

GEOLOGIC NOTES

**DIVISION OF GEOLOGY
STATE DEVELOPMENT BOARD
COLUMBIA, S. C.**

JANUARY-FEBRUARY 1961



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GEOLOGIC ACTIVITIES IN SOUTH CAROLINA DURING 1960

BY

H. S. JOHNSON, JR. 1/

DURING 1960, THE DIVISION OF GEOLOGY, SOUTH CAROLINA STATE DEVELOPMENT BOARD, CONTINUED ITS INVESTIGATIONS OF THE GEOLOGY AND MINERAL RESOURCES OF THE STATE. THE STAFF NOW COMPRISES ONE FULL TIME GEOLOGIST, ONE GEOLOGIC SECRETARY, A CERAMICS CONSULTANT, AND NINE PART TIME GEOLOGISTS AND GEOLOGIC ASSISTANTS.

ACCORDING TO THE U. S. BUREAU OF MINES, MINERAL PRODUCTION IN SOUTH CAROLINA IN 1960 IS ESTIMATED TO HAVE DECREASED 4 PERCENT FROM 1959. THE PRINCIPAL MINERAL INDUSTRIES WERE MANUFACTURING CEMENT AND MINING CRUSHED STONE, CLAYS, SAND AND GRAVEL, AND VERMICULITE. SOUTH CAROLINA RANKED SECOND IN THE NATION IN OUTPUT OF KAOLIN, KYANITE, AND VERMICULITE, AND FOURTH IN SCRAP MICA. TOTAL SHIPMENTS OF CEMENT DECREASED 11 PERCENT IN VALUE IN SPITE OF A 42 PERCENT INCREASE IN OUTPUT OF MASONRY CEMENT. TOTAL CLAY PRODUCTION INCREASED 11 PERCENT IN TONNAGE AND 8 PERCENT IN VALUE. OF THIS, KAOLIN OUTPUT INCREASED 2 PERCENT AND MISCELLANEOUS CLAY OUTPUT INCREASED 16 PERCENT. BOTH TYPES OF CLAY SET NEW PRODUCTION RECORDS. TOTAL STONE PRODUCTION DECREASED IN TONNAGE AND VALUE. SAND AND GRAVEL OUTPUT DECREASED 2 PERCENT BUT VALUE INCREASED 2 PERCENT. VERMICULITE OUTPUT INCREASED 5 PERCENT, AND VALUE INCREASED 12 PERCENT FOR A NEW RECORD. KYANITE OUTPUT INCREASED 13 PERCENT BUT DECREASED SLIGHTLY IN VALUE. THERE WAS NO APPRECIABLE CHANGE IN SCRAP MICA OUTPUT, BUT SHEET MICA PRODUCTION CONTINUED A DECLINE BEGUN IN 1959. FELDSPAR PRODUCTION INCREASED 64 PERCENT AND GAINED 82 PERCENT IN VALUE.

PROJECTS

THE FOLLOWING REMARKS SERVE AS AN INDEX TO PROJECTS CARRIED ON DURING 1960 BY THE DIVISION OF GEOLOGY OR WITH ITS KNOWLEDGE AND SUPPORT.

LIMESTONE AND MARL OF THE COASTAL PLAIN OF SOUTH CAROLINA (S. D. HERON, JR.). -- A COMPREHENSIVE REPORT OF THE LIMESTONE RESOURCES OF THE COASTAL PLAIN IS NOW UNDERGOING TECHNICAL CRITICISM AND EDITING PRIOR TO PUBLICATION. TREMENDOUS RESOURCES OF LIMESTONE CONTAINING 80 TO 95 PERCENT CaCO_3 ARE PRESENT IN THE COASTAL PLAIN, PARTICULARLY IN ORANGEBURG, CALHOUN, DORCHESTER, AND BERKELEY COUNTIES.

1/ CHIEF GEOLOGIST, DIVISION OF GEOLOGY, SOUTH CAROLINA STATE DEVELOPMENT BOARD

MINERALS INDUSTRY OF SOUTH CAROLINA (MRS. CAMILLA McCAULEY). -- PART TIME LIBRARY RESEARCH IS CONTINUING IN ORDER TO ASSEMBLE ALL AVAILABLE INFORMATION ON THE MINERAL INDUSTRY OF SOUTH CAROLINA FROM THE COLONIAL PERIOD TO THE PRESENT.

GEOLOGY AND MINERAL RESOURCES OF EDGEFIELD COUNTY, S. C. (W. T. McCUTCHEN AND H. S. JOHNSON, JR.). -- FIELD WORK ESSENTIALLY COMPLETE. REPORT NOW UNDERGOING TECHNICAL CRITICISM AND REVISION.

GEOLOGY AND MINERAL RESOURCES OF PICKENS COUNTY, S. C. (C. Q. BROWN). -- FIELD WORK ESSENTIALLY COMPLETE. REPORT IN PREPARATION.

GEOLOGY AND MINERAL RESOURCES OF NEWBERRY COUNTY, S. C. (J. F. McCAULEY). -- FIELD WORK ESSENTIALLY COMPLETE. REPORT IN PREPARATION.

GEOLOGY AND MINERAL RESOURCES OF ORANGEBURG COUNTY, S. C. (W. K. POOSER). -- FIELD WORK COMPLETE. REPORT IN PREPARATION.

GEOLOGY AND MINERAL RESOURCES OF YORK COUNTY, S. C. (J. R. BUTLER). -- PRELIMINARY RECONNAISSANCE INVESTIGATIONS BEGAN ON PART TIME BASIS AT YEAR'S END. FIELD WORK EXPECTED TO BEGIN IN SUMMER OF 1961.

FULLERS EARTH TYPE SHALES OF THE COASTAL PLAIN OF SOUTH CAROLINA (L. N. SMITH AND G. C. ROBINSON). -- FIELD AND LABORATORY WORK ESSENTIALLY COMPLETE. REPORT IN PREPARATION.

