARE IN THE LIMESTONE, AND VERY RARE IN THE PHOSPHATE BED.

MITRA SP.

PLATE 2, FIGURE 13

RESEMBLES MITRA SP. AS FIGURED BY KELLUM (1926, PL. 5, FIG. 19, 20) FROM THE CASTLE HAYNE FORMATION OF NORTH CAROLINA.

PYROPSIS SP.

PLATE 2, FIGURE 14

ONE POORLY PRESERVED MOLD FROM THE PHOSPHATE ROCK.

DOLIUM (MALEA) SP.

PLATE 2, FIGURE 17

SEVERAL SPECIMENS FROM THE LIMESTONE ARE IDENTICAL WITH MATERIAL REFERRED TO DOLIUM (MALEA) SP. BY MACNEIL (MALDE, 1959, P. 20). ACCORDING TO MACNEIL, IT MAY BE NEW AND IS RELATED TO D. CAMURA (GUPPY) FROM THE MIOCENE OF THE DOMINICAN REPUBLIC.

OTHER FOSSILS

AMONG THE SPECIMENS NOT STUDIED ARE SOME SPECIMENS OF BARNACLE (BALANUS SP.) WHICH ARE IDENTICAL WITH MATERIAL FROM THE COOPER MARL IN THE COLLECTIONS OF THE ACADEMY OF NATURAL SCIENCES, A SCAPHOPOD (DENTALIUM SP.), NUMEROUS SPECIES OF BRYOZOA, TEETH OF SHARKS AND RAYS, AND VARIOUS MISCELLANEOUS BONE FRAGMENTS.

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PLATE 1

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|----------|--|----|
| FIG. 1. | <u>CHLAMYS</u> CF. <u>AOANIKOS</u> GARDNER | x1 |
| FIG. 2. | <u>ASTARTE</u> CF. <u>VICINA</u> SAY | x2 |
| FIG. 3. | <u>MERETRIX</u> SP. | x1 |
| FIG. 4. | <u>PHACODIDES CONTRACTA</u> (SAY) SQUEEZE | x1 |
| FIG. 5. | " <u>LUCINA</u> " SP. | x1 |
| FIG. 6. | <u>ASTARTE</u> CF. <u>VICINA</u> SAY | x2 |
| FIG. 7. | <u>AMUSIUM</u> CF. <u>CERINUS</u> (CONRAD) | x2 |
| FIG. 8. | " <u>LUCINA</u> " SP. | x1 |
| FIG. 9. | <u>PANOPE</u> SP. | x1 |
| FIG. 10. | <u>MERETRIX</u> XP. | x1 |
| FIG. 11. | " <u>LUCINA</u> " SP. | x1 |