GEOLOGY OF THE FORT JACKSON NORTH QUADRANGLE, S. C. (W. K. POOSER AND H. S. JOHNSON, JR.). -- REPORT AND MAP UNDERGOING FINAL EDITING.

GEOLOGY OF THE BLANEY QUADRANGLE, S. C. (D. C. RIDGEWAY AND J. F. McCAULEY). -- REPORT AND MAP UNDERGOING AUTHOR REVISION.

GEOLOGY OF THE IRMO N. E. QUADRANGLE, S. C. (W. E. BRIGHT). -- FIELD WORK IN PROGRESS ON PART TIME BASIS FOR MS DEGREE AT UNIVERSITY OF SOUTH CAROLINA.

GEOLOGY OF THE BLYTHEWOOD QUADRANGLE (W. D. PARADESES). FIELD WORK IN PROGRESS ON PART TIME BASIS FOR MS DEGREE AT UNIVERSITY OF SOUTH CAROLINA.

BENTONITIC CLAYS OF THE COASTAL PLAIN OF SOUTH CAROLINA (S. D. HERON, JR.). -- FIELD WORK ESSENTIALLY COMPLETE. LABORATORY TESTS IN PROGRESS.

DEPTH TO COOPER MARL IN THE LADSON QUADRANGLE, S. C.
(D. J. COLQUHOUN). -- AVAILABLE PUBLISHED DATA HAVE BEEN PLOTTED, AND ADDITIONAL CONTROL IS BEING OBTAINED WITH A SMALL REFRACTION SEISMOGRAPH.

WACCAMAW AND CROATAN DEPOSITS OF THE CAROLINAS
(JULES DUBAR). -- FIELD WORK CONTINUED DURING THE SUMMER. LABORATORY WORK AND REPORT PREPARATION NOW IN PROGRESS.

PROVISIONAL GEOLOGIC MAP OF THE CRYSTALLINE ROCKS OF SOUTH CAROLINA (W. C. OVERSTREET AND HENRY BELL III). -- BEDROCK GEOLOGY HAS BEEN INFERRED FROM COUNTY SOIL MAPS AND REPORTS OF THE U. S. DEPARTMENT OF AGRICULTURE. THE MAP AND ACCOMPANYING TEXT IS CURRENTLY UNDERGOING TECHNICAL CRITICISM AND AUTHOR REVISION.

SHORTER INVESTIGATIONS

ALBURN STONE OIL SEEP, FLORENCE COUNTY. -- INVESTIGATION OF A REPORTED OIL SEEP ON THE ALBURN STONE PROPERTY NEAR JOHNSONVILLE INDICATED THAT THE SEEP WAS NOT A NATURAL OCCURRENCE.

PRELIMINARY APPRAISAL OF MINERAL RESOURCE POTENTIAL OF JASPER COUNTY, S. C. -- SAND, GRAVEL, BRICK CLAY, BENTONITE, AND POSSIBLY PEAT AND HEAVY MINERALS ARE THE PRINCIPAL MINERAL RESOURCES OF JASPER COUNTY.

DRILLING IN GEORGETOWN COUNTY. -- DIVISION OF GEOLOGY AUGER HOLES INDICATE THAT LIMESTONE UNDERLIES MUCH OF EASTERN GEORGETOWN COUNTY AT ABOUT 20 FEET BELOW SEA LEVEL. THIS LIMESTONE APPEARS TO BE LATE TERTIARY (?) IN AGE.

JAMISON BRICK CLAY. -- SURFICIAL CLAY OF THE HAWTHORNE (?) FORMATION NEAR JAMISON IN ORANGEBURG COUNTY CONTAINS VARYING AMOUNTS OF SAND AND GRAVEL AND IS NOT THOUGHT TO BE WELL SUITED FOR USE IN A MODERN BRICK PLANT.

GABBRO IN NEWBERRY COUNTY. -- ALONG BUSH RIVER, ABOUT 8 MILES NORTHWEST OF NEWBERRY, A BEDROCK EXPOSURE OF GABBRO MAY BE SUITABLE FOR A QUARRY SITE. TWO MODERATELY WELL DEVELOPED SETS OF STEEPLY DIPPING JOINTS (N. 100° E. AND N. 80° W.) AND A FOLIATION (N-S, 40° W.) WERE NOTED AT THIS LOCALITY. RAIL TRANSPORTATION IS AVAILABLE TWO MILES NORTH OF THE SITE OVER A GOOD ALL WEATHER ROAD. THE GABBRO APPEARS TO HAVE PROMISE FOR MONUMENTAL STONE AND POLISHED INTERIOR PANELS.

MANGANESE, EDGEFIELD COUNTY. -- PISOLITIC MANGANIFEROUS RESIDUAL CLAY FORMED DURING WEATHERING OF A BASIC ROCK IS PRESENT ON THE PROPERTY OF SAM MEDLOCK NEAR BRUNSON CROSSROADS.

IN NORTHWESTERN EDGEFIELD COUNTY. A REPRESENTATIVE SAMPLE WAS FOUND TO CONTAIN 4.95 PERCENT MANGANESE. THIS MATERIAL MIGHT POSSIBLY BE USED TO ADD COLOR TO BRICK.

BLOATING SHALE, RICHLAND COUNTY. -- SEVERAL CORE HOLES TO DEPTHS OF 50 TO 100 FEET NEAR BLYTHEWOOD INDICATE THAT LAMINATED META-ARGILLITE OF THE CAROLINA SLATE GROUP BLOATS WELL BUT CONTAINS UNDESIRABLE AMOUNTS OF CALCITE.

LAMAR GOLD MINE, KERSHAW COUNTY. -- A 300 FOOT CORE HOLE AT THIS PROPERTY CUT A LARGE BODY OF SILICIFIED, PYRITIZED VOLCANIC ROCK OF THE CAROLINA SLATE GROUP. FAIRLY HOMOGENEOUS LOW-GRADE GOLD MINERALIZATION APPARENTLY ACCOMPANIES THE PYRITE. LARGE TONNAGES OF ROCK CARRYING GOLD VALUES UP TO SEVERAL DOLLARS PER TON MAY BE PRESENT.

DRILLING, HORRY COUNTY. -- TEN POWER AUGER HOLES WERE DRILLED BY THE DIVISION OF GEOLOGY TO AID DR. J. R. DUBAR IN HIS STUDY OF THE WACCAMAW FORMATION (PLIOCENE ?).

BENTONITIC CLAY, ORANGEBURG AND CALHOUN COUNTIES. -- A 5 TO 20 FOOT THICK BED OF BENTONITIC CLAY OF EOCENE AGE HAS BEEN FOUND TO EXTEND OVER ABOUT 30 MILES IN AN EAST-WEST DIRECTION IN WESTERN CALHOUN AND NORTHWESTERN ORANGEBURG COUNTIES.

COMMON CLAY, CHARLESTON AND BERKELEY COUNTIES. -- SEVERAL HAND AUGER HOLES IN EXTENSIVE, FLAT, LOWLYING AREAS ALONG THE WANDO RIVER SUGGEST THAT LARGE RESERVES OF PLASTIC COMMON CLAY ARE PRESENT IN THESE AREAS BUT THAT THE CLAY DEPOSITS COMMONLY GRADE Laterally AND VERTICALLY WITHIN SHORT DISTANCES INTO SAND AND CLAYEY SAND. A POWER AUGER HOLE ABOUT 0.6 MILE EAST OF GOOSE CREEK POST OFFICE IN BERKELEY COUNTY SUGGESTS THAT LARGE AREAS BETWEEN GOOSE CREEK AND THE COOPER RIVER MAY BE UNDERLAIN BY PLASTIC COMMON CLAY AT VERY SHALLOW DEPTHS.

KAOLIN, SUMTER COUNTY. -- BRIEF RECONNAISSANCE IN NORTHWESTERN SUMTER COUNTY SUGGESTS THAT EXTENSIVE RESOURCES OF IMPURE KAOLIN SUITABLE FOR USE IN BRICK MANUFACTURE MAY BE PRESENT IN THE TUSCALOOSA FORMATION IN THIS AREA.

SAND, RICHLAND COUNTY. -- SEVERAL DIVISION OF GEOLOGY AUGER HOLES IN THE NORTHEASTERN CORNER OF THE FORT JACKSON NORTH QUADRANGLE AND THE NORTHWESTERN CORNER OF THE MESSERS POND QUADRANGLE INDICATE EXTENSIVE RESERVES OF FAIRLY CLEAN SAND IN THIS AREA. THE SAND DEPOSIT WAS FOUND TO BE AS GREAT AS 90 FEET THICK IN ONE PLACE WHERE IT HAD APPARENTLY ACCUMULATED IN THE LEE OF A HILL FORMED BY THE TOP OF THE TUSCALOOSA FORMATION.

DRILLING, NORTHERN COLLETON COUNTY. -- SEVERAL DIVISION OF GEOLOGY AUGER HOLES NEAR GREEN POND CHURCH INDICATE THE COOPER MARL IS OVERLAIN BY A GREENISH-BLACK, VERY PLASTIC, SLIGHTLY CALCAREOUS CLAY UP TO 10 FEET THICK OVER MUCH OF THIS AREA. THIS CLAY UNIT IS THOUGHT TO BE THE HAWTHORNE FORMATION OF MIOCENE AGE. CAROLINA BAYS IN THE AREA ARE YOUNGER THAN THIS CLAY UNIT AND COMMONLY CUT THROUGH IT AND ARE FLOODED IN COOPER MARL. DEEP, ACTIVE SINKHOLES IN THE AREA ARE YOUNGER THAN THE CAROLINA BAYS AND APPEAR TO BE RELATED TO CAVING OF CAVERNS IN THE SANTEE LIMESTONE, WHICH IS PRESENT BENEATH THE COOPER MARL.

REPORTS

DURING 1960 THE DIVISION OF GEOLOGY PUBLISHED BULLETIN 26, EXPLORATION FOR HEAVY MINERALS ON HILTON HEAD ISLAND, S. C.. THIS REPORT IS NOW AVAILABLE AT A COST OF 50 CENTS PER COPY. CURRENTLY IN PRESS IS BULLETIN 25, COMMON CLAYS OF THE COASTAL PLAIN OF SOUTH CAROLINA - AND THEIR USE IN THE STRUCTURAL CLAY PRODUCTS INDUSTRY.

GEOLOGIC NOTES, THE BIMONTHLY PUBLICATION OF THE DIVISION OF GEOLOGY, INCLUDED THE FOLLOWING ARTICLES DURING 1960:

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| MARCH-APRIL
VOL. 4 No. 2 | BRICK CLAYS OF MEDWAY PLANTATION, BERKELEY COUNTY, S. C. - G. C. ROBINSON AND H. S. JOHNSON, JR. |
| MAY-JUNE
VOL. 4 No. 3 | OLIGOCENE FOSSILS FROM THE OLD BOLTON MINE NEAR CHARLESTON, S. C. - H. G. RICHARDS AND A. H. HOPKINS.
GEOLOGY OF THE BLANEY QUADRANGLE, S. C. - D. C. RIDGEWAY |
| JULY-AUGUST
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NOTES ON THE CALCIUM CARBONATE CONTENT OF THE SANTEE LIMESTONE - S. D. HERON, JR.
EXPLORATION FOR HEAVY MINERALS ON HILTON HEAD ISLAND, S. C. (ABSTRACT) - CAMILLA K. MCCAULEY |
| SEPTEMBER-OCTOBER
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A PRELIMINARY REPORT ON THE GABBROS OF NEWBERRY COUNTY, S. C. - J. F. MCCAULEY. |

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WHITEHEAD BROTHERS FOUNDRY SAND
OPERATION, LUGOFF, SOUTH CAROLINA.
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UNDERGROUND STORAGE OF NATURAL GAS
IN S. C. - H. S. JOHNSON, JR.