1



2



3



4



5



6



7



8



9



10

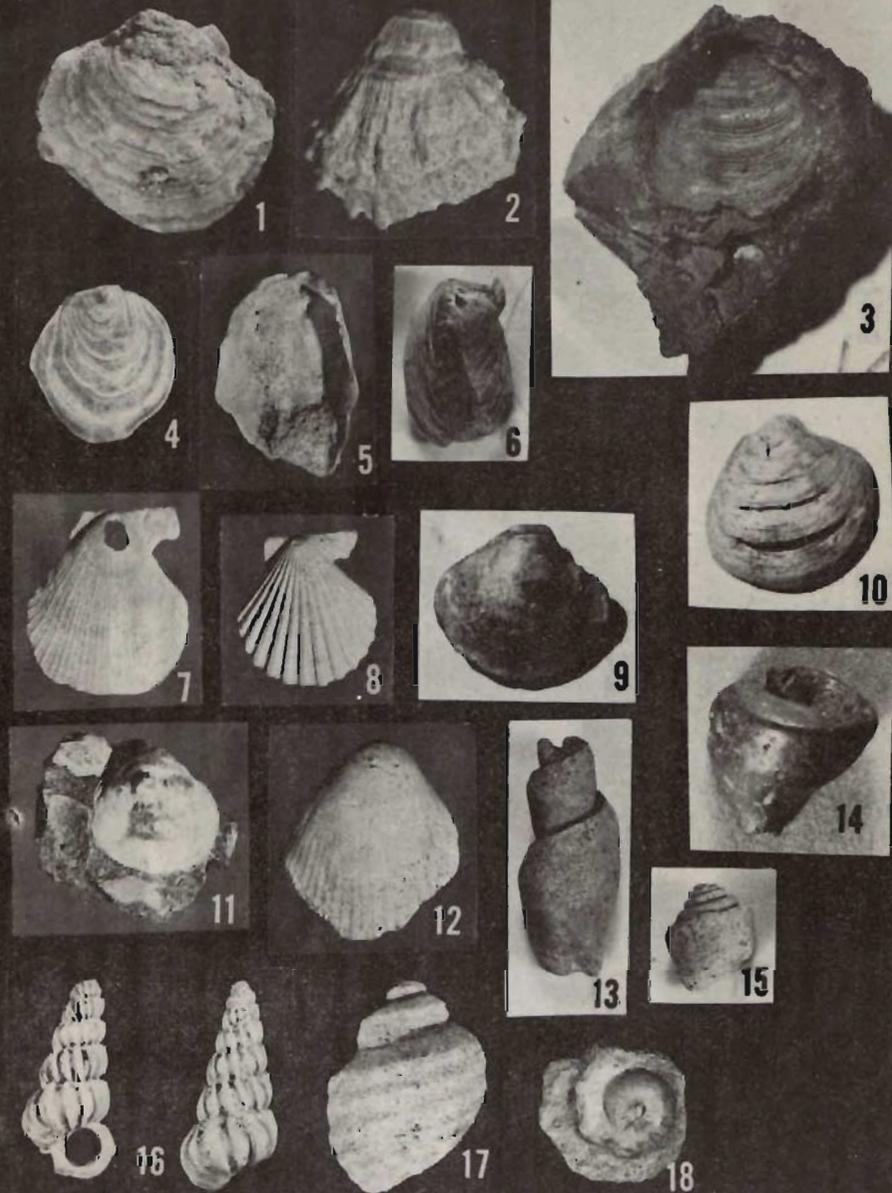


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FOSSILS FROM OLD BOLTON PHOSPHATE MINE
CHARLESTON COUNTY, S. C.

PLATE 2

- FIG. 1. ANOMIA SIMPLEX D'ORBIGNY x 1
 FIG. 2. ANOMIA JUGOSA CONRAD x 1
 FIG. 3. ANTIGONA (ARTENA) UNDULATA (CONRAD) SQUEEZE x 1
 FIG. 4. GRYPHAEDSTREA PLICATELLA (MORTON) x 1
 FIG. 5. OSTREA SP. JUV. x 1
 FIG. 6. OSTREA SP. JUV. x 1
 FIG. 7. CHLAMYS CF. CROCUS (COOKE) x 1
 FIG. 8. CHLAMYS CF. ACANIKOS GARDNER x 1
 FIG. 9. ANTIGONA (ARTENA) UNDULATA (CONRAD) x 1
 FIG. 10. ANTIGONA (ARTENA) UNDULATA (CONRAD) SQUEEZE x 1
 FIG. 11. ANTIGONA (ARTENA) UNDULATA (CONRAD) x 1
 FIG. 12. VENERICARDIA (?) SP. x 1
 FIG. 13. MITRA SP. x 1
 FIG. 14. PYROPSIS SP. x 1
 FIG. 15. CONUS SP. x 1
 FIG. 16. EPITONIUM CHARLESTONIANA JOHNSON
 FIG. 17. DOLIUM (MALEA) SP. x 1
 FIG. 18. XENOPHORA CONCHYLIOPHORA BORN x 1



GEOLOGY OF THE BLANEY QUADRANGLE, S. C.