THE POWER AUGER AS A GEOLOGIC TOOL IN THE COASTAL PLAIN OF SOUTH CAROLINA

By

L. N. SMITH ^{1/}

INTRODUCTION

GEOLOGIC MAPPING IN COASTAL PLAIN AREAS OF THE SOUTHEASTERN STATES WITHOUT THE BENEFIT OF SOME SUBSURFACE INFORMATION IS FRUSTRATING ACTIVITY AT BEST. THE CORRECTNESS OF INTERPRETATIONS AND STRATIGRAPHIC CORRELATIONS IS ALMOST NEVER THAT WHICH THE RESULTING MAP OR TEXT WOULD LEAD READERS TO BELIEVE. FORMATIONS ARE NAMED, CONTACTS ARE DRAWN, AGES ARE POSTULATED, AND A PRODUCT IS PUBLISHED WITH THE GEOLOGIST HAVING SEEN VERY LITTLE, IF ANY, UNWEATHERED MATERIAL IN THE AREA MAPPED. WITHOUT THE BENEFIT OF SUBSURFACE INFORMATION, WORK IS ESSENTIALLY RESTRICTED TO VALLEYS AND THE SHALLOW ARTIFICIAL OPENINGS THAT ARE AVAILABLE. EVEN THE GOOD ROAD CUTS ARE IN THE VALLEY SIDES WHERE ROADS CROSS MAJOR DRAINAGES. THE WORKER WHEN FACED WITH THESE DIFFICULTIES IS IN DANGER OF BECOMING CALLOUS AND TENDS TO LOOSE SIGHT OF THE FACT THAT HE HAS NOT SEEN AN UNWEATHERED SAMPLE AND THUS IS SOMETIMES UNAWARE OF THE ACTUAL NATURE OF THE ROCKS WITH WHICH HE IS WORKING. ALLUVIAL AND COLLUVIAL COVER ARE PERHAPS AN EVEN GREATER PROBLEM THAN CHEMICAL CHANGES. THERE IS ALMOST ALWAYS A SURFICIAL BLANKETLIKE DEPOSIT OF SAND OR CLAY IN ANY COASTAL PLAIN AREA.

WHAT IS NEEDED IS A CHEAPLY OPERATED, SIMPLE, AND EFFICIENT SET OF TOOLS THAT ALLOWS THE GEOLOGIST TO OBTAIN FRESH SAMPLES AND TO PENETRATE SURFICIAL COVER. THE COST OF THEIR USE SHOULD BE CALCULATED AS PART OF THE COST OF THE FIELD WORK. THESE COSTS ARE EASILY JUSTIFIED BY THE ADDED QUALITY OF THE FINISHED WORK, AND IN SOME CASES BY THE SPEEDIER COMPLETION OF THE WORK.

THE POWER AUGER

IN AN EFFORT TO OVERCOME SOME OF THE PREVIOUSLY MENTIONED PROBLEMS AND TO PROVIDE THE TOOLS NEEDED FOR COASTAL PLAIN GEOLOGIC MAPPING THE DIVISION OF GEOLOGY, SOUTH CAROLINA STATE DEVELOPMENT BOARD, PURCHASED A POWER AUGER CAPABLE OF DRILLING TO 100 FEET IN SOFT ROCK AND AN ALTIMETER THAT CAN BE READ TO ONE FOOT DIFFERENCE IN ELEVATION.

^{1/} DEPARTMENT OF BIOLOGY AND GEOLOGY, APPALACHIAN STATE TEACHERS COLLEGE, BOONE, N. C. FORMERLY STAFF GEOLOGIST, DIVISION OF GEOLOGY, S. C. STATE DEVELOPMENT BOARD.

DRILL HOLE LOG - CALHOUN COUNTY

Drill hole: Calhoun #4 (Power auger)

Location: On County Highway 72 approx. 200' S. of Hutto Pond;
2.1 mi. S. 75° E. of Creston.

Collar elevation: 130' (altimeter) Total depth: 50'

Drilled by: Division of Geology, S. C. State Development Board

Date: 8-25-59

Logged by: S. D. Heron, Jr. Bearing & inclination vertical

<u>Field name</u>	<u>Footage</u>	<u>Description</u>
Road fill	0-7'	Sand, F, becoming argillaceous near 6' depth.
Santee ls.	7-11' 11-15'	Limestone, yellow, non-glaucous; <u>SAMPLE #1 (7-15')</u> . Limestone, dusty yellow-green (5GY 5/2).
Congaree (?) fm.	15-23' 23-27' 27-33'	Mudrock, greenish-black (5G 2/1), glaucous, slightly calcareous; at 22' changed to slightly lighter color (less glaucous); <u>SAMPLE #2 (15-23')</u> . Siltstone, light gray; poor sample; <u>SAMPLE #3 (23-27')</u> . Sand, F-M, micaceous, white; gets darker near bottom; <u>SAMPLE #4 (27-33')</u> .
Black Mingo (?) fm.	33-50'	Mudrock, grayish-black (N2), non-calcareous, micaceous; possibly Black Mingo; <u>SAMPLE #5 (35')</u> .
<u>Remarks:</u>		Unit 33-50' very similar lithologically to section beneath Santee limestone in water well at Carolina Giant Cement Plant (Harleyville).

FIGURE 2. - LOG OF AUGER HOLE CALHOUN #4, CALHOUN COUNTY, S. C.

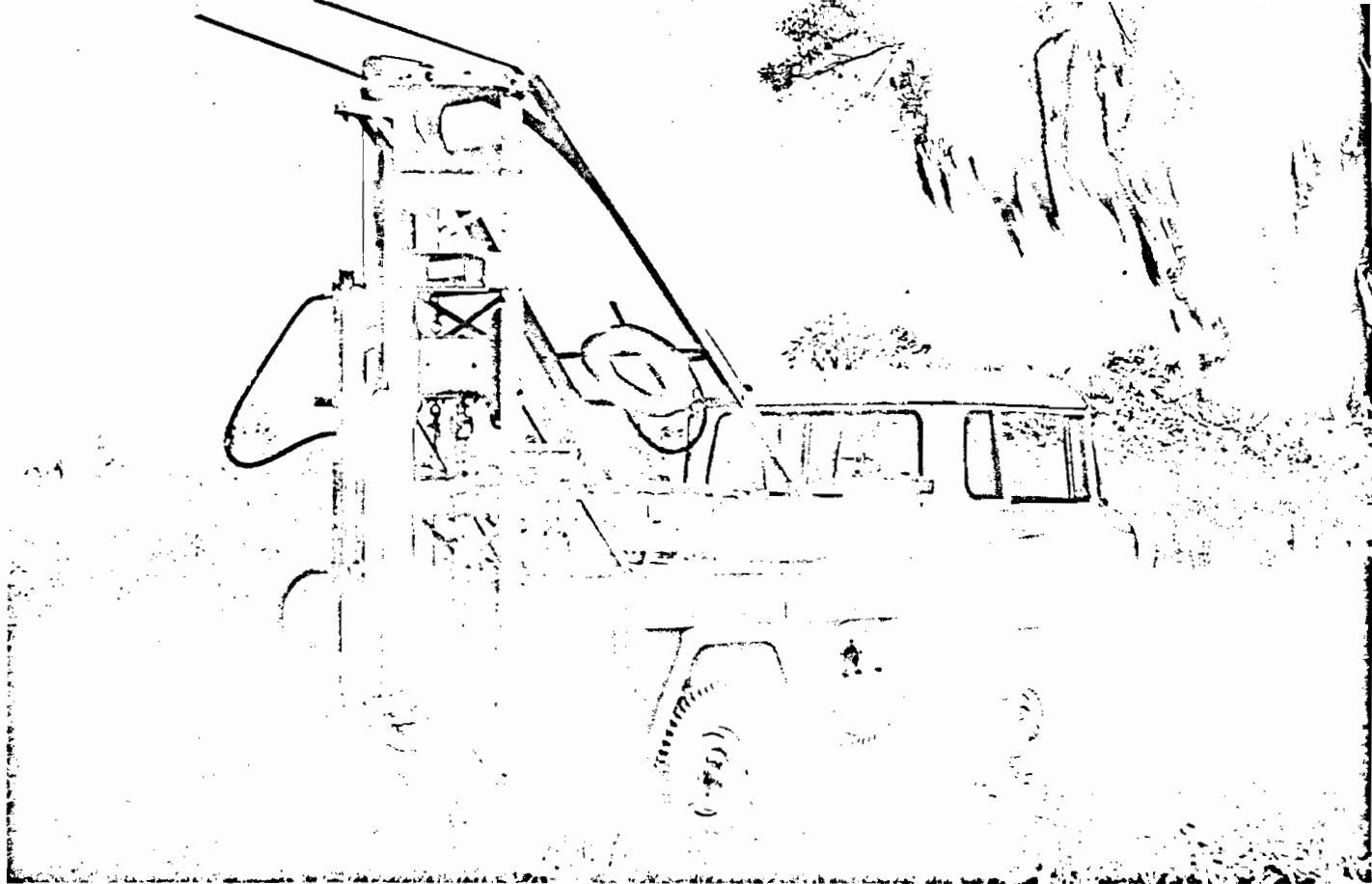


FIGURE 1. - POWER AUGER USED AS GEOLOGIC TOOL BY DIVISION OF GEOLOGY,
S. C. STATE DEVELOPMENT BOARD.

THE POWER AUGER (FIG. 1) IS A MOBILE DRILLING COMPANY MODEL B-27. THIS IS MOUNTED ON AN FC-150 WILLYS JEEP PICKUP TRUCK. THE JEEP MOTOR IN ADDITION TO FURNISHING MOTIVE POWER FOR THE JEEP ALSO DRIVES THE AUGER THROUGH A POWER-TAKEOFF TRANSMISSION AND FURNISHES THE UP AND DOWN MOTION FOR THE RODS THROUGH AN ATTACHED HYDRAULIC PUMP. THE AUGER HAS THREE FORWARD SPEEDS AND ONE REVERSE. IT WAS FOUND THAT DUAL WHEELS ARE VERY HELPFUL ON THE REAR OF THE FC-150 JEEP TO SUPPORT THE LOAD OF THE DRILL AND RODS ON SOFT GROUND. THE ENTIRE UNIT WEIGHS 5,250 LBS. COMPLETE WITH 100 FEET OF AUGER RODS.