By

D. C. RIDGEWAY

ABSTRACT

THE BLANEY $7\frac{1}{2}$ MINUTE QUADRANGLE, WITH THE TOWN OF BLANEY ALMOST IN ITS CENTER, IS 15 MILES NORTHEAST OF THE CITY OF COLUMBIA, SOUTH CAROLINA.

PIEDMONT ROCKS UNDERLIE THE GREATER PART OF THE NORTHWESTERN PORTION OF THE QUADRANGLE. THESE ARE ESSENTIALLY METAMORPHOSED TUFFACEOUS SEDIMENTS WHICH DECREASE IN METAMORPHIC RANK TOWARD THE NORTHWEST. IN THE EXTREME NORTHWESTERN CORNER OF THE QUADRANGLE THE ROCKS ARE PREDOMINANTLY ARGILLITE. TO THE SOUTHEAST, THE ARGILLITE GRADES INTO OR OVERLIES UNCONFORMABLY QUARTZ-SERICITE PHYLLITE AND FINE-GRAINED SCHIST.

THE PIEDMONT ROCKS ARE BELIEVED TO HAVE BEEN SUBJECTED TO TWO, OR POSSIBLY MORE, PERIODS OF DEFORMATION. THE SCHIST AND PHYLLITE ARE TIGHTLY FOLDED - WITH FOLDS BEING ASYMMETRICAL TO THE SOUTHEAST - AND DISPLAY BOTH PERIODS OF DEFORMATION. THE ARGILLITE IS OPENLY FOLDED AND SHOWS ONLY SLIGHT METAMORPHISM, REPRESENTING THE LAST PERIOD OF DEFORMATION. THE ATTITUDE OF AXIAL PLANE CLEAVAGE IN THE ARGILLITE INDICATES THAT THESE FOLDS ARE ALSO ASYMMETRICAL TO THE SOUTHEAST. THE SCHIST AND PHYLLITE ARE BELIEVED TO BE EARLY PALEOZOIC, WITH THE ARGILLITE BEING SOMEWHAT YOUNGER IN AGE.

THE SOUTHEASTERN PART OF THE QUADRANGLE IS UNDERLAIN BY UNCONSOLIDATED COASTAL PLAIN SEDIMENTS WHICH WERE PREVIOUSLY LUMPED AS THE TUSCALOOSA FORMATION OF UPPER CRETACEOUS AGE. THESE SEDIMENTS HAVE BEEN SUBDIVIDED INTO THREE UNITS IN THIS REPORT ON THE BASIS OF LITHOLOGY AND STRATIGRAPHIC POSITION. THE UPPER UNIT, CONSISTING OF UNCONSOLIDATED SAND, IS CONSIDERED YOUNGER THAN THE TUSCALOOSA, AND IS TENTATIVELY ASSIGNED A TERTIARY OR PLEISTOCENE AGE. MUCH OF THIS DEPOSIT SEEMS TO BE OF EOLIAN ORIGIN. AN INDURATED SANDSTONE BED ABOUT FIVE FEET THICK WAS FOUND AT ONE PLACE NEAR THE BASE OF THE COASTAL PLAIN SEDIMENTS, SEPARATED FROM THE CRYSTALLINE PIEDMONT ROCKS BY AN ANGULAR UNCONFORMITY. IT MAY REPRESENT A FACIES OF THE BASAL TUSCALOOSA FORMATION OR MAY BE A CHANNEL DEPOSIT OF YOUNGER AGE.

OLIVINE-BEARING DIABASE DIKES, GENERALLY CONSIDERED TRIASSIC IN AGE, CUT THE PIEDMONT ROCKS IN A NORTH-WESTERLY DIRECTION. FIVE OF THESE DIKES ARE KNOWN TO OCCUR IN THE BLANEY QUADRANGLE.

MATERIALS OF ECONOMIC INTEREST FOUND WITHIN THE
BLANEY QUADRANGLE ARE COMMON CLAY, KAOLIN, SERICITE, SAND,
AND NATURAL STONE WHICH MAY BE SUITABLE FOR LIMITED CON-
STRUCTION WORK, OR AS AGGREGATE OR BALLAST.