THE AUGER RODS HAVE A CONTINUOUS FLIGHT FOR CLOCKWISE ROTATION AND ARE 5 FEET BY 4 INCHES. THE ROD JOINTS ARE HEXAGONAL AND ARE JOINED BY MEANS OF A HAMMERED CLIP PIN. THERE ARE SEVERAL TYPES OF BITS AVAILABLE FOR AUGER RODS OF THIS TYPE. THE BIT GAUGE SHOULD BE A LEAST $\frac{1}{2}$ INCH LARGER THAN THE AUGER ROD DIAMETER. EXPERIENCE HAS SHOWN THAT A BIT WITH SIX DETACHABLE, HARD FACED, TEETH IS BEST FOR ALL AROUND DRILLING IN MOST ANY TYPE OF ROCK ENCOUNTERED IN COASTAL PLAIN AREAS. A "CLAY" FISHTAIL TYPE BIT IS SOMETIMES USED, BUT CONSTANT WEAR MAKES IT NECESSARY TO HAVE THIS TYPE OF BIT BUILT UP AND HARD FACED WHEN THE GAUGE BECOMES TOO SMALL. THIS IS MORE EXPENSIVE, AND MORE TROUBLE, THAN REPLACING THE TEETH IN THE OTHER TYPE BIT.

DRILLING PROCEDURE

THE OPERATION OF THIS TYPE OF POWER AUGER IS VERY SIMPLE. THERE ARE THREE CONTROLS — ACCELERATOR, CLUTCH, AND LIFTING AND LOWERING CONTROL. ONE CAN LEARN TO RUN THE DRILL AFTER A VERY SHORT TIME JUST BY PLAYING WITH IT AFTER READING A SHORT INSTRUCTION MANUAL FURNISHED BY THE MANUFACTURER. WE HAVE TAUGHT PEOPLE TO DRILL IN AS LITTLE AS 30 MINUTES.

WITH THE DRILL IN OPERATION INCONJUNCTION WITH THE ALTIMETER IT IS POSSIBLE FOR THREE MEN, WITH ONE VEHICLE IN ADDITION TO THE DRILL JEEP, TO LOCATE A HOLE, GET A COLLAR ELEVATION, DRILL A 100 FOOT HOLE, LOG AND SAMPLE IT, PLUG THE HOLE, AND MOVE TO ANOTHER LOCATION IN AN HOUR OR TWO. IT IS COMMON TO COMPLETE 300 TO 500 FEET OF DRILLING IN ONE EIGHT HOUR DAY. THIS TIME BALANCED AGAINST THE TIME REQUIRED TO FIND AND MEASURE GENERALLY MUCH SMALLER SECTIONS AND GET THE ELEVATIONS FOR THE SECTIONS MAKES DRILLING VERY DESIRABLE.

THE DRILLING PROCEDURE THAT IS GENERALLY USED BY THE DIVISION OF GEOLOGY IS AS FOLLOWS: THE PARTY IS MADE UP

OF THREE MEN, THE GEOLOGIST, THE DRILLER (WHO IS GENERALLY A GEOLOGIST), AND A HELPER. A NEEDED HOLE IS LOCATED AND THE DRILL IS MOVED ON LOCATION. THE DRILLER AND HELPER THEN LEVEL THE DRILL WITH JACKS AND BEGIN THE HOLE. WHILE THIS IS GOING ON THE GEOLOGIST LOCATES THE HOLE ON AN AIR PHOTO OR TOPO MAP AND GETS THE COLLAR ELEVATION FROM A NEARBY BENCH MARK OR SPOT ELEVATION USING THE ALTIMETER. HE THEN RETURNS TO THE LOCATION AND BEGINS THE LOG. DRILLING PROCEEDS, WITH THE DRILLER CALLING CHANGES IN THE MATERIAL THAT IS BEING DRILLED. THIS IS DONE BY FEEL AND CHECKING THE DRILLING TIME AGAINST DRILLING RATE. THE HOLE IS RUN DOWN TO THE DESIRED DEPTH AND SAMPLES TAKEN. WHILE THE DRILLER AND HELPER ARE PULLING RODS AND FILLING THE HOLE, THE GEOLOGIST FINISHES THE LOG, LABELS THE SAMPLES, AND LOCATES THE NEXT HOLE.

THE PRECEDING METHOD SEEMS VERY SIMPLE AND CLEAR-CUT -- AND IT IS WHEN THE CREW GAINS EXPERIENCE. THERE ARE HOWEVER A NUMBER OF STUMBLING BLOCKS IN THE PROCEDURE AND LIMITATIONS ON THE MACHINERY. THESE CAN USUALLY BE OVERCOME WHEN THE CREW GAINS EXPERIENCE WITH DIFFERENT TYPES OF MATERIAL ENCOUNTERED IN THE AREA DRILLED.

INTERPRETATION

EACH TYPE OF LITHOLOGY THAT IS FOUND IN A GIVEN AREA REQUIRES A DIFFERENT TECHNIQUE OF DRILLING TO GET ACCURATE INFORMATION AND GOOD, UNCONTAMINATED SAMPLES. THIS FACT HAS CAUSED SOME DISCOURAGEMENT IN THE USE OF AN AUGER DRILL. AUGERING IS ESSENTIALLY A MIXING OPERATION. AS THE BIT CUTS, THE MATERIAL CUT IS TURNED OVER AND OVER AS THE CUTTINGS COME UP THE AUGER FLIGHTS. IT WOULD BE HARD TO FIND A MORE EFFICIENT WAY OF MIXING DRILL CUTTINGS IF THAT WAS WHAT WAS DESIRED. THERE IS A TIME LAG FROM WHEN THE DRILL PENETRATES A GIVEN FOOTAGE UNTIL THE MATERIAL FROM THAT FOOTAGE REACHES THE SURFACE. WHEN AN INTERFACE IS REACHED BY THE BIT, SAY A RED CLAY SAND OVER A GRAY CLAY, THERE APPEARS TO BE NO ABRUPT CHANGE AS THE CUTTINGS ARE FIRST RED CLAY SAND, THEN A MIXTURE OF RED CLAY SAND WITH INCREASING PROPORTIONS OF GRAY CLAY, AND FINALLY GRAY CLAY. THIS WOULD IN ALL PROBABILITY BE INTERPRETED AS A GRADATIONAL CONTACT IF PRIOR KNOWLEDGE OF THE MIXING ACTION OF THE DRILL WAS NOT KNOWN. WITH THE ADDITION OF WATER, WHICH IS ALWAYS PRESENT IN COASTAL PLAIN DRILLING WHEN ANY DEPTH IS ATTAINED, THIS PROBLEM IS SEEMINGLY FURTHER COMPLICATED.

THE MIXING PROBLEM CAN BE OVERCOME. THE FIRST STEP IS A GEOLOGIST AT THE CONTROLS OF THE DRILL. HE IS BETTER QUALIFIED THROUGH TRAINING AND EXPERIENCE THAN UN-TRAINED PERSONNEL TO KNOW WHAT IS TAKING PLACE AT THE BIT WHILE THE DRILL IS WORKING. THE DRILL BEHAVES AS ANY MACHINE UNDER VARYING CONDITIONS. ANY EXPERIENCED CAR DRIVER COULD BE BLINDFOLDED AND TELL IF HIS CAR WAS PULLING

HARD AND LABORING UP A HILL, THROUGH MUD, OR SAND, OR ON A ROUGH ROAD. THE DRILL BEHAVES THE SAME WAY; IT LABORS WHEN CUTTING HARD CLAY AND SPEEDS UP IN DRY SAND. EACH MATERIAL HAS ITS OWN DRILLING CHARACTERISTICS. ONCE THESE CHARACTERISTICS ARE ESTABLISHED IT IS A SIMPLE MATTER TO TELL WHEN THE BIT PASSES FROM ONE TYPE OF MATERIAL TO ANOTHER BY THE FEEL OF THE DRILL, THE SOUNDS THAT IT MAKES, AND THE EASE OF PENETRATION. THE DRILLER CALLS A DRILLING CHANGE TO THE LOGGER, WHO NOTES THE FOOTAGE IN THE MARGIN OF HIS LOG BOOK. THEN, WHEN THE MATERIAL COMES UP THE AUGER FLIGHT THE LOGGER RECORDS A DETAILED DESCRIPTION OF IT.

SAMPLING

THE SAMPLING IS ANOTHER MATTER. THIS REQUIRES MORE THOUGHT AND EXPERIENCE. WE HAVE FOUND THAT IT IS POSSIBLE TO GET GOOD CLEAN SAMPLES IF PROPER CARE IS EXERCISED BEFORE, DURING, AND AFTER DRILLING.

IN SAMPLING FOR CHEMICAL COMPOSITION OR MICRO-FAUNA THE DRILL RODS MUST BE CLEAN. IT STANDS TO REASON THAT A VERY SMALL AMOUNT OF HIGHLY FOSSILIFEROUS LIMESTONE OR MARL WOULD CONTAMINATE A LARGE AMOUNT OF RELATIVELY UNFOSSILIFEROUS CLAY OR SILT. THE CALCIUM CARBONATE CONTENT OF A SILTSTONE SAMPLE COULD BE MATERIALLY RAISED IN THE SAME FASHION.

THE DIVISION OF GEOLOGY INSTALLED A SMALL PUMP AND SEPARATE GAS MOTOR FOR WASHING PURPOSES. THIS IS THE TYPE OF PUMP USED FOR IRRIGATION OR FIRE FIGHTING AND HAS THE NEEDED PRESSURE TO CUT STICKY MATERIAL OFF THE DRILL RODS. ON THE COMPLETION OF EACH HOLE WHERE CLEAN SAMPLES ARE DESIRABLE THE DRILL IS DRIVEN TO A CONVENIENT CULVERT, POND, OR BRIDGE; THE SUCTION LINE LOWERED INTO THE WATER; AND THE RODS ARE WASHED DOWN AND THE TRUCK CLEANED AS NEEDED. FREQUENT WASHING ALSO IS A GREAT AID TO MAINTENANCE AND MORALE, AS CLEAN EQUIPMENT IS EASIER TO KEEP UP AND TO WORK WITH. PRIOR TO THE INSTALLATION OF THE PUMP, WASHINGS WERE INFREQUENT. IT WAS NOT PRACTICAL TO HAVE THIS DONE AT A SERVICE STATION OR COMMERCIAL CAR WASH ESTABLISHMENT.

SAMPLING IS PERHAPS THE MOST CRITICAL PART OF THE OPERATION OF THE DRILL. THE SAMPLES VARY FROM VERY GOOD TO VIRTUALLY USELESS, AND IN SOME CASES NO SAMPLES CAN BE RECOVERED AT ALL. THIS IS DEPENDENT ON THE TYPE OF MATERIAL DRILLED, THE GROUND WATER CONDITIONS, THE DEPTH OF THE HOLE, AND THE CARE AND THOUGHT USED IN DRILLING. THE QUALITY OF THE SAMPLE MUST BE JUDGED ON THE SPOT AND THIS FACTOR CLEARLY NOTED ON THE LOG AND SAMPLE DESCRIPTION. THIS CAN READILY BE DONE ON LOCATION.

SAMPLING FALLS INTO TWO BROAD CATEGORIES WITH MINOR VARIATIONS IN EACH CATEGORY. THESE ARE (1) SAMPLING OF GRANULAR MATERIAL THAT WILL NOT STICK TO THE AUGER RODS, E. G. SAND OR SOFT LIMESTONE, AND (2) SAMPLING OF PLASTIC MATERIAL THAT WILL STICK TO THE AUGER RODS, E. G. CLAY OR MARL.

IN THE FIRST CATEGORY THE MATERIAL PENETRATED COMES TO THE SURFACE WITH SOME TIME LAG AND WELL BROKEN UP AND MIXED. AN ACCURATE REPRESENTATIVE SAMPLE CAN BE COLLECTED ONLY IF THE UNIT DRILLED IS THICK ENOUGH TO PERMIT SOME CONSISTENCY TO THE MATERIAL THAT REACHES THE SURFACE. THIS TYPE OF MATERIAL IS USUALLY WET AND RUNNY IF IT COMES FROM BELOW THE WATER TABLE. THE SAMPLING TOOL IN THIS CASE IS A LARGE KITCHEN SPOON, ACID IS USED ON THE SLURRY AS IT COMES FROM THE HOLE TO CHECK ITS CALCIUM CARBONATE CONTENT.

THE MATERIAL THAT FALLS IN THE SECOND CATEGORY MUST BE BROUGHT TO THE SURFACE BY BRINGING THE AUGER RODS OUT OF THE HOLE. THIS IS DONE BY USING THE MINIMUM RPM AND MAXIMUM PENETRATION SPEED. WHEN FIVE OR SO FEET HAVE BEEN DRILLED IN THIS MANNER THE RODS ARE BROKEN LOOSE FROM THE BOTTOM BY SLOW ROTATION AND HIGH HYDRAULIC "UP" PRESSURE. AFTER THE RODS ARE BROKEN LOOSE AND ARE COMING UP THE HOLE EASILY, ROTATION IS STOPPED. WHEN THE BOTTOM ROD HAS REACHED THE SURFACE THE AUGER FLIGHTS ARE PACKED WITH THE MATERIAL DRILLED. THERE IS A SURFACE COATING OF SAND OR OTHER MATERIAL THAT MUST BE SCRAPED AWAY BEFORE A SAMPLE CAN BE COLLECTED DIRECTLY FROM THE RODS. A SMALL MASONS TROWEL IS AN EXCELLENT TOOL FOR THIS.

OF COURSE, MATERIAL ENCOUNTERED IN COASTAL PLAIN DRILLING VARIES WIDELY. EACH TYPE OF MATERIAL HAS ITS OWN CHARACTERISTICS THAT EFFECT SAMPLING AND DRILLING AND MUST BE DEALT WITH SEPARATELY. IT HAS BEEN FOUND, HOWEVER, THAT WITH A LITTLE PATIENCE AND EXPERIENCE, ANY UNIT CAN BE DRILLED AND SAMPLED, IF IT IS NOT TOO HARD FOR THE DRILL TO PENETRATE.

THE DIVISION OF GEOLOGY HAS FOUND THAT IF THE SAMPLE IS TO BE STORED, EVEN FOR A VERY SHORT TIME, IT IS NECESSARY TO COLLECT THE SAMPLES IN A PLASTIC AIR-TIGHT BAG. CLAYS AND SHALE BREAK DOWN AND ARE MUCH MORE EASILY WASHED IF THE ORIGINAL WATER IS STILL IN THE SAMPLE. SOME TYPES OF MATERIAL SEEM TO FORM A CEMENT ON DRYING THAT DEFIES EVEN THE MOST VIGOROUS WASHING. A VERY CONVENIENT CONTAINER IS A PLASTIC LIVER BAG THAT IS AVAILABLE AT ANY WHOLESALE PAPER SUPPLY IN VARIOUS SIZES. WIRE TAPE TIES ARE ALSO AVAILABLE FROM THE SAME SOURCE, TO SEAL THESE BAGS, AND TO MAKE THEM ESSENTIALLY AIR TIGHT INDEFINITELY. THESE PLASTIC BAGS ARE THEN PLACED IN A CLOTH OR PAPER BAG FOR LABELLING AND STORAGE UNTIL NEEDED.

LOGS

THE LOGS OF DRILL HOLES FOR STRATIGRAPHIC PURPOSES ARE REVISED AND TYPED WHEN THE CREW RETURNS TO THE OFFICE. FIGURE 2 IS A TYPICAL LOG THAT SHOWS THE GENERAL FORM AND THE INFORMATION SHOWN. THE DIVISION OF GEOLOGY HAS A REGULAR DISTRIBUTION LIST FOR THESE LOGS. THE DIVISION ALSO STORES THE SAMPLES OR MICROFAUNAL WASHINGS FROM ALL DRILL HOLES. THE LOGS ARE DISTRIBUTED ON THE BASIS OF INTEREST TO GEOLOGISTS THAT ARE WORKING IN OR ARE PARTICULARLY INTERESTED IN THE COASTAL PLAIN OF SOUTH CAROLINA, AND THE SAMPLES ARE AVAILABLE FOR EXAMINATION BY ANY INTERESTED PERSONS.

USES OF DRILL

IN ADDITION TO STRATIGRAPHIC INFORMATION THE DRILL IS USED TO OBTAIN INFORMATION ON ECONOMIC CLAY, SAND, GRAVEL, AND LIMESTONE RESOURCES IN SOUTH CAROLINA. IT IS ALSO VERY USEFUL FOR OBTAINING DATA ON FOUNDATION CONDITIONS AND DEPTH TO GROUND WATER AT PROPOSED SITES FOR INDUSTRIAL PLANTS OR OTHER STRUCTURES.

PERHAPS THE REASON FOR THE SUCCESSFUL USE OF THE POWER AUGER TYPE DRILL BY THE S. C. DIVISION OF GEOLOGY IS THE FACT THAT IT IS OPERATED BY THE PERSON OR PERSONS THAT NEED THE INFORMATION AND NOT LEFT IN THE HANDS OF A DRILL CREW THAT DOES NOT GRASP THE PROBLEMS INVOLVED WITH CAREFUL, ACCURATE WORK OR THE VALUE OF THE INFORMATION OBTAINED. GEOLOGISTS USING THE DRILL ARE MUCH MORE CAREFUL WITH MAINTENANCE AND PRECISION OF WORK THAN A DRILL CREW WITH LITTLE OR NO RESPONSIBILITY FOR A DRILLING PROGRAM OTHER THAN THE OPERATION OF THE DRILL,

